

PROPOSAL * SPECIFICATIONS * CONTRACT * BOND FORMS

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SEGUIN, TEXAS

GOLF CART BARN

BID NO. TF-2023-44

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SEGUIN CITY COUNCIL

Donna Dodgen – Mayor

Joe Rea – Mayor Pro Tem

Sonia Mendez

Jim Lievens

Chris Rangel

Paul Gaytan

Monica Carter

Jason Biesenbach

Bill Keller

Steve Parker, City Manager

Rick Cortes, Assistant City Manager

Bruce Allen, Golf Course Manager

* * * * *



**TRC ENGINEERS, INC.
809 E. COURT STREET, SUITE 106
SEGUIN, TEXAS 78155
T.B.P.E. FIRM REGISTRATION # F-8632**



AUGUST 2023

TRC PROJECT NO. 498355

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REQUEST FOR BIDS

OWNER: City of Seguin, Texas

PROJECT: Golf Cart Barn, Bid No. TF-2023-44

DATE: August 16, 2023

I. BACKGROUND

Pursuant to chapter 2269 of the Texas Government Code and chapter 252 of the Texas Local Government Code, the City of Seguin, Texas solicits bids from qualified firms interested in providing construction services in connection with the construction of the Golf Cart Barn, Bid No. TF-2023-44 (the “Project”). The City will award the contract for the Project based on “competitive bidding” method to the lowest responsible bidder as that term and its selection criteria are defined in section 2269.101 of the Texas Government Code.

The Project has been designed by TRC Engineers, Inc. The Project is anticipated to include some or all of the following items within its scope: an 80’ x 60’ x 14’ prefabricated metal building with concrete slab foundation, electrical, mechanical, and plumbing systems, approximately 1,500 SY of asphalt paving, 55 SY of concrete wash rack, a 50’ x 12’ x 8’ prefabricated canopy, miscellaneous site work; and all other appurtenances necessary for the complete Project.

Responses are solicited for this service in accordance with the terms, conditions, and instructions set forth in the Request for Bids’ (RFB) guidelines.

The City of Seguin will receive responses to this RFB at the offices of City of Seguin’s City Secretary until 3:00 p.m. on Tuesday, September 12, 2023. Receipt of response does not bind City of Seguin to any contract for said services, nor does it give any guarantee that a contract for the Project will be awarded.

II. PURPOSES OF RFP

The City of Seguin invites the submittal of responses to this “RFB” from qualified firm(s) interested in providing construction services in accordance with Chapter 2269 of the Texas Government Code and chapter 252 of the Local Government Code in connection with the construction of a Golf Cart Barn that will incorporate an 80’ x 60’ x 14’ prefabricated metal building with concrete slab foundation, electrical, mechanical, and plumbing systems, approximately 1,500 SY of asphalt paving, 55 SY of concrete wash rack, a 50’ x 12’ x 8’ prefabricated canopy, miscellaneous site work, and all other necessary appurtenances.

III. LOCATION

The facility will be located at Starcke Park Golf Course, south of the existing club house, in Seguin, Texas.

IV. PROJECT DURATION

The City of Seguin has estimated a projected completion date to be 180 consecutive calendar days after the date on the Notice to Proceed. The City of Seguin reserves the right to phase the

construction of the Project or modify the schedule as needed and determined by the City of Seguin due to modifications in scope.

V. OBJECTIVES

Owner proposes to retain a highly qualified, capable firm to act as its general contractor for the construction of the Project using the Competitive Bidding procurement method authorized by chapter 2269 of the Texas Government Code. Firms who participate in this RFB process are sometimes referred to as “Bidders”, “Respondents” and “Offerors”. Owner will award the contract to the lowest responsible bidder, giving consideration to the criteria listed in this RFB. Pursuant to its statutory authority, Owner reserves the right to negotiate with a selected Respondent but shall not be obligated to enter into any contract with any Respondent on any terms or conditions.

VI. SCOPE OF WORK

Owner anticipates the scope of work to consist of the following responsibilities:

The selected Respondent will be the general contractor for the Project, which is the construction of Golf Cart Barn, Bid No. TF-2023-44. The City anticipates the following items will be included in the scope of the Project: an 80' x 60' x 14' prefabricated metal building with concrete slab foundation, electrical, mechanical, and plumbing systems, approximately 1,500 SY of asphalt paving, 55 SY of concrete wash rack, a 50' x 12' x 8' prefabricated canopy, miscellaneous site work; and all other appurtenances necessary for the complete Project. The Project will be designed and constructed so as to meet all applicable federal, state, and local accessibility standards.

The selected Offeror will be also responsible for: obtaining all applicable permits and inspections; providing all necessary performance and payment bonds and insurance certificates; and providing the Owner with all manufacturers' warranties and all operations and maintenance (O & M) manuals for all equipment installed.

The selected Offeror may be required to perform some or all of the following pre-construction and construction services. Preconstruction Services may include, but not necessarily be limited to, planning and value engineering the Work. Construction Services may include, but not necessarily be limited to, all work associated with construction, occupancy and warranty of the facilities.

The following represents a summary of the proposed improvements and estimated budget:

- An 80' x 60' x 14' prefabricated metal building with concrete slab foundation.
- Electrical, mechanical, and plumbing systems for the prefabricated metal building.
- Approximately 1,500 SY of asphalt paving.
- 55 SY of concrete wash rack.
- A 50' x 12' x 8' prefabricated canopy.
- Miscellaneous site work.
- Miscellaneous appurtenances necessary for the complete Project.

VII. SELECTION PROCESS

Respondents should prepare a bid package responsive to all information requested in this RFB.

Owner will use a selection committee to evaluate the bids. The statement of qualifications received will be part of the selection process utilized by Owner. Owner will receive, publicly open, and read aloud the names of the offerors and their bids.

From a review of the statements of qualifications received, Owner's evaluation team will award the contract to the lowest responsible bidder, considering the criteria listed below.

VIII. EVALUATION CRITERIA

The criteria used to evaluate the RFB responses will include the following (items listed below are not listed in order of importance):

- IX. Price;
- X. Offeror's experience and reputation;
- XI. Quality of the offeror's goods or services;
- XII. Impact on the ability of the governmental entity to comply with rules relating to historically underutilized businesses;
- XIII. Offeror's safety record;
- XIV. Offeror's proposed personnel; and
- XV. Whether the Offeror's financial capability is appropriate to the size and scope of the project.

XVI. ADDITIONAL INSTRUCTIONS, NOTIFICATIONS, AND INFORMATION

XVII. All information True – Respondent represents and warrants to Owner that all information provided in the response shall be true, correct and complete. Respondents who provide false, misleading, or incomplete information, whether intentional or not, in any of the documents presented to Owner for consideration in the selection process shall be excluded.

XVIII. Inquiries – Do not contact Owner during the selection process to make inquiries about the progress of this selection process. Such contact may result in disqualification. Respondents will be contacted when it is appropriate to do so.

XIX. Cost of Responses – Owner will not be responsible for the costs incurred by anyone in the submittal of responses.

XX. Contract Negotiations – This RFB is not to be construed as a contract or as a commitment of any kind. If this RFB results in a contract offer by Owner, the specific scope of work, associated fees, and other contractual matters will be determined during contract negotiations.

XXI. No Obligation – Owner reserves the sole right to (1) evaluate the responses submitted; (2) waive any irregularities therein; (3) select candidates for the submittal of more detailed or alternate bids (4)

accept any submittal or portion of submittal; (5) reject any or all Respondents submitting responses, should it be deemed in Owner's best interest, or (6) cancel the entire process.

XXII. Bid Bond – Each Bid must be accompanied by a certified or cashier's check, or an approved Bidder's bond in an amount not less than 5% of the maximum total bid, payable to the City of Seguin, Texas without recourse, as a guarantee that the Bidder will enter into a contract and execute performance and payment bonds on the forms provided, within ten (10) days after the award of contract.

XXIII. PLANS AND SPECIFICATIONS

Plans and specifications may be examined without charge at the City of Seguin City Hall at 205 North River, Seguin, Texas 78155. Bid Documents and Construction Drawings for the project may be viewed and downloaded free of charge (with the option to purchase hard copies) at www.civcastusa.com. Bidders must register on this website in order to view and/or download specifications, plans and other related documents for this project. Printed copies of the specifications and drawings may also be viewed at the Engineer's office, TRC Engineers, Inc., 505 East Huntland Drive, Suite 250, Austin, Texas 78752, (512) 454-8716.

Please submit questions for this project 48 hours prior to bid opening through www.civcastusa.com in the Q&A portal. All addenda issued for this project will be posted on www.civcastusa.com. It is the responsibility of the Contractor bidding to proper scaling, paper width and length, etc. Failure to do so may result in error in the Unit Bid Quantities and/or Bid Amounts.

A non-mandatory pre-bid conference will be held on Wednesday, August 30, 2023, at 10:00 AM (CDST) at the Seguin City Hall, 205 North River, Seguin, Texas 78155.

XXIV. SUBMITTAL INSTRUCTIONS

Sealed submittals are required. Submittals shall be delivered to the Office of the City Secretary at the address set forth below or before 3:00 PM local time, Tuesday, September 12, 2023. All submittals must be labeled on the outside with the Respondent's name and the name of the Project. Late submittals will not be considered.

One (1) hard copy

of the responses are to be addressed to:

The City of Seguin

c/o City Secretary

City Hall, 205 North River, Seguin, Texas 78155

END OF SECTION

SECTION 00 21 13

INSTRUCTIONS TO BIDDERS

PART 1 - GENERAL

1.01 SCOPE OF PROJECT

- A. The City of Seguin (OWNER) invites bids for the construction of a Golf Cart Barn, Bid No. TF-2023-44. Principal items of construction will include an 80' x 60' x 14' prefabricated metal building with concrete slab foundation, electrical, mechanical, and plumbing systems, approximately 1,500 SY of asphalt paving, 55 SY of concrete wash rack, a 50' x 12' x 8' prefabricated canopy, miscellaneous site work, and all other necessary appurtenances.

B. METHOD OF BIDDING

- 1. In conjunction with these Instructions to Bidders, OWNER has issued a Request for Bids (RFB) for this Project. OWNER has identified its decision to utilize competitive sealed bids for this procurement in the RFB.
- 2. In addition to the submittal from Offerors in response to the criteria upon which rankings and selection will be based, Offerors are to submit pricing information in accordance with the following instruction:
 - a. Where the bid consists of various major items of work, Offerors should provide prices for each item in the bid. Should Offerors have costs for any incidental work, the costs of such work will be reflected in the unit costs of the bid items in the bid.

1.02 WITHDRAWAL OF BIDS

- A. Offerors may withdraw their bid at any time until the specified closing time for acceptance of bids. After the specified time, no bid may be withdrawn for a period of ninety (90) days or until a contract is awarded, whichever occurs first.

1.03 ACCESS TO AND INSPECTION OF PROJECT SITE

- A. Offerors may arrange for access to the Site by contacting ENGINEER at any time between publication of the RFB and the deadline for receipt of bids. Such access will be granted to allow Offerors to make a complete inspection and careful examination of the project site and familiarize themselves with the soil and water conditions to be encountered, construction to be projected, disposal sites for surplus materials not designated to be salvaged materials, method of providing ingress and egress to private properties, and methods of handling traffic during construction of the entire project.
- B. By submitting a bid, Offeror acknowledges it has inspected the site, has read and become thoroughly familiar with the plans and contract documents (including all addenda).

1.04 BID SECURITY

- A. Each bid must be accompanied by cash, certified check of the Offeror or a bid bond, duly executed by the Offeror as principal and having as surety thereto a surety company approved by the OWNER, in the amount of 5% of the bid. Such cash, checks or bid bonds will be returned to all

except the three highest ranked Offerors within ten days after the opening of bids, and the remaining cash, checks or bid bonds will be returned promptly after the OWNER and the accepted Offeror have executed the Contract, or, if no award has been made within ninety (90) days after the date of the opening of bids, upon demand of the Offeror at any time thereafter, so long as he has not been notified of the acceptance of his bid.

- B. Any cash, check or bid bond is a guarantee that the Offeror will enter into a Contract and execute performance and payment bonds on the forms provided, within ten (10) days after the award of Contract to him/her. Failure to execute these documents within the required time shall be justification for the OWNER to consider this a forfeiture of the security by the Offeror to the OWNER.

1.05 QUALIFICATIONS OF OFFEROR

- A. The OWNER may investigate the Offerors and the information provided in the bid as deemed necessary to determine the ability of the Offeror to perform the Work. The OWNER reserves the right to conduct interviews with the Offerors. Should the OWNER choose to conduct interviews, all qualified Offerors will receive written notice of that decision as well as a time and location for the interviews to occur. Information provided to the OWNER during the interview process will be used to assist in the final rankings.
- B. The OWNER reserves the right to reject any bid if the evidence submitted by, or investigation of, such Offeror fails to satisfy the OWNER that such Offeror is properly qualified to carry out the obligations of the Contract and to complete the work therein.
- C. No bid will be accepted from an Offeror who is engaged on any work which would impair his ability to perform or finance his Work.

1.06 LAWS AND REGULATIONS

- A. The Offeror's attention is directed to the fact that all applicable State laws, municipal ordinances and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the Contract throughout, and they will be deemed to be included in the Contract the same as though written out in full.

1.07 GEOTECHNICAL DATA

- A. The locations of the test holes, if applicable, are shown in the Geotechnical Report. Logs of these test holes are included in the Geotechnical Report. Test holes information represents subsurface characteristics to the extent indicated and only for the point location of the test hole. Each Offeror shall make his/her own interpretation of the character and condition of the materials which will be encountered. Each prospective Offeror may, at his/her own expense, make additional surveys and investigations as he may deem necessary to determine conditions which will affect performance of the Work.

1.08 ADDENDA AND INTERPRETATIONS

- A. No interpretation of the meaning of the plans, specifications or other prebid documents will be made to any Offeror orally. Every request for such interpretation should be in writing addressed to TRC Engineers, Inc., 505 East Huntland Drive, Suite 250, Austin, Texas 78752, and to be given consideration must be received at least fourteen (14) days prior to the date fixed for the opening of bids.

- B. Any and all such interpretations and supplemental instructions will be in the form of written addenda to the specifications which, if issued, all prospective Offerors will be notified, not later than twenty-four hours (24) prior to the date fixed for the opening of bids. Failure of any Offeror to receive any such addendum or interpretation shall not relieve such Offeror from any obligation under his/her bid as submitted. All addenda so issued shall become part of the contract documents.

1.09 EXAMINATION OF SITE OF THE PROJECT

- A. Offerors shall make a careful examination of the site of the project, soil and water conditions to be encountered, improvements to be protected, disposal sites for surplus material not designated to be salvage materials, and as to methods of providing ingress and egress to private properties.

1.10 REPLACEMENT OF MISCELLANEOUS IMPROVEMENTS

- A. The CONTRACTOR shall repair or replace all existing utilities, water and sewer mains, fences, concrete walls, sidewalks, concrete curbs and concrete pavement, signs, culverts, asphalt pavement, building walls and attachments and other miscellaneous improvements damaged by the CONTRACTOR due to his operations on this project, to a condition equal to or better than their condition before construction, at no additional expense to the OWNER. No direct payment will be made for this item.

1.11 CLEAN-UP

- A. The CONTRACTOR shall at all times keep the jobsite as free from all material, debris, and rubbish as is practicable and shall remove same from any portion of the job site when it becomes objectionable in the opinion of the OWNER and ENGINEER.
- B. After construction work is completed and before final acceptance of improvements by OWNER, CONTRACTOR shall remove all debris from site of project, including all existing debris to an approved place of disposal. Temporary structures, forms, equipment, objectionable rocks, concrete and other debris shall be removed in such manner as to leave the site of work in a neat and presentable condition throughout and restore in an acceptable manner all property damaged in the progress of this work.
- C. No direct payment will be made for clean-up.
- D. Materials cleared from project shall not be deposited on adjacent public or private property without written permission of the property owner thereof filed with ENGINEER. Any materials so deposited shall be leveled and left in a condition satisfactory to the OWNER.

1.12 EXCAVATION

- A. Excavation in this Contract shall be unclassified and shall not be included as a separate charge by unit item or scheduled value as all excavation is associated with other work. There is no separate pay item under this Contract for excavation and its cost shall be included in such pay items as are provided in the Contract and bid.

1.13 EXISTING UTILITIES

- A. Existing surface and subsurface structures (gas mains, water mains, sewer mains, storm sewers, telephone cables, sprinkler systems, etc.) are shown on the plans if their location has been determined, but it shall be the responsibility of the CONTRACTOR to avoid damaging these

existing structures regardless of whether they are shown on the plans. The OWNER assumes no responsibility for failure to show any or all of these structures on the plans or to show them in their exact location. It is mutually agreed that such failure to show these structures will not be considered sufficient basis for claims for additional compensation for extra work or for increasing the pay quantities in any manner whatsoever. The CONTRACTOR expressly assumes responsibility for locating, protecting, and constructing the Project without damage to existing underground utilities and structures. If any structure is damaged by the CONTRACTOR, it shall be his responsibility to repair the damage at his own expense and restore the structure to its intended and fully functional use.

- B. CONTRACTOR shall locate and determine (verify if depth is shown on plans) elevation of all existing underground utilities a minimum of 500 feet ahead of trenching. If a utility is found to be in conflict with proposed grades, the ENGINEER shall be contacted and grades adjusted to avoid conflict. CONTRACTOR expressly waives any claims for additional compensation related to measures taken or accommodations and changes made to the Work as a result of such conflict avoidance.
- C. The OWNER will provide liaison with property owners and the limited information it has concerning locations, sizes, materials, etc. of existing utilities or structures, but any delays or investigations required of the CONTRACTOR shall be deemed incidental to the project.
- D. The CONTRACTOR shall call “One Call” and/or any other locating service or hotline to have all underground utilities marked before beginning any excavation or other activity that may conflict with buried structures.

1.14 NOTICES TO OWNERS AND AUTHORITIES WHEN EXCAVATING

- A. Utilities and other concerned agencies shall be notified at least 48 hours prior to excavating near underground utilities or pole lines or in accordance with the utilities, “One Call”, and concerned agencies’ regulations. It shall be the CONTRACTOR’s responsibility to confirm if OWNER’s utilities are on the “One Call” system.

1.15 PRECONSTRUCTION CONFERENCE

- A. After award and execution of a contract between the OWNER and CONTRACTOR, a formal preconstruction conference will be held in prior to commencement of the work. This conference will include review of technical specifications in order to insure clarity as to the type of construction machinery to be used, construction methods to be used, and materials to be used, obligations of both the CONTRACTOR and the Owner’s representative, personnel, safety, issues/requirements, permitting requirements, payment requests, construction scheduling, surveying, progress meetings, control of the project, guaranty/warranty, and the method of inspection and decision-making to be used during this project.

1.16 CONSTRUCTION WORKING HOURS

- A. The CONTRACTOR shall submit to the OWNER and ENGINEER prior to the preconstruction conference a construction schedule which shall meet the OWNER and ENGINEER’s approval before construction can begin.
- B. Generally, the CONTRACTOR shall perform all construction activities between 8:00 a.m. to 5:00 p.m., Monday through Friday only. However, the CONTRACTOR may be allowed to work on Saturdays, Sundays, or Legal Holidays upon the OWNER or ENGINEER’s written approval. CONTRACTOR shall be responsible for paying all costs, fees, etc. related to Owner’s

representative during hours on Saturdays, Sundays, or Legal Holidays and outside 8:00 am to 5:00 p.m. Requests must be received from the CONTRACTOR a minimum of 48 hours in advance of work outside that as stated above.

- C. The CONTRACTOR shall keep the OWNER and the ENGINEER informed as to his construction progress. Because of traffic congestion, the CONTRACTOR may be required to schedule construction in some areas between the hours of 6:00 p.m. and 7:00 a.m. if the OWNER or ENGINEER determines it to be necessary. CONTRACTOR will be required to perform work in a fashion that will cause the least amount of inconvenience to the general public.
- D. The CONTRACTOR may be required to finally complete portions of the project prior to proceeding with other portions. All work scheduling shall be coordinated with OWNER and approved by OWNER before work can proceed. The CONTRACTOR will be required to have someone on call 24 hours per day during the course of the project.
- E. The following requirements shall apply to all construction areas:

- 1. Pavement reconstruction shall be done in half-width road sections unless approved by the ENGINEER.
- 2. Residence's driveways shall be accessible by vehicles at the end of each day (5:00 p.m.).

1.17 COOPERATION AND COORDINATION WITH PUBLIC

- A. The CONTRACTOR shall conduct his work so as to cause the least amount of disruption to the public. Closing of any streets or lanes of traffic will be coordinated with OWNER and TxDOT, if applicable. All citizens along each street will be notified by the CONTRACTOR in advance of construction activities. CONTRACTOR shall submit to the OWNER an acceptable notification media such as door hangers, pamphlets, etc.

1.18 SALVAGE RIGHTS

- A. Old valves, appurtenances of any kind, street paving materials, etc., excavated, removed, or produced during the project by the CONTRACTOR shall be delivered to the OWNER's yard, if desired by the OWNER. If the OWNER desires not to keep these materials, they shall be disposed of properly and according to current laws. CONTRACTOR shall not be entitled to additional compensation for such delivery or disposal.

1.19 DISPOSAL OF EXCAVATED MATERIALS

- A. All excavated materials not used in backfilling will be disposed of by the CONTRACTOR at a site obtained by the CONTRACTOR and approved by the OWNER. Disposal of excavated materials shall be in accordance with all rules and regulations of the Texas Commission on Environmental Quality (TCEQ). Any pieces of material such as broken concrete, asphalt, or pipe measuring twelve (12") inches or larger in any dimension, shall be disposed of by the CONTRACTOR at an approved landfill or as directed by the OWNER. Spoil areas shall be leveled with a motor grader for future mowing. The CONTRACTOR shall include in his bid the cost to dispose of the materials.
- B. All trees, stumps, slashings, brush, or other debris removed from the site prior to construction shall be removed from the property and disposed of in a manner approved by the ENGINEER and OWNER.

1.20 SANITARY FACILITIES

- A. The CONTRACTOR shall provide sufficient chemical toilet facilities for the use of his forces. Adequacy of these facilities will be subject to the approval of the ENGINEER and maintenance of same must be satisfactory to the Engineer at all times. CONTRACTOR shall provide a maintenance schedule to the OWNER for approval.

1.21 STAKING FOR CONSTRUCTION

- A. The CONTRACTOR will provide all construction staking services for the project. The cost of these services will be reflected in the unit price amount in the bid.

1.22 EXCAVATION, TRENCHING, AND SHORING

- A. All excavation, trenching, and shoring shall conform to the U.S. Department of Labor, Occupational Safety, and Health Administration Guidelines (Subpart P - Excavation, Trenching, and Shoring). The CONTRACTOR will be required to submit an excavation, trenching, and shoring plan to the ENGINEER for approval prior to construction. See Section ETS of these specifications.

1.23 BUY AMERICAN

- A. CONTRACTOR agrees to comply with any applicable "Buy American" statutes or regulations in effect at the time for performance of the Project.

1.24 PREVAILING WAGE SCALE

- A. The applicable wage scale determination is contained with these Instructions to Bidders or the specifications for the Project.

1.25 BACKFILL AND PAVEMENT REPAIR

- A. Separate payment **WILL NOT** be made for repair of gravel surfaces crossed or damaged by the CONTRACTOR's work. However, separate payment **WILL** be made for asphaltic (or concrete) pavement repair in the bid and shown on the plans.

1.26 VIDEO OF CONSTRUCTION AREA

- A. The CONTRACTOR shall provide the OWNER with a video (DVD) showing the construction area in detail prior to construction, to include audio to describe locations.

1.27 TESTING

- A. All concrete work shall be tested by cylinder breaks at an approved testing laboratory. Three (3) standard test cylinders shall be taken during each continuous pour. Costs for these cylinder breaks will be borne by the CONTRACTOR.
- B. Density tests will be taken of the CONTRACTOR's finished subgrade, each base course lift, and asphalt at 200' intervals along the length of streets. Costs for the subgrade and base course densities will be per the bid item in the bid. The cost for the asphalt densities will be borne directly by the CONTRACTOR. Densities by a nuclear density gauge will be accepted for asphalt testing. The cost of retesting cause by failure of initial test will be paid by the

CONTRACTOR. Any other materials, testings and batch designs required by these specifications will be paid by the CONTRACTOR.

- C. All testing of materials required under these specifications shall be performed by an approved agency for testing materials. The nomination of the laboratory and the payment for such services shall be made by the CONTRACTOR. The ENGINEER shall approve the laboratory nominated to do the testing of material.

1. Equipment

- a. As conditions permit, the CONTRACTOR shall furnish all materials, labor, and equipment required for preliminary field-testing of any equipment to be furnished.
- b. Upon completion of the work and prior to final acceptance and payment, all equipment to be furnished shall be tested as specified or required to insure compliance with the Plans and Specifications.
- c. Should the equipment tested either for preliminary or final tests not comply with the requirements as set forth on the plans or in the specifications, the CONTRACTOR shall make the necessary changes and adjustments, or replacements as may be required.
- d. All costs for testing of equipment shall be borne by the CONTRACTOR.

2. Concrete

- a. Testing and control of concrete to be used in the work shall be done by a commercial laboratory employed and paid for by the CONTRACTOR.
- b. The CONTRACTOR shall furnish the concrete and concrete materials for such testing at his expense, as provided hereinafter in these specifications.

3. HMAC

- a. Testing and design of hot mix asphaltic concrete (HMAC) shall be performed by an independent laboratory employed and paid for by the CONTRACTOR.
- b. The CONTRACTOR shall furnish all labor and materials necessary for such testing at his expense, as provided in these specifications.
- c. As a minimum, the CONTRACTOR shall perform one (1) sample (three (3) test specimens) for determination of Proctor density and stability and one (1) sample for determination of proportioning of materials. These samples shall be daily during HMAC construction activities.

4. Density

- a. Testing of subgrade, fill, and/or backfill layers shall be performed by an independent geotechnical testing agency employed and paid for by the CONTRACTOR per the item in the bid.
- b. The CONTRACTOR shall furnish all labor and materials necessary for such testing at his expense, as provided in these specifications.

- c. CONTRACTOR shall proceed with subsequent work only after test results for previously completed work comply with requirements.
- d. All failed tests shall be retested by the CONTRACTOR at the CONTRACTOR's expense.

1.28 QUALITY CONTROL

A. General

- 1. CONTRACTOR shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents. The CONTRACTOR is solely responsible for maintaining that the quality of work is in accordance with the Contract Documents. The CONTRACTOR shall be responsible for the notification and scheduling required to ensure that a certified technician from the testing laboratory is present during all sampling and testing procedures required in the Contract Documents. The CONTRACTOR shall not proceed with construction work requiring such testing without the presence of the laboratory's certified technician. The OWNER, at his option, may perform additional tests as quality monitoring. Quality monitoring activities of the OWNER and ENGINEER, or failure on the part of the OWNER or ENGINEER to perform tests on constructed works, in no way relieves the CONTRACTOR of the obligation to perform work and furnish materials conforming to the Contract Documents.

B. CONTRACTOR's Responsibilities

- 1. Control the quality of work produced and verify that the work performed meets the standards of quality established in the Contract Documents.
 - a. Inspect and verify conformance of all materials furnished and work performed, whether by the CONTRACTOR, its subcontractors or its suppliers.
 - b. Provide and pay for the services of a testing laboratory approved by Engineer to insure that products proposed for use fully comply with the Contract Documents.
 - c. Perform tests as indicated in this and other sections of the specifications. Schedule the time and sequence of testing with the OWNER and ENGINEER. Testing is to be observed by the ENGINEER or OWNER.
 - d. Promptly replace any defective materials and/or construction work incorporating defective materials or workmanship.
 - e. Provide Certified Test Reports as required. Reports are to indicate that materials and construction are in compliance with the Contract Documents.
- 2. Assist the OWNER, and OWNER's testing organization to perform quality monitoring activities.

C. Quality Monitoring Activities by Engineer

- 1. Quality Monitoring activities of the OWNER through their own forces or through contracts with materials testing laboratories and survey crews are for the OWNER's use in

monitoring the results of the CONTRACTOR's work and quality control activities, if deemed necessary by the OWNER.

2. The Quality Monitoring activities of the Owner DO NOT relieve the CONTRACTOR of its responsibility to provide testing in accordance with the requirements of the Contract Documents or to provide materials and construction work complying with the Contract Documents.

D. Submittals

1. Submittals shall be in accordance with Section 01 35 00 – SPECIAL INSTRUCTIONS and shall include:
 - a. The name of the proposed primary and secondary testing laboratories along with documentation of qualifications, a list of tests that can be performed, and a list of the certified laboratory technicians and the licensed engineers who will be performing the sampling and testing for the Construction Work along with their certifications and licenses.
 - b. Test reports per Test Reports Paragraph of this supplementary condition.

E. Standards

1. Provide a testing laboratory that complies with the ASTM (American Society of Testing Materials) and/or ACIL (American Council of Independent Laboratories) "Recommended Requirements for Independent Laboratory Qualifications", or other specified testing organizations.
2. Perform tests listed in the specifications.

F. Delivery and Storage

1. Handle and protect test specimens of products and construction materials at the construction site in accordance with ASTM or other applicable testing procedures.

G. Verification Testing

1. Provide verification testing when tests performed by the OWNER indicate that materials or the results of construction activities are not in conformance with Contract Documents.
2. Verification testing is to be provided at the CONTRACTOR's expense to verify products or constructed works are in compliance after corrections have been made.
3. Tests must comply with recognized methods or with methods recommended by the ENGINEER's testing laboratory and approved by the ENGINEER and OWNER.

H. Test Reports

1. Test reports are to be prepared for all tests.
 - a. Tests performed by testing laboratories may be submitted on their standard test report forms. These reports must include the following:

- 1) Name of the OWNER, project title and number, equipment installer and general contractor.
 - 2) Name of the laboratory, address, and telephone number.
 - 3) Name and signature of the certified laboratory personnel performing the sampling and testing.
 - 4) Date and time of sampling, inspection, and testing.
 - 5) Date the report was issued.
 - 6) Description of the test performed.
 - 7) Weather conditions and temperature at time of test or sampling.
 - 8) Location at the site or structure where the test was taken.
 - 9) Standard or test procedure used in making the test.
 - 10) A description of the results of the test.
 - 11) Statement of compliance or non-compliance with Contract Documents.
 - 12) Interpretations of test results, if appropriate.
2. Distribute copies of the test reports to:

	No. of Copies
OWNER	2
ENGINEER	1
CONTRACTOR	1

I. Non-Conforming Work:

1. CONTRACTOR shall promptly correct any work that is not in compliance with the Contract Documents and shall immediately notify the ENGINEER and OWNER when the corrective work will be performed.
2. Payment for non-conforming work shall be withheld until such work is corrected or replaced with work complying with the Contract Documents.

1.29 EXCAVATION

- A. Excavation as such in this contract is not a separate pay item. No classification of excavation material will be made.

1.30 PUMPING, BAILING AND DRAINING

- A. The CONTRACTOR shall immediately remove all surface or seepage water from sewers, drains, ditches, and other sources which may accumulate during the excavation and construction work by providing the necessary underdrains or otherwise and by doing the necessary pumping, bailing

or draining. The CONTRACTOR shall have available at all times sufficient equipment in proper working order for doing the work herein required. All water removed from excavations shall be disposed of in an approved manner so as to not create unsanitary conditions nor to interfere unduly with the use of streets, private driveways, or entrances. Pumping, bailing, draining, underdrains, ditches, etc., shall be considered as incidental work and will not be paid for as separate items, but their cost shall be included in the contract prices in the Bid for the various units of excavation measure.

1.31 BARRICADES AND DANGER SIGNALS

- A. Where the work is carried on, in or adjacent to any street, alley, or public place, the CONTRACTOR shall, at his own cost and expense, furnish and erect barricades and/or fences, lights and/or danger signals, and take any other steps necessary, for the protection of persons or property. Barricades shall be painted with a reflectorized paint or scotchlite tape. From sunset to sunrise, the CONTRACTOR shall furnish and maintain lights at each barricade. Barricades shall be erected to endeavor to keep vehicles from being driven on or into any work under construction.
- B. The CONTRACTOR will be held responsible for all damage to the work due to the failure of barricades, signs, lights, and watchmen to protect it, and whenever evidence is found of such damage, the ENGINEER may order the damaged portion immediately removed and replaced by the CONTRACTOR at his cost and expense. The CONTRACTOR's responsibility for the maintenance of barricades, signs, and lights and for providing watchmen shall not cease until the project has been accepted by the ENGINEER.
- C. The CONTRACTOR shall meet all applicable local, state, and federal regulations for barricades and danger signals.

1.32 SAFETY

- A. CONTRACTOR shall place the highest priority on health and safety and shall maintain a safe working environment during performance of the Work. The site shall be considered to be drug and alcohol free and such policy will be strictly enforced. All employees shall adhere to these policies while on site. CONTRACTOR shall comply, and shall secure compliance by its employees, agents, and lower-tier CONTRACTOR's, with all applicable health, safety, and security laws and regulations including, without limitation, federal, state and local laws and regulations, any health and safety plans issued by the ENGINEER as well as all policies and regulations of the OWNER. Compliance with such requirements shall represent the minimum standard required of CONTRACTOR. CONTRACTOR will be performing Work on the OWNER's property.
- B. CONTRACTOR agrees to furnish protective devices and clothing as required by applicable laws, regulations, health and safety plans and OWNER rules and regulations, and to ensure that such devices or clothing are properly used by its employees, agents, lower-tier Contractors and other invitees of CONTRACTOR at the jobsite. Safety protection is required at all times while working onsite including a hardhat and a high visibility, tear-off reflective vest.

1.33 PROJECT MAINTENANCE

- A. The CONTRACTOR shall maintain and keep in good repair the improvements covered by these plans and specifications during the life of his contract. Existing improvements shall at all times be protected by the CONTRACTOR during the construction of the work as specified herein. All such improvements shall be left in a condition equal to that prior to start of construction.

1.34 PROPERTY LINES AND MONUMENTS

- A. The CONTRACTOR shall protect all property corner markers, and when any such markers or monuments are in danger of being disturbed, they shall be properly referenced and if disturbed, shall be reset at the expense of the CONTRACTOR.

1.35 OFF-SITE STORAGE

- A. Off-site storage for any materials and equipment not incorporated into the Work but included in the Applications for Payment shall not be allowed.

1.36 CONNECTIONS TO EXISTING FACILITIES

- A. Unless otherwise specified or indicated, the CONTRACTOR shall make all necessary connections to existing facilities, including structures, drain lines, and utilities such as water, sewer, gas, telephone and electric. The CONTRACTOR shall give the OWNER or owning utility written notice seven (7) days in advance of making all connections. In each case, the CONTRACTOR shall receive written permission from the OWNER or the owning utility prior to undertaking connections. The CONTRACTOR shall protect facilities against deleterious substances and damage.
- B. Connections to existing facilities which are in service shall be thoroughly planned in advance, and all required equipment, materials, and labor shall be on hand at the time of undertaking the connections. Work shall proceed continuously (around the clock) if necessary to complete connections in the minimum time. Operation of valves or other appurtenances on existing utilities, when required, shall be by or under the direct supervision of the owning utility.

1.37 CONNECTIONS TO EXISTING PIPELINES

- A. All connections to existing piping shall be made using joints and/or fittings suitable for the conditions encountered. The CONTRACTOR shall field-verify the location, pipe material, and connection requirements of all existing pipe before ordering any new piping to be installed under this contract.

1.38 UNFAVORABLE CONSTRUCTION CONDITIONS

- A. During unfavorable weather, wet ground, or other unsuitable conditions, the CONTRACTOR shall confine its operations to work which will not be adversely affected by such conditions. No portion of the Work shall be constructed under conditions which would adversely affect the quality or efficiency thereof, unless special means or precautions are taken by the CONTRACTOR to perform the Work in a proper and satisfactory manner. CONTRACTOR shall ensure all roadways are able to be traversed by vehicular traffic during such times.

1.39 DEWATERING

- A. The CONTRACTOR shall at his own expense remove any water that may be encountered during the course of the work, by pumping, well pointing, or other approved methods. The water shall be stored in a storage tank provided by the CONTRACTOR and disposed of in accordance with all applicable State rules and regulations. Newly placed concrete or grout shall be adequately protected from possible damage resulting from groundwater or from handling and disposal of water.

- B. All surface drainage or natural waterways shall be controlled by dikes or ditches without damage to adjacent property or structures and without interference with the right of either public or private owners.

1.40 EXISTING STRUCTURES/EQUIPMENT

- A. Exact dimensions of existing structures, buildings, equipment roads, utility locations, etc. shown on the plans have not been field verified by the ENGINEER. Prior to submittal preparation by the CONTRACTOR, or construction activities as applicable, all dimensions of these existing items shall be verified by the CONTRACTOR in the field. It shall be the CONTRACTOR's responsibility to field verify all field dimensions.

1.41 PERMITS, CERTIFICATES, LAWS AND ORDINANCES

- A. The CONTRACTOR shall, at his own expense, procure any and all permits, certificates and licenses required of him by law for the execution of his work. The OWNER will furnish permits from the Texas Department of Highways and Public Transportation and railroad companies for crossing their properties with utility extensions if such are required.

1.42 MANUFACTURER'S CERTIFICATES

- A. All manufacturers' certificates required herein are to be furnished by the CONTRACTOR at his own expense.

1.43 DETAIL PLANS

- A. Detail plans for construction are furnished herewith and made a part of these specifications, the same as if they were written herein.

1.44 TREE DAMAGES

- A. The protection of existing trees within the right-of-way and on private property is the essence of the contract. For each tree that any work shall damage or destroy, the amount per tree shall be \$500.00. This will be deducted from the monies due the CONTRACTOR, not as a penalty but as liquidated damages. In addition, the CONTRACTOR shall replace the tree with a caliper-inch to caliper-inch replacement.
- B. This sum of money thus deducted for such failure to protect the trees is not to be considered as a penalty, but it shall be deemed, taken and treated as reasonable liquidated damages, since it would be impractical and extremely difficult to fix the actual damages and the OWNER may withhold from the CONTRACTOR's compensation such sum as liquidated damages.

1.45 MATERIALS

- A. The CONTRACTOR shall furnish all materials for a complete job as shown on the plans and as required by the specifications.

1.46 COPIES OF PLANS AND SPECIFICATIONS

- A. Four (4) sets of the Plans and the Specifications shall be furnished to the CONTRACTOR, without charge, for construction purposes. Additional copies may be obtained from the ENGINEER at actual reproduction cost. One (1) additional set of plans shall be marked and returned to the ENGINEER as "RECORD" drawings.

1.47 MATERIALS AND WORKMANSHIP

- A. The CONTRACTOR shall furnish all materials for a complete job as shown on the plans and as required by the specifications.
- B. No material which has been used by the CONTRACTOR for any temporary purpose whatever is to be incorporated in the permanent structure without written consent of the ENGINEER.
- C. Where materials or equipment are specified by a trade or brand name, it is not the intention of the OWNER to discriminate against an equal product or another manufacturer, but rather to set a definite standard of performance and to establish an equal basis for the evaluation of bids. Where the words "equivalent", "proper", or "equal to" are used, they shall be understood to mean that the article or process is equal, in the opinion or judgment of the ENGINEER, to the article or process specified by name. Unless otherwise specified, all materials shall be the best of their respective kinds and shall be in all cases fully equal to approved samples. Notwithstanding that the words "or equal to" or other such expressions are used in the specifications, the material, manufactured article or process specifically designated shall be used unless a substitute shall be approved in writing by the ENGINEER, and the ENGINEER shall have the right to require the use of such specifically designated material, article or process.
- D. The CONTRACTOR should note that his bid will be based on the material, manufactured article or process specifically designated in the specifications.

1.48 ABBREVIATIONS

- A. Wherever the abbreviations defined herein occur on the plans, in the specifications, contract, bonds, advertisement, bid, or in any other document or instrument herein contemplated or to which the specifications apply or may apply, the intent and meaning shall be as follows:

A.A.S.H.O.	American Association of State Highway Officials	In. or "	Inch or Inches
		Lin.	Linear
A.S.T.M.	American Society for Testing Materials	Lb.	Pound
		M.H.	Manhole
A.W.W.A.	American Water Works Association	Max.	Maximum
Asph.	Asphalt	Min.	Minimum
Ave.	Avenue	Mono.	Monolithic
Blvd.	Boulevard	No.	Number
D.I.	Ductile Iron	%	Percent
C.L.	Centerline	P.S.I.	Pounds per square inch
C.O.	Cleanout	P.V.C.	Polyvinyl Chloride
Conc.	Concrete	Reinf.	Reinforced
Cond.	Conduit	Rem.	Remove
Corr.	Corrugated	Rep.	Replace
Cu.	Cubic	R/W. or ROW	Right-of-Way
Culv.	Culvert	Sani.	Sanitary
Dia.	Diameter	Sq.	Square
Dr.	Drive or Driveway	Std.	Standard
Elev.	Elevation	St.	Street or Storm
F.	Fahrenheit	Str.	Strength
Ft. or '	Foot or Feet	Vol.	Volume
Gal.	Gallon	Yd.	Yard

- B. In reference to such abbreviations as A.S.T.M., A.W.W.A., etc. where a specification number is referred to, the latest revision of said specification shall apply.

1.49 REFERENCE SPECIFICATIONS

- A. Where reference is made in these specifications to specifications compiled by other agencies, organizations, or departments, such reference is made for expediency and standardization from the material suppliers' point of view, and such specifications referred to are hereby made a part of these specifications.
- B. Whenever reference is made to the furnishing of materials or testing thereof to conform to the Standards of any technical society, organization, or body, it shall be construed to mean the latest standard, code, specification, or tentative specification adopted and published at the time of advertisement for bids, even though reference has been made to an earlier standard, and such standards are made a part hereof to the extent which is indicated or intended.
- C. The following are names and abbreviations of such groups:

1.	AASHO	American Association of State Highway Officials
2.	ACI	American Concrete Institute
3.	AGMA	American Gear Manufacturers Association
4.	AIEE	American Institute of Electrical Engineers
5.	AISC	American Institute of Steel Construction
6.	API	American Petroleum Institute
7.	AREMA	American Railway Engineering and Maintenance-of-Way Association
8.	ASCE	American Society of Civil Engineers
9.	ASA	American Standards Association
10.	ASHE	American Society of Heating & Ventilating Engineers
11.	ASTM	American Society for Testing Materials
12.	ASME	American Society of Mechanical Engineers
13.	AWSC	American Welding Society Code
14.	AWPA	American Wood Preservers Association
15.	AWWA	American Water Works Association
16.	FED. SPEC.	Federal Specification
17.	NAVY SPEC.	Navy Department Specification
18.	NEC	National Electric Code

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| 19. | NEMA | National Electrical Manufacturer's Association |
| 20. | SAE | Society of Automotive Engineers Standards |
| 21. | SHBI | Steel Heating Boiler Institute |
| 22. | U.L., INC. | Underwriters' Laboratories, Incorporated |
- D. Where no reference is made to a code, standard, or specification, the Standard Specifications of the ASTM, the ASA, the ASME, the AIEE, or the NEMA shall govern.

1.50 INCIDENTAL ITEMS

- A. CONTRACTORS are especially notified that no incidental items of work will be paid for unless there appears an item in the bid for such work. It must be strictly understood that the prices bid are for complete and acceptable work.

1.51 PUBLIC UTILITIES AND OTHER PROPERTY

- A. In case it is necessary to change or move the property of OWNER or of a public utility, such property shall not be moved or interfered with until ordered to do so by the ENGINEER and OWNER. The right is reserved to the ENGINEER of public utilities to enter upon the limits of the project for the purposed of making such changes or repairs of their property that may be made necessary by performance of this contract.

1.52 USE OF EXPLOSIVES

- A. Use of explosives will not be allowed.

1.53 MANUFACTURED PRODUCTS

- A. All equipment of standard manufacture specified herein shall be the manufacturer's latest and proven design. Specifications and drawings call attention to certain features but do not purport to cover all details entering into the design of the products or systems. The completed product or system shall be compatible with the functions required and the equipment furnished by the CONTRACTOR.

1.54 TOOLS AND ACCESSORIES

- A. The CONTRACTOR shall, unless otherwise stated in the detailed specifications, furnish with each type, kind, or size of equipment, one (1) complete set of suitably marked high grade tools and appliances which may be needed to adjust, operate, maintain, or repair the equipment.
- B. Such tools and appliances shall be furnished in approved painted steel cases, properly labeled and equipped with good grade cylinder locks and duplicate keys.
- C. Spare parts shall be furnished as specified in the specific provisions or contract items.
- D. Each piece of equipment shall be provided with a substantial name plate securely fastened in place and clearly inscribed with the manufacturer's name, year of manufacture, and principal rating data.

1.55 REFERENCE STANDARDS

- A. Reference to standards, specifications, manuals or codes of any technical society, organization, or association, or to the laws or regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard specification, manual code, or laws or regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated. However, no provision of any referenced standard, specification, manual, or code, (whether or not specifically incorporated by reference in the Contract Documents) shall be effective to change the duties and responsibilities of the OWNER, CONTRACTOR, or ENGINEER, or any of their Consultants, agents, or employees from those set forth in the Contract Documents, nor shall it be effective to assign to ENGINEER and OWNER, or any of the their consultants, agents, or employees, any duty or authority to supervise or direct the furnishing or performance of the Work.

1.56 PUBLIC UTILITIES AND OTHER PROPERTY

- A. In case it is necessary to change or move the property of the OWNER or of a public utility, such property shall not be moved or interfered with until authorized by the utility company, OWNER, or ENGINEER.
- B. It will be the CONTRACTOR's responsibility to contact the proper authority, and set up a field meeting to verify by uncovering of the utility and determine the location and elevation of each major utility described above, at least two weeks prior to crossing the utility. If field conditions vary from those shown on the contract plans, the CONTRACTOR shall notify the ENGINEER immediately of field conditions to be encountered, so sufficient time exists to make any necessary adjustments in line or grade. Failure by the CONTRACTOR to make proper and timely verification of the above described utilities shall be justification for rejection of claim for extra cost by the CONTRACTOR.
- C. If, after field verification, it is necessary to change or move the property of a property owner or of a public utility, seven (7) days notice shall be given before such change, and such property shall not be moved or interfered with until authorized by the property owner or the utility company. The right is reserved to the property owner or public utilities to enter upon the limits of the project for the purpose of making such changes or repairs of their property that may be made necessary by the performance of this contract.

1.57 POLLUTION CONTROL

- A. CONTRACTOR shall prevent the release of sanitary wastes, sediment, debris and other substances resulting from construction activities. No sanitary wastes will be permitted to enter any drain or watercourse other than sanitary sewers. No sediment, debris or other substance will be permitted to enter sanitary sewers and reasonable measures will be taken to prevent such materials from entering any drain or watercourse.

1.58 CONTRACTOR'S WARRANTY OF TITLE

- A. CONTRACTOR warrants and guarantees that title to all work, materials, and equipment covered by any Application for Payment, whether incorporated in the project or not, will pass to OWNER at the time of payment free and clear of all liens, claims, security interests, and encumbrances.

1.59 CONSTRUCTION IN PUBLIC ROADS

- A. CONTRACTOR will be responsible for complying with all federal, State, County and City regulations pertaining to construction in public roadway and traffic safety. No public road shall be entirely closed overnight. It shall be the responsibility of the CONTRACTOR to build and maintain all weather bypasses and detours, if necessary, and to properly light, barricade and mark all bypasses and detours that might be required on and across the roads involved in the work included in this contract.
- B. The CONTRACTOR shall make every effort to complete construction and allow immediate access to adjacent property at driveway entrances located along the roads. Owners or tenants of improvements where access and/or entrance drives are located shall be notified at least twenty-four (24) hours prior to the time the construction will be started at their drive-ins or entrances, and the CONTRACTOR shall provide temporary ingress to entrance drives where necessary. The CONTRACTOR shall be responsible for all road and entrance reconstruction and repairs and maintenance for same for a period of one year from the date of acceptance of the project.
- C. In addition to roads and entrances cut by construction excavation, if any other roads or streets in the area are used by the CONTRACTOR or Subcontractors during the progress of construction and are damaged by the CONTRACTOR in the opinion of the Engineer, the Contractor, when directed by the OWNER, shall immediately repair such damage. In the event the repairs and maintenance are not made in a reasonable period of time and it becomes necessary for the County, City, OWNER or ENGINEER to make such repairs, the CONTRACTOR shall reimburse the County, City, OWNER or ENGINEER for the cost of such repairs.
- D. The CONTRACTOR shall, at all times, keep a sufficient width of the roadway clear of dirt and other materials to allow the free flow of traffic on the project site. The CONTRACTOR shall assume any and all responsibility for damage, personal or otherwise, that may be caused by the construction along roads or private drives.

1.60 PRELIMINARY FIELD TESTS

- A. As soon as conditions permit, the CONTRACTOR shall furnish all labor, materials, and instruments and shall make preliminary field tests of equipment. If the preliminary field tests disclose any equipment furnished under this contract which does not comply with the requirements of the contract documents, the CONTRACTOR shall, prior to the acceptance tests, make all changes, adjustments, and replacements required.
- B. Equipment which is subject to a "start-up" will be paid at ninety-five percent (95%) of the schedule of values amount, less retainage, when construction of the equipment is complete. The remaining five percent (5%) will be paid when the equipment is placed in service. Retainage will be released as per the Final Payment terms.

1.61 FINAL FIELD TESTS

- A. Upon completion of the work and prior to final payment, all items installed under this contract shall be subjected to acceptance tests as specified or required to comply with the contract documents.
- B. The CONTRACTOR shall furnish labor, fuel, energy, water, and all other materials, equipment and instruments necessary for all acceptance tests, at no additional cost to the OWNER.

1.62 FENCES, IMPROVEMENTS, AND DRAINAGE CHANNELS

- A. Fences or other improvements removed to permit construction shall be replaced in the same location and left in a condition as good as, or better, than that in which they were found. There shall be no separate pay item for fences removed or damaged beyond the limits shown in the plans.
- B. Temporary fencing for maintenance of site security shall be provided by the CONTRACTOR at his expense. Temporary fencing, with gates, to restrain livestock shall be provided through areas where livestock are pastured, unless the CONTRACTOR makes satisfactory arrangements with the landowner and/or tenant. The temporary fence shall be installed on the easement lines and shall be removed after the trench has been backfilled.
- C. Where surface drainage channels or drainage structures are disturbed or altered during construction, they shall be restored to their original condition of grade and cross section as soon as possible.
- D. Temporary channels required to provide adequate drainage during construction shall be provided and maintained by the CONTRACTOR. No separate payment shall be allowed.

1.63 DUST CONTROL

- A. CONTRACTOR shall take responsible measures to prevent unnecessary dust. Earth surfaces subject to dusting shall be kept moist with water or by application of a chemical dust suppressant. Dusty materials in piles or in transit shall be covered when practical to prevent blowing. Dust control shall be provided on all days within the contract period regardless of work taking place or not. CONTRACTOR shall allow at least four times per day as required. No separate pay shall be provided.
- B. Buildings or operating facilities which may be affected adversely by dust shall be adequately protected from dust. Existing or new machinery, motors, instrument panels or similar equipment, shall be protected by suitable dust screens. Proper ventilation shall be included with dust screens.

1.64 ENVIRONMENTAL PROTECTION REQUIREMENTS

- A. The CONTRACTOR shall provide and maintain, during the life of the contract, environmental protection as defined herein:
 1. Plan for and provide environmental protective measures to control pollution that develops during normal construction practice.
 2. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project.
 3. Comply with Federal, State, and local regulations pertaining to the environment, including water, air, solid waste, hazardous waste and substances, oily substances, and noise pollution. Obtain all construction and disposal permits as required.

1.65 ENVIRONMENTAL PROTECTION PLAN

- A. All of the CONTRACTOR's employees shall be trained on the site Environmental Protection Plan requirements. The CONTRACTOR shall meet all requirements of the OWNER's Environmental Protection Plan described herein.
 - 1. Land Resources: Except in areas to be cleared, DO NOT remove, cut, deface, injure, or destroy trees or shrubs without the OWNER's permission. DO NOT fasten or attach ropes, cables, or guys to existing nearby trees for anchorages unless authorized by the OWNER. Where such use of attached ropes, cables, or guys is authorized, the CONTRACTOR shall be responsible for any resultant damage.
 - 2. Replacement: Trees and other landscape features scarred or damaged by equipment operations, and replace with equivalent, undamaged trees and landscape features. Obtain OWNER approval before replacement.
 - 3. Oily and Hazardous Substances: Prevent oil or hazardous substances from entering the ground, drainage areas, or navigable waters. In accordance with 40 CFR §112, surround all temporary fuel oil or petroleum storage tanks with a temporary berm or containment of sufficient size and strength to contain the contents of the tanks, plus ten percent (10%) freeboard for precipitation. The berm shall be impervious to oil for seventy-two (72) hours and be constructed so that any discharge will not permeate, drain, infiltrate, or otherwise escape before cleanup occurs.
 - 4. Storm Water Drainage: There shall be no discharge of excavation groundwater to the sanitary sewer, storm drains, or to drainage ditches without prior specific authorization by required regulatory agencies and OWNER in writing. Discharge of hazardous substances will not be permitted under any circumstances. Construction site runoff shall be prevented from entering any storm drain or the drainage ditch directly by the use of straw bales or other method suitable to the ENGINEER. CONTRACTOR shall provide erosion protection of the surrounding soils. CONTRACTOR shall be responsible for payment and receipt of a stormwater permit if necessary. CONTRACTOR shall maintain stormwater controls of said permit per state, local agencies or ENGINEER and OWNER.
 - 5. Fish and Wildlife Resources: DO NOT disturb fish and wildlife. DO NOT alter water flows or otherwise significantly disturb the native habitat adjacent to the project and critical to the survival of fish and wildlife, except as indicated or specified.
 - 6. Burn-off: Burn-off of the ground cover is not permitted.
 - 7. Protection of Erodible Soils: Immediately finish the earthwork brought to a final grade, as indicated or specified. Immediately protect the side slopes and back slopes upon completion of rough grading. Plan and conduct earthwork to minimize the duration of exposure of unprotected soils.
 - 8. Temporary Protection of Erodible Soils: Use the following methods to prevent erosion and control sedimentation:
 - a. Mechanical Retardation and Control of Runoff: Mechanically retard and control the rate of runoff from the construction site. This includes construction of diversion ditches, benches, berms, and use of silt fences and straw bales to retard and divert runoff to protected drainage courses.

- b. Vegetation and Mulch: Provide temporary protection on sides and back slopes as soon as rough grading is completed or sufficient soil is exposed to require erosion protection. Protect slopes by accelerated growth of permanent vegetation, temporary vegetation, mulching, or netting. Stabilize slopes by hydro-seeding, anchoring mulch in place, covering with anchored netting, sodding, or such combination of these and other methods necessary for effective erosion control.
 - c. Provide new seeding where ground is disturbed. Include topsoil or nutrients during the seeding operation necessary to establish a suitable stand of grass.
- 9. Control and Disposal of Solid Wastes: Prevent contamination of the site or other areas when handling and disposing of wastes. At project completion, leave the areas clean. Remove all solid waste (including non-hazardous debris) from the property and dispose off-site at an approved landfill. Solid waste disposal off-site must comply with most stringent local, State, and Federal requirements including 40 CFR §241, 40 CFR §243, and 40 CFR §258.
- 10. Dust Control: Keep dust down at all times, including during nonworking periods. Sprinkle or treat, with dust suppressants, the soil at the site, haul roads, and other areas disturbed by operations. Dry power brooming will not be permitted. Instead, use vacuuming, wet mopping, wet sweeping, or wet power brooming. Air blowing will not be permitted.
- 11. Noise: Make the maximum use of low-noise emission products, as certified by the EPA. Confine soil placement operations to the period between 7 A.M. and 5 P.M., Monday through Friday, exclusive of holidays, unless otherwise specified.
- 12. Spill Control: In the event of a spill or release of a hazardous substance (as designated in 40 CFR §302), pollutant, contaminant, or oil (as governed by the Oil Pollution Act (OPA), 33 U.S.C. 2701 et seq.), the CONTRACTOR shall notify the OWNER immediately. Immediate containment actions shall be taken to minimize the effect of any spill or leak. Cleanup shall be in accordance with applicable federal, state, and local regulations. As directed by the OWNER, additional sampling and testing shall be performed to verify spills have been cleaned up. Spill cleanup and testing shall be done at no additional cost to the OWNER.
- 13. Spill Response Materials:
 - a. The CONTRACTOR shall provide appropriate spill response materials including, but not limited to the following: containers, adsorbents, shovels, and personal protective equipment. Spill response materials shall be available at all times when contaminated materials/wastes are being handled or transported. Spill response materials shall be compatible with the type of materials and contaminants being handled.
 - b. Within five days after the award of contract, the CONTRACTOR shall meet with the OWNER to discuss the project and verify a mutual understanding relative to the details of environmental protection, including measures for protecting natural resources, required reports, and other measures to be taken.
 - c. The ENGINEER must receive from the CONTRACTOR a letter signed by an officer of the firm appointing a project Environmental Manager and stating that he/she is responsible for managing and implementing the Environmental Program as described in this contract. The Environmental Manager must have authority to direct

the removal and replacement of non-conforming work, and the letter shall include a statement of this authority.

1.66 ISRAEL LAW

- A. A government entity may not enter into a contract with a Company for goods or services unless the contract contains a written verification from the Company that it:
1. Does not boycott Israel; and
 2. Will not boycott Israel during the term of the contract.

END OF SECTION

SECTION 00 41 00
BID FORM
CITY OF SEGUIN, TEXAS
GOLF CART BARN

DATE: _____

Gentlemen:

Having carefully examined the Instructions to Bidders, the General Conditions of the Contract, and Detailed Plans and Specifications, the undersigned Bidder hereby proposes to do all the work and furnish all necessary superintendence, labor, machinery, equipment, tools and materials, and to complete all the work this refers to, for the construction of all items listed at the prices shown for each item on the following bid schedule.

The bid schedule attached lists the various divisions of construction contemplated in the Plans and Specifications. Bid prices must be shown in Words and Figures for each item listed in the Bid, and in the event of a discrepancy, the words shall control.

Receipt is hereby acknowledged of the following addenda to the Contract Documents:

Addendum No. 1 dated _____ Received _____

Addendum No. 2 dated _____ Received _____

Addendum No. 3 dated _____ Received _____

All the various phases of work enumerated in the detailed specifications with their individual jobs and overhead, whether specifically mentioned, included by implication or appurtenant thereto, are to be performed by the Contractor under one of the items listed in the bid schedule, irrespective of whether it is named in said list.

Bidder agrees to perform all of the work listed in the bid and as described in the specifications and shown on the plans, for the following unit prices:

**CITY OF SEGUIN
GOLF CART BARN
BASE BID**

ITEM NO.	NO. OF UNITS	UNIT	ITEM AND UNIT PRICE (FILL IN BOTH SCRIPT AND FIGURES)	TOTAL AMOUNT
P.1.	1	L.S.	<p>For furnishing the required Performance and Payment Bonds for the project, as described in these specifications, for the sum of:</p> <hr/> <p style="text-align: right;">Dollars _____</p> <hr/> <p style="text-align: right;">Cents _____</p> <p style="text-align: right;">(\$ _____) per lump sum</p>	\$ _____
P.2.	1	L.S.	<p>For furnishing the required Stormwater Pollution Prevention Plan and maintaining the plan requirements for the project, complete in place, for the sum of:</p> <hr/> <p style="text-align: right;">Dollars _____</p> <hr/> <p style="text-align: right;">Cents _____</p> <p style="text-align: right;">(\$ _____) per lump sum</p>	\$ _____
P.3.	4,665	S.Y.	<p>For furnishing and installing seeding (hydro-mulching) Bermuda grass, for erosion control, as detailed and directed, at locations shown on the Plans and all disturbed areas, complete in place, for the sum of:</p> <hr/> <p style="text-align: right;">Dollars _____</p> <hr/> <p style="text-align: right;">Cents _____</p> <p style="text-align: right;">(\$ _____) per square yard</p>	\$ _____

**CITY OF SEGUIN
GOLF CART BARN
BASE BID**

ITEM NO.	NO. OF UNITS	UNIT	ITEM AND UNIT PRICE (FILL IN BOTH SCRIPT AND FIGURES)	TOTAL AMOUNT
P.4.	4	EA.	<p>For furnishing all material, labor, and equipment to install and maintain tree protection at location shown on the plans, complete in place, for the sum of:</p> <hr/> <p style="text-align: right;">_____ Dollars</p> <p style="text-align: right;">_____ Cents</p> <p style="text-align: right;">(\$) per each</p>	\$_____
P.5.	1	L.S.	<p>For furnishing the required Proposed Golf Cart Barn Metal Building for the project, including but not limited to mechanical, electrical, and plumbing systems for both the building and the site, concrete slab foundation, subgrade excavation, fill, and preparation, offsite disposal of excavated material, and miscellaneous appurtenances, to include all construction not specifically described in other bid items, ready for use by the Owner, for the sum of:</p> <hr/> <p style="text-align: right;">_____ Dollars</p> <p style="text-align: right;">_____ Cents</p> <p style="text-align: right;">(\$) per lump sum</p>	\$_____
P.6.	1	L.S.	<p>For furnishing the required 1000-gallon Oil-Water Separator (OWS) for the project, complete in place, for the sum of:</p> <hr/> <p style="text-align: right;">_____ Dollars</p> <p style="text-align: right;">_____ Cents</p> <p style="text-align: right;">(\$) per lump sum</p>	\$_____

**CITY OF SEGUIN
GOLF CART BARN
BASE BID**

ITEM NO.	NO. OF UNITS	UNIT	ITEM AND UNIT PRICE (FILL IN BOTH SCRIPT AND FIGURES)	TOTAL AMOUNT
P.7.	1	L.S.	<p>For furnishing the required reinforced concrete Wash Rack for the project, including inlet and subgrade, complete in place, for the sum of:</p> <hr/> <hr/> <hr/> <p style="text-align: right;">Dollars</p> <hr/> <p style="text-align: right;">Cents</p> <p style="text-align: right;">(\$) per lump sum</p>	\$ _____
P.8.	1	L.S.	<p>For furnishing the required Wash Rack Canopy for the project, complete in place, for the sum of:</p> <hr/> <hr/> <hr/> <p style="text-align: right;">Dollars</p> <hr/> <p style="text-align: right;">Cents</p> <p style="text-align: right;">(\$) per lump sum</p>	\$ _____
P.9.	1	EA.	<p>For furnishing the required 2" Reduced Pressure Zone Backflow Preventer for the project, complete in place, for the sum of:</p> <hr/> <hr/> <hr/> <p style="text-align: right;">Dollars</p> <hr/> <p style="text-align: right;">Cents</p> <p style="text-align: right;">(\$) per each</p>	\$ _____
P.10.	1	EA.	<p>For furnishing and installing all materials and equipment to construct 4" diameter standard manholes, including Raven coating, at locations shown as shown on the Plans, complete in place, for the sum of:</p> <hr/> <hr/> <hr/> <p style="text-align: right;">Dollars</p> <hr/> <p style="text-align: right;">Cents</p> <p style="text-align: right;">(\$) per each</p>	\$ _____

**CITY OF SEGUIN
GOLF CART BARN
BASE BID**

ITEM NO.	NO. OF UNITS	UNIT	ITEM AND UNIT PRICE (FILL IN BOTH SCRIPT AND FIGURES)	TOTAL AMOUNT
P.11.	1	L.S.	<p>For furnishing and installing OSHA required trench excavation protection on all waterlines, complete in place, for the sum of</p> <hr/> <p style="text-align: right;">_____ Dollars</p> <p style="text-align: right;">_____ Cents</p> <p style="text-align: right;">(\$) per lump sum</p>	\$ _____
P.12.	160	L.F.	<p>For furnishing all labor, materials, and equipment for the inductive water tracer detection wire for the water mains, complete in place, for the sum of:</p> <hr/> <p style="text-align: right;">_____ Dollars</p> <p style="text-align: right;">_____ Cents</p> <p style="text-align: right;">(\$) per linear foot</p>	\$ _____
P.13.	24	EA.	<p>For furnishing all labor and material for Density Tests for Contractor's finished subgrade, each base course lift and asphalt. (Retesting of failed tests shall be paid for by Contractor), complete in place, for the sum of:</p> <hr/> <p style="text-align: right;">_____ Dollars</p> <p style="text-align: right;">_____ Cents</p> <p style="text-align: right;">(\$) per each</p>	\$ _____

**CITY OF SEGUIN
GOLF CART BARN
BASE BID**

ITEM NO.	NO. OF UNITS	UNIT	ITEM AND UNIT PRICE (FILL IN BOTH SCRIPT AND FIGURES)	TOTAL AMOUNT
P.14.	1,548	S.Y.	<p>For excavation and subgrade preparation for asphalt paving, including offsite material disposal, complete in place, for the sum of:</p> <hr/> <hr style="margin-top: 10px;"/> <p style="text-align: right;">Dollars</p> <hr/> <p style="text-align: right;">Cents</p> <p style="text-align: right;">(\$) per square yard</p>	\$ _____
P.15.	1,548	S.Y.	<p>For installing geogrid TenSAR TX-5 TRIAX or approved equivalent for asphalt paving, complete in place, for the sum of:</p> <hr/> <hr style="margin-top: 10px;"/> <p style="text-align: right;">Dollars</p> <hr/> <p style="text-align: right;">Cents</p> <p style="text-align: right;">(\$) per square yard</p>	\$ _____
P.16.	1,488	S.Y.	<p>For installing 2" type D hot-mix asphalt, including prime coat (and tack coat if necessary), complete in place, for the sum of:</p> <hr/> <hr style="margin-top: 10px;"/> <p style="text-align: right;">Dollars</p> <hr/> <p style="text-align: right;">Cents</p> <p style="text-align: right;">(\$) per square yard</p>	\$ _____
P.17.	1,548	S.Y.	<p>For installing 8" moisture conditioned/compacted subgrade for asphalt paving, complete in place, for the sum of:</p> <hr/> <hr style="margin-top: 10px;"/> <p style="text-align: right;">Dollars</p> <hr/> <p style="text-align: right;">Cents</p> <p style="text-align: right;">(\$) per square yard</p>	\$ _____

**CITY OF SEGUIN
GOLF CART BARN
BASE BID**

ITEM NO.	NO. OF UNITS	UNIT	ITEM AND UNIT PRICE (FILL IN BOTH SCRIPT AND FIGURES)	TOTAL AMOUNT
P.18.	1,548	S.Y.	<p>For installing 12" (crushed stone) flex base for asphalt paving, complete in place, for the sum of:</p> <hr/> <hr style="margin-top: 10px;"/> <p style="text-align: right;">Dollars _____</p> <p style="text-align: right;">Cents _____</p> <p style="text-align: right;">(\$ _____) per square yard</p>	\$ _____
P.19.	1	L.S.	<p>For demolition and offsite disposal of existing cart barn and existing asphalt, including but not limited to mechanical, electrical, and plumbing systems, concrete slab foundation, asphalt base material, and miscellaneous appurtenances, including compacted fill of void areas, releveling, and regrading, complete in place, for the sum of:</p> <hr/> <hr style="margin-top: 10px;"/> <p style="text-align: right;">Dollars _____</p> <p style="text-align: right;">Cents _____</p> <p style="text-align: right;">(\$ _____) per lump sum</p>	\$ _____
P.20.	1,569	S.Y.	<p>For asphalt removal at proposed cart barn site & offsite disposal, at locations shown on the Plans, including base material, complete in place, for the sum of:</p> <hr/> <hr style="margin-top: 10px;"/> <p style="text-align: right;">Dollars _____</p> <p style="text-align: right;">Cents _____</p> <p style="text-align: right;">(\$ _____) per square yard</p>	\$ _____

**CITY OF SEGUIN
GOLF CART BARN
BASE BID**

ITEM NO.	NO. OF UNITS	UNIT	ITEM AND UNIT PRICE (FILL IN BOTH SCRIPT AND FIGURES)	TOTAL AMOUNT
P.21.	2	EA.	<p>For tree removal & offsite disposal, at locations shown on the Plans, complete in place, for the sum of:</p> <hr/> <hr/> <hr/> <p style="text-align: right;">Dollars</p> <p style="text-align: right;">Cents</p> <p style="text-align: right;">(\$) per each</p>	\$ _____
TOTAL BASE BID PROPOSAL: (SUMMATION OF ITEMS P.1. THROUGH P.21.)				\$ _____
<hr/> <hr/> <hr/> <p style="text-align: right;">Dollars</p> <p style="text-align: right;">Cents</p>				\$ _____

The above prices shall include all labor, materials, overhead, profit, insurance, etc. to cover the finished work of the several kinds called for.

The work proposed to be done shall be accepted when fully completed and finished in accordance with the plans and specifications to the satisfaction of the Engineer.

The undersigned Bidder hereby declares that he has visited the site of the work and has carefully examined the contract documents pertaining to the work covered in the above bid, and that the bid prices contained in the bid form have been carefully checked and are submitted as correct and final.

The Contractor agrees to complete the project on which he has bid, as specified and shown on the plans, within **180** consecutive calendar days as provided in the General Conditions of the Agreement.

EXPERIENCE RECORD

The Contractor shall list in the spaces provided below, similar projects of equal or greater dollar amount that have been installed and are in operation within the past five (5) years. Separate sheets may be attached.

No.	Location	Description (Size, Type, Length)	Contact Person Phone Number	Date of Installation
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

STATEMENT OF BIDDER'S QUALIFICATIONS

All questions must be answered and the data given must be clear and comprehensive. This statement must be notarized. If necessary, questions may be answered on separate attached sheets. The Bidder may submit any additional information he desires.

Name of Bidder: _____ Date Organized: _____

Address: _____ Date Incorporated: _____

Federal ID Number: _____

Number of years in contracting business under present name: _____

List Names of Owners, Partners, or shareholders:

Contracts on hand:

<u>Contract</u>	<u>Amount</u>	<u>Anticipated Completion Date</u>
-----------------	---------------	--

Type of work performed by your company: _____

Have you ever failed to complete any work awarded to you?

Have you ever defaulted on a contract?

List the more important projects recently completed by your firm (be sure to include project of similar importance):

Major equipment available for this contract:

Credit Available: \$ _____

Bank reference and bank officer: _____

The undersigned hereby authorizes and requests any person, firm, or corporation to furnish any information requested by the _____ in verification of the recitals comprising this Statement of Bidder's Qualifications.

Executed this _____ day of _____, 2023

By: _____

Title: _____

Email Address:

The Owner reserves the right to delete any bid items or portions thereof. If the Owner elects to delete any portions of the PROJECT from the contract, then the contract can be awarded on that basis.

The undersigned Bidder hereby declares that he has visited the site of the work and has carefully examined the Contract Documents pertaining to the work covered by the above bid. Upon issuance of notice to proceed, a mutually agreed upon start date will be determined.

Enclosed with this bid is a Certified Check for:

_____ Dollars (\$ _____)
or a Bid Bond in the sum of:

5% of Bid Amount _____ Dollars (\$ 5% of Bid Amount)

which it is agreed shall be collected and retained by the Owner as liquidated damages in the event this bid is accepted by the Owner within ninety (90) days after bids are received and the undersigned fails to execute the contract and the required bond for the Owner within fifteen (15) days after the date said bid is accepted, otherwise said check or bond shall be returned to the undersigned upon request.

Texas Government Code, Sections 2252.908 requires a business entity to submit a disclosure of interested parties to the governmental entity at the time the business entity submits the signed contract to the governmental entity following the guidelines prescribed by the Texas Ethics Commission at www.ethics.state.tx.us. The law applies to contracts that require an action or vote by the governing body of the governmental entity before the contract is signed. The Form 1295 is included herein for informational purposes. The completed Form 1295 must be submitted electronically by the business entity to the state. The original of the certified Form 1295 including the certification number generated by the state must be provided before a contract can be executed.

(Contractor)

By: _____
Printed Name

Signature

Title: _____

Date: _____

Address: _____

City _____ State _____ Zip _____

Telephone Number: _____

Fax Number: _____

Email Address: _____

**STATEMENT OF STATUTORY COMPLIANCE
SB 13, 19, 89 & 2116 VERIFICATION FORM**

Pursuant to Senate Bill 13 of the 87th regular Texas Legislature session:

Verification Regarding Boycotting Energy Companies – Pursuant to Chapter 2274, Texas Government Code, Contractor verifies (1) it does not boycott energy companies, and (2) it will not boycott energy companies during the term of this Agreement. Contractor acknowledges this Agreement may be terminated and payment withheld if this verification is inaccurate. (Note: This provision only applies in a contract that (1) has a value of \$100,000 or more that is to be paid wholly or partly from public funds and (2) is with a for-profit entity, not including a sole proprietorship, that has ten (10) or more full-time employees.)

Pursuant to Senate Bill 19 of the 87th regular Texas Legislature session:

Discrimination Against Firearm Entities – In accordance with Texas Government Code Chapter 2274, Contractor verifies that it does not have a practice, policy, guidance or directive that discriminates against a firearm entity or firearm trade association; and will not discriminate during the term of the contract against a firearm entity or firearm trade association. This section only applies if: (i) Contractor has ten (10) or more full-time employees and (ii) this Agreement has a value of \$100,000 or more to be paid under the terms of this Agreement; and does not apply: (i) if Contractor is a sole proprietor, a non-profit entity, or a governmental entity; (ii) to a contract with a sole-source provider; or (iii) to a contract for which none of the bids from a company were able to provide the required certification.

Pursuant to Senate Bill 2116 of the 87th regular Texas Legislature session:

Section 2274.0102, prohibits a governmental entity from entering into a contract or other agreement relating to “critical infrastructure” (defined to mean a communication infrastructure system, cybersecurity system, electric grid, hazardous waste treatment system, or water treatment facility) in this state with a company if the city knows that the company is: (1) owned by or the majority of stock or other ownership interest of the company is held or controlled by: (a) individuals who are citizens of China, Iran, North Korea, Russia, or other designated countries; or (b) a company or other entity, including a governmental entity, that is owned or controlled by citizens of or is directly controlled by the government of China, Iran, North Korea, Russia, or other designated countries; or (2) headquartered in China, Iran, North Korea, Russia, or other designated countries.

Pursuant to Section 2270.001, 2270.002, 808.001, Texas Government Code:

1. “Boycott Israel” means refusing to deal with, terminating business activities with, or otherwise taking any action that is intended to penalize, inflict economic harm on, or limit commercial relations specifically with Israel, or with a person or entity doing business in Israel or in an Israeli-controlled territory, but does not include an action made for ordinary business purposes; and
2. “Company” has the meaning assigned by Section 808.001, except that the term does not include a sole proprietorship.

I, _____ (*person name*), the undersigned representative of (*company or business name*) _____ (*hereinafter referred to as Company*) being an adult over the age of eighteen (18) years of age, do hereby depose and verify under oath that the company named-above, under the provisions of Subtitle F, Title 10, Government Code Chapter 2270; depose and verify under oath that the Company, under the provisions of Subtitle A, Title 8, Government Code, is amended by adding Chapter 809; do hereby depose and verify under oath that the Company, under the provisions of Subtitle F, Title 10, Government Code, is amended by adding Chapter 2274 will not discriminate and/or boycott any of these provisions outlined and defined in House Bills 13, 19 and 89.

SIGNATURE OF COMPANY REPRESENTATIVE

DATE

On this the _____ day of _____, 2023, personally appeared _____, the above-named person, who after by me being duly sworn, did swear and confirm that the above is true and correct.

NOTARY SEAL

NOTARY SIGNATURE

DATE

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CONFLICT OF INTEREST QUESTIONNAIRE

For vendor doing business with local governmental entity

FORM CIQ

This questionnaire reflects changes made to the law by H.B. 23, 84th Leg., Regular Session.

This questionnaire is being filed in accordance with Chapter 176, Local Government Code, by a vendor who has a business relationship as defined by Section 176.001(1-a) with a local governmental entity and the vendor meets requirements under Section 176.006(a).

By law this questionnaire must be filed with the records administrator of the local governmental entity not later than the 7th business day after the date the vendor becomes aware of facts that require the statement to be filed. See Section 176.006(a-1), Local Government Code.

A vendor commits an offense if the vendor knowingly violates Section 176.006, Local Government Code. An offense under this section is a misdemeanor.

OFFICE USE ONLY

Date Received

1 Name of vendor who has a business relationship with local governmental entity.

2 Check this box if you are filing an update to a previously filed questionnaire. (The law requires that you file an updated completed questionnaire with the appropriate filing authority not later than the 7th business day after the date on which you became aware that the originally filed questionnaire was incomplete or inaccurate.)

3 Name of local government officer about whom the information is being disclosed.

Name of Officer

4 Describe each employment or other business relationship with the local government officer, or a family member of the officer, as described by Section 176.003(a)(2)(A). Also describe any family relationship with the local government officer. Complete subparts A and B for each employment or business relationship described. Attach additional pages to this Form CIQ as necessary.

A. Is the local government officer or a family member of the officer receiving or likely to receive taxable income, other than investment income, from the vendor?

Yes No

B. Is the vendor receiving or likely to receive taxable income, other than investment income, from or at the direction of the local government officer or a family member of the officer AND the taxable income is not received from the local governmental entity?

Yes No

5 Describe each employment or business relationship that the vendor named in Section 1 maintains with a corporation or other business entity with respect to which the local government officer serves as an officer or director, or holds an ownership interest of one percent or more.

6 Check this box if the vendor has given the local government officer or a family member of the officer one or more gifts as described in Section 176.003(a)(2)(B), excluding gifts described in Section 176.003(a-1).

7

Signature of vendor doing business with the governmental entity

Date

CONFLICT OF INTEREST QUESTIONNAIRE

For vendor doing business with local governmental entity

A complete copy of Chapter 176 of the Local Government Code may be found at <http://www.statutes.legis.state.tx.us/Docs/LG/htm/LG.176.htm>. For easy reference, below are some of the sections cited on this form.

Local Government Code § 176.001(1-a): "Business relationship" means a connection between two or more parties based on commercial activity of one of the parties. The term does not include a connection based on:

- (A) a transaction that is subject to rate or fee regulation by a federal, state, or local governmental entity or an agency of a federal, state, or local governmental entity;
- (B) a transaction conducted at a price and subject to terms available to the public; or
- (C) a purchase or lease of goods or services from a person that is chartered by a state or federal agency and that is subject to regular examination by, and reporting to, that agency.

Local Government Code § 176.003(a)(2)(A) and (B):

- (a) A local government officer shall file a conflicts disclosure statement with respect to a vendor if:

- (2) the vendor:
 - (A) has an employment or other business relationship with the local government officer or a family member of the officer that results in the officer or family member receiving taxable income, other than investment income, that exceeds \$2,500 during the 12-month period preceding the date that the officer becomes aware that
 - (i) a contract between the local governmental entity and vendor has been executed; or
 - (ii) the local governmental entity is considering entering into a contract with the vendor;
 - (B) has given to the local government officer or a family member of the officer one or more gifts that have an aggregate value of more than \$100 in the 12-month period preceding the date the officer becomes aware that:
 - (i) a contract between the local governmental entity and vendor has been executed; or
 - (ii) the local governmental entity is considering entering into a contract with the vendor.

Local Government Code § 176.006(a) and (a-1)

- (a) A vendor shall file a completed conflict of interest questionnaire if the vendor has a business relationship with a local governmental entity and:

- (1) has an employment or other business relationship with a local government officer of that local governmental entity, or a family member of the officer, described by Section 176.003(a)(2)(A);
- (2) has given a local government officer of that local governmental entity, or a family member of the officer, one or more gifts with the aggregate value specified by Section 176.003(a)(2)(B), excluding any gift described by Section 176.003(a-1); or
- (3) has a family relationship with a local government officer of that local governmental entity.

- (a-1) The completed conflict of interest questionnaire must be filed with the appropriate records administrator not later than the seventh business day after the later of:

- (1) the date that the vendor:
 - (A) begins discussions or negotiations to enter into a contract with the local governmental entity; or
 - (B) submits to the local governmental entity an application, response to a request for proposals or bids, correspondence, or another writing related to a potential contract with the local governmental entity; or
- (2) the date the vendor becomes aware:
 - (A) of an employment or other business relationship with a local government officer, or a family member of the officer, described by Subsection (a);
 - (B) that the vendor has given one or more gifts described by Subsection (a); or
 - (C) of a family relationship with a local government officer.

PREVAILING WAGE SCALE

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Superseded General Decision Number: TX20220007

State: Texas

Construction Types: Heavy and Highway

Counties: Atascosa, Bandera, Bastrop, Bell, Bexar, Brazos, Burleson, Caldwell, Comal, Coryell, Guadalupe, Hays, Kendall, Lampasas, McLennan, Medina, Robertson, Travis, Williamson and Wilson Counties in Texas.

HEAVY (excluding tunnels and dams, not to be used for work on Sewage or Water Treatment Plants or Lift / Pump Stations in Bell, Coryell, McClellon and Williamson Counties) and HIGHWAY Construction Projects

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	<ul style="list-style-type: none">. Executive Order 14026 generally applies to the contract.. The contractor must pay all covered workers at least \$16.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2023.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	<ul style="list-style-type: none">. Executive Order 13658 generally applies to the contract.. The contractor must pay all covered workers at least \$12.15 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2023.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at

Modification Number Publication Date
0 01/06/2023

SUTX2011-006 08/03/2011

Rates Fringes

CEMENT MASON/CONCRETE
FINISHER (Paving and
Structures).....\$ 12.56 **

ELECTRICIAN.....\$ 26.35

FORM BUILDER/FORM SETTER
Paving & Curb.....\$ 12.94 **
Structures.....\$ 12.87 **

LABORER

Asphalt Raker.....\$ 12.12 **
Flagger.....\$ 9.45 **
Laborer, Common.....\$ 10.50 **
Laborer, Utility.....\$ 12.27 **
Pipelayer.....\$ 12.79 **
Work Zone Barricade
Servicer.....\$ 11.85 **

PAINTER (Structures).....\$ 18.34

POWER EQUIPMENT OPERATOR:

Agricultural Tractor.....\$ 12.69 **
Asphalt Distributor.....\$ 15.55 **
Asphalt Paving Machine.....\$ 14.36 **
Boom Truck.....\$ 18.36
Broom or Sweeper.....\$ 11.04 **
Concrete Pavement
Finishing Machine.....\$ 15.48 **
Crane, Hydraulic 80 tons
or less.....\$ 18.36
Crane, Lattice Boom 80
tons or less.....\$ 15.87 **
Crane, Lattice Boom over
80 tons.....\$ 19.38
Crawler Tractor.....\$ 15.67 **
Directional Drilling
Locator.....\$ 11.67 **
Directional Drilling
Operator.....\$ 17.24
Excavator 50,000 lbs or
Less.....\$ 12.88 **
Excavator over 50,000 lbs....\$ 17.71
Foundation Drill, Truck
Mounted.....\$ 16.93
Front End Loader, 3 CY or
Less.....\$ 13.04 **
Front End Loader, Over 3 CY.\$ 13.21 **
Loader/Backhoe.....\$ 14.12 **
Mechanic.....\$ 17.10
Milling Machine.....\$ 14.18 **
Motor Grader, Fine Grade....\$ 18.51
Motor Grader, Rough.....\$ 14.63 **
Pavement Marking Machine....\$ 19.17
Reclaimer/Pulverizer.....\$ 12.88 **

Roller, Asphalt.....\$ 12.78 **
Roller, Other.....\$ 10.50 **
Scraper.....\$ 12.27 **
Spreader Box.....\$ 14.04 **
Trenching Machine, Heavy....\$ 18.48

Servicer.....\$ 14.51 **

Steel Worker
 Reinforcing.....\$ 14.00 **
 Structural.....\$ 19.29

TRAFFIC SIGNALIZATION:

Traffic Signal Installation
 Traffic Signal/Light Pole
 Worker.....\$ 16.00 **

TRUCK DRIVER

 Lowboy-Float.....\$ 15.66 **
 Off Road Hauler.....\$ 11.88 **
 Single Axle.....\$ 11.79 **
 Single or Tandem Axle Dump
 Truck.....\$ 11.68 **
 Tandem Axle Tractor w/Semi
 Trailer.....\$ 12.81 **

WELDER.....\$ 15.97 **

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

** Workers in this classification may be entitled to a higher minimum wage under Executive Order 14026 (\$16.20) or 13658 (\$12.15). Please see the Note at the top of the wage determination for more information.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at <https://www.dol.gov/agencies/whd/government-contracts>.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current

negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

END OF GENERAL DECISION"

SECTION 00 52 00
STANDARD FORM OF AGREEMENT

STATE OF TEXAS §
 §
COUNTY OF GUADALUPE §

This Agreement is made and entered into as of the _____ day of _____, 2023 by and between the:

“OWNER” City of Seguin, Texas 205 N. River Street Seguin, Texas 78155 Phone: 830-379-3212	and	“CONTRACTOR” [name of Contractor] [address] Phone:
--	-----	--

For the following Project:

Golf Cart Barn, Seguin Bid No. TF-2023-44

The ENGINEER for the Project is:

TRC Engineers, Inc.
809 E. Court Street, Suite 106
Seguin, Texas 78155
Office: (512) 454-8716
Fax: (512) 454-2433

PART 1 - SCOPE OF WORK

1.01 THE WORK OF THIS CONTRACT

- A. Unless otherwise provided in these Contract Documents, the CONTRACTOR shall be responsible for performing or causing to be performed all Work including labor and materials, necessary to build, construct, erect and equip in accordance with the Contract Documents and at its own proper cost and expenses to furnish all the materials, supplies, machinery, equipment, tools, superintendence, labor, insurance, and other accessories and services necessary to complete the said construction, in accordance with the conditions and prices stated in the Bid Form attached hereto.

1.02 CONTRACT TIME AND COMPLETION

- A. The date of commencement of the Work shall be stated in a Notice to Proceed issued by the OWNER.
- B. Contract Time
1. The Contract Time shall be measured from the date of commencement.
 2. Time is of the essence in all phases of the Work. It is specifically understood and agreed to by and between OWNER and CONTRACTOR that time is of the essence in the substantial completion of the Work, and that failure to substantially complete the Work within the designated period, or as it may be extended, shall be construed as a breach of this Agreement.
- C. Substantial Completion
1. The CONTRACTOR shall achieve Substantial Completion of the entire Work not later than 150 calendar days from the date of commencement, subject to and adjustments of this Contract Time as provided in the Contract Documents and Change Orders modifying and extending this Agreement.
- D. Liquidated Damages
1. The CONTRACTOR acknowledges and recognizes that the OWNER is entitled to full and beneficial occupancy and use of the completed work following expiration of the Contract Time. The CONTRACTOR further acknowledges and agrees that, if the CONTRACTOR fails to substantially, or cause the Substantial Completion of any portion of the Work within the Contract time, the OWNER will sustain actual damages as a result of such failure. The exact amount of such damages will be difficult to ascertain. Therefore, the OWNER and CONTRACTOR agree that, if the CONTRACTOR shall neglect, fail, or refuse to achieve substantial completion of the Work by the Substantial Completion date, subject to proper extension granted by the OWNER, then the CONTRACTOR agrees to pay the OWNER the sum of:

Amount of Contract	Amount of Liquidated Damages per Day
Less than \$500,000	\$500.00
\$500,000 to \$750,000	\$600.00
\$750,000 to \$1,000,000	\$800.00

Amount of Contract	Amount of Liquidated Damages per Day
Over \$1,000,000	\$1,000.00

2. For each day in which such Work is not completed, not as penalty, but as liquidated damages, for the damages ("Liquidated Damages") that would be suffered by OWNER as a result of delay for each and every calendar day that the CONTRACTOR shall have failed to have completed the Work as required herein. The Liquidated Damages shall be in lieu of any and all other damages which may be incurred by OWNER as a result of the failure of CONTRACTOR to complete within the Contract Time.

1.03 FINAL COMPLETION

- A. Timely final completion is an essential condition of this contract. CONTRACTOR agrees to achieve final completion of the Work within 180 days of the designated or extended substantial completion date. The date of Substantial Completion shall be fixed by this Agreement, unless modified by Change Order, and memorialized by a Certificate of Substantial Completion as provided in the General Conditions to this Agreement.
- B. Final Completion means actual completion of the Work, including any extras or Change Orders reasonably required or contemplated under the Contract Documents other than warranty work that may be required pursuant to the Contract Documents.

1.04 CONTRACT SUM

- A. The OWNER shall pay the CONTRACTOR the Contract Sum in current funds for the CONTRACTOR's performance of the Contract. The Contract Sum shall [insert written total] (\$[insert numerical total]) subject to additions and deductions as provided in the Contract Documents.
- B. Unit prices, if any, shall be as shown in the Bid Form Section.

1.05 PAYMENT

- A. Applications for Payment: Each Application for Payment shall be based on the most recent schedule of values submitted by the CONTRACTOR in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Amount among the various portions of the Work. The schedule of values shall be prepared in such form and supported by such data to substantiate its accuracy as the ENGINEER and OWNER may require. This schedule, unless objected to by the ENGINEER or OWNER, shall be used as a basis for reviewing the CONTRACTOR's Applications for Payment.
- B. Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.
- C. Subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:
 1. Take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the

Contract Sum allocated to that portion of the Work in the schedule of values, less retainage per the General Conditions Article 14. Pending final determination of cost to the OWNER of changes in the Work, amounts not in dispute shall be included;

2. Add that portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction (or, if approved in advance by the OWNER, suitably stored off the site at a location agreed upon in writing), less retainage per the General Conditions Article 14;
 3. Subtract the aggregate of previous payments made by the OWNER; and
 4. Subtract amounts, if any, for which the ENGINEER has withheld or nullified a Certificate for Payment.
- D. The progress payment amount determined in accordance with General Conditions 14.1 shall be further modified under the following circumstances:
1. Add, upon Substantial Completion of the Work, a sum sufficient to increase the total payments to the full amount of the Contract Sum, less such amounts as the ENGINEER shall determine for incomplete Work, retainage applicable to such work and unsettled claims; and
 2. Add, if final completion of the Work is thereafter materially delayed through no fault of the CONTRACTOR, any additional amounts payable.
- E. Except with the OWNER's prior approval, the CONTRACTOR shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

1.06 FINAL PAYMENT

- A. Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the OWNER to the CONTRACTOR when:
1. The CONTRACTOR has fully performed the Contract except for the CONTRACTOR's responsibility to correct Work, as provided by the General Conditions, and to satisfy other requirements, if any, which extend beyond final payment; and
 2. A letter of Final Acceptance has been issued by the ENGINEER and accepted by the OWNER.
- B. The OWNER's final payment to the CONTRACTOR shall be made no later than 30 days after the Work has been completed and accepted by the OWNER, in writing, following the issuance of the ENGINEER's final Certificate for Payment.

This Agreement is entered into as of the day and year written above ("The Date of Execution"):

OWNER

By: _____

Title: _____

CONTRACTOR

By: _____

Title: _____

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SECTION 00 61 13.13
PERFORMANCE BOND

THE STATE OF TEXAS §
 §
COUNTY OF _____ §

KNOW ALL BY THESE PRESENTS: That we, _____, as Principal herein, and [Surety], a corporation organized and existing under the laws of the State of [Surety's state of incorp], and who is authorized and admitted to issue surety bonds in the State of Texas, Surety herein, are held and firmly bound unto _____, located in _____ County, Texas, Obligee herein, in the sum of [verbal amount of bond] Dollars (\$[numeric amount of bond]) for the payment of which sum we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, Principal has entered into a certain written contract with the Obligee dated the _____ day of _____, 20____, herein referred to as "the Contract" and incorporated herein and made a part hereof for all purposes, for the construction of the _____.

NOW, THEREFORE, the condition of this obligation is such, if the said Principal shall faithfully perform the work in accordance with the plans, specifications, and other Contract Documents and shall fully indemnify and hold harmless the Obligee from all costs and damages which Obligee may suffer by reason of Principal's failure to perform the Work in conformity with the Contract Documents, and reimburse and repay Obligee for all outlay and expense that Obligee may incur in making good such default, then this obligation shall be void; otherwise, to remain in full force and effect. Whenever Contractor shall be declared by Obligee to be in default under the Contract, the Surety shall, upon request of Obligee and within seven (7) calendar days from receipt of Obligee's notice of Contractor's default, commence and thereafter complete performance of Contractor's obligations under the Contract. This Bond covers all contractual obligations of Contractor under the Contract, including, without limitation, the indemnity, warranty and guaranty obligations. The Surety stipulates and agrees that no change, extension of time, alteration, omission, addition or other modification to the terms of any of the Contract will affect its obligations on this bond, and it hereby waives notice of any such changes, extensions of time, alterations, omissions, additions, or other modifications, to the Contract or to related subcontracts, purchase orders or other obligations, and any notices provided in such regard shall not create as to any party a duty related thereto. The penal limit of this bond shall automatically be increased by the amount of any change order, supplemental agreement or amendment which increases the price of the Contract.

PROVIDED, HOWEVER, that this bond is executed pursuant to Chapter 2253 of the Texas Government Code, as amended, and all rights and liabilities on this bond shall be determined in accordance with the provisions of such statute, to the same extent as if it were copied at length herein. All notices shall be delivered in writing to the addresses shown below or to addresses provided in the Contract Documents.

IN WITNESS WHEREOF, the duly authorized representatives of the Principal and the Surety have executed this instrument.

SIGNED and SEALED this _____ day of _____, 20____.

The date of bond shall not be prior to date of Contract.

ATTEST:

(Principal) Secretary

(S E A L)

Witness as to Principal

ATTEST:

Secretary

(S E A L)

Witness as to Surety

PRINCIPAL

By:

Name:

Title:

Address:

Telephone Number:

Fax Number:

Email:

SURETY

By:

Name:

Title:

Address:

Telephone Number:

Fax Number:

An original copy of Power of Attorney shall be attached to Bond by the Attorney-in-Fact.

Approved as to Form:

By: _____

Title: _____

Date: _____

Executed __ originals.

(seal)

(seal)

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SECTION 00 61 13.16

PAYMENT BOND

THE STATE OF TEXAS §
§
COUNTY OF _____ §

KNOW ALL BY THESE PRESENTS: That we, _____, as Principal herein, and _____, a corporation organized and existing under the laws of the State of _____ and who is authorized and admitted to use surety bonds in the State of Texas, as surety, are held and firmly bound unto _____ located in _____ County, Texas, Obligee herein, in the amount of [printed amount of bond] Dollars (\$[numeric amount of bond]) for the payment whereof, the said Principal and Surety bind themselves and their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written contract with the Obligee dated the ____ day of _____, 20____, which contract is hereby referred to herein as "the Contract" and is incorporated herein to the same extent as if copied at length, for the following project:
_____.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said Principal shall directly or indirectly timely make payment to each and every claimant (as defined in Chapter 2253, Texas Government Code, as amended) supplying labor or materials in the prosecution of the work under the Contract, then this obligation shall be void; otherwise, to remain in full force and effect. *This obligation may be enforced by the Obligee in the event of bankruptcy or default by Principal in payments to suppliers of labor or materials in the prosecution of the work under the Contract, in either of which events the Surety shall make such payments as Principal has failed to pay and as may be required to complete the work under the contract.* The Surety stipulates and agrees that no change, extension of time, alteration, omission, addition or other modification to the terms of the Contract will affect its obligations on this bond, and it hereby waives notice of any such changes, extensions of time, alterations, omissions, additions, or other modifications, to the Contract or to related subcontracts, purchase orders or other obligations, and any notices provided in such regard shall not create as to any party a duty related thereto.

PROVIDED, HOWEVER, that this bond is executed pursuant to Chapter 2253 of the Texas Government Code, as amended, and all rights and liabilities on this bond shall be determined in accordance with the provisions of said statute, to the same extent as if it were copied at length herein. All notices shall be delivered in writing to the addresses shown below or to addresses provided in the Contract Documents.

IN WITNESS WHEREOF, the duly authorized representatives of the Principal and the Surety have executed this instrument.

SIGNED and SEALED this _____ day of _____, 20____.

The date of bond shall not be prior to date of Contract.

ATTEST:

(Principal) Secretary

(S E A L)

Witness as to Principal

ATTEST:

Secretary

(S E A L)

Witness as to Surety

PRINCIPAL

By:

Name:

Title:

Address:

Telephone Number:

Fax Number:

Email:

SURETY

By:

Name:

Title:

Address:

Telephone Number:

Fax Number:

An original copy of Power of Attorney shall be attached to Bond by the Attorney-in-Fact.

Approved as to Form:

By: _____

Title: _____

Date: _____

Executed ____ originals.

(seal)

(seal)

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SECTION 00700
GENERAL CONDITIONS

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ARTICLE 1 - DEFINITIONS

Whenever used in these General Conditions or in the other Contract Documents, the following terms have the meanings indicated which are applicable to both the singular and plural thereof:

1.1 Addenda - Written or graphic instruments issued prior to the receipt of Proposals or the opening of Bids that clarify, correct or change the proposal or bidding requirements or the Contract Documents.

1.2 Agreement - Prescribed form, Standard Form of Agreement.

1.3 Bid Documents - The advertisement or invitation for bids, instructions to bidders, the bid form, the Contract Documents and Addenda.

1.4 Calendar Day - Any day of the week; no days being excepted. Work on Saturdays, Sundays, and/or Legal Holidays shall only be conducted with prior express written consent of the OWNER.

1.5 Change Directive - A written directive to the CONTRACTOR, signed by the OWNER, ordering a change in the Work and stating a proposed basis for adjustment, if any, in the Contract Amount or Contract Time, or both. A Change Directive may be used in the absence of total agreement on the terms of a Change Order. A Change Directive does not change the Contract Amount or Contract Time, but is evidence that the parties expect that the change directed or documented by a Change Directive will be incorporated in a subsequently issued Change Order.

1.6 Change Orders - Written agreements entered into between the CONTRACTOR and the OWNER authorizing an addition, deletion, or revision to the Contract, issued on or after the Execution Date of the Agreement and within the Contract term.

1.7 Claim - A written demand seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract.

1.8 Contract - The Contract represents the entire and integrated agreement between the OWNER and the CONTRACTOR for performance of the Work, as evidenced by the Contract Documents.

1.9 Contract Amount - The amount payable by the OWNER to the CONTRACTOR for completion of the Work in accordance with the Contract Documents.

1.10 Contract Documents – Invitation to Bid, Instructions to Bidders, General Conditions, Supplemental General Conditions (if any), Special Conditions (if any), Technical Specifications, Project Manual, Drawings, Addenda and Change Orders.

1.11 Contract Time - The number of days allowed for completion of the Work as defined by the Contract. When any period is referred to in days, it will be computed to exclude the

first and include the last day of such period. A day of twenty-four (24) hours measured from midnight to the next midnight will constitute a day.

1.12 CONTRACTOR - The individual, firm, corporation, or other business entity with whom the OWNER has entered into the Contract.

1.13 Date of Execution - Date of last signature of the parties to the Agreement.

1.14 Drawings - Those portions of the Contract Documents which are graphic representations of the scope, extent and character of the Work to be furnished and performed by the CONTRACTOR and which have been approved by the OWNER. Drawings may include plans, elevations, sections, details, schedules and diagrams. Shop Drawings are not Drawings as so defined.

1.15 Engineer - The OWNER's design professional identified as such in the Contract.

1.16 Equal - The terms "equal" or "approved equal" shall have the same meaning.

1.17 Field Order - A written order issued by Owner's Representative which orders minor changes in the Work and which does not involve a change in the Contract Amount or the Contract Time.

1.18 Final Acceptance - The stage in the Contract process when, in the OWNER's opinion, Final Completion of the Work has been attained and a Certificate of Acceptance approved by the OWNER is issued.

1.19 Final Completion - The stage in the progress of the Work when, in the OWNER's opinion, the entire Work has been completed, the CONTRACTOR's obligations under the Contract Documents have been fulfilled, and the OWNER is processing or has made final payment to the CONTRACTOR, as evidenced by a Certificate of Acceptance approved by the OWNER.

1.20 Inspector - The authorized representative of any regulatory agency that has jurisdiction over any portion of the Work.

1.21 Legal Holidays

1.22 The following are recognized by the OWNER:

<u>Holiday</u>	<u>Date Observed</u>
New Year's Day	January 1
Martin Luther King, Jr.'s Birthday	Third Monday in January
President's Day	Third Monday in February
Memorial Day	Last Monday in May

Independence Day	July 4
Labor Day	First Monday in September
Veteran's Day	November 11
Thanksgiving Day	Fourth Thursday in November
Friday after Thanksgiving	Friday after Thanksgiving
Christmas Eve	December 24
Christmas Day	December 25

1.22.1 If a Legal Holiday falls on Saturday, it will be observed on the preceding Friday. If a Legal Holiday falls on Sunday, it will be observed on the following Monday.

1.22.2 If Christmas Eve falls on a Saturday or a Sunday, the preceding Friday is observed as the Christmas Eve holiday.

1.22.3 If Christmas Day falls on a Saturday or a Sunday, the following Monday is observed as the Christmas Day holiday.

1.23 Milestones - A significant event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.

1.24 Notice to Proceed - A Written Notice given by the OWNER to the CONTRACTOR fixing the date on which the Contract Times will commence to run and on which the CONTRACTOR shall start to perform the CONTRACTOR's obligations under the Contract Documents.

1.25 OWNER – The City of Seguin, acting through its City Manager or his/her designee, officers, agents or employees to administer design and construction of the Project.

1.26 Owner's Representative - The designated representative of the OWNER. Such designation shall be provided to ENGINEER and CONTRACTOR in writing.

1.27 Partial Occupancy or Use - Use by the OWNER of a partially completed part of the Work for the purpose for which it is intended (or a related purpose) prior to Substantial Completion of all the Work.

1.28 Project - The total construction of which the Work to be provided under the Contract Documents may be the whole, or a part, as indicated elsewhere in the Contract Documents.

1.29 Project Manual - That portion of the Contract Documents which may include the following: introductory information; bidding requirements, Contract forms and General and

Supplemental General Conditions; General Requirements; Specifications; Drawings; Project Safety Manual; and Addenda.

1.30 Proposal Documents – The advertisement or invitation for Proposals, Instruction to Offerors, the Proposal form, the Contract Documents and Addenda.

1.31 Resident Project Representative - The authorized representative of ENGINEER who may be assigned to the site or any part thereof.

1.32 Shop Drawings - All drawings, diagrams, illustrations, schedules and other data or information which are specifically prepared or assembled by or for the CONTRACTOR and submitted by the CONTRACTOR as required by the Contract Documents.

1.33 Specifications - Those portions of the Contract Documents consisting of written technical descriptions as applied to the Work, which set forth to the CONTRACTOR, in detail, the requirements which must be met by all materials, equipment, construction systems, standards, workmanship, equipment and services in order to render a completed and useful project.

1.34 Substantial Completion - The stage in the progress of the Work when the Work, or designated portions thereof, is sufficiently complete in accordance with the Contract Documents so as to be operational and fit for the use intended.

1.35 Subcontractor - An individual, firm, or corporation having a direct contract with the CONTRACTOR for the performance of a part of the Work.

1.36 Sub-subcontractor - A person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work.

1.37 Superintendent - The representative of the CONTRACTOR authorized in writing to receive and fulfill instructions from Owner's Representative, and who shall supervise and direct construction of the Work.

1.38 Supplier - An individual or entity having a direct contract with the CONTRACTOR or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by the CONTRACTOR or any Subcontractor.

1.39 Time Extension Request - A request for time extension on a form acceptable to the OWNER.

1.40 Work - The entire completed construction, or the various separately identifiable parts thereof, required to be furnished under the Contract Documents.

1.41 Working Day - Any day of the week, not including Saturdays, Sundays, or Legal Holidays, in which conditions not under the CONTRACTOR's control will permit work for at least seven (7) hours of the Working Times. Upon authorization by the Owner's Representative, work on Saturdays, Sundays and/or Legal Holidays may be allowed and in that event a Working Day will be counted for each such day.

1.42 Working Times - Times of day(s) during which work may be performed. Unless authorized by OWNER, all Work shall be performed between 8:00 a.m. and 5:00 p.m. on weekdays. If authorized by the OWNER between 8:00 a.m. and 5:00p.m. on Saturdays, Sundays or Legal Holidays. When the CONTRACTOR has been authorized to perform Work during hours outside Working Times, such hours shall be considered time worked on Working Day contracts. Notwithstanding the preceding, emergency work may be done without prior permission only as provided in paragraph 6.11.5 herein.

1.43 Written Notice - Written communication between the OWNER and the CONTRACTOR. Written Notice shall be deemed to have been duly served if delivered in person to Owner's Representative or to the CONTRACTOR's duly authorized representative, or if such Written Notice is delivered to or sent by registered or certified mail to the attention of Owner's Representative or to the CONTRACTOR's duly authorized representative at the last business address known to the party giving notice. Written Notice sent or transmitted by electronic mail or facsimile must be actually received to be considered delivered and to comply with notice requirements herein. Transmission done by electronic mail or facsimile does not constitute delivery.

ARTICLE 2 - PRELIMINARY MATTERS

2.1 Delivery of Agreement, Bonds, Insurance, and Other Documentation:

2.1.1 Within ten (10) Calendar Days after written notification of award of Contract, the CONTRACTOR shall deliver to the OWNER signed Agreement, Bond(s), Insurance Certificate(s) and other documentation required for execution of the Contract.

2.2 Copies of Documents:

2.2.1 The OWNER shall furnish to the CONTRACTOR three (3) printed copies of the Contract Documents and one (1) copy in electronic portable document format (PDF) unless otherwise specified. Additional printed copies will be furnished, upon request, at the cost of reproduction.

2.3 Commencement of Contract Times; Notice to Proceed:

2.3.1 The Contract Time(s) will begin to run on the day indicated in the Notice to Proceed.

2.4 Before Starting Construction:

2.4.1 No Work shall be done at the site prior to the preconstruction conference without the OWNER's approval. Before undertaking each part of the Work, the CONTRACTOR shall carefully study and compare the Contract Documents and check and verify pertinent figures shown thereon and all applicable field measurements. The CONTRACTOR shall promptly report in writing to OWNER & ENGINEER any conflict, error, ambiguity or discrepancy which the CONTRACTOR may discover and shall obtain a written interpretation or clarification from ENGINEER before proceeding with any Work affected thereby. Should Contractors perform the Work after discovery of such a conflict without reporting the conflict or before receipt of a clarification or interpretation by Engineer, Contractor will be solely liable for any

correction or other measures that may be required to overcome the conflict or bring the Work into compliance with the Contract Documents.

2.4.2 The CONTRACTOR shall submit the following to Owner's Representative for review and approval no later than the preconstruction conference:

- .1 a preliminary progress schedule indicating the times (number of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents, identifying when all Subcontractors will be utilized, and taking into consideration any limitations on Working Hours;
- .2 a preliminary schedule of Shop Drawing and sample submittals;
- .3 a preliminary schedule of values for all of the Work, subdivided into component parts in sufficient detail to serve as the basis for progress payments during construction. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work;
- .4 a letter designating CONTRACTOR's Superintendent;
- .5 a letter from the CONTRACTOR and Subcontractor(s) listing any salaried specialists;
- .6 if applicable, a letter designating the "Competent Person(s)" on general safety and trench safety measures;
- .7 if applicable, a trench safety system plan;
- .8 if applicable, a plan illustrating proposed locations of temporary facilities;
- .9 if applicable, a traffic control plan;
- .10 a completed Non-Use of Asbestos Affidavit (Prior to Construction); and
- .11 if applicable, a letter designating the Texas Registered Professional Land Surveyor that shall be employed for any portion of the Work required by the Contract Documents to be performed by a RPLS.

2.5 Preconstruction Conference:

2.5.1 Prior to commencement of Work at the site, a preconstruction conference attended by the CONTRACTOR, Owner's Representative and others will be held.

ARTICLE 3 - CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.1 Intent:

3.1.1 The intent of the Contract Documents is to include all information necessary for the proper execution and completion of the Work by the CONTRACTOR. The Contract

Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the CONTRACTOR shall be required to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the intended results. In cases of disagreement, the following order of precedence shall govern (top item receiving priority of interpretation):

- Signed Agreement
- Addenda to the Contract Documents
- Special Conditions
- Supplemental General Conditions
- General Conditions
- Performance and Payment Bonds
- Other Bidding Documents and Contract Forms
- Special Provisions to the Standard Technical Specifications
- Special Specifications
- Standard Technical Specifications
- Drawings (figured dimensions shall govern over scaled dimensions)
- Project Safety manual, if applicable

3.1.2 Unless otherwise stated in the Contract Documents, words which have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

3.2 Reporting and Resolving Discrepancies:

3.2.1 If, during the performance of the Work, the CONTRACTOR discovers any conflict, error, ambiguity or discrepancy within the Contract Documents or between the Contract Documents and any provisions of any such law or regulation applicable to the performance of the Work or of any such standard, specification, manual or code or instructions of any Supplier, the CONTRACTOR shall immediately report it to ENGINEER in writing, and the CONTRACTOR shall not proceed with the Work affected thereby until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in section 3.3. The CONTRACTOR shall be liable to the OWNER for failure to report any such conflict, error, ambiguity or discrepancy of which the CONTRACTOR knew or reasonably should have known.

3.3 Amending and Supplementing Contract Documents:

3.3.1 The Contract Documents may be amended to provide for additions, deletions and revisions in the Work or to modify the terms and conditions thereof in one or more of the following ways:

- .1 Change Order.
- .2 Change Directive.

3.3.2 In addition, the requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, in one or more of the following ways:

- .1 Field Order.
- .2 Review of a Shop Drawing or sample.
- .3 Written interpretation or clarification.

3.4 Reuse of Documents Prohibited:

3.4.1 The CONTRACTOR and any Subcontractor or Supplier or other person or organization performing or furnishing any of the Work under a direct or indirect contract with the OWNER: (i) shall not have or acquire any title to or ownership rights in any of the Drawings, Specifications or other documents (or copies of any thereof) prepared by or bearing the seal of ENGINEER or ENGINEER's consultants, and (ii) shall not reuse any of such Drawings, Specifications, other documents or copies on extensions of the Project or any other project without written consent of the OWNER and ENGINEER.

ARTICLE 4 - AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; REFERENCE POINTS

4.1 Availability of Lands:

4.1.1 The OWNER shall furnish, as indicated in the Contract Documents, all required rights to use the lands upon which the Work is to be performed, rights-of-way and easements for access thereto, and such other lands which are designated for the use of the CONTRACTOR. The OWNER shall identify any encumbrances or restrictions not of general application but specifically related to use of lands so furnished with which the CONTRACTOR will have to comply in performing the Work. Easements for permanent structures or permanent changes in existing facilities will be obtained and paid for by the OWNER, unless otherwise provided in the Contract Documents. If the OWNER fails to furnish these lands, rights-of-way or easements in a timely manner, the CONTRACTOR may make a Claim for adjustments in the Contract Times. The CONTRACTOR shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of spoils, materials and equipment.

4.2 Subsurface and Physical Conditions:

4.2.1 CONTRACTOR accepts the responsibility to satisfy itself as to the soil conditions and nature and type of geological formations in and through which this Project will be constructed. Such information as may be obtained from the test borings (if borings have been provided) and accompanying notations shown on the plans is merely for the guidance of the CONTRACTOR and is not to be construed in any manner as a guarantee by the OWNER that such conditions of sub-surface strata are infallible.

4.2.2 The CONTRACTOR hereby represents and covenants that it has examined the site of the proposed Work and is familiar with all of the conditions surrounding construction of the Project, having conducted all inquiries, tests and investigations deemed necessary and proper.

4.2.3 CONTRACTOR waives any and all rights to make a claim against OWNER relating to representations related to geotechnical data provided in the contract documents, plans and

specifications. The locations of the test holes, if applicable, are shown in the Geotechnical Report. Logs of these test holes are included in the Geotechnical Report. Test holes information represents subsurface characteristics to the extent indicated and only for the point location of the test hole. CONTRACTOR shall make its own interpretation of the character and condition of the materials, which will be encountered. CONTRACTOR may, at its own expense, make additional surveys and investigations as it may deem necessary to determine conditions, which will affect performance of the Work.

4.2.4 If conditions are encountered at the site which are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, that differ materially from those normally encountered in the type of work being performed under this Contract, then notice by the observing party shall be given to the other party promptly before conditions are disturbed and in no event later than seven (7) calendar days after first observance of the conditions. ENGINEER will promptly investigate such conditions and, if they differ materially and cause an increase or decrease in the CONTRACTOR's cost of, or time required for, performance of any part of the Work, may recommend an equitable adjustment in the Contract Amount or Contract Time, or both. If ENGINEER determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the CONTRACTOR shall be notified in writing, stating the reasons. If CONTRACTOR disagrees with ENGINEER'S determination, CONTRACTOR may appeal such determination to OWNER. Such appeal must be presented to OWNER with all supporting documentation evidencing CONTRACTOR'S claim for an adjustment to the Contract Amount or Contract Time within thirty (30) calendar days of completing the Work. Any unresolved disputes arising from ENGINEER'S OR OWNER'S determination shall be resolved in accordance with Article 16.

4.2.5 Notwithstanding any other provision of this Contract, the CONTRACTOR shall be solely responsible for the location and protection of any and all public lines and utility customer service lines in the Work area. For the purposes of this section, "public lines" means the all utility distribution and supply system within public rights-of-way or easements, and "utility customer service lines" (service) means any utility line connecting a utility customer to the utility distribution system. Generally, existing service connections within right-of-way or easements are not shown on the Drawings. The CONTRACTOR shall notify the OWNER and "One Call" and exercise due care to locate and to mark, uncover or otherwise protect all such lines in the construction zone and any of the CONTRACTOR's work or storage areas. The CONTRACTOR's obligation hereunder shall be primary and non-delegable. The CONTRACTOR shall be liable for any expenses or costs (including fines that may be levied against the OWNER) that may result from unauthorized or accidental damage to all public lines and utility customer service lines in the Work area.

4.3 Reference Points:

4.3.1 Unless otherwise specified, the OWNER will furnish all reference points, benchmarks, survey monuments, and control points which, in the OWNER's opinion, are suitable for laying out the Work.

4.3.2 All reference points, benchmarks, survey monuments and control points shall be carefully preserved by the CONTRACTOR by use of flags, laths or other appropriate measures and, in case of destruction or removal by the CONTRACTOR or its employees, such reference points, benchmarks, survey monuments, and control points shall be replaced by a Registered Professional Land Surveyor at the CONTRACTOR's expense. When reference points, benchmarks, survey monuments, or control points are in conflict with the Work, the CONTRACTOR will provide notice of the conflict to ENGINEER and note the location of such on a set of red-lined drawings to be maintained at all times on the jobsite. Reestablishment will be the CONTRACTOR's responsibility during or upon completion of the Work.

4.4 Hazardous Materials:

4.4.1 The OWNER shall be responsible for any hazardous material uncovered or revealed at the site which was not shown, indicated or identified in the Contract Documents to be within the scope of the Work and which may present a substantial danger to persons or property exposed thereto in connection with the Work at the site. The CONTRACTOR shall immediately notify the OWNER of any suspected hazardous materials encountered before or during performance of the Work and shall take all necessary precautions to avoid further disturbance of the materials.

4.4.2 The CONTRACTOR shall be responsible for any hazardous materials brought to the site by the CONTRACTOR, Subcontractor, Suppliers or anyone else for whom the CONTRACTOR is responsible.

4.4.3 CONTRACTOR shall be responsible for securing and protecting the site and ensuring that no third-parties or other persons enter the site without authorization. CONTRACTOR shall be responsible for all costs and damages resulting from any harm or injury that is caused by hazardous materials on the site to any unauthorized entrants. CONTRACTOR shall indemnify and hold OWNER and ENGINEER harmless from any claims, costs, or damages related to a breach of this section pursuant to the INDEMNIFICATION provisions contained herein.

4.4.4 No asbestos-containing materials shall be incorporated into the Work or brought on the Project site without prior approval of the OWNER.

ARTICLE 5 - BONDS AND INSURANCE

5.1 Surety and Insurance Companies:

5.1.1 All bonds and insurance required by the Contract Documents shall be obtained from surety or insurance companies that are duly licensed by the State of Texas and authorized by the State of Texas and the Texas Department of Insurance to issue bonds or insurance policies for the limits and coverages required by the Contract Documents. The bonds shall be in a form acceptable to the OWNER and shall be issued by a surety that complies with the requirements of Chapter 3503 of the Texas Insurance Code.

5.2 Contractor Insurance Requirements

5.2.1 For specific insurance requirements, refer to Exhibit A to these General Conditions, OWNER's Insurance Requirements.

5.2.1 General Requirements:

- .1** CONTRACTOR shall carry insurance in the types and amounts indicated for the duration of the Contract, which shall include items owned by OWNER in the care, custody and control of CONTRACTOR prior to and during construction and warranty period.
- .2** CONTRACTOR must complete and forward the required Certificates of Insurance to OWNER within ten (10) calendar days of the Date of Execution the Contract is executed as verification of coverage required below. CONTRACTOR shall not commence Work until the required insurance is obtained and until such insurance has been reviewed by OWNER. Approval of insurance by OWNER shall not relieve or decrease the liability of CONTRACTOR hereunder and shall not be construed to be a limitation of liability on the part of CONTRACTOR. CONTRACTOR must also complete and forward the required Certificates of Insurance to OWNER whenever a previously identified policy period has expired as verification of continuing coverage.
- .3** All endorsements naming the OWNER and ENGINEER as additional insured, waivers, and notices of cancellation endorsements as well as the Certificate of Insurance shall indicate: City of Seguin and TRC Engineers, Inc.
- .4** Where the OWNER and ENGINEER are additional insured shown on any policy, it is intended that policies required in the Contract, covering both OWNER, ENGINEER and CONTRACTOR, shall be considered primary coverage as applicable.
- .5** If insurance policies are not written for amounts specified in Exhibit A, Owner's Insurance Requirements, CONTRACTOR shall carry Umbrella or Excess Liability Insurance for any differences in amounts specified. If Excess Liability Insurance is provided, it shall follow the form of the primary coverage.
- .6** OWNER and ENGINEER shall be entitled, upon request and without expense, to receive certified copies of policies and endorsements thereto and may make any reasonable requests for deletion or revision or modification of particular policy terms, conditions, limitations, or exclusions except where policy provisions are established by law or regulations binding upon either of the parties hereto or the underwriter on any such policies.
- .7** OWNER and ENGINEER reserve the right to review the insurance requirements set forth during the effective period of this Contract and to make reasonable adjustments to insurance coverage, limits, and exclusions when deemed necessary and prudent by OWNER or ENGINEER based upon changes in statutory law, court decisions, the claims history of the industry or financial condition of the insurance company as well as CONTRACTOR.
- .8** CONTRACTOR shall not cause any insurance to be canceled nor permit any insurance to lapse during the term of the Contract or as required in the Contract.

- .9 CONTRACTOR shall be responsible for premiums, deductibles and self-insured retentions, if any, stated in policies. All deductibles or self-insured retentions shall be disclosed on the Certificate of Insurance.
- .10 CONTRACTOR shall provide OWNER and ENGINEER thirty (30) days written notice of erosion of the aggregate limits below occurrence limits for all applicable coverages indicated within the Contract.
- .11 If OWNER-owned property is being transported or stored off-site by CONTRACTOR, then the appropriate property policy will be endorsed for transit and storage in an amount sufficient to protect OWNER's property.
- .12 The insurance coverages required under this contract are required minimums and are not intended to limit the responsibility or liability of CONTRACTOR.

5.3 Bonds:

5.3.1 General.

- .1 Bonds, when required, shall be executed on forms furnished by or acceptable to OWNER. All bonds signed by an agent must be accompanied by a certified copy of such agent's authority to act.
- .2 If the surety on any bond furnished by CONTRACTOR is declared bankrupt or becomes insolvent or its right to do business is terminated in the State of Texas or it ceases to meet the requirements of the preceding paragraph, CONTRACTOR shall within ten (10) calendar days thereafter substitute another bond and surety, both of which must be acceptable to OWNER.
- .3 Bonds provided by CONTRACTOR shall conform to the requirements contained in Chapter 2253 of the Government Code.

5.3.2 Performance Bond.

- .1 CONTRACTOR shall furnish OWNER with a Performance Bond in the form set out by OWNER, which shall extend for the two (2) year warranty period.

5.3.3 Payment Bond.

- .1 CONTRACTOR shall furnish OWNER with a Payment Bond in the form set out by OWNER.

ARTICLE 6 - CONTRACTOR'S RESPONSIBILITIES

6.1 Supervision and Superintendence:

- 6.1.1** The CONTRACTOR shall supervise, inspect and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be

necessary to perform the Work in accordance with the Contract Documents. The CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences and procedures of construction.

6.1.2 The CONTRACTOR shall have an English-speaking, competent Superintendent on the Work at all times that work is in progress. Upon OWNER'S request, the CONTRACTOR shall present the resume of the Superintendent to Owner's Representative showing evidence of experience and successful superintendence and direction of work of a similar scale and complexity. If, in the OWNER'S opinion, the proposed Superintendent does not indicate sufficient experience in line with the Work, he/she will not be allowed to be the designated Superintendent for the Work. The Superintendent shall not be replaced without written consent of the OWNER. Such consent shall not be unreasonably withheld. The Superintendent will be the CONTRACTOR's representative on the Work and shall have the authority to act on behalf of the CONTRACTOR. All communications given to the Superintendent shall be as binding as if given to the CONTRACTOR. Either the CONTRACTOR or the Superintendent shall provide an emergency and home telephone number at which one or the other may be reached if necessary when work is not in progress.

6.2 Labor, Materials and Equipment:

6.2.1 The CONTRACTOR agrees to employ only orderly and competent workers, skillful in performance of the type of Work required under this Contract. The CONTRACTOR shall at all times maintain good discipline and order on or off the site in all matters pertaining to the Project.

6.2.2 CONTRACTOR shall provide and pay for labor in accordance with the prevailing wage in the locality and shall not pay less than the prevailing wage.

6.2.3 Unless otherwise specified, the CONTRACTOR shall provide and pay for all materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities and all other facilities and incidentals necessary for the furnishing, performance, re-testing of defective work, start-up and completion of the Work.

6.2.4 All materials and equipment shall be of good quality and new, except as otherwise provided in the Contract Documents. If required by OWNER, the CONTRACTOR shall furnish satisfactory evidence (reports of required tests, manufacturer's certificates of compliance with material requirements, mill reports, etc.) as to the kind, quantity and quality of materials and equipment. All materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with instructions of the applicable Supplier, except as otherwise provided in the Contract Documents. All special or manufacturer's warranties required by the specifications shall expressly run to the benefit of the OWNER.

6.2.5 No material or equipment shall be purchased from a business entity that is owned by, or the majority of stock or other ownership interest of the company is held or controlled by individuals who are citizens of China, Iran, North Korea, or a designated country; or a company or other entity, including a governmental entity, that is owned or controlled by citizens or is

directly controlled by the government of China, Iran, North Korea, Russia, a designated country or is headquartered in one of the aforementioned countries.

6.2.6 Substitutes and "Approved Equal" Items:

6.2.6.1 Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function and quality required. Unless the specification or description contains words reading that no like, equivalent or "approved equal" item or no substitution is permitted, other items of material or equipment of other Suppliers may be submitted to OWNER under the following circumstances:

- .1 "Approved Equal": If, in the OWNER's sole discretion, an item of material or an item of equipment proposed by the CONTRACTOR is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by the OWNER as an "approved equal" item, in which case review of the proposed item may, in the OWNER's sole discretion, be accomplished without compliance with some or all of the requirements for evaluation of proposed substitute items. The CONTRACTOR shall provide the OWNER with the documentation required for the OWNER to make its determination.
- .2 Substitute Items: If, in the OWNER's sole discretion, an item of material or an item of equipment proposed by the CONTRACTOR does not qualify as an "approved equal" item under paragraph 6.2.6.1.1, then it will be considered a proposed substitute item. The CONTRACTOR shall submit sufficient information to allow the OWNER to determine that the item of material or item of equipment proposed is essentially equivalent to that named and a substitute therefor.

6.2.6.2 Substitute Construction Methods and Procedures: If a specific means, method, technique, sequence or procedure of construction is shown or indicated in and expressly required by the Contract Documents, the CONTRACTOR may with prior approval of the OWNER furnish or utilize a substitute means, method, technique, sequence, or procedure of construction. The CONTRACTOR shall submit sufficient information to OWNER's Representative to allow the OWNER, in the OWNER's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents.

6.2.6.3 OWNER's Evaluation: The OWNER will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to paragraph 6.2.6.1.1 and paragraph 6.2.6.1.2. The OWNER will be the sole judge of acceptability. No "approved equal" or substitute shall be ordered, installed, or utilized until the OWNER's review is complete, which will be evidenced by either a Change Order or completion of the Shop Drawing review procedure. The OWNER may require the CONTRACTOR to furnish at the CONTRACTOR's expense a special performance guarantee or other surety bond with respect to any "approved equal" or substitute. The OWNER shall not be responsible for any delay due to review time for any "approved equal" or substitute.

6.2.6.4 CONTRACTOR's Expense: All data to be provided by the CONTRACTOR in support of any proposed "approved equal" or substitute item will be at the CONTRACTOR's expense.

6.2.6.5 Special Guarantee: OWNER may require CONTRACTOR to furnish at CONTRACTOR'S expense a special performance guarantee or other warranty bond with respect to any substitute.

6.2.6.6 Effect of Engineer's Determination: If ENGINEER approves the substitution request, CONTRACTOR shall execute any required documentation and proceed with the substitution. The ENGINEER'S denial of a substitution request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents.

6.2.7 Shop Drawings, Samples, and Other Submittals:

6.2.7.1 Shop Drawing and Sample Submittal Requirements:

- .1** Before submitting a Shop Drawing or Sample, Contractor shall have:
 - a. reviewed and coordinated the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;
 - b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;
 - c. determined and verified the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
 - d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.
- .2** Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that submittal, and that Contractor approves the submittal.
- .3** With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be set forth in a written communication separate from the Shop Drawings or Sample submittal; and, in addition, in the case of Shop Drawings by a specific notation made on each Shop Drawing submitted to Engineer for review and approval of each such variation.

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

.1 Shop Drawings:

- a. Contractor shall submit the number of copies and format as required in the Specifications.

- b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide and to enable Engineer to review the information provided.
- .2 Samples:
 - a. Contractor shall submit the number of Samples required in the Specifications.
 - b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal.
- .3 Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.
- .4 After review and approval of Submittal, Shop Drawing or Sample by Engineer in accordance with this section, Contractor may rely on the information provided by Engineer. Work performed in accordance with an approved Submittal, Shop Drawing, or Sample and the Contract Documents will be presumed to be acceptable to Owner unless an actual defect in the Work is discovered.

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

6.2.7.4 Engineer's Review:

- .1 Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
- .2 Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 6.2.6 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such approved variation from the requirements of the Contract Documents in a Field Order.
- .3 Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, shall not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.

- .4 Neither Engineer's receipt, review, acceptance or approval of a Shop Drawing, Sample, or other submittal shall result in such item becoming a Contract Document.
- .5 Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples subject to the obligations and limitations provided in section 6.2.7.4.2 above.

6.2.7.5 Resubmittal Procedures:

- .1 Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.
- .2 Contractor shall furnish required submittals with sufficient information and accuracy to obtain required approval of an item with no more than three submittals. Engineer will record Engineer's time for reviewing a fourth or subsequent submittal of a Shop Drawings, sample, or other item requiring approval, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges.
- .3 If Contractor requests a change of a previously approved submittal item, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

6.3 Progress Schedule:

6.3.1 Unless otherwise directed, the CONTRACTOR shall adhere to the progress schedule established in accordance with paragraph 2.4.2.1 as it may be adjusted from time to time as provided below:

- .1 The CONTRACTOR shall submit to OWNER for acceptance proposed adjustments in the progress schedule that will not change the Contract Times or Milestones. Such adjustments will conform generally to the progress schedule then in effect.
- .2 Proposed adjustments in the progress schedule that will change the Contract Times or Milestones shall be submitted in accordance with the requirements of Article 12. Such adjustments may only be made by a Change Order or Time Extension Request in accordance with Article 12.
- .3 The CONTRACTOR shall submit updated progress schedules with each application for payment showing progress in the work and the plan for the progress of the work thereafter.
- .4 A current and updated progress schedule shall be posted at the site at all times.

6.4 Concerning Subcontractors, Suppliers and Others:

6.4.1 Assignment: The CONTRACTOR agrees to retain direct control of and give direct attention to the fulfillment of this Contract. The CONTRACTOR shall not assign this Contract without the prior written consent of the OWNER.

6.4.2 Award of Subcontracts for Portions of the Work: The CONTRACTOR shall not employ any Subcontractor, Supplier or other person or organization, whether initially or as a substitute, against whom the OWNER may have reasonable objection. The CONTRACTOR must provide the OWNER with a list of all Subcontractors, Suppliers, or other persons or organizations it intends to use in the Work, and such list must be provided prior to the preconstruction conference. Should the OWNER have objections, the OWNER will communicate such objections by Written Notice.

6.4.3 The CONTRACTOR shall enter into written agreements with all Subcontractors and Suppliers which specifically bind the Subcontractors or Suppliers to the applicable terms and conditions of the Contract Documents for the benefit of the OWNER.

6.4.4 The CONTRACTOR shall be fully responsible to the OWNER for all acts and omissions of the Subcontractors, Suppliers and other persons and organizations performing or furnishing any of the Work under a direct or indirect contract with the CONTRACTOR just as the CONTRACTOR is responsible for the CONTRACTOR's own acts and omissions.

6.4.5 The CONTRACTOR shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers and other persons and organizations performing or furnishing any of the Work under a direct or indirect contract with the CONTRACTOR. The CONTRACTOR shall require all Subcontractors, Suppliers and such other persons and organizations performing or furnishing any of the Work to communicate with the OWNER through the CONTRACTOR.

6.4.6 The divisions and sections of the Specifications and the identifications of any Drawings shall not control the CONTRACTOR in dividing or delineating the Work to be performed by any specific trade.

6.5 Patent Fees and Royalties:

6.5.1 The CONTRACTOR shall be responsible at all times for compliance with applicable patents or copyrights encompassing, in whole or in part, any design, device, material, or process utilized, directly or indirectly, in the performance of the Work or the formulation or presentation of its Bid.

6.5.2 The CONTRACTOR shall pay all royalties and license fees and shall provide, prior to commencement of Work hereunder and at all times during the performance of same, for lawful use of any design, device, material or process covered by letters, patent or copyright by suitable legal agreement with the patentee, copyright holder, or their duly authorized representative whether or not a particular design, device, material, or process is specified by the OWNER.

6.5.3 THE CONTRACTOR SHALL DEFEND ALL SUITS OR CLAIMS FOR INFRINGEMENT OF ANY PATENT OR COPYRIGHT AND SHALL INDEMNIFY, DEFEND, AND HOLD THE OWNER HARMLESS FROM ANY LOSS OR LIABILITY, DIRECT OR INDIRECT, ARISING WITH RESPECT TO THE CONTRACTOR'S PROCESS IN THE FORMULATION OF ITS BID OR THE PERFORMANCE OF THE WORK OR OTHERWISE ARISING IN CONNECTION THEREWITH. THE OWNER RESERVES THE RIGHT TO PROVIDE ITS OWN DEFENSE TO ANY SUIT OR CLAIM OF INFRINGEMENT OF ANY PATENT OR COPYRIGHT IN WHICH EVENT THE CONTRACTOR SHALL INDEMNIFY AND SAVE HARMLESS THE OWNER FROM ALL COSTS AND EXPENSES OF SUCH DEFENSE AS WELL AS SATISFACTION OF ALL JUDGMENTS ENTERED AGAINST THE OWNER.

6.6 Permits, Fees:

Unless otherwise provided in the Contract Documents, the CONTRACTOR shall obtain and pay for all construction permits, licenses and fees required for prosecution of the Work.

OWNER will obtain and pay for the following permits, licenses and/or fees, if required:

- .1 Site Development Permit.
- .2 Building Permit(s).
- .3 Texas Department of Transportation permit for work in State rights-of-way.
- .4 Railroad Utility License Agreement.

6.7 Laws and Regulations:

6.7.1 The CONTRACTOR shall give all notices and comply with all laws and regulations applicable to furnishing and performing the Work. Except where otherwise expressly required by applicable laws and regulations, neither the OWNER nor ENGINEER shall be responsible for monitoring the CONTRACTOR's compliance with any laws and regulations.

6.7.2 The CONTRACTOR shall plan and execute its operations in compliance with all applicable Federal, State and local laws and regulations, including those concerning control and abatement of water pollution and prevention and control of air pollution.

6.7.3 If the CONTRACTOR performs any Work knowing or having reason to know that it is contrary to laws or regulations, then the CONTRACTOR shall bear all claims, costs, losses and damages arising therefrom; however, it shall not be the CONTRACTOR's primary responsibility to make certain that the Specifications and Drawings are in accordance with laws and regulations, but this does not relieve the CONTRACTOR of the CONTRACTOR's obligations under Article 3.

6.8 Taxes:

6.8.1 The CONTRACTOR shall pay all sales, consumer, use and other similar taxes required to be paid by the CONTRACTOR in accordance with the laws and regulations of the State of Texas.

6.8.2 The OWNER is an exempt organization as defined by Chapter 11 of the Texas Tax Code and is thereby exempt from payment of sales tax. To enjoy the cost-savings benefits of its tax-exempt status, the OWNER will provide a Tax Exemption Certificate to the CONTRACTOR for use on the Project. The CONTRACTOR shall use that certificate to exempt any purchases made for the Work from taxes. All savings for the tax-exempt status will be passed on to the OWNER by the CONTRACTOR. The CONTRACTOR agrees to bind all SUBCONTRACTORS of any tier to the obligation to present and use the Tax Exemption Certificate and pass all savings to the OWNER.

6.9 Use of Premises:

6.9.1 The CONTRACTOR shall confine construction equipment, the storage of materials and equipment and the operations of workers to the site and land and areas identified in and permitted by the Contract Documents and other land and areas permitted by laws and regulations, rights-of-way, permits and easements, and shall not unreasonably encumber the premises with construction equipment or other materials or equipment. The CONTRACTOR shall assume full responsibility for any damage to any such land or area, or to the OWNER or occupant thereof or of any adjacent land or areas, resulting from the performance of the Work. Should any claim be made by any such owner or occupant because of the performance of the Work, the CONTRACTOR shall promptly settle with such other party by negotiation or otherwise resolve the claim by dispute resolution proceeding or at law. THE CONTRACTOR SHALL INDEMNIFY, DEFEND AND HOLD HARMLESS THE OWNER, ENGINEER, ENGINEER'S CONSULTANTS AND ANYONE DIRECTLY OR INDIRECTLY EMPLOYED BY IT, FROM AND AGAINST ALL CLAIMS, COSTS, LOSSES AND DAMAGES (INCLUDING COURT COSTS AND REASONABLE ATTORNEYS' FEES) ARISING OUT OF OR RESULTING FROM ANY CLAIM OR ACTION, LEGAL OR EQUITABLE, BROUGHT BY ANY SUCH OWNER OR OCCUPANT AGAINST THE OWNER, ENGINEER OR ANY OTHER PARTY INDEMNIFIED HEREUNDER TO THE EXTENT CAUSED BY OR BASED UPON PERFORMANCE OF THE WORK OR FAILURE TO PERFORM THE WORK.

6.9.2 During the progress of the Work, the CONTRACTOR shall keep the premises free from accumulations of waste materials, rubbish and other debris resulting from the Work. At the completion of the Work, the CONTRACTOR shall remove all waste materials, rubbish and debris from and about the premises as well as all tools, appliances, construction equipment and machinery and surplus materials. The CONTRACTOR shall leave the site clean and ready for occupancy by the OWNER at Substantial Completion. The CONTRACTOR shall, at a minimum, restore to original condition all property not designated for alteration by the Contract Documents.

6.9.3 The CONTRACTOR shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall the CONTRACTOR subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

6.10 Record Documents:

The CONTRACTOR shall maintain in a safe place at the site, or other location acceptable to the OWNER, one (1) record copy of all Drawings, Specifications, Addenda, Change Orders, Change Directives, Field Orders and written interpretations and clarifications (issued pursuant to paragraph 9.5) in good order and annotated to show all changes made during construction. These record documents, together with all final samples and all final Shop Drawings, will be available to the OWNER and ENGINEER for reference during performance of the Work. Prior to Final Acceptance of the Work, these record documents, samples and Shop Drawings shall be promptly delivered to the OWNER. Delivery of these record documents is a condition precedent to Final Completion.

6.11 Safety and Protection:

6.11.1 The CONTRACTOR shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Upon request, and prior to installation of measures, the CONTRACTOR shall submit a site security plan for approval by the OWNER. By reviewing the plan or making recommendations or comments, the OWNER will not assume liability nor will the CONTRACTOR be relieved of liability for damage, injury or loss. The CONTRACTOR shall take all necessary precautions for the safety of and shall provide the necessary protection to prevent damage, injury or loss to:

- .1 all persons on the Work site or who may be affected by the Work;
- .2 all the Work and materials and equipment to be incorporated therein, whether in storage on or off the site; and
- .3 other property at the site or adjacent thereto, including but not limited to, trees, shrubs, lawns, walks, pavements, roadways, structures, utilities and underground facilities not designated for removal, relocation or replacement in the course of construction.

6.11.2 The CONTRACTOR shall comply with all applicable laws and regulations of any public body having jurisdiction for safety of persons or property or to protect them from damage, injury or loss; and shall erect and maintain all necessary safeguards for such safety and protection. The CONTRACTOR shall notify OWNERS of adjacent property and of underground facilities, and utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation and replacement of their property. All damage, injury or loss to any property referred to in paragraph 6.11.1.2 and paragraph 6.11.1.3 caused, directly or indirectly, in whole or in part, by the CONTRACTOR, shall be remedied by the CONTRACTOR. The CONTRACTOR's duties and responsibilities for safety and protection of the Work shall continue until such time as all the Work is finally complete.

6.11.3 Safety Representative: The CONTRACTOR shall designate a qualified and experienced safety representative at the site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs. Upon request of the OWNER, the CONTRACTOR shall provide certifications or other documentation of the safety representative's qualifications.

6.11.4 Hazard Communication Programs: The CONTRACTOR shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the site in accordance with laws and regulations.

6.11.5 Emergencies:

6.11.5.1 In emergencies affecting the safety or protection of persons or the Work at the site or adjacent thereto, the CONTRACTOR, without special instruction or authorization from the OWNER or ENGINEER, is obligated to act reasonably to prevent threatened damage, injury or loss and to mitigate damage or loss to the Work. The CONTRACTOR shall give Owner's Representative prompt written notice if the CONTRACTOR believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby. If Owner's Representative determines that a change in the Contract Documents is required because of the action taken by the CONTRACTOR in response to such an emergency, a Change Directive or Change Order will be issued to document the consequences of such action; otherwise the OWNER will not be responsible for the CONTRACTOR's emergency action.

6.11.5.2 In the event there is an accident involving injury to any individual on or near the Work, the CONTRACTOR shall notify Owner's Representative within twenty-four (24) hours of the event and shall be responsible for recording the location of the event and the circumstances surrounding the event through photographs, interviewing witnesses, obtaining medical reports and other documentation that describes the event. Copies of such documentation shall be provided to Owner's Representative, for the OWNER's and ENGINEER's records, within forty-eight (48) hours of the event. Nothing in this section will relieve CONTRACTOR of its obligations and responsibilities with respect to an injury under any state and federal laws and regulations.

6.12 Continuing the Work:

The CONTRACTOR shall carry on the Work and adhere to the progress schedule during all disputes or disagreements with the OWNER. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as the OWNER and the CONTRACTOR may agree in writing.

6.13 CONTRACTOR's General Warranty and Guarantee:

6.13.1 The CONTRACTOR warrants and guarantees to the OWNER that all Work will be performed in a good and workmanlike manner in accordance with the Contract Documents and will not be defective. The CONTRACTOR's warranty and guarantee hereunder excludes defects or damage caused by:

- .1 abuse, modification or improper maintenance or operation by persons other than the CONTRACTOR, Subcontractors or Suppliers; or
- .2 normal wear and tear under normal usage.

6.13.2 The CONTRACTOR's obligation to perform and complete the Work in a good and workmanlike manner in accordance with the Contract Documents shall be absolute. None of the following will constitute acceptance of Work not in accordance with the Contract Documents or a release of the CONTRACTOR's obligation to perform the Work in accordance with the Contract Documents:

- .1 observations by OWNER and/or ENGINEER;
- .2 recommendation of any progress or final payment by OWNER;
- .3 the issuance of a certificate of Substantial Completion or any payment by the OWNER to the CONTRACTOR under the Contract Documents;
- .4 use or occupancy of the Work or any part thereof by the OWNER;
- .5 any acceptance by the OWNER or any failure to do so;
- .6 any review of a Shop Drawing or sample submittal;
- .7 any inspection, test or approval by others; or
- .8 any correction of defective Work by the OWNER.

6.13.3 The Contractor warrants and guarantees for two (2) years from Substantial Completion, the Work. This includes a Warranty and Guarantee against any and all defects. The Contractor must correct any and all defects in material and/or workmanship which may appear during the Warranty and Guarantee period, or any defects that occur within two (2) years of Substantial Completion even if discovered more than two (2) years after Substantial Completion, by repairing (or replacing with new items or new materials, if necessary) any such defect at no cost to the Owner, within a reasonable period of time, and to the Owner's satisfaction.

6.14 Indemnification:

6.14.1 THE CONTRACTOR SHALL DEFEND, INDEMNIFY AND HOLD HARMLESS THE OWNER, ITS OFFICERS, DIRECTORS, PARTNERS, EMPLOYEES, AGENTS AND CONSULTANTS FROM AND AGAINST ALL CLAIMS, COSTS, LOSSES AND DAMAGES (INCLUDING BUT NOT LIMITED TO ALL FEES AND CHARGES OF ENGINEERS, ARCHITECTS, ATTORNEYS AND OTHER PROFESSIONALS AND ALL COURT OR OTHER DISPUTE RESOLUTION COSTS) ARISING OUT OF OR RESULTING FROM THE PERFORMANCE OF THE WORK, PROVIDED THAT ANY SUCH CLAIM, COST, LOSS OR DAMAGE:

- .1 IS ATTRIBUTABLE TO BODILY INJURY, SICKNESS, DISEASE OR DEATH, OR TO INJURY TO OR DESTRUCTION OF TANGIBLE PROPERTY (OTHER THAN THE WORK ITSELF), INCLUDING THE LOSS OF USE RESULTING THEREFROM, AND
- .2 IS CAUSED IN WHOLE OR IN PART BY ANY NEGLIGENT ACT OR OMISSION OF THE CONTRACTOR, ANY SUBCONTRACTOR, ANY SUPPLIER, ANY PERSON OR ORGANIZATION DIRECTLY OR INDIRECTLY EMPLOYED BY ANY OF THEM TO PERFORM OR FURNISH ANY OF THE WORK OR ANYONE FOR WHOSE ACTS ANY OF THEM MAY BE LIABLE, REGARDLESS OF WHETHER OR NOT CAUSED IN PART BY ANY NEGLIGENCE OR OMISSION OF A PERSON OR ENTITY INDEMNIFIED HEREUNDER OR WHETHER LIABILITY IS IMPOSED UPON SUCH INDEMNIFIED PARTY BY LAWS AND REGULATIONS REGARDLESS OF THE NEGLIGENCE OF ANY SUCH PERSON OR ENTITY.

6.14.2 The indemnification obligation under paragraph 6.14.1 shall not be limited in any way by any limitation on the amount or type of damages, or compensation or benefits payable by or for the CONTRACTOR or any such Subcontractor, Supplier or other person or organization under workers' compensation acts, disability benefit acts or other employee benefit acts.

6.14.3 In the event the CONTRACTOR unreasonably delays progress of the work being done by others on the site so as to cause loss for which the OWNER becomes liable, then the CONTRACTOR shall reimburse the OWNER for such loss.

6.15 Survival of Obligations:

6.15.1 All representations, indemnifications, warranties and guarantees made in, required by or given in accordance with the Contract Documents, will survive final payment, completion and acceptance of the Work and termination or completion of the Agreement.

6.16 Force Majeure

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

1. severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;
2. abnormal weather conditions;

3. acts or failures to act of utility owners (other than those performing other work at or adjacent to the Site by arrangement with the Owner, as contemplated in Article 7); and
4. acts of war or terrorism.

6.17 Notice of Claim:

6.17.1 Should the CONTRACTOR suffer injury or damage to person or property because of any error, omission or act of the OWNER or of any of the OWNER's employees or agents or others for whose acts the OWNER is liable, a Claim will be made to the other party within ninety (90) calendar days of the event giving rise to such injury or damage. The provisions of this paragraph shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitations or statute of repose.

ARTICLE 7 - OTHER WORK

7.1 The OWNER may perform other work related to the Project at the site by the OWNER's own forces, or let other contracts therefor, or have other work performed by utility owners. If the CONTRACTOR believes that delay or additional cost is involved because of such action by the OWNER, the CONTRACTOR may make a Claim as provided in Article 11 or Article 12.

7.2 The CONTRACTOR shall afford other contractors who are in a contract with the OWNER and each utility owner (and the OWNER, if the OWNER is performing the additional work with the OWNER'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 other work and shall properly connect and coordinate the Work with theirs. Unless otherwise provided in the Contract Documents, the 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. The CONTRACTOR shall not endanger any work of others by cutting, excavating or otherwise altering their work and will only cut or alter their work with the written consent of Owner's Representative and the other contractors whose work will be affected. The CONTRACTOR shall promptly remedy damage wrongfully caused by the CONTRACTOR to completed or partially completed construction or to property of the OWNER or separate contractors.

7.3 If the proper execution or results of any part of the CONTRACTOR's Work depends upon work performed by others under this Article 7, the CONTRACTOR shall inspect such other work and promptly report to Owner's Representative in writing any delays, defects or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of the CONTRACTOR's Work. The CONTRACTOR's failure to report will constitute an express waiver of claims and an acceptance of such other work as fit and proper for integration with the CONTRACTOR's Work except for latent or non-apparent defects and deficiencies in such other work.

7.4 The OWNER shall provide for coordination of the activities of the OWNER's own forces and of each separate contractor with the Work of the CONTRACTOR, who shall

cooperate with them. The CONTRACTOR shall participate with other separate contractors in reviewing their construction schedules when directed to do so. The CONTRACTOR shall make any revisions to the construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the CONTRACTOR, separate contractors and the OWNER until subsequently revised.

7.5 Unless otherwise stated herein, costs caused by delays or by improperly timed activities or defective construction shall be borne by the party responsible therefor.

ARTICLE 8 - OWNER'S RESPONSIBILITIES

8.1 Prior to the start of construction, the OWNER will designate in writing a person or entity to act as Owner's Representative during construction. Except as otherwise provided in these General Conditions, the OWNER shall issue all communications to the CONTRACTOR through Owner's Representative. This section shall not limit the ENGINEER'S role as the OWNER's design professional or its ability to communicate with the CONTRACTOR to ensure the Work complies with the Contract Documents.

8.2 The OWNER will not supervise, direct, control or have authority over or be responsible for the CONTRACTOR's means, methods, techniques, sequences or procedures of construction or the safety precautions and programs incident thereto. The OWNER is not responsible for any failure of the CONTRACTOR to comply with laws and regulations applicable to furnishing or performing the Work. The OWNER is not responsible for the CONTRACTOR's failure to perform or furnish the Work in accordance with the Contract Documents. Failure or omission of the OWNER to discover, or object to or condemn any defective Work or material shall not release the CONTRACTOR from the obligation to properly and fully perform the Contract.

8.3 Information or services under the OWNER's control shall be furnished by the OWNER with reasonable promptness to avoid delay in the orderly progress of the Work.

8.4 The foregoing are in addition to other duties and responsibilities of the OWNER enumerated herein and especially those in respect to Article 4 (Availability of Lands; Subsurface and Physical Conditions; Reference Points), Article 7 (Other Work) and Article 14 (Payments to the CONTRACTOR and Completion).

8.5 Notice of Claim:

8.5.1 Should the OWNER suffer injury or damage to person or property because of any error, omission or act of the CONTRACTOR or of any of the CONTRACTOR's employees or agents or others for whose acts the CONTRACTOR is liable, a Claim will be made to the other party within ninety (90) calendar days of the event giving rise to such injury or damage. The provisions of this paragraph shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitations or statute of repose.

ARTICLE 9 - ENGINEER STATUS DURING CONSTRUCTION

9.1 ENGINEER's Authority and Responsibilities:

9.1.1 The duties and responsibilities and the limitations of authority of ENGINEER during construction are set forth in the Contract Documents and shall not be extended without written consent of the OWNER and ENGINEER. The assignment of any authority, duties or responsibilities to ENGINEER under the Contract Documents, or under any agreement between the OWNER and ENGINEER, or any undertaking, exercise or performance thereof by ENGINEER, is intended to be for the sole and exclusive benefit of the OWNER and is not for the benefit of the CONTRACTOR, Subcontractor, Sub-subcontractor, Supplier, or any other person or organization, or for any surety or employee or agent of any of them.

9.1.2 If the OWNER so directs, ENGINEER will review the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds and certificates of inspection, tests and approvals and other documentation required to be delivered by Article 14, but only to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests and approvals that the results certified indicate compliance with, the Contract Documents.

9.1.3 The limitations upon authority and responsibility set forth in this paragraph 9.1 shall also apply to ENGINEER's Consultants, Resident Project Representative and assistants.

9.2 ENGINEER as Owner's Representative:

9.2.1 The OWNER may designate the ENGINEER as the Owner's Representative. Any such designation will be made in writing to the CONTRACTOR with a copy to the ENGINEER.

9.3 Visits to Site:

9.3.1 If the OWNER so directs, ENGINEER will make visits to the site at intervals appropriate to the various stages of construction as is necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of the CONTRACTOR's executed Work. Based on information obtained during such visits and observations, ENGINEER will endeavor for the benefit of the OWNER to determine if the Work is proceeding in accordance with the Contract Documents. ENGINEER's efforts will be directed toward providing for the OWNER a greater degree of confidence that the completed Work will conform to the Contract Documents. On the basis of such visits and on-site observations, ENGINEER will keep the OWNER informed of the progress of the Work and will endeavor to guard the OWNER against defective Work.

9.4 Project Representative:

9.4.1 If the OWNER and ENGINEER agree, ENGINEER will furnish a Resident Project Representative to assist ENGINEER in providing more continuous observation of the Work. The responsibilities and authority and limitations of any such Resident Project Representative and assistants will be as provided in paragraph 9.1. The OWNER may designate another

representative or agent to represent the OWNER at the site who is not ENGINEER, ENGINEER's consultant, agent or employee.

9.5 ENGINEER shall review and approve Shop Drawings and Samples in accordance with section 6.2.6.

9.6 Clarifications and Interpretations:

9.6.1 ENGINEER may determine that written clarifications or interpretations of the requirements of the Contract Documents (in the form of drawings or otherwise) are necessary. Such written clarifications or interpretations will be consistent with the intent of and reasonably inferable from the Contract Documents, will be issued with reasonable promptness. The CONTRACTOR may seek a written clarification or interpretation from the engineer through a written Request for Information (RFI). The ENGINEER shall respond to all RFI's promptly. If the OWNER or the CONTRACTOR believes that a written clarification or interpretation justifies an adjustment in the Contract Amount or the Contract Times, the OWNER or the CONTRACTOR may make a Claim therefor as provided in Article 11 or Article 12.

9.7 Rejecting Defective Work:

9.7.1 ENGINEER will recommend that the OWNER disapprove or reject Work which ENGINEER believes to be defective, or believes will not produce a completed Project that conforms to the Contract Documents or will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

ARTICLE 10 - CHANGES IN THE WORK

10.1 Changes:

10.1.1 Without invalidating the Contract and without notice to any surety, the OWNER may, at any time or from time to time, order additions, deletions or revisions in the Work. Such changes in the Work will be authorized by Change Order, Change Directive or Field Order.

10.1.2 Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the CONTRACTOR shall proceed promptly, unless otherwise provided in the Change Order, Change Directive or Field Order.

10.1.3 The CONTRACTOR shall not be entitled to an increase in the Contract Amount or an extension of the Contract Times with respect to any Work performed that is not required by the Contract Documents as amended, modified and supplemented as provided in paragraph 3.3.1 and paragraph 3.3.2, except in the case of an emergency as provided in paragraph 6.11.5 or in the case of uncovering Work as provided in paragraph 13.4.

10.1.4 Except in the case of an emergency as provided in paragraph 6.11.5, a Change Order or Change Directive is required before the CONTRACTOR commences any activities associated with a change in the Work which, in the CONTRACTOR's opinion, will result in a change in the Contract Amount and/or Contract Times.

10.2 Change Orders:

10.2.1 The OWNER and the CONTRACTOR shall execute appropriate written Change Orders covering:

- .1 a change in the Work;
- .2 the amount of the adjustment in the Contract Amount, if any; and
- .3 the extent of the adjustment in the Contract Time, if any.

10.2.2 An executed Change Order shall represent the complete, equitable, and final amount of adjustment in the Contract Amount and/or Contract Time owed to the CONTRACTOR or the OWNER as a result of the occurrence or event causing the change in the Work encompassed by the Change Order.

10.3 Change Directives:

10.3.1 The OWNER may by written Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Amount and Contract Time being adjusted as necessary. A Change Directive shall be used in the absence of complete and prompt agreement on the terms of a Change Order.

10.3.2 If the Change Directive provides for an adjustment to the Contract Amount, the adjustment shall be based on the method provided for in paragraph 11.5.

10.3.3 Upon receipt of a Change Directive, CONTRACTOR shall promptly proceed with the change in the Work involved.

10.4 Field Order:

10.4.1 The OWNER or ENGINEER may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Amount or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These shall be accomplished by written Field Order and shall be binding on the CONTRACTOR who shall perform the Work involved promptly.

10.4.2 If the CONTRACTOR believes that a Field Order would require an adjustment in the Contract Amount and/or Contract Times, the CONTRACTOR shall make written request to The Owner for a Change Order. Any request by the CONTRACTOR for an adjustment in Contract Amount and/or Contract Times shall be made in writing prior to beginning the work covered by the Field Order.

10.5 No Damages for Delay:

10.5.1 The CONTRACTOR shall receive no compensation for delays or hindrances to the Work. CONTRACTOR expressly waives any right to an adjustment in Contract Price for any event of delay. CONTRACTOR's sole remedy for any delay shall be limited to an adjustment in Contract Time. If delay is caused by specific orders given by the OWNER to stop work or by performance of extra Work or by failure of the OWNER to provide information, access to the work, material or necessary instructions for carrying on the Work, then such delay will entitle the CONTRACTOR to an extension of time. No such extension of time shall release the CONTRACTOR from all the CONTRACTOR's obligations hereunder which shall remain in full force until discharge of the Contract.

ARTICLE 11 - CHANGE OF CONTRACT AMOUNT

11.1 The Contract Amount is stated in the Agreement and, including authorized adjustments, is the total amount payable by the OWNER to the CONTRACTOR for performance of the Work under the Contract Documents.

11.2 The original Contract Amount may not be increased by more than twenty-five percent (25%) and it may not be decreased more than twenty-five percent (25%) without the consent of the CONTRACTOR to such decrease.

11.3 The Contract Amount shall only be changed by a Change Order or Change Directive. Any claim for an adjustment in the Contract Amount shall be made by Written Notice delivered by the party making the Claim to the other party promptly (but in no event later than ninety (90) calendar days) after the start of the occurrence or event giving rise to the Claim and stating the general nature of the Claim. Notice of the amount of the Claim with supporting data shall be delivered with the Written Notice of Claim delivered by claimant to the extent the data is available, and shall represent that the adjustment claimed covers all known amounts to which claimant is entitled as a result of said occurrence or event. If the OWNER and the CONTRACTOR cannot otherwise agree, all Claims for adjustment in the Contract Amount shall be determined as set out in Article 16.

11.4 Determination of Value of Work:

11.4.1 The value of any Work covered by a Change Order or of any Claim for an adjustment in the Contract Amount will be determined by one or more of the following methods:

- .1 by application of unit prices contained in the Contract Documents to the quantities of the items involved.
- .2 by a mutually agreed lump sum properly itemized and supported by sufficient substantiating data to permit evaluation.
- .3 by cost of Work plus the CONTRACTOR's fee for all overhead costs and profit (determined as provided in paragraph 11.5).

11.4.2 A Cost of Work determined pursuant to 11.5 shall only be used if the OWNER and CONTRACTOR cannot resolve a value determination by agreement on unit pricing or lump sum.

11.5 Cost of Work:

11.5.1 If an agreement cannot be achieved before a change in the Work is commenced which will result in an adjustment in the Contract Amount, then the change in the Work will be performed by a Change Directive and payment will be made as follows:

- .1** For all personnel, the CONTRACTOR will receive the rate or wage specified in the prevailing wage rate determination applicable to the Project. If the rate determination does not contain burden, then burden shall be calculated as such: 55% of the base wage excluding markup for CONTRACTOR's overhead and profit. For each hour that said personnel are actually engaged in such Work, to which will be added an amount equal to twenty-five percent (25%) of the sum thereof as compensation for the CONTRACTOR's total overhead and profit will be added. No separate charge will be made by the CONTRACTOR for organization or overhead expenses. The actual cost of the CONTRACTOR's bond(s) on the extra Work will be paid based on invoices from surety. No charge for superintendence will be made unless considered necessary and ordered by the OWNER.
- .2** The CONTRACTOR will receive the actual cost, including freight charges, of the materials used on such Work, to which costs will be added a sum equal to twenty-five percent (25%) thereof as compensation for the CONTRACTOR's total overhead and profit. In case material invoices indicate a discount may be taken, the actual cost will be the invoice price minus the discount.
- .3** For machinery, trucks, power tools, or other similar equipment agreed to be necessary by the OWNER and the CONTRACTOR, the OWNER will allow the CONTRACTOR the rate as given in the latest edition of the Associated General Contractors of America "Contractor's Equipment Cost Guide" as published by Dataquest for each hour that said tools or equipment are in use on such work, which rate includes the cost of fuel, lubricants and repairs. No additional compensation will be allowed on the equipment for the CONTRACTOR's overhead and profit.
- .4** The compensation, as herein provided for, shall be received by the CONTRACTOR and any affected Subcontractor as payment in full for work done by Change Directive and will include use of small tools, and total overhead expense and profit. The CONTRACTOR and the Owner's Representative shall compare records of work done by Change Directive at the end of each day. Copies of these records will be made upon forms provided for this purpose by the OWNER or ENGINEER and signed by both Owner's Representative and the CONTRACTOR, with one (1) copy being retained by the OWNER and one (1) by the CONTRACTOR. Refusal by the CONTRACTOR to sign these records does not invalidate the accuracy of the record.

11.6 Unit Price Work:

11.6.1 Where the Contract Documents provide that all or part of the Work is to be unit price Work, initially the Contract Amount will be deemed to include for all unit price work an amount equal to the sum of the established unit price for each separately identified item of unit price work times the estimated quantity of each item as indicated in the Bid. The estimated quantities of items of unit price work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Amount. Determinations of the actual quantities and classifications of unit price work performed by the CONTRACTOR will be made by the ENGINEER. OWNER and ENGINEER will review with the CONTRACTOR the preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise).

11.6.2 Each unit price will 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.

11.6.3 Right to Verify Information: The CONTRACTOR agrees that any designated representative of the OWNER shall have the right to examine the CONTRACTOR's records to verify the accuracy and appropriateness of the pricing data used to price change proposals.

ARTICLE 12 - CHANGE OF CONTRACT TIMES

12.1 Working Day and Calendar Day Contracts:

12.1.1 The Contract Times (or Milestones) shall only be changed by Change Order or Time Extension Request duly executed by both the CONTRACTOR and the OWNER. Any claim for an adjustment of the Contract Times (or Milestones) shall be made by Written Notice delivered by the party making the Claim to the other party promptly after the start of the occurrence or event giving rise to the delay and stating the general nature of the delay. Notice of the extent of the delay with supporting data shall be delivered with the Written Notice of Claim, and shall represent that the adjustment claimed is the entire adjustment to which claimant is entitled as a result of said occurrence or event. If the OWNER and the CONTRACTOR cannot otherwise agree, all Claims for adjustment in the Contract Times (or Milestones) shall be determined as set out in Article 16. No Claim for an adjustment in the Contract Times (or Milestones) will be valid if not submitted in accordance with the requirements of this paragraph.

12.1.2 When the CONTRACTOR is at fault and the OWNER stops the Work so that corrections in the Work can be made by the CONTRACTOR, then no extension in time will be allowed.

12.1.3 When the CONTRACTOR is prevented from completing any part of the Work within the Contract Times (or Milestones) due to delay beyond the control of both the OWNER and the CONTRACTOR, an extension of the Contract Times (or Milestones) in an amount equal to the time lost due to such delay shall be the CONTRACTOR's sole and exclusive remedy for such delay. However, adverse weather shall not be considered justification for extension of Contract Times on Calendar Day contracts except as provided for in paragraph 12.2.

12.1.4 The OWNER will consider time extension requests and may grant the CONTRACTOR an extension of time because of:

- .1 Changes ordered in the work which justify additional time.
- .2 Failure of materials or products being at the Project site due to delays in transportation or delivery, which are not the result of the CONTRACTOR's, Subcontractor's or Supplier's negligence. The request for an extension of time shall be supported by a recitation of acts demonstrating that such delays were beyond the control of the CONTRACTOR, including but not limited to, the CONTRACTOR's efforts to overcome such delays documented as follows:
 - a) Copy of purchase order for delayed item(s) indicating date ordered by the CONTRACTOR/Subcontractor and date purchase order received by Supplier.
 - b) If item(s) require Shop Drawings or other submittal information in accordance with the Contract Documents, provide record of date submittal(s) forwarded to Owner's Representative, date submittal(s) returned to the CONTRACTOR, and date submittal(s) forwarded to Supplier.
 - c) Copy of document(s) from Supplier, on Supplier's letterhead, indicating date(s) item(s) would be ready for shipment and/or actual shipment date(s).
 - d) Copies of all correspondence between the CONTRACTOR/ Subcontractor and Supplier indicating the CONTRACTOR/ Subcontractor's efforts to expedite item(s).
 - e) If item(s) are being purchased by a Subcontractor, provision of meeting notes, correspondence, and the like which reflect the CONTRACTOR's efforts with the Subcontractor to expedite delivery of the item(s).
- .3 When acts of the OWNER, ENGINEER, utility owners or other contractors employed by the OWNER delay progress of work through no fault of the CONTRACTOR.
- .4 Events of delay listed in section 6.16.

12.2 Calendar Day Contracts:

Under a Calendar Day Contract, Contractor may also be granted an extension of time because of unusual inclement weather, which is beyond the normal weather recorded and expected for Seguin, Texas. Normal rainfall complied by the State climatologist, based on U.S. Weather Bureau Records for Seguin, Texas, is considered a part of the Calendar Day Contract, and is not a justification for an extension of time. Listed as follows are the mean number of days in which there occurred 0.10 inch or more of precipitation:

January 4 days

February	3 days
March	4 days
April	3 days
May	5 days
June	5 days
July	3 days
August	3 days
September	4 days
October	5 days
November	3 days
December	3 days

Rain days per month in amounts exceeding the number of days shown above may be credited as a Rain Day if a Claim is made in accordance with the general conditions and meets the following definition: a "Rain Day" is any day in which a rain event occurs at the site and is sufficient to prevent Contractor from performing units of Work critical to maintaining the project schedule.

ARTICLE 13 - TESTS AND INSPECTIONS; AND CORRECTION OR REMOVAL OF DEFECTIVE WORK

13.1 Notice of Defects:

13.1.1 Prompt notice of all defective Work of which the OWNER or ENGINEER has actual knowledge will be given to the CONTRACTOR. All defective Work may be rejected or corrected as provided for in Article 13.

13.2 Access to Work:

13.2.1 The OWNER, ENGINEER, ENGINEER's Consultants, other representatives and personnel of the OWNER, independent testing laboratories and governmental agencies having jurisdiction will have unrestricted physical access to the Work site for observing, inspecting and testing. The CONTRACTOR shall provide them proper and safe conditions for such access, and advise them of the CONTRACTOR's site safety procedures and programs so that they may comply therewith as applicable.

13.3 Tests and Inspections:

13.3.1 The CONTRACTOR shall give timely notice of readiness of the Work for all required inspections, tests or approvals, and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.

13.3.2 The CONTRACTOR shall employ and pay for services of an independent testing laboratory to perform all inspections, tests or approvals required by the Contract Documents except:

- .1 for inspections, tests or approvals covered by paragraph 13.3.3 below;
- .2 for re-inspecting or retesting defective Work; and
- .3 as otherwise specifically provided in the Contract Documents.

All testing laboratories shall be submitted to and approved by the OWNER.

13.3.3 If laws or regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested or approved by an employee or other representative of such public body, the CONTRACTOR shall assume full responsibility for arranging and obtaining such inspections, tests or approvals, pay all costs in connection therewith and furnish Owner's Representative the required certificates of inspection or approval. The CONTRACTOR shall also be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests or approvals required for the OWNER's and ENGINEER's review of materials or equipment to be incorporated in the Work, or of materials, mix designs or equipment submitted for review prior to the CONTRACTOR's purchase thereof for incorporation in the Work.

13.4 Uncovering Work:

13.4.1 If any Work (or the work of others) that is to be inspected, tested or approved is covered by the CONTRACTOR without OWNER's or ENGINEER's concurrence, or if any Work is covered contrary to the OWNER's written request, it must, if requested by the OWNER or ENGINEER, be uncovered and recovered at the CONTRACTOR's expense.

13.4.2 ENGINEER has the authority to require special inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

13.4.3 If any Work is covered contrary to the written request of ENGINEER, then CONTRACTOR shall, if requested by ENGINEER, uncover such Work for ENGINEER's observation, and then replace the covering, all at CONTRACTOR's expense.

13.4.4 If ENGINEER considers it necessary or advisable that covered Work be observed by ENGINEER or inspected or tested by others, then CONTRACTOR, upon OWNER's approval and ENGINEER's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as ENGINEER may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.

1. If it is found that the uncovered Work is defective, CONTRACTOR shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending CONTRACTOR's full discharge of this

responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.

2. If the uncovered Work is not found to be defective, CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then CONTRACTOR may submit a Change Proposal within 30 calendar days of the determination that the Work is not defective.

13.5 OWNER May Stop the Work:

13.5.1 If the Work is defective, or the CONTRACTOR fails to supply sufficient skilled workers or suitable materials or equipment, or fails to furnish or perform the Work in such a way that the completed Work will conform to the Contract Documents, the OWNER may order the CONTRACTOR to stop the Work, or any portion thereof, until the cause for such order has been eliminated.

13.5.2 A notice to stop the Work, based on causes listed in 13.5.1, shall not stop calendar or working days charged to the Project.

13.6 Correction or Removal of Defective Work:

13.6.1 If required by the OWNER, the CONTRACTOR shall promptly, as directed, either correct all defective Work, whether or not fabricated, installed or completed, or, if the Work has been rejected by Owner's Representative, remove it from the site and replace it with Work that is not defective. The CONTRACTOR shall correct or remove and replace defective Work, or submit a plan of action detailing how the deficiency will be corrected, within the time frame identified in the notice of defective Work. The CONTRACTOR shall pay all claims, costs, losses and damages caused by or resulting from such correction or removal (including but not limited to all costs of repair or replacement of work of others).

13.7 Warranty period:

13.7.1 If within two years after the date of Substantial Completion any Work is in need of repair, adjustment, modification, correction, or found to be defective, or if the repair of any damages to the Site, adjacent areas that CONTRACTOR has arranged to use through construction easements or otherwise, and other adjacent areas used by CONTRACTOR, is found to be defective, then CONTRACTOR shall promptly, without cost to OWNER and in accordance with OWNER's written instructions:

1. correct the defective repairs to the Site or such other adjacent areas;
2. correct such defective Work;
3. if the defective Work has been rejected by OWNER, remove it from the Project and replace it with Work that is not defective, and

4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting therefrom.

13.7.2 If CONTRACTOR does not promptly comply with the terms of OWNER's written instructions, or in an emergency where delay would cause serious risk of loss or damage, OWNER may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. CONTRACTOR shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others).

13.7.3 In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

13.7.4 Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of two years after such correction or removal and replacement has been satisfactorily completed.

13.7.5 CONTRACTOR's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

13.8 OWNER May Correct Defective Work:

13.8.1 If the CONTRACTOR fails within a reasonable time after Written Notice of the OWNER to correct defective Work, or to remove and replace rejected Work, or if the CONTRACTOR fails to perform the Work in accordance with the Contract Documents, or if the CONTRACTOR fails to comply with any other provision of the Contract Documents, the OWNER may, after seven (7) calendar days' Written Notice to the CONTRACTOR, correct and remedy any such deficiency. In exercising the rights and remedies under this paragraph, the OWNER shall proceed expeditiously. In connection with such corrective and remedial action, the OWNER may exclude the CONTRACTOR from all or part of the site, take possession of all or part of the Work, and suspend the CONTRACTOR's services related thereto, and incorporate in the Work all materials and equipment stored at the site or for which the OWNER has paid the CONTRACTOR but which are stored elsewhere. The CONTRACTOR shall allow the OWNER, its agents and employees, the OWNER's other contractors, ENGINEER and ENGINEER's consultants access to the site to enable the OWNER to exercise the rights and remedies under this paragraph. CONTRACTOR shall be liable to OWNER for all claims, costs, losses and damages incurred or sustained by the OWNER in exercising such rights and remedies will be charged against the CONTRACTOR. Such claims, costs, losses and damages will include but not be limited to all costs of repair or replacement of work of others destroyed or damaged by correction, removal or replacement of the CONTRACTOR's defective Work. The CONTRACTOR shall not be allowed an extension of the Contract Times (or Milestones), or claims of damage because of any delay in the performance of the Work attributable to the exercise by the OWNER of the OWNER's rights and remedies hereunder.

ARTICLE 14 - PAYMENTS TO CONTRACTOR AND COMPLETION

14.1 Application for Progress Payment:

14.1.1 Not more than once per month, the CONTRACTOR shall submit to ENGINEER for review an Application for Payment, in a form acceptable to the OWNER, filled out and signed by the CONTRACTOR covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents.

14.1.2 Such applications shall not include requests for payment of amounts the CONTRACTOR does not intend to pay to a Subcontractor or Supplier because of a dispute or other reason.

14.1.3 Owner will pay for materials or equipment not incorporated in the work but delivered and suitably stored at the site. Unless specifically authorized by OWNER, payment for materials stored off-site will not be made unless and until those materials are delivered to the jobsite and suitably stored or incorporated into the Work.

14.1.4 The OWNER will pay to the CONTRACTOR the total amount of approved Application for Payment, less five percent (5%) of the amount thereof, which five percent (5%) will be retained until final payment, less all previous payments and less all sums that may be retained by the OWNER under the terms of this Agreement. In either case, if the Work is near completion and delay occurs due to no fault or neglect of the CONTRACTOR, the OWNER may pay a portion of the retained amount to the CONTRACTOR. The CONTRACTOR, at the OWNER's option, may be relieved of the obligation to complete the Work and, thereupon, the CONTRACTOR shall receive payment of the balance due under the Contract subject to the conditions stated under paragraph 15.2.

14.1.5 Applications for Payment shall include the following documentation:

- .1 updated progress schedule;
- .2 monthly subcontractor report; and
- .3 any other documentation required under any Supplemental General Conditions.

14.2 CONTRACTOR's Warranty of Title:

14.2.1 The CONTRACTOR warrants and guarantees that title to all Work, materials and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to the OWNER not later than the time of payment to the CONTRACTOR free and clear of all liens.

14.3 Review of Applications for Progress Payment:

14.3.1 ENGINEER will, within seven (7) calendar days after receipt of each Application for Payment, either indicate a recommendation for payment and forward the Application for processing by the OWNER, or return the Application to the CONTRACTOR indicating

ENGINEER's reasons for refusing to recommend payment. In the latter case, the CONTRACTOR may make the necessary corrections and resubmit the Application.

14.3.2 ENGINEER's recommendation of any payment requested in an Application for Payment will constitute a representation by ENGINEER, based upon ENGINEER's on-site observations of the executed Work and on ENGINEER's review of the Application for Payment and the accompanying data and schedules, that to the best of ENGINEER's knowledge, information and belief:

- .1 the Work has progressed to the point indicated; and
- .2 the quality of the Work is in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, to the results of any subsequent tests called for in the Contract Documents, and to any other qualifications stated in the recommendation).

14.3.3 By recommending any such payment, ENGINEER will not thereby be deemed to have represented that:

- .1 exhaustive or continuous on-site inspections have been made to check the quality or the quantity of the Work;
- .2 examination has been made to ascertain how or for what purpose the CONTRACTOR has used money previously paid on account of the Contract Amount;
- .3 the CONTRACTOR's construction means, methods, techniques, sequences or procedures have been reviewed; or
- .4 that there may not be other matters or issues between the parties that might entitle the CONTRACTOR to be paid additionally by the OWNER or entitle the OWNER to withhold payment to the CONTRACTOR.

14.4 Decisions to Withhold Payment:

14.4.1 The OWNER may withhold or nullify the whole or part of any payment to such extent as may be necessary on account of:

- .1 defective Work not remedied;
- .2 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Amount;
- .3 damage to the OWNER or another contractor;
- .4 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay;

- .5 failure of the CONTRACTOR to submit a schedule of values in accordance with the Contract Documents;
- .6 failure of the CONTRACTOR to submit a submittal schedule in accordance with the Contract Documents;
- .7 failure of the CONTRACTOR to submit or update construction schedules in accordance with the Contract Documents;
- .8 failure of the CONTRACTOR to maintain a record of changes on drawings and documents;
- .9 failure of the CONTRACTOR to maintain weekly payroll reports;
- .10 the CONTRACTOR's neglect or unsatisfactory prosecution of the Work, including failure to clean up; or
- .11 failure of the CONTRACTOR to comply with any provision of the Contract Documents.

14.4.2 Should OWNER withhold payment for any reason in 14.4.1, and upon removal of the basis for the withholding by CONTRACTOR, the CONTRACTOR shall resubmit a statement for the value of Work performed. Payment will be made, within thirty (30) calendar days of receipt of approved Application for Payment.

14.5 Delayed Payments:

14.5.1 Timeliness and interest on payments due to CONTRACTOR from OWNER are subject to and shall be controlled by Chapter 2251 of the Texas Government Code.

14.6 Arrears:

14.6.1 No money shall be paid by the OWNER upon any claim, debt, demand or account whatsoever, to any person, firm or corporation who is in arrears to the OWNER; and the OWNER shall be entitled to counterclaim and offset against any such debt, claim, demand or account so in arrears and no assignment or transfer of such debt, claim, demand or account, shall affect the right of the OWNER to so offset said amounts, and associated penalties and interest if applicable, against the same.

14.7 Substantial Completion:

14.7.1 If a Certificate of Occupancy is required by public authorities having jurisdiction over the Work, said certificate shall be issued before the Work or any portion thereof is considered substantially complete. When the CONTRACTOR considers that the Work, or a portion thereof which the OWNER agrees to accept separately, is substantially complete, the CONTRACTOR shall notify OWNER and ENGINEER and request a determination as to whether the Work or designated portion thereof is substantially complete. If OWNER or ENGINEER does not consider the Work substantially complete, OWNER or ENGINEER will

notify the CONTRACTOR giving reasons therefor. Failure on the OWNER's part to list a reason does not alter the responsibility of the CONTRACTOR to complete all Work in accordance with the Contract Documents. After satisfactorily completing items identified by OWNER or ENGINEER, the CONTRACTOR shall then submit another request for OWNER and ENGINEER to determine substantial completion. If OWNER and ENGINEER consider the Work substantially complete, the ENGINEER will prepare and deliver a certificate of Substantial Completion which shall establish the date of Substantial Completion, shall include a punch list of items to be completed or corrected before final payment, and shall establish responsibilities of the OWNER and the CONTRACTOR for security, maintenance, heat, utilities, damage to the Work, warranty and insurance. Failure to include an item on the punch list does not alter the responsibility of the CONTRACTOR to complete all Work in accordance with the Contract Documents. The certificate of Substantial Completion shall be signed by the OWNER and the CONTRACTOR to evidence acceptance of the responsibilities assigned to them in such certificate.

14.7.2 After Substantial Completion the CONTRACTOR shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases CONTRACTOR may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

14.8 Partial Utilization:

14.8.1 The OWNER, at the OWNER's sole option, shall have the right to take possession of and use any completed or partially completed portion of the Work regardless of the time for completing the entire Work. The OWNER's exercise of such use and possession shall not be construed to mean that the OWNER acknowledges that any part of the Work so possessed and used is substantially complete or that it is accepted by OWNER, and the OWNER's exercise of such use and possession shall not relieve the CONTRACTOR of its responsibility to complete all Work in accordance with the Contract Documents.

14.9 Final Inspection:

14.9.1 Upon Written Notice from the CONTRACTOR that the entire Work or an agreed portion thereof is complete, ENGINEER will make a final inspection with the CONTRACTOR and provide Written Notice of all particulars in which this inspection reveals that the Work is incomplete or defective. The CONTRACTOR shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

14.10 Final Application for Payment:

14.10.1 The CONTRACTOR may make application for final payment following the procedure for progress payments after the CONTRACTOR has completed all such corrections to the satisfaction of ENGINEER and delivered the following documents:

- .1** Complete operating and maintenance manuals, each containing maintenance and operating instructions, schedules, guarantees, and other documentation required by the Contract Documents, Quantity as determined by the contract documents;

- .2 Record documents (as provided in paragraph 6.10);
- .3 Consent of surety to final payment;
- .4 Certificate evidencing that insurance required by the General Conditions will remain in force after final payment and through any warranty period;
- .5 Non-Use of Asbestos Affidavit (After Construction); and
- .6 Any other documentation called for in the Contract Documents.

14.11 Final Payment and Acceptance:

14.11.1 If, on the basis of observation of the Work during construction, final inspection, and review of the final Application for Payment and accompanying documentation as required by the Contract Documents, ENGINEER is satisfied that the Work has been completed and the CONTRACTOR's other obligations under the Contract Documents have been fulfilled, ENGINEER will recommend the final Application for Payment and thereby notify the OWNER, who will pay to the CONTRACTOR the balance due the CONTRACTOR under the terms of the Contract.

14.11.2 ENGINEER will issue a letter of final acceptance to the OWNER and CONTRACTOR and must be acknowledged and accepted by the OWNER, which establishes the Final Completion date.

14.12 Waiver of Claims:

14.12.1 The making and acceptance of final payment will constitute:

- .1 a waiver of claims by the OWNER against the CONTRACTOR, except claims arising from previously noticed and unsettled claims, from defective Work appearing after final inspection, from failure to comply with the Contract Documents or the terms of any warranty specified therein, or from the CONTRACTOR's continuing obligations under the Contract Documents; and
- .2 a waiver of all claims by the CONTRACTOR against the OWNER other than those previously made in writing and still unsettled.

ARTICLE 15 - SUSPENSION OF WORK AND TERMINATION

15.1 OWNER May Suspend Work Without Cause and for Convenience:

15.1.1 At any time and without cause and for convenience, the OWNER may suspend the Work or any portion thereof for a period of not more than ninety (90) calendar days by written agreement or by Written Notice to the CONTRACTOR which will fix the date on which the Work will be resumed. The CONTRACTOR shall resume the Work on the date so fixed. The CONTRACTOR may be allowed an adjustment in the Contract Amount or an extension of

the Contract Times, or both, directly attributable to any such suspension if the CONTRACTOR makes an approved Claim therefor as provided in Article 11 and Article 12.

15.2 OWNER May Terminate Without Cause:

15.2.1 Upon seven (7) calendar days' Written Notice to the CONTRACTOR, the OWNER may, without cause and without prejudice to any right or remedy of the OWNER, elect to terminate the Agreement. In such case, the CONTRACTOR shall be paid (without duplication of any items):

- .1 for completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination;
- .2 for all claims incurred in settlement of terminated contracts with Suppliers, Subcontractors, and others. The CONTRACTOR agrees to negotiate in good faith with Subcontractors, Suppliers and others to mitigate the OWNER's cost; and
- .3 for anticipated profits on entire Contract not previously paid. This sum shall not include any overhead or general field conditions on unperformed work.

15.3 OWNER May Terminate With Cause:

15.3.1 Upon the occurrence of any one or more of the following events:

- .1 if the CONTRACTOR persistently fails to perform the Work in accordance with the Contract Documents;
- .2 if the CONTRACTOR disregards laws or regulations of any public body having jurisdiction;
- .3 if the CONTRACTOR disregards the OWNER's authority;
- .4 if the CONTRACTOR fails to maintain a work force adequate to accomplish the Work within the Contract Time;
- .5 if the CONTRACTOR fails to make adequate progress and endangers successful completion of the Contract; or
- .6 if the CONTRACTOR otherwise violates in any substantial way any provisions of the Contract Documents;

The OWNER may, after giving the CONTRACTOR (and the surety, if any) seven (7) calendar days' Written Notice terminate the services of the CONTRACTOR. The OWNER, at its option, may proceed with negotiation with surety for completion of the Work. Alternatively, the OWNER may under these circumstances exclude the CONTRACTOR from the site and take possession of the Work (without liability to the CONTRACTOR for trespass or conversion), incorporate in the Work all materials and equipment stored at the site or for which the OWNER has paid the CONTRACTOR but which are stored elsewhere, and finish the Work

as the OWNER may deem expedient. In such case the CONTRACTOR shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Amount exceeds all claims, costs, losses and damages sustained by the OWNER arising out of or resulting from completing the Work, such excess will be paid to the CONTRACTOR. If such claims, costs, losses and damage exceed such unpaid balance, the CONTRACTOR or surety shall pay the difference to the OWNER. Should OWNER proceed to complete the Work, CONTRACTOR expressly acknowledges that the OWNER is exempted from competitive bidding requirements for competition work pursuant to the terms of Texas Local Government Code Section 252.022.

15.3.2 Where the CONTRACTOR's services have been so terminated by the OWNER, the termination will not affect any rights or remedies of the OWNER against the CONTRACTOR and surety then existing or which may thereafter accrue. Any retention or payment of amounts due the CONTRACTOR by the OWNER will not release the CONTRACTOR from liability.

15.4 CONTRACTOR May Stop Work or Terminate:

15.4.1 If through no act or fault of the CONTRACTOR, the Work is suspended for a period of more than ninety (90) calendar days by the OWNER or under an order of court or other public authority, or (except during disputes) ENGINEER fails to forward for processing any mutually acceptable Application for Payment within thirty (30) calendar days after it is submitted, or (except during disputes) the OWNER fails for sixty (60) calendar days after it is submitted to pay the CONTRACTOR any sum finally determined by the OWNER to be due, then the CONTRACTOR may, upon fifteen (15) calendar days' Written Notice to the OWNER, and provided the OWNER does not remedy such suspension or failure within that time, terminate the Agreement and recover from the OWNER payment on the same terms as provided in paragraph 15.2. In lieu of terminating the Agreement and without prejudice to any other right or remedy, if (except during disputes) ENGINEER has failed to forward for processing any mutually acceptable Application for Payment within thirty (30) calendar days after it is submitted, or (except during disputes) the OWNER has failed for sixty (60) calendar days after it is submitted to pay the CONTRACTOR any sum finally determined by the OWNER to be due, the CONTRACTOR may upon fifteen (15) calendar days' Written Notice to the OWNER stop the Work until payment of all such amounts due the CONTRACTOR, including interest thereon. The provisions of this paragraph 15.4 are not intended to preclude the CONTRACTOR from making a Claim under Article 11 and Article 12 for an increase in Contract Amount or Contract Times or otherwise for expenses or damage directly attributable to the CONTRACTOR's stopping Work as permitted by this paragraph.

ARTICLE 16 - DISPUTE RESOLUTION

16.1 Filing of Claims:

16.1.1 Claims arising from the circumstances identified in the Contract Documents or other occurrences or events, shall be made by Written Notice delivered by the party making the Claim to the other party within ninety (90) calendar days after the start of the occurrence or event giving rise to the Claim and stating the general nature of the Claim. Notice of the amount of the Claim with supporting data if not delivered with the notice, shall be delivered within thirty

(30) calendar days after Written Notice of Claim is delivered by claimant and shall represent that the adjustment claimed covers all known amounts to which claimant is entitled.

16.1.2 Within thirty (30) calendar days of receipt of notice of the amount of the Claim with supporting data, OWNER and the CONTRACTOR shall meet to discuss the Claim, after which an offer of settlement or notification of no settlement offer will be made to claimant. If claimant is not satisfied with the proposal presented, claimant shall have thirty (30) calendar days in which to:

- .1 submit additional supporting data requested by the other party;
- .2 modify the initial Claim; or
- .3 request Alternative Dispute Resolution.

16.2 Alternative Dispute Resolution:

16.2.1 If a dispute exists concerning a Claim, the parties agree to use the following procedure prior to pursuing any other available remedies. The OWNER reserves the right to include ENGINEER as a party.

16.2.2 Negotiating with Previously Uninvolved Personnel: Either party may make a written request for a meeting to be held between representatives of each party within fourteen (14) calendar days of the request or such later period that the parties may agree to. Each party shall endeavor to include, at a minimum, one (1) previously uninvolved senior level decision maker empowered to negotiate on behalf of their organization. The purpose of this and subsequent meetings will be good faith negotiations of the matters constituting the dispute. Negotiations shall be concluded within thirty (30) calendar days of the first meeting, unless mutually agreed otherwise. This step may be waived by written agreement of both parties, in which event the parties may proceed directly to mediation as described below.

16.2.3 Mediation:

16.2.3.1 If the procedure described in paragraph 16.2.2 proves unsuccessful or is waived pursuant to its terms, the parties shall initiate the mediation process. The parties agree to select within thirty (30) calendar days one (1) mediator trained in mediation skills, to assist with resolution of the dispute. The OWNER and the CONTRACTOR agree to act in good faith in the selection of the mediator and to give consideration to qualified individuals nominated to act as mediator. Nothing in this agreement prevents the parties from relying on the skills of a person who also is trained in the subject matter of the dispute and/or a contract interpretation expert.

16.2.3.2 The OWNER and CONTRACTOR may agree to suspend or abate the mediation requirement until such time that the Project is complete such that multiple claims that might have remained unresolved during the course of the Project may be negotiated and mediated jointly.

16.2.3.3 If Mediation is unsuccessful, the parties may litigate any remaining claims or disputes in a court of competent jurisdiction with venue in Guadalupe County, Texas.

ARTICLE 17 - RIGHT TO AUDIT

17.1 Right to Audit:

17.1.1 Whenever the OWNER enters into any type of contractual arrangement with the CONTRACTOR, then the CONTRACTOR's "records" shall upon reasonable notice be open to inspection and subject to audit and/or reproduction during normal business working hours. The OWNER's representative, or an outside representative engaged by the OWNER, may perform such audits. The CONTRACTOR shall maintain all records relating to this Agreement for four (4) years from the date of final payment under this Agreement.

17.1.2 The OWNER shall have the exclusive right to examine the records of the CONTRACTOR. The term "records" as referred to herein shall include any and all information, materials and data of every kind and character, including without limitation records, books, papers, documents, contracts, schedules, commitments, arrangements, notes, daily diaries, reports, drawings, receipts, vouchers and memoranda, and any and all other agreements, sources of information and matters that may, in the OWNER's judgment, have any bearing on or pertain to any matters, rights, duties or obligations under or covered by any contract document. Such records shall include (hard copy, as well as computer-readable data if it can be made available), written policies and procedures, time sheets, payroll registers, cancelled checks, personnel file data, correspondence, general ledger entries, and any other record in the CONTRACTOR's possession which may have a bearing on matters of interest to the OWNER in connection with the CONTRACTOR's dealings with the OWNER (all of the foregoing are hereinafter referred to as "records"). In addition, the CONTRACTOR shall permit interviews of employees as well as agents, representatives, vendors, subcontractors and other third parties paid by the CONTRACTOR to the extent necessary to adequately permit evaluation and verification of the following:

- a) The CONTRACTOR's compliance with contract requirements;
- b) The CONTRACTOR's compliance with the OWNER'S business ethics policies; and
- c) If necessary, the extent of the Work performed by the CONTRACTOR at the time of contract termination.

17.1.3 The CONTRACTOR shall require all payees (examples of payees include subcontractors, insurance agents, material suppliers, etc.) to comply with the provisions of this Article 17 by securing the requirements hereof in a written agreement between the CONTRACTOR and payee. Such requirements include a flow-down right of audit provision in contracts with payees that also apply to subcontractors and sub-subcontractors, material suppliers, etc. The CONTRACTOR shall cooperate fully and shall require Related Parties and all of the CONTRACTOR's subcontractors to cooperate fully in furnishing or in making available to the OWNER from time to time whenever requested, in an expeditious manner, any and all such information, materials, and data.

17.1.4 The OWNER's authorized representative or designee shall have reasonable access to the CONTRACTOR's facilities, shall be allowed to interview all current or former employees to discuss matters pertinent to the performance of this Agreement, and shall be

provided adequate and appropriate work space in order to conduct audits in compliance with this Article 17.

17.1.5 If an audit inspection or examination in accordance with this Article 17 discloses overpricing or overcharges of any nature by the CONTRACTOR to the OWNER in excess of one-half of one percent (.5%) of the total contract billings, then the reasonable actual cost of the OWNER's audit shall be reimbursed to the OWNER by the CONTRACTOR. Any adjustments and/or payments, which must be made as a result of any such audit or inspection of the CONTRACTOR's invoices and/or records, shall be made within a reasonable amount of time (not to exceed 90 calendar days) from presentation of the OWNER's findings to the CONTRACTOR.

ARTICLE 18 - MISCELLANEOUS

18.1 Venue and Choice of Law:

18.1.1 In the event of any suit at law or in equity involving the Contract, venue shall be in in the district court in Guadalupe County, Texas which is where Project is located. The laws of the state of Texas shall apply to Contract interpretation and enforcement.

18.2 Extent of Agreement:

18.2.1 This Contract represents the entire and integrated agreement between the OWNER and the CONTRACTOR and supersedes all prior negotiations, representations or agreements, either written or oral.

18.3 Cumulative Remedies:

18.3.1 The rights and remedies available to the parties are not to be construed in any way as a limitation of any rights and remedies available to any or all of them which are otherwise imposed or available by laws or regulations, by special warranty or guarantees or by other provisions of the Contract Documents, and the provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right and remedy to which they apply.

18.4 Severability:

18.4.1 If any word, phrase, clause, sentence or provision of the Contract, or the application of same to any person or set of circumstances is for any reason held to be unconstitutional, invalid or unenforceable, that finding shall only effect such word, phrase, clause, sentence or provision, and such finding shall not effect the remaining portions of this Contract; this being the intent of the parties in entering into the Contract; and all provisions of the Contract are declared to be severable for this purpose.

18.5 Independent Contractor

18.5.1 The Contract shall not be construed as creating an employer/employee relationship, a partnership, or a joint venture. The CONTRACTOR's services shall be those of an

independent contractor. The CONTRACTOR agrees and understands that the Contract does not grant any rights or privileges established for employees of the OWNER.

End of General Conditions

EXHIBIT A.
OWNER'S INSURANCE REQUIREMENTS OF CONTRACTOR

1. Specific Insurance Requirements

The following insurance shall be maintained in effect with limits not less than those set forth below at all times during the term of this Agreement and thereafter as required:

INSURANCE	COVERAGE/LIMITS	OTHER REQUIREMENTS
Commercial General Liability (Occurrence Basis)	Amounts of coverage shall be no less than: <ul style="list-style-type: none"> • \$1,000,000 Per Occurrence • \$2,000,000 General Aggregate • \$2,000,000 Products/Completed Operations Aggregate • \$1,000,000 Personal And Advertising Injury • Designated Construction Project(s) General Aggregate Limit 	<ul style="list-style-type: none"> • Current ISO edition of CG 00 01 • Additional insured status shall be provided in favor of Owner Parties on a combination of ISO forms CG 20 10 10 01 and CG 20 37 10 01. • This coverage shall be endorsed to provide primary and non-contributing liability coverage. It is the intent of the parties to this Agreement that all insurance coverage required herein shall be primary to and will not seek contribution from any other insurance held by Owner Parties, with Owner Parties' insurance being excess, secondary and non-contributing. • Stop Gap coverage shall be provided if any work is to be performed in a monopolistic workers' compensation state. • The following exclusions/limitations (or their equivalent(s)), are prohibited: <ul style="list-style-type: none"> ○ Contractual Liability Limitation CG 2139 ○ Amendment of Insured Contract Definition CG 24 ○ 26 ○ Limitation of Coverage to Designated Premises or Project, CG 2144 ○ Exclusion-Damage to Work Performed by Subcontractors On Your Behalf, CG 22 94 or CG 22 95 ○ Exclusion-Explosion, Collapse and Underground ○ Property Damage Hazard, CG 2142 or CG 2143 o Any Classification limitation ○ Any Construction Defect Completed Operations exclusion ○ Any endorsement modifying the Employer's ○ Liability exclusion or deleting the exception to it ○ Any endorsement modifying or deleting Explosion, Collapse or Underground coverage ○ Any habitational or residential exclusion applicable to the Work ○ Any "Insured vs. Insured" exclusion except ○ Named Insured vs. Named Insured ○ Any Punitive, Exemplary or Multiplied Damages exclusion ○ Any Subsidence exclusion
Business Auto Liability	Amount of coverage shall be no less than: <ul style="list-style-type: none"> • \$1,000,000 Per Accident 	<ul style="list-style-type: none"> • Current ISO edition of CA 00 01 • Arising out of any auto (Symbol 1), including owned, hired and nonowned

INSURANCE	COVERAGE/LIMITS	OTHER REQUIREMENTS
Workers' Compensation and Employer's Liability	<p>Amounts of coverage shall be no less than:</p> <ul style="list-style-type: none"> • Statutory Limits • \$1,000,000 Each Accident and Disease • Alternate Employer endorsement • USL&H must be provided where such exposure exists. 	<ul style="list-style-type: none"> • The State in which work is to be performed must listed under Item 3.A. on the Information Page • Such insurance shall cover liability arising out of the Contractor's employment of workers and anyone for whom the Contractor may be liable for workers' compensation claims. Workers' compensation insurance is required, and no "alternative" forms of insurance shall be permitted. • Where a Professional Employer Organization (PEO) or "leased employees" are utilized, Contractor shall require its leasing company to provide Workers' Compensation insurance for said workers and such policy shall be endorsed to provide an Alternate Employer endorsement in favor of Contractor and Owner. Where Contractor uses leased employees with Workers' Compensation insurance provided by a PEO or employee leasing company, Contractor is strictly prohibited from subletting any of its work without the express written agreement of Owner.
Excess Liability (Occurrence Basis)	<p>Amounts of coverage shall be no less than:</p> <ul style="list-style-type: none"> • \$5,000,000 Each Occurrence • \$5,000,000 Annual Aggregate 	<ul style="list-style-type: none"> • Such insurance shall be excess over and be no less broad than all coverages described above. • Drop-down coverage shall be provided for reduction and/or exhaustion of underlying aggregate limits and shall include a duty to defend any insured.
Professional Liability	<p>Amounts of coverage shall be no less than:</p> <ul style="list-style-type: none"> • \$1,000,000 Each Occurrence • \$2,000,000 Annual Aggregate • If a combined Contractor's Pollution Liability and Professional Liability policy is utilized, the limits shall be \$3,000,000 Each Loss and Aggregate. • Such insurance shall cover all services rendered by the Contractor and its consultants under the Agreement, including but not limited to design or design/build services. • Policies written on a Claims-Made basis shall be maintained for at least two years beyond termination of the Agreement. 	<ul style="list-style-type: none"> • Such insurance shall cover all services rendered by the Contractor and its subcontractors under the Agreement. • This insurance is not permitted to include any type of exclusion or limitation of coverage applicable to claims arising from: <ul style="list-style-type: none"> ◦ Bodily injury or property damage where coverage is provided in behalf of design professionals or design/build contractors ◦ Habitational or residential operations ◦ mold and/or microbial matter and/or fungus and/or biological substance ◦ Punitive, exemplary or multiplied damages. • Any retroactive date must be effective prior to beginning of services for the Owner. • Policies written on a Claims-Made basis shall have an extended reporting period of at least two years beyond termination of the Agreement. Vendor shall trigger the extended reporting period if identical coverage is not otherwise maintained with the expiring retroactive date.
Contractors Pollution Liability	<p>Amounts of coverage shall be no less than:</p> <ul style="list-style-type: none"> • \$1,000,000 Each Loss • \$2,000,000 Annual Aggregate • If a combined Contractor's Pollution Liability and Professional Liability policy is utilized, the limits shall be \$3,000,000 Each Loss and Aggregate. • The policy must provide coverage for: 	<ul style="list-style-type: none"> • The policy must insure contractual liability, name Owner Parties as an Additional Insured, and be primary and noncontributory to all coverage available to the Additional Insured. • This insurance is not permitted to include any type of exclusion or limitation of coverage applicable to claims arising from:

INSURANCE	COVERAGE/LIMITS	OTHER REQUIREMENTS
Contractors Pollution Liability	<ul style="list-style-type: none"> ○ The full scope of the named insured's operations (on-going and completed) as described within the scope of work for this Agreement ○ Loss arising from pollutants including but not limited to fungus, bacteria, biological substances, mold, microbial matter, asbestos, lead, silica and contaminated drywall ○ Third party liability for bodily injury, property damage, clean up expenses, and defense arising from the operations; ○ Diminution of value and Natural Resources damages ○ Contractual liability ○ Claims arising from non-owned disposal sites utilized in the performance of this Agreement. 	<ul style="list-style-type: none"> ○ Insured vs. insured actions. However exclusion for claims made between insured within the same economic family are acceptable. ○ Impaired property that has not been physically injured ○ Materials supplied or handled by the named insured. However, exclusions for the sale and manufacture of products are allowed. Exclusionary language pertaining to materials supplied by the insured shall be reviewed by the certificate holder for approval. ○ Property damage to the work performed by the contractor ○ Faulty workmanship as it relates to clean up costs o punitive, exemplary or multiplied damages ○ Work performed by subcontractors • If coverage is provided on a Claims Made basis, coverage will at least be retroactive to the earlier of the date of this Agreement or the commencement of contractor services relation to the Work. • The policy will offer an extended discovery or extended reporting clause of at least three (3) years. • Completed Operations coverage shall be maintained through the purchase of renewal policies to protect the insured and additional insured for at least two (2) years after the property owner accepts the project or this contract is terminated. The purchase of an extended discovery period or an extended reporting period on a Claims Made policy or the purchase of occurrence based Contractors Environmental Insurance will not be sufficient to meet the terms of this provision.
Builders Risk	<ul style="list-style-type: none"> • Coverage shall be provided in an amount equal at all times to the full contract value, including change orders, and cost of debris removal for any single occurrence. • Coverage shall be at least as broad as an unmodified ISO Special form, shall be provided on a completed-value basis, and shall be primary to any other insurance coverage available to the named insured parties, with that other insurance being excess, secondary and non-contributing. • The policy must provide coverage for: <ul style="list-style-type: none"> ○ Agreed Value Included ○ Damage arising from Included <ul style="list-style-type: none"> error, omission or deficiency in construction methods, design, specifications, workmanship or materials, including collapse ○ Debris removal additional limit <p style="text-align: right;">\$1,000,000</p>	<ul style="list-style-type: none"> • Insureds shall include Owner, General Contractor, all Loss Payees and Mortgagees, and subcontractors of all tiers in the Work as Insureds. • Such insurance shall cover: <ul style="list-style-type: none"> ○ All structure(s) under construction, including retaining walls, paved surfaces and roadways, bridges, glass, foundation(s), footings, underground pipes and wiring, excavations, grading, backfilling or filling; ○ All temporary structures (e.g., Fencing, scaffolding, cribbing, false Work, forms, site lighting, temporary utilities and buildings) located at the site; ○ All property including materials and supplies on site for installation; ○ All property including materials and supplies at other locations but intended for use at the site; ○ All property including materials and supplies in transit to the site for installation by all means of

INSURANCE	COVERAGE/LIMITS		OTHER REQUIREMENTS
Builders Risk	<ul style="list-style-type: none"> ○ Earthquake and Earthquake Sprinkler Leakage \$5,000,000 ○ Flood \$5,000,000 ○ Freezing Included ○ Mechanical breakdown including hot & cold testing Included ○ Ordinance or law \$1,000,000 ○ Pollutant clean-up and removal \$25,000 ○ Preservation of property Included ○ Theft Included • Deductible shall not exceed <ul style="list-style-type: none"> ○ All Risks of Direct Damage, per Occurrence, except \$10,000 ○ Named Storm 2% subject to \$50,000 minimum ○ Earthquake and Earthquake Sprinkler Leakage, per Occurrence \$1,000,000 ○ Flood, per Occurrence or excess of NFIP if in Flood Zone A or V \$1,000,000 		<p>transportation other than ocean transit; and</p> <ul style="list-style-type: none"> ○ Other work at the site identified in the Agreement to which this Exhibit is attached. • No protective safeguard warranty shall be permitted. • The termination of coverage provision shall be endorsed to permit occupancy of the covered property being constructed. This insurance shall be maintained in effect, unless otherwise provided for the Agreement Documents, until the earliest of: <ul style="list-style-type: none"> ○ The date on which all persons and organizations ○ Who are insureds under the policy agree that it shall be terminated; ○ Occupancy, in whole or in part; ○ The date on which release of substantial completion is executed; or ○ The date on which the insurable interests of ○ Contractor in the Covered Property has ceased • A waiver of subrogation provision shall be provided in favor of all insureds

2. General Insurance Requirements

A. Definitions. For purposes of this Agreement:

- i. "ISO" means Insurance Services Office.
- ii. "Contractor" shall include subcontractors of any tier.
- iii. "Owner Parties" means (a) City of Seguin ("Owner"), (b) TRC Engineers, Inc. (c) the Project, (d) any lender whose loan is secured by a lien against the Work, (e) their respective shareholders, members, partners, joint venturers, affiliates, subsidiaries, successors and assigns, (f) any directors, officers, employees, or agents of such persons or entities, and (g) others as required by the Construction Documents.

B. Policies.

- i. Contractor shall maintain such General Liability, Excess Liability, Professional and Pollution insurance in identical coverage, form and amount, including required endorsements, for at least two (2) years following Date of Substantial Completion of the Work to be performed under this Agreement. Contractor shall provide written representation to Owner stating Work completion date.
- ii. All policies must:
 - a. Be written through insurance companies authorized to do business in the State in which the work is to be performed and rated no less than A-: VII in the most current edition of A. M. Best's Key Rating Guide at all times Work is to be performed.
 - b. Provide a waiver of subrogation in favor of Owner Parties on all insurance coverage carried by Contractor, whether required herein or not.
 - c. Contain an endorsement providing for thirty (30) days prior written notice of cancellation to Owner.

- d. Be provided to the Owner Parties in compliance with the requirements herein and shall contain no endorsements that restrict, limit, or exclude coverage required herein in any manner without the prior express written approval of the Owner.
- iii. Failure of any Owner Party to demand such certificate or other evidence of full compliance with these insurance requirements or failure of any Owner Party to identify a deficiency from evidence that is provided shall not be construed as a waiver of the Contractor's obligation to maintain such insurance.
- iv. Contractor shall provide to the Owner a certified copy of all insurance policies required herein within ten (10) days of any such request. Renewal policies, if necessary, shall be delivered to the Owner prior to the expiration of the previous policy.
- v. Commencement of Work without provision of the required certificate of insurance, evidence of insurance and/or required endorsements, or without compliance with any other provision of this Agreement, shall not constitute a waiver by any Owner Party of any rights. The Owner shall have the right, but not the obligation, of prohibiting the Contractor or any subcontractor from performing any Work until such certificate of insurance, evidence of insurance and/or required endorsements are received and approved by the Owner.

C. Limits. Deductibles and Retentions

- i. The limits of liability may be provided by a single policy of insurance or by a combination of primary and excess policies, but in no event shall the total limits of liability available for any one occurrence or accident be less than the amount required herein.
- ii. No deductible or self-insured retention shall exceed \$25,000 without prior written approval of the Owner, except as otherwise specified herein. All deductibles and/or retentions shall be paid by, assumed by, for the account of, and at the Contractor's sole risk. The Contractor shall not be reimbursed for same.

D. Forms.

- i. If the forms of policies, endorsements, certificates or evidence of insurance required by this Exhibit are superseded or discontinued, Owner will have the right to require other equivalent forms.
- ii. Any policy or endorsement form other than a form specified in this Exhibit must be approved in advance by Owner.

E. Evidence of Insurance. Insurance must be evidenced as follows:

- i. ACORD Form 25 Certificate of Liability Insurance for liability coverages.
- ii. ACORD Form 28 Evidence of Commercial Property Insurance for property coverages.
- iii. Evidence shall be provided to Owner prior to commencing Work and prior to the expiration of any required coverage.
- iv. ACORD Forms specify:
 - a. Owner as certificate holder at Owner's mailing address;
 - b. Insured's name, which must match that on this Agreement;
 - c. Insurance companies producing each coverage and the policy number and policy date of each coverage;
 - d. Producer of the certificate with correct address and phone number and have the signature of the authorized representative of the producer;
 - e. Additional Insured status in favor of Owner Parties;
 - f. Amount of any deductible or self-insured retention in excess of \$25,000;
 - g. Designated Construction Project(s) General Aggregate Limit;
 - h. Primary and non-contributory status;
 - i. Waivers of subrogation; and

- j. All exclusions and limitations added by endorsement to the General Liability coverage. This can be achieved by attachment of the Schedule of Forms and Endorsements page.
- v. Copies of the following shall also be provided:
 - a. General Liability Additional insured endorsement(s);
 - b. General Liability Schedule of Forms and Endorsements page(s);and
 - c. Thirty (30) Day Notice of Cancellation endorsement applicable to all required policies.

F. Contractor Insurance Representations to Owner Parties

- i. It is expressly understood and agreed that the insurance coverages required herein (a) represent Owner Parties' minimum requirements and are not to be construed to void or limit the Contractor's indemnity obligations as contained in this Agreement nor represent in any manner a determination of the insurance coverages the Contractor should or should not maintain for its own protection; and (b) are being, or have been, obtained by the Contractor in support of the Contractor's liability and indemnity obligations under this Agreement. Irrespective of the requirements as to insurance to be carried as provided for herein, the insolvency, bankruptcy or failure of any insurance company carrying insurance of the Contractor, or the failure of any insurance company to pay claims accruing, shall not be held to affect, negate or waive any of the provisions of this Agreement.
- ii. Failure to obtain and maintain the required insurance shall constitute a material breach of, and default under, this Agreement. If the Contractor shall fail to remedy such breach within ten (10) business days after notice by the Owner, the Contractor will be liable for any and all costs, liabilities, damages and penalties resulting to the Owner Parties from such breach, unless a written waiver of the specific insurance requirement(s) is provided to the Contractor by the Owner. In the event of any failure by the Contractor to comply with the provisions of this Agreement, the Owner may, without in any way compromising or waiving any right or remedy at law or in equity, on notice to the Contractor, purchase such insurance, at the Contractor's expense, provided that the Owner shall have no obligation to do so and if the Owner shall do so, the Contractor shall not be relieved of or excused from the obligation to obtain and maintain such insurance amounts and coverages.
- iii. This Exhibit is an independent contract provision and shall survive the termination or expiration of the Construction
- iv. Agreement.

G. Insurance Requirements of Contractor's Subcontractors

- i. Insurance similar to that required of the Contractor shall be provided by all subcontractors (or provided by the Contractor on behalf of subcontractors) to cover operations performed under any subcontract agreement. The Contractor shall be held responsible for any modification in these insurance requirements as they apply to subcontractors. The Contractor shall maintain certificates of insurance from all subcontractors containing provisions similar to those listed herein (modified to recognize that the certificate is from subcontractor) enumerating, among other things, the waivers of subrogation, additional insured status, and primary liability as required herein, and make them available to the Owner upon request.
- ii. The Contractor is fully responsible for loss and damage to its property on the site, including tools and equipment, and shall take necessary precautions to prevent damage to or vandalism, theft, burglary, pilferage and unexplained disappearance of property. Any insurance covering the Contractor's or its subcontractor's property shall be the Contractor's and its subcontractor's sole and complete means or recovery for any such loss. To the extent any loss is not covered by said insurance or subject to any deductible

or co-insurance, the Contractor shall not be reimbursed for same. Should the Contractor or its subcontractors choose to self insure this risk, it is expressly agreed that the Contractor hereby waives, and shall cause its subcontractors to waive, any claim for damage or loss to said property in favor of the Owner Parties.

H. Use of the Owners Equipment

The Contractor, its agents, employees, subcontractors or suppliers shall use the Owners equipment only with express written permission of the Owners designated representative and in accordance with the Owners terms and condition for such use. If the Contractor or any of its agents, employees, subcontractors or suppliers utilize any of the Owners equipment for any purpose, including machinery, tools, scaffolding, hoists, lifts or similar items owned, leased or under the control of the Owner, the Contractor shall defend, indemnify and be liable to the Owner Parties for any and all loss or damage which may arise from such use.

I. Release and Waiver

The Contractor hereby releases, and shall cause its subcontractors to release, the Owner Parties from any and all claims or causes of action whatsoever which the Contractor and/or its subcontractors might otherwise now or hereafter possess resulting in or from or in any way connected with any loss covered by insurance, whether required herein or not, or which should have been covered by insurance required herein, including the deductible and/or uninsured portion thereof maintained and/or required to be maintained by the Contractor and/or its subcontractors pursuant to this Agreement. THE FOREGOING RELEASE AND WAIVER APPLY EVEN IF THE LOSS OR DAMAGE IS CAUSED IN WHOLE OR IN PART BY THE FAULT OR NEGLIGENCE OR STRICT LIABILITY OF THE OWNER PARTIES.

SECTION 01 35 00

SPECIAL INSTRUCTIONS

PART 1 - MISCELLANEOUS

1.01 TRAFFIC CONTROL

- A. The CONTRACTOR will be responsible for furnishing and using all barricades, warning lights, signs, etc. necessary to protect his work and maintain traffic flow satisfactory to the OWNER, ENGINEER, and TxDOT (if applicable). Warning devices shall be as required in the Texas Manual on Uniform Traffic Control Devices. Construction shall be scheduled to cause the least amount of disruption to traffic. All work scheduling shall be coordinated with the City or County staff, and be approved by the City or County staff before work can proceed. No separate payment will be made for traffic control required to be added to the project to address health and safety issues.
- B. Traffic Control plans and details provided (if applicable) in the plans are to show a minimum expectation required by the CONTRACTOR and may not cover all specific construction means and methods proposed by the CONTRACTOR. Alternate plans may be presented for approval by the OWNER and ENGINEER by the CONTRACTOR. All plans shall be sealed by a professional engineer registered in the State of Texas. The OWNER or ENGINEER may require additional warning devices be installed at any time on the project to address health and safety issues at no additional cost to the OWNER.

1.02 STAKING FOR CONSTRUCTION

- A. The CONTRACTOR will provide all construction staking services for the project. The cost of these services will be reflected in the unit price amount in the bid form. No separate payment will be made.
- B. TRC Engineers, Inc. provided topographical surveying services for the design portion of this project. Information to the CONTRACTOR for construction staking may be available from TRC Engineers, Inc.

1.03 OFFICE AT SITE OF WORK

- 1. During the performance of this contract, CONTRACTOR shall maintain a suitable office at the project site. The office shall be the headquarters of his representative authorized to receive drawings, instructions, or other communication or articles. Any communication given to the said representative or delivered at CONTRACTOR's office at the site of the work in his absence shall be deemed to have been delivered to CONTRACTOR.
- 2. Copies of the Drawings, Specifications, and other Contract Documents shall be kept at CONTRACTOR's office at the site of the work and available for use at all times.
- 3. CONTRACTOR shall provide all power for heating, lighting, operation of CONTRACTOR's plant or equipment, or for any other use by CONTRACTOR. Temporary heat, lighting and air conditioning shall be maintained until the work is accepted. CONTRACTOR shall work with the OWNER to establish temporary power to the site, however all costs required shall be borne by the CONTRACTOR.

4. CONTRACTOR shall be responsible for protection of the site, and all work, materials, equipment, and existing facilities thereon, against vandals and other unauthorized persons.
5. No claim shall be made against ENGINEER or OWNER by reason of any act of an employee or trespasser.
6. CONTRACTOR shall provide and maintain suitable parking areas for the use of all construction workers and others performing work or furnishing services in connection with the Project, as required, to avoid any need for parking personal vehicles where they may interfere with public traffic, OWNER's operations, or construction activities.
7. CONTRACTOR shall provide suitable working space for ENGINEER or Owner's representative within office. Room shall be at least 200 square feet of the floor space, either adjacent to or partitioned off from CONTRACTOR'S office. The office shall be provided with an outside entrance door with a substantial lock; glazed windows suitable for light and ventilation; and adequate heating, air conditioning, electrical, and lighting facilities. The office shall be equipped with a suitable desk, two chairs, plan rack, four-drawer file cabinet, a work table, and a garbage can. The general arrangement of the office and facilities provided shall be acceptable to the ENGINEER and OWNER.

1.04 WATER

- A. Water required for water jetting, flooding, testing and construction will be provided by OWNER at no cost to the CONTRACTOR. The CONTRACTOR shall provide temporary water piping, valves, transportation, etc. to the project location as required.

1.05 POWER FOR CONSTRUCTION

- A. The electrical service to the site will be provided by the CONTRACTOR. The CONTRACTOR shall furnish and install all necessary temporary wiring, and furnish and install area distribution boxes so located that the individual trades may use their own construction type extension cords to obtain adequate power and artificial lighting at all points where required by inspectors and for safety. All necessary permits shall be acquired by the CONTRACTOR.

1.06 CONSTRUCTION ORDER

- A. The CONTRACTOR shall complete the various projects in order of priority (Item 1. being highest priority), as follows:
 1. A Prefabricated Metal building (80' x 60' x 14') with concrete slab foundation.
 2. Electrical, mechanical, and plumbing systems for the building.
 3. Approximately 1,500 SY of asphalt paving.
 4. Approximately 55 SY of concrete wash rack.
 5. A 50' x 12' x 8' prefabricated canopy.
 6. Miscellaneous site work.
 7. Upon completion of golf cart barn, demolish existing cart barn and appurtenances.

- B. Each consecutive priority item shall be completed as soon as possible. This is not to preclude work on lesser priority items if there are long lead delivery requirements on materials for the higher priority items. However, as materials become available, the higher priority item shall be completed first.

1.07 SUBMITTAL DATA

A. Submittal Procedure

1. The CONTRACTOR shall furnish Submittals for any and all such parts of the work and equipment as set forth in the specifications and indicated on the plans. The procedures for review of the submittals shall be as follows:
 - a. The CONTRACTOR shall submit to the ENGINEER for his review, four (4) prints of drawings, plus whatever number of prints the CONTRACTOR desires to be returned to himself. The submitted prints shall be accompanied by a letter of transmittal, in duplicate of drawings, titles, and other requirements. The letter of transmittal shall be of the form supplied by or approved by the ENGINEER. If advance approval is obtained by OWNER and ENGINEER, electronic submission of certain submittals may be acceptable.
 - b. When a drawing is satisfactory to the ENGINEER, the number of prints the CONTRACTOR desires returned to him will be stamped or marked, "No Exceptions Taken" or "Make Corrections Noted", will be dated, and will be returned to the CONTRACTOR by letter.
 - c. Should a drawing be unsatisfactory to the Engineer, he will stamp thereon "Revise and Resubmit", or "Rejected", and will return one (1) or more copies thereof to the CONTRACTOR with the necessary corrections and changes indicated. The CONTRACTOR must make such corrections and changes, and again submit at least four (4) prints of the drawings for approval. The CONTRACTOR shall revise and resubmit the working drawings, as required by the ENGINEER, until satisfactory review thereof is obtained.
 - d. The CONTRACTOR shall allow sufficient time for preliminary review, correction, and resubmission, and final review of all working (shop) drawings. The CONTRACTOR should allow not less than fourteen (14) days for each review. Drawings of items critical to job progress, when requested in writing by the CONTRACTOR, will be given priority review.

B. Submittal Format

1. Submittals shall be printed on heavy, first quality paper, 8-1/2" x 11" size with standard 3-hole punching. If pre-approved, electronic submittals may be acceptable. Drawings and diagrams shall be reduced to 8-1/2" x 11" or 11" x 17".
2. All materials and equipment submitted for review shall meet the following criteria: Each sheet of descriptive literature submitted shall be marked by the CONTRACTOR to identify the material or equipment as follows:

- a. Equipment and materials descriptive literature and drawings shall show the specification paragraph for which the equipment applies, and shall list equipment tag numbers applicable.
- b. Submittal sheets or drawings showing more than the particular item under consideration shall have crossed out all but the pertinent description of the item for which review is requested.
- c. Equipment and materials descriptive literature not readily cross-referenced with the drawings or specifications shall be identified by a suitable notation.

C. Submittal Content

1. The submittals shall show that all requirements of the specification section have been met. The submittals shall contain the following information as applicable:
 - a. Equipment, function, normal operating characteristics, and limiting conditions.
 - b. Assembly, installation, alignment, adjustment, and checking instructions.
 - c. Outline, cross-section, and assembly drawings; engineering data; and wiring diagrams.
 - d. Test data and performance curves, where applicable.
 - e. The operational and maintenance manual for the equipment item and/or system as designated in Table 1 below, or as required elsewhere within these specifications shall be submitted.

TABLE 1. SUBMITTAL AND O & M SUMMARY				
Item Description	Submittal Required	O&M Manual Required	Working Drawing Required	O&M Instructions Required
Water Softener	X	X		
Oil Water Separator	X	X		

f. Working Drawings:

- 1) Items for which working drawings are required include, but are not limited to, the non-equipment items listed in Table 1, and as set forth elsewhere within these specifications.
- 2) The drawings shall be numbered consecutively and shall accurately and distinctly present the following:
 - a) All working and erection dimensions.
 - b) Arrangement and sectional views.
 - c) Necessary details, including complete information for making connections between functional parts.

- d) Kinds of materials and finishes.
 - e) Parts list and description thereof.
- 3) Each drawing shall be dated and shall bear the name of the project, names of equipment or materials, and the location where the equipment or materials are to be installed in the project. The Engineer may decline to consider any working drawings, which do not contain complete data on the work and full information on related matters.
- 4) If working drawings show departures from the contract requirements, the CONTRACTOR shall make specific mention thereof in a letter attached to the submittal form; otherwise, review of such submittals will not constitute acceptance of the departure from the contract.
- 5) No Work called for by working drawings shall be initiated until the said drawings have been accepted by the ENGINEER.

PART 2 - SEWER ITEMS

2.01 MATERIALS FOR SANITARY SEWER LINE CONSTRUCTION

- A. The gravity sewer pipe shall meet the requirements of ASTM 3034 SDR 26 for 15" diameter and smaller pipe and F-679 Type T-1 cell class 12454B for 18" diameter pipe and larger, (minimum pipe stiffness 115) as described in Section S – SANITARY SEWER CONSTRUCTION of these specifications, unless otherwise noted on plans.

2.02 BEDDING

- A. The project may include the installation of gravel bedding for the construction of the sewer mains. The requirement for the bedding method shall be as follows:
1. Gravel Bedding – An approved gravel bedding material shall be brought up by hand backfilling equally on each side of the pipe and extend from a point six (6") inches below the pipe to a height of twelve(12") inches over the top of the pipe. The initial lift of the gravel bedding material shall be placed on the trench floor and then shaped and compacted mechanically to insure that the sewer pipe is evenly supported along its entire length.

2.03 MANHOLES

- A. Manholes will be measured and paid for at the unit price bid per each, without regard to the number of connections, amount of concrete, total excavation and backfill, etc., necessary for each individual site. All manholes will not require the same amount of materials or labor, but the unit price bid per each will be the same. Manhole rings and covers shall be H-20 load rated and conform to AASHTO M-306.

2.04 ABANDONMENT OF EXISTING SEWER LINE

- A. This project will parallel several existing sewer lines. It will be the CONTRACTOR's responsibility to take these existing sewer lines out of service, whether or not the lines to be abandoned are indicated on the plans. The CONTRACTOR shall plug the existing lines to be abandoned with an approved fitting. This work shall be deemed incidental to the project. No separate payment will be made.

2.05 SEWAGE HAULING AND BYPASS PUMPING

- A. The CONTRACTOR's bid cost shall include all sewage hauling and sewage bypass pumping required for the complete installation of the project. The CONTRACTOR's requirements shall include, but not necessarily be limited to, the following:
1. Sewage hauling must be utilized during times when the existing sewer mains or proposed sewer main cannot be used to convey the sewage from the system.
 2. Bypass pumping may be required for the sewer projects to pump around the existing manholes or during construction.
 3. The hauled sewage shall be deposited into existing manholes approved by the OWNER at a rate that will not surcharge the manhole or downstream manholes.
 4. The sewage hauling and bypass pumping systems shall include all facilities, pumps, piping, trucks, equipment, labor, etc. to convey all anticipated flows from the sewage collection system. Sewage overflows or spills are not acceptable. Excessive odors (as determined by ENGINEER) from the collection system, from stagnant sewage due to the lack of pumping or hauling are not acceptable. The sewage levels in the existing collection system shall be maintained at an acceptable level so the sewage does not back up or affect the businesses that supply the collection system.
 5. The OWNER shall be notified a minimum of seven (7) days before any bypass pumping or sewage hauling is initiated.
 6. The bypass pumping or sewage hauling operating period shall be kept to an absolute minimum. Prior to bypass pumping or sewage hauling initiation, the CONTRACTOR shall have all necessary labor, equipment, materials, piping, fittings, machinery, etc. in place at the site for the sewer main pipe work.
 7. The CONTRACTOR shall be responsible for installing all temporary facilities, operation and maintenance of all facilities which may include 24-hour operations. Facilities shall include labor, equipment, materials, pumps, piping, temporary electrical connections, level control devices, fuel, etc. as required for a complete system.
 8. The CONTRACTOR shall discuss with the OWNER the proposed sewage hauling or bypass pumping operation and shall not commence until the OWNER is satisfied with the proposed operation.

2.06 ADJUSTING EXISTING MANHOLES AND VALVE COVERS

- A. The CONTRACTOR will adjust all existing manholes (to include telephone, electrical, sanitary sewer or other), valve covers (to include water, gas, or other) within the construction area to meet the grade of the finished asphalt. The following procedure will be followed where the valve or manhole is in an area that is to be excavated and new base material installed or existing base material re-constructed:
1. Locate and accurately tie down by measurement from identifiable objects (such as power poles, fire hydrants, fences, etc.) all existing manholes and valve covers for future use.

2. Remove and lower existing manholes and valve boxes to an elevation below the finished subgrade. The depth on manholes shall be sufficient that on reconstruction, the manhole shall be low enough to provide an adequate cone section and manhole ring and cover.
3. A steel plate of sufficient size shall be placed over the open manhole and/or box riser at subgrade elevation.
4. Placement and compaction of all crushed stone base material shall be made within the construction area to achieve compaction over the entire sheet.
5. The CONTRACTOR shall then relocate all manholes and valve steel covers from tie downs in #1 and remove steel covers.
6. Manholes and valve box covers shall be reconstructed to finished asphalt grade. Backfill around the reconstructed covers shall be concrete to top of base material grade.
7. Final placement and compaction of the Hot Mix (unless otherwise shown on the plans) shall follow. Extreme care shall be taken in the lowering of manholes to avoid any dirt, gravel, concrete or other foreign material from falling into manhole. Should this occur, the CONTRACTOR shall remove the foreign material immediately in order to avoid stopping the flow of sewage.

PART 3 - WATER ITEMS

3.01 MATERIALS FOR WATER MAIN CONSTRUCTION

- A. Pipe for PVC water main construction, unless otherwise shown on the plans, shall be polyvinyl chloride pipe, meeting the requirements of AWWA C-900. Pipe shall be blue in color (other colors not acceptable). Pipe joints shall be rubber ring type gasket in an integrated thickened bell. All other fittings 12" and smaller shall be short body ductile iron.
- B. All pipe, fittings, and valves shall be new. All water pipe shall be approved by the Underwriters laboratories for fire protection, approved by the National Sanitation Foundation and installed according to manufacturer's specifications and Section W - WATER MAIN CONSTRUCTION of these specifications.
- C. All fittings and valves for WATER MAIN CONSTRUCTION shall be mechanical joint or as specified on the plans.

3.02 WATER MAIN – RESTRAINED JOINTS

- A. All fittings for the proposed water main projects shall include meg-a-lug restrained joints. This shall include valves and fire hydrants.

3.03 WATER LINE DISINFECTION

- A. The CONTRACTOR's unit price bid costs shall include the services of a certified laboratory to perform the "Bac-T" tests for the newly installed water mains/services. The sample shall be acquired by a direct employee of the lab. Samples acquired by the CONTRACTOR will not be acceptable. Sampling and testing shall meet all requirements of TCEQ. The Owner's representative will be notified of when the sample will be acquired. The CONTRACTOR shall submit the name of the laboratory to the ENGINEER for approval. There will be no separate pay for these services.

3.04 BEDDING

- A. The project may include the installation of gravel bedding for the construction of the water mains. The requirement for the bedding method shall be as follows:
1. Gravel Bedding - An approved gravel bedding material shall be brought up by hand backfilling equally on each side of the pipe and extend from a point six(6") inches below the pipe to a height of twelve(12") inches over the top of the pipe. The initial lift of the gravel bedding material shall be placed on the trench floor and then shaped and compacted mechanically to insure that the water pipe is evenly supported along its entire length.

3.05 ABANDONMENT OF EXISTING WATER LINES

- A. The project will parallel several existing water lines. It will be the CONTRACTOR's responsibility to take these existing water lines out of service, whether or not the lines to be abandoned are indicated on the plans. The CONTRACTOR shall plug the existing lines to be abandoned with an approved fitting. This work shall be deemed incidental to the project. No separate payment will be made.

3.06 ADJUSTING EXISTING MANHOLES AND VALVE COVERS

- A. The CONTRACTOR will adjust all existing manholes (to include telephone, electrical, sanitary sewer or other), valve covers (to include water, gas, or other) within the construction area to meet the grade of the finished elevation. The following procedure will be followed where the valve or manhole is in an area that is to be excavated and new base material installed or existing base material re-constructed:
1. Locate and accurately tie down by measurements from identifiable objects (such as power poles, fire hydrants, fences, etc.) all existing manholes and valve covers for future use.
 2. Remove and lower existing manholes and valve boxes to an elevation below the finished subgrade. The depths on manholes shall be sufficient that on reconstruction, the manhole shall be low enough to provide an adequate cone section and manhole ring and cover.
 3. A steel plate of sufficient size shall be placed over the open manhole and/or box riser at subgrade elevation.
 4. Placement and compaction of all crushed stone base material shall be made within the construction area to achieve compaction over the entire street.
 5. The CONTRACTOR shall then relocate all manholes and valve steel covers from tie downs in #1 and remove steel covers.
 6. Manholes and valve box covers shall be reconstructed to finished asphalt grade. Backfill around the reconstructed covers shall be concrete to top of base material grade.
 7. Final placement and compaction of the Hot Mix (unless otherwise shown on the plans) shall follow. Extreme care shall be taken in the lowering of manholes to avoid any dirt, gravel, concrete or other foreign material from falling into manhole. Should this occur, the CONTRACTOR shall remove the foreign material immediately in order to avoid stopping the flow of sewage.

PART 4 - STORM SEWER ITEMS

4.01 MATERIALS FOR STORM SEWER CONSTRUCTION

- A. Reinforced concrete pipe (RCP) shall meet the requirements as described in TxDOT Specifications for Item 464.

4.02 BEDDING

- A. The project may include the installation of cement stabilized backfill for the construction of the storm sewer mains. The requirement for the bedding method shall be as follows:

1. **Gravel Bedding** - An approved gravel bedding material shall be brought up by hand backfilling equally on each side of the pipe and extend from a point six(6") inches below the pipe to a height of twelve(12") inches over the top of the pipe. The initial lift of the gravel bedding material shall be placed on the trench floor and then shaped and compacted mechanically to insure that the sewer pipe is evenly supported along its entire length.

4.03 MANHOLES

- A. Manholes will be measured and paid for at the unit price bid per each, without regard to the number of connections, amount of concrete, total excavation and backfill, etc., necessary for each individual site. All manholes will not require the same amount of materials or labor, but the unit price bid per each will be the same. Manhole rings and covers shall be H-20 load rated and conform to AASHTO M-306.

4.04 ADJUSTING EXISTING MANHOLES AND VALVE COVERS

- A. The CONTRACTOR will adjust all existing manholes (to include telephone, electrical, sanitary sewer or other), valve covers (to include water, gas, or other) within the construction area to meet the grade of the finished elevation. The following procedure will be followed where the valve or manhole is in an area that is to be excavated and new base material installed or existing base material re-constructed:

1. Locate and accurately tie down by measurements from identifiable objects (such as power poles, fire hydrants, fences, etc.) all existing manholes and valve covers for future use.
2. Remove and lower existing manholes and valve boxes to an elevation below the finished subgrade. The depths on manholes shall be sufficient that on reconstruction, the manhole shall be low enough to provide an adequate cone section and manhole ring and cover.
3. A steel plate of sufficient size shall be placed over the open manhole and/or box riser at subgrade elevation.
4. Placement and compaction of all crushed stone base material shall be made within the construction area to achieve compaction over the entire street.
5. The CONTRACTOR shall then relocate all manholes and valve steel covers from tie downs in #1 and remove steel covers.
6. Manholes and valve box covers shall be reconstructed to finished asphalt grade. Backfill around the reconstructed covers shall be concrete to top of base material grade.

7. Final placement and compaction of the Hot Mix (unless otherwise shown on the plans) shall follow. Extreme care shall be taken in the lowering of manholes to avoid any dirt, gravel, concrete or other foreign material from falling into manhole. Should this occur, the CONTRACTOR shall remove the foreign material immediately in order to avoid stopping the flow of sewage.

PART 5 - PAVEMENT ITEMS

5.01 ADJUSTING EXISTING MANHOLES AND VALVE COVERS

- A. The CONTRACTOR will adjust all existing manholes (to include telephone, electrical, sanitary sewer or other), valve covers (to include water, gas, or other) within the construction area to meet the grade of the finished elevation. The following procedure will be followed where the valve or manhole is in an area that is to be excavated and new base material installed or existing base material re-constructed:
 1. Locate and accurately tie down by measurements from identifiable objects (such as power poles, fire hydrants, fences, etc.) all existing manholes and valve covers for future use.
 2. Remove and lower existing manholes and valve boxes to an elevation below the finished subgrade. The depths on manholes shall be sufficient that on reconstruction, the manhole shall be low enough to provide an adequate cone section and manhole ring and cover.
 3. A steel plate of sufficient size shall be placed over the open manhole and/or box riser at subgrade elevation.
 4. Placement and compaction of all crushed stone base material shall be made within the construction area to achieve compaction over the entire street.
 5. The CONTRACTOR shall then relocate all manholes and valve steel covers from tie downs in #1 and remove steel covers.
 6. Manholes and valve box covers shall be reconstructed to finished asphalt grade. Backfill around the reconstructed covers shall be concrete to top of base material grade.
 7. Final placement and compaction of the Hot Mix (unless otherwise shown on the plans) shall follow. Extreme care shall be taken in the lowering of manholes to avoid any dirt, gravel, concrete or other foreign material from falling into manhole. Should this occur, the CONTRACTOR shall remove the foreign material immediately in order to avoid stopping the flow of sewage.

5.02 CURB BACKFILL, DRIVEWAY LEAVE-OUTS AND STREET INTERSECTIONS

- A. The CONTRACTOR shall perform “unclassified excavation” for curb & gutter and six (6”) inch concrete curb. Backfill shall be performed behind curb in sufficient amount to cause lateral surface drainage to spill over top of curb as shown on the detail sheet of the plans.
- B. No separate payment will be made for driveway curb leave-outs. The CONTRACTOR shall be prepared to make all driveway leave-outs at existing driveways as shown on plans or as directed by the OWNER and compensations therefore shall be included in the unit price bid for curb & gutter and six (6”) inch concrete curb.

- C. When existing street or driveway is cut for construction of the curb the CONTRACTOR shall reshape the existing street or driveway as needed to provide adequate drainage and approach the proposed curb. All existing street and driveway pavement structures that adjoin the new roadway construction shall be saw cut. All driveways shall be reconstructed as shown on the detail sheet of the plans.
- D. All existing private concrete sidewalks that extend towards the right of way and are within 10' of curb back shall be connected to new curb with five (5") inch thick concrete reinforced # 3 dowels at 8" O.C. (12" long), same width as existing.

5.03 POST CONSTRUCTION SURVEY

- A. The CONTRACTOR's unit price bid costs shall include topographical survey cross-sections of the completed street surfaces prior to placement of HMAC, to show that the finished grades meet those proposed in the bid documents. Cross-sections shall span the entire road width (curb-to-curb, edge of asphalt-to-edge of asphalt, or any combination thereof) and be spaced every 100' (maximum) and include all grade breaks. Survey data shall utilize bench marks provided by the ENGINEER. Surveying shall be done under the supervision of a registered surveyor (R.P.L.S.). Survey data shall be submitted to ENGINEER to verify that the constructed grades are acceptable. The HMAC shall not be installed until verification from the Engineer is received by the CONTRACTOR. There will be no separate pay for these services.

END OF SECTION

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SECTION 01100
SUMMARY OF WORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions and other DIVISION 1 - GENERAL REQUIREMENTS sections, apply to this Section.

1.02 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project Identification: Project consists of an 80' x 60' x 14' prefabricated metal building with concrete slab foundation, electrical, mechanical, and plumbing systems, approximately 1,500 SY of asphalt paving, 55 SY of concrete wash rack, a 50' x 12' x 8' prefabricated canopy, miscellaneous site work; and all other appurtenances necessary for the complete Project.

1. Project Locations:

- a. The facility will be located at Starcke Park Golf Course, south of the existing club house, in Seguin, Texas.

2. OWNER: City of Seguin, Texas

- B. ENGINEER Identification: The Contract Documents, dated August 16, 2023, were prepared for the Project by TRC Engineers, Inc., 809 E. Court St., Suite 106, Seguin, Texas 78155.

C. The work includes but is not limited to:

1. An 80' x 60' x 14' prefabricated metal building with concrete slab foundation.
2. Electrical, mechanical, and plumbing systems for the prefabricated metal building.
3. Approximately 1,500 SY of asphalt paving.
4. 55 SY of concrete wash rack.
5. A 50' x 12' x 8' prefabricated canopy.
6. Miscellaneous site work.
7. Upon completion of golf cart barn, demolish existing cart barn and appurtenances.
8. All other appurtenances necessary for the complete Project.

1.03 CONTRACTS

- A. Project will be constructed under one single contract.

1.04 USE OF PREMISES

- A. General: The CONTRACTOR shall have such use of the plant site property as designated by the OWNER. The CONTRACTOR'S use of premises is limited only by OWNER'S right to perform work or to retain other contractors on portions of Project.
- B. Other contractors may be present on the plant site. The CONTRACTOR shall coordinate with the contractors and provide access as required.

1.05 SPECIFICATION FORMATS AND CONVENTIONS

- A. Specification Format: The Specifications are organized into Divisions and Sections using the 16-division format and CSI/CSC's "MasterFormat" numbering system.
 - 1. Section Identification: The Specifications use section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of sections in the Contract Documents.
- B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
 - 2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by CONTRACTOR. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by CONTRACTOR or by others when so noted.

END OF SECTION

SECTION 01105
MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.01 ADMINISTRATIVE SUBMITTALS

- A. Schedule of Values: Submit schedule on CONTRACTOR'S standard form.
- B. Schedule of Estimated Progress Payments:
 - 1. Submit with initially acceptable schedule of values.
 - 2. Submit adjustments thereto with Application for Payment.
- C. Application for Payment: In accordance with the General Conditions and any modifications there to as specified herein.
- D. Final Application for Payment: As specified herein.

1.02 SCHEDULE OF VALUES

- A. Reference the General Conditions.
- B. Format:
 - 1. Prepare a separate schedule of values for each schedule of work under the Agreement.
 - 2. Lump Sum Work:
 - a. Provide separate value for each item or task on the progress schedule.
 - b. An unbalanced or front-end loaded schedule will not be acceptable.
 - c. List separately such items as Bonds and insurance premiums, mobilization, demobilization and contract closeout, facility startup, and other appropriate Division 1 activities.
 - d. The maximum percentage of mobilization/demobilization (combined) cost shall be no greater than 3% (three percent) of the total contract value.
 - 3. Summation of the complete schedule of values representing all work under the Agreement to equal the Contract Price.

1.03 SCHEDULE OF ESTIMATED PROGRESS PAYMENTS

- A. Show estimated payment requests throughout Contract Times aggregating initial Contract Price.
- B. Base estimated progress payments on initially acceptable progress schedule. Adjust to reflect subsequent adjustments in progress schedule and Contract Price as reflected by modifications to the Contract Documents.

1.04 APPLICATION FOR PAYMENT

- A. Reference the General Conditions.
- B. Transmittal Summary Form: Provided by CONTRACTOR. Attach one Summary Form with each Application for Payment for each schedule, include Request for Payment of Materials and Equipment on Hand as applicable. Execute certification by authorized Officer of CONTRACTOR.
- C. Use Application for Payment Form acceptable to OWNER and ENGINEER.
 - 1. Provide separate form for each schedule as applicable.
 - 2. Include accepted schedule of values for each schedule or portion of work, the price breakdown for work, a listing of OWNER-selected equipment, if applicable, and allowances, as appropriate.
- D. Preparation:
 - 1. Round values to nearest dollar.
 - 2. List each Change Order and written Amendment executed prior to date of submission as separate line item. Totals to equal those shown on the Summary sheet for each schedule as applicable.
 - 3. Submit Application for Payment, including a Transmittal Summary Form and detailed Application for Payment Form for each schedule as applicable, a listing of materials on hand for each schedule as applicable, and such supporting data as may be requested by ENGINEER.

1.05 PAYMENT

- A. General: Progress payment will be made monthly on the date established at the preconstruction meeting.
- B. Payment for all work shown or specified in the Contract Documents is included in the Contract Price.
- C. Payment for Mobilization/Demobilization: Partial payment for mobilization/demobilization will be as follows. The adjusted contract amount for construction items as used below is defined as the Total Contract Amount less the amount for mobilization.
 - 1. When 1 percent of the adjusted contract amount for construction items is earned, 33 percent of the mobilization/demobilization amount or 1 percent of the Total Contract Amount.
 - 2. When 5 percent of the adjusted contract amount for construction items is earned, 50 percent of the mobilization/demobilization amount or 1.5 percent of the Total Contract Amount, whichever is less, will be paid less any previous payments under this item.
 - 3. When 10 percent of the adjusted contract amount for construction items is earned, 67 percent of the mobilization/demobilization amount or 2 percent of the Total Contract Amount, whichever is less, will be paid less any previous payments under this item.

4. Upon completion of all work under this contract, payment for the remainder of mobilization/demobilization amount will be made.

1.06 NONPAYMENT FOR REJECTED OR UNUSED PRODUCTS

- A. Payment will not be made for following:

1. Loading, hauling, and disposing of rejected material.
2. Quantities of material wasted or disposed of in manner not called for under Contract Documents.
3. Rejected loads of material, including material rejected after it has been placed by reason of failure of CONTRACTOR to conform to provisions of Contract Documents.
4. Material not unloaded from transporting vehicle.
5. Defective work not accepted by OWNER.
6. Material remaining on hand after completion of work.

1.07 PARTIAL PAYMENT FOR STORED MATERIALS AND EQUIPMENT

- A. Partial Payment: Reference the General Conditions. No partial payments will be made for materials and equipment delivered or stored on site unless Shop Drawings or preliminary operation and maintenance manuals are acceptable to ENGINEER.
- B. Final Payment: Will be made only for materials incorporated in work; remaining materials for which partial payments have been made, to revert to CONTRACTOR unless otherwise agreed, and partial payments made for those items will be deducted from final payment.

1.08 FINAL APPLICATION FOR PAYMENT

- A. Reference the General Conditions.
- B. Prior to submitting final application, make acceptable delivery of required documents.
 1. Affidavit of Bills Paid.
 2. Certification of Completion
 3. Other documentation that may be required elsewhere in the Contract Documents.

END OF SECTION

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SECTION 01110
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. For the purpose of this Specification, 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 consideration of air, water, and land, and involves management of noise and solid waste, as well as other pollutants.
- C. Schedule and conduct all work in a manner that will minimize the erosion of soils in the area of the work. Provide erosion control measures such as sedimentation or filtration systems, berms, silt fences, seeding, mulching or other special surface treatments as are required to prevent silting and muddying of streams, rivers, impoundments, lakes, etc. All erosion control measures shall be in place in an area prior to any construction activity in that area.
- D. These Specifications are 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 approval of the Texas Commission on Environmental Quality (TCEQ) and the U.S. Environmental Protection Agency (EPA).

1.02 APPLICABLE REGULATIONS

- A. Comply with all applicable Federal, State, and local laws and regulations concerning environmental pollution control and abatement.

1.03 NOTIFICATIONS

- A. The ENGINEER will notify the CONTRACTOR in writing of any observed non-compliance with the foregoing provisions or of any environmentally objectionable acts and corrective action to be taken. State or local agencies responsible for verification of certain aspects of the environmental protection requirements shall notify the CONTRACTOR in writing, through the ENGINEER, of any non-compliance with State or local requirements. The CONTRACTOR shall, after receipt of such notice from the ENGINEER or from the regulatory agency through the ENGINEER, immediately take corrective action. Such notice, when delivered to the CONTRACTOR or its authorized representative at the site of the work, shall be deemed sufficient for the purpose. If the CONTRACTOR fails or refuses to comply promptly, the OWNER may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be made the subject of

a claim for extension of time or for excess costs or damages by the CONTRACTOR unless it is later determined that the CONTRACTOR was in full compliance.

1.04 IMPLEMENTATION

- A. Prior to commencement of the work, meet with the OWNER to develop mutual understandings relative to compliance with this provision and administration of the environmental pollution control program.
- B. 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 PROTECTION OF WATERWAYS

- A. The CONTRACTOR shall observe the rules and regulations of the State of Texas and agencies of the U.S. Government prohibiting the pollution of any lake, stream, river, or wetland by the dumping of any refuse, rubbish, dredge material, or debris therein.
- B. CONTRACTORS are specifically cautioned that disposal of materials into any waters of the State must conform with the requirements of the TCEQ, and an applicable permit from the U.S. Army Corps of Engineers.
- C. The CONTRACTOR shall be responsible for providing holding ponds or an approved method which will handle, carry through, or divert around his work all flows, including storm flows and flows created by construction activity, so as to prevent silting of waterways or flooding damage to the property or adjacent properties.
 - 1. Any materials removed from water bodies are to be dewatered in a manner that prevents silting or return of material to water body.
 - 2. Liquid/solid separation to be performed mechanically, by gravity separation in holding ponds or by other means that comply with the requirements. Holding ponds to incorporate means to remove liquid such as filtered riser pipes, decant pipes, underdrains, etc.
- D. The CONTRACTOR is responsible for researching the need for a U.S. EPA NPDES (Stormwater Pollution Prevention Plan) permit for the construction site. If one is required, the CONTRACTOR is responsible for obtaining the permit and for monitoring the site per the permit requirements until final completion. Costs associated with this activity shall be included in the CONTRACTOR'S bid.

1.06 DISPOSAL OF EXCESS EXCAVATION AND OTHER WASTE MATERIALS

- A. Material not suitable for backfill and other waste material must be disposed of at sites approved by the OWNER and ENGINEER. Excess excavated material suitable for backfill, but not used, shall be spread, and compacted in the designated spoils area as shown on the Drawings.
- B. Unacceptable disposal sites, include, but are not limited to, sites within a wetland or critical habitat and sites where disposal will have a detrimental effect on surface water or groundwater quality.
- C. The CONTRACTOR may make his own arrangements for disposal subject to submission of proof to the ENGINEER that the OWNER of the proposed site(s) has a valid fill permit issued

by the appropriate governmental agency and submission of a haul route plan including a map of the proposed route(s).

- D. The CONTRACTOR shall provide watertight conveyance of any liquid, semi-liquid, or saturated solids which tend to bleed or leak during transport. No liquid loss from transported materials will be permitted whether being delivered to the construction site or being hauled away for disposal. Fluid materials hauled for disposal must be specifically acceptable at the selected disposal site.

1.07 USE OF 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 the U.S. EPA or the U.S. Department of Agriculture or any other applicable regulatory agency. Use of all such chemicals and disposal of residues shall be in conformance with the manufacturer's instructions.
- B. Any oil or other hydrocarbon spilled or dumped on the OWNER'S site during construction must be excavated and completely removed from the site prior to final acceptance. Soil contaminated by the CONTRACTOR'S operations shall become the property of the CONTRACTOR, who will bear all costs of testing and disposal.
- C. If the OWNER is using or storing any chemicals on-site, the following steps shall be completed before a CONTRACTOR commences work:
1. The OWNER will inform CONTRACTOR of his rights under the Texas Hazards Communication Act.
 2. The OWNER will provide a copy of the Chemical List giving the hazardous chemicals to which the CONTRACTOR, his employees and agents may be exposed to on the project site.
 3. The OWNER will provide copies of all MSDSs to the CONTRACTOR for the hazardous chemicals which he may be exposed to on the project site.
 4. The OWNER will inform the CONTRACTOR of his obligation to inform his employees and agents of each of the above requirements.
 5. The CONTRACTOR shall provide MSDSs for all hazardous chemicals he may bring onto the project site that OWNER'S employees may be exposed to.
 6. The CONTRACTOR shall sign a Contractor Acknowledgement certifying that he has received the information provided by the OWNER on hazardous chemicals and maintain the Acknowledgement with the original Contract.

1.08 PAYMENT

- A. The work specified in this Section shall be considered incidental and payment will be included as part of the appropriate lump sum or unit prices specified in the Bid Form.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 EROSION CONTROL

- A. Provide positive means of erosion control such as shallow ditches or small berms around construction to carry off surface water. Erosion control measures, such as siltation basins, mulching, jute netting and other equivalent techniques, shall be used as appropriate. Flow of surface water into excavated areas shall be prevented. Ditches around construction area shall also be used to carry away water resulting from dewatering of excavated areas. At the completion of the work, ditches shall be backfilled, berms removed, and the ground surface restored to original condition.

3.02 PROTECTION OF STREAMS

- A. Care shall be taken to prevent, or reduce to a minimum, any damage to any stream 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 the streams.
- 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.
- 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 TCEQ. CONTRACTOR shall submit two copies of approved contingency plans to the ENGINEER.
- D. Water being flushed from structures or pipelines after disinfection, with a chlorine residue of 1 mg/L or greater, shall be treated with a dechlorination solution, in a method approved by the ENGINEER, prior to discharge.

3.03 PROTECTION OF LAND RESOURCES

- A. Land resources within the project boundaries and outside the limits of permanent work shall be restored to a condition, after completion of construction that will appear to be natural and not detract from the appearance of the project. Confine all construction activities 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, 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. Where trees may possibly be defaced, bruised, injured, or otherwise damaged by the CONTRACTOR'S equipment, dumping or other operations, protect such trees by placing boards, planks, or poles around them. Monuments and markers shall be protected similarly before beginning operations near them.
- D. Any trees or other landscape feature scarred or damaged by the CONTRACTOR'S equipment or operations shall be restored as nearly as possible to its original condition. The ENGINEER will decide what method of restoration shall be used and whether damaged trees shall be treated and healed or removed and disposed of.
 - 1. All scars made on trees by equipment, construction operations, or by the removal of limbs larger than 1 in. in diameter shall be coated as soon as possible with an approved tree wound dressing. All trimming or pruning shall be performed in an approved manner by experienced workmen with saws or pruning shears. Tree trimming with axes will not be permitted.
 - 2. Climbing ropes shall be used where necessary for safety. Trees that are to remain, either within or outside established clearing limits, that are subsequently damaged by the CONTRACTOR and are beyond saving in the opinion of the ENGINEER, shall be immediately removed and replaced.
- E. The locations of the CONTRACTOR'S storage, and other construction buildings, required temporarily in the performance of the work, shall be cleared portions of the job site or areas to be cleared as shown on the Drawings and shall require written approval of the ENGINEER and shall not be within wetlands or floodplains. The preservation of the landscape shall be an imperative consideration in the selection of all sites and in the construction of buildings. Drawings showing storage facilities shall be submitted for approval of the ENGINEER.
- F. If the CONTRACTOR proposes to construct temporary roads or embankments and excavations for plant and/or work areas, he/she shall submit the following for approval at least ten days prior to scheduled start of such temporary work.
 - 1. A layout of all temporary roads, excavations, and embankments 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. A landscaping drawing showing the proposed restoration of the area. Removal of any trees and shrubs outside the limits of existing clearing area shall be indicated. The drawing shall also indicate location of required guard posts or barriers required to control vehicular traffic passing close to trees and shrubs to be maintained undamaged. The drawing 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.
- G. Remove all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or 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 thereon.

- H. All debris and excess material shall be disposed of outside wetland or floodplain areas in an environmentally sound manner.

3.04 PROTECTION OF AIR QUALITY

- A. Burning. The use of burning at the project site for the disposal of refuse and debris will not be permitted, unless approved by the OWNER.
- B. Dust Control. The CONTRACTOR will be required to maintain all excavations, embankment, stockpiles, access roads, plant sites, waste areas, borrow areas, and all other work areas within or without 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. Sprinkling, to be approved, must be repeated at such intervals as to keep all parts of the disturbed area at least damp at all times, and the CONTRACTOR must have sufficient suitable equipment on the job to accomplish this if sprinkling is used. Dust control shall be performed as the work proceeds and whenever a dust nuisance or hazard occurs, as determined by the ENGINEER.

3.05 MAINTENANCE OF POLLUTION CONTROL FACILITIES DURING CONSTRUCTION

- A. During the life of this Contract, 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.

3.06 NOISE CONTROL

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

END OF SECTION

SECTION 01120
GEOTECHNICAL DATA

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The OWNER has obtained geotechnical information, which may include laboratory test results, logs of borings, and recommendations from geotechnical consultants. That information is included in the Appendices of these specifications. The CONTRACTOR shall be familiar with the subsurface materials and conditions on the Project and shall be knowledgeable of how they will affect the Work. The following is a partial listing of sources of information available to the CONTRACTOR about subsurface materials and conditions: the geotechnical information provided by the OWNER; geologic maps, publications and reports available from the University of Texas Bureau of Economic Geology at the J.J. Pickle Research Center in Austin, Texas; subcontractors familiar with local ground conditions; and, local consulting geologists and geotechnical engineers. The CONTRACTOR may make their own subsurface investigations.
- B. The soil information provided in the geotechnical report is representative of the specific bore locations only. Neither the OWNER or ENGINEER guarantee the soil conditions where bores were not acquired. For preparation of the bid costs, it shall be the CONTRACTOR'S responsibility to determine the soil conditions for the project.

END OF DOCUMENT

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SECTION 01300
SUBMITTALS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, and specific City of Seguin requirements or provisions apply to this Section.
- B. The contractor, sub-contractors, vendors, suppliers, manufacturers, etc. and any other trade providing submittals on the project will not be paid by the OWNER for submittal preparation.

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals, including but not limited to the following:
 - 1. Security plan.
 - 2. Contractor's construction schedule
 - 3. Shop drawings.
 - 4. Product data.
 - 5. Quality assurance and quality control submittals, including, but not limited to, calculations, mix designs, and substantiating test results.
- B. Administrative Submittals: Refer to other Division 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to, the following:
 - 1. Permits.
 - 2. Applications for Payment.
 - 3. Performance and Payment bonds.
 - 4. Insurance certificates.

1.03 RELATED WORK

- 1. SECTION 01105 - MEASUREMENT AND PAYMENT for submitting Applications for Payment.
- 2. SECTION 01310 - PROGRESS SCHEDULES AND MEETINGS for submitting schedules and reports, including CONTRACTOR's Construction Schedule and the Submittals Schedule.

3. SECTION 01321 - CONSTRUCTION PHOTOGRAPHS for submitting periodic construction photographs.
4. SECTION 01400 - QUALITY ASSURANCE QUALITY CONTROL for submitting test and inspection reports and Delegated-Design Submittals.
5. SECTION 01770 - CLOSEOUT PROCEDURES for submitting Record Drawings, and Record Product Data.
6. SECTION 01740 - WARRANTIES AND BONDS for submitting warranties.
7. SECTION 01782 - OPERATION AND MAINTENANCE DATA for operation and maintenance manual requirements.

1.04 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires ENGINEER'S responsive action.
- B. Informational Submittals: Written information that does not require ENGINEER'S approval. Submittals may be rejected for not complying with requirements.

1.05 SUBMITTAL PROCEDURES

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. ENGINEER reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- B. Submittals Schedule: Comply with requirements SECTION 01310 - PROGRESS SCHEDULES AND MEETINGS for list of submittals and time requirements for scheduled performance of related construction activities.
- C. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on ENGINEER'S receipt of submittal.
 1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. ENGINEER will advise CONTRACTOR when a submittal being processed must be delayed for coordination.
 2. If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Allow 15 days for processing each resubmittal.

4. In the event a submittal is stamped "Revise and Resubmit" three (3) or more times, the ENGINEER will record ENGINEER'S time for reviewing a fourth or subsequent submittal of a shop drawing, sample, or other item requiring approval, and CONTRACTOR shall be responsible for ENGINEER'S charges to OWNER for such time.
 5. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.
- D. Identification: Place a permanent label or title block on each submittal for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
 2. Provide a space approximately 4 by 5 inches on label or beside title block to record CONTRACTOR's review and approval markings and action taken by ENGINEER.
 3. Include the following information on label for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name and address of ENGINEER.
 - d. Name and address of CONTRACTOR.
 - e. Name and address of subcontractor.
 - f. Name and address of supplier.
 - g. Name of manufacturer.
 - h. Unique identifier, including revision number.
 - i. Number and title of appropriate Specification Section.
 - j. Drawing number and detail references, as appropriate.
 - k. Other necessary identification.
- E. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.
- F. Number transmittals in sequence for each Series of the Specifications thus: XXXXX-X. The number before the dash indicates the Section of the Specifications, and the number after the dash is the sequence number of the transmittal. For example, the first item submitted related to Specification SECTION 02422 – MANHOLES would be labeled 02422-1, the second item submitted would be labeled 02422-2, etc. Identify resubmittals with a letter of the alphabet following the original sequence number, using "A" for the first resubmittal, "B" for the second resubmittal, etc. For example, the first resubmittal of the second item submitted for Specification SECTION 02422 - MANHOLES would be labeled "02422-2A". Electronic files submitted shall be labeled the same way.

- G. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. ENGINEER will return submittals, without review, received from sources other than CONTRACTOR.
1. Include CONTRACTOR's certification stating that information submitted complies with requirements of the Contract Documents.
 2. Transmittal Form: Use sample form at end of Section.
- H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- I. Use for Construction: Use only final submittals with mark indicating action taken by ENGINEER in connection with construction.
- J. One (1) electronic copy in Portable Document Format (PDF) of all submittals and re-submittals, including schedules, shall be submitted suitable for distribution over electronic mail or File Transfer Protocol (FTP). Other file formats may be used upon approval of Owner and Engineer. **For final approved submittals provide PDF and two (2) hard copies.**

1.06 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: Prepare a fully developed, horizontal bar-chart-type, Contractor's construction schedule in electronic format. Submit initial schedule prior to or at the Pre-construction conference and submit updated schedules at each regularly scheduled Project Meeting and with each pay application and as directed by the ENGINEER.
1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the Work as indicated in the "Schedule of Values."
 2. Within each time bar, indicate estimated completion percentage in 10 percent increments. As Work progresses, place a contrasting mark in each bar to indicate Actual Completion.
 3. Prepare the schedule on a sheet, or series of sheets, of sufficient width to show data for the entire construction period.
 4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the Work. Show each activity in proper sequence. Indicate graphically the critical path items and the sequences necessary for completion of related portions of the Work.
 5. Indicate the phases of work in which subcontractors will be participating. Subcontractors shall be indicated by name.
 6. Coordinate the Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittal Schedule, progress reports, payment requests, and other schedules.

7. Indicate substantial completion in advance of the date established for Final Completion to allow time for the Engineer's procedures necessary for certification of Substantial and Final Completion.
- B. Work Stages: Indicate important stages of construction for each major portion of the Work, including submittal review, testing, and installation.
- C. Cost Correlation: At the head of the schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of Work performed as of the dates used for preparation of applications for payment. Refer to Article 14, "General Conditions", Payment to Contractor and Completion for cost reporting and payment procedures.
- D. Distribution: Following response to the initial schedule submittal, print and distribute copies to the Engineer, subcontractors, suppliers, and other parties required to comply with scheduled dates. Keep a copy at the Project Site at all times.
 1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.
- E. Schedule Updating: Revise the schedule after each meeting, event, or activity where revisions have been recognized or made and as requested by the Engineer. Issue the updated schedule concurrently with the report of each meeting, or as requested by the Engineer.
- F. The Contractor shall also provide a Four (4) Week Look-Ahead schedule at each progress meeting and with each pay request. This schedule shall show, by day of the week, the previous two (2) weeks construction activities performed and the planned construction activities of the following four (4) weeks.
- G. The Contractor shall submit the updated Overall and Four Week Look-Ahead schedules to the Engineer with the Contractors monthly pay request. The schedules must be acceptable to the Engineer and approved prior to the Engineer approving the pay request.

1.07 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's written recommendations.
 - b. Manufacturer's product specifications.
 - c. Manufacturer's installation instructions.

- d. Manufacturer's catalog cuts.
 - e. Wiring diagrams showing factory-installed wiring.
 - f. Printed performance curves.
 - g. Operational range diagrams.
 - h. Compliance with recognized trade association standards.
 - i. Compliance with recognized testing agency standards.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
- 1. Preparation: Include the following information, as applicable:
 - a. Dimensions.
 - b. Identification of products.
 - c. Fabrication and installation drawings.
 - d. Roughing-in and setting diagrams.
 - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
 - f. Shopwork manufacturing instructions.
 - g. Templates and patterns.
 - h. Schedules.
 - i. Notation of coordination requirements.
 - j. Notation of dimensions established by field measurement.
 - 2. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
 - 3. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 40 inches.
- D. Coordination Drawings: Comply with requirements in Division 1 Section "Project Management and Coordination."
- E. Samples: Prepare physical units of materials or products, including the following:
- 1. Comply with requirements in Division 1.
 - 2. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

- a. Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. ENGINEER will return submittal with options selected.
 - 3. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from the same material to be used for the Work, cured, and finished in manner specified, and physically identical with the product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Submit three sets of Samples. ENGINEER will retain one Sample sets; remainder will be returned.
 - 4. Preparation: Mount, display, or package Samples in manner specified to facilitate review of qualities indicated. Prepare Samples to match ENGINEER'S sample where so indicated. Attach label on unexposed side.
 - 5. Submit Samples for review of kind, color, pattern, and texture for a final check of these characteristics with other elements and for a comparison of these characteristics between final submittal and actual component as delivered and installed.
 - 6. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
- F. Product Schedule or List: Prepare a written summary indicating types of products required for the Work and their intended location.
- G. Delegated-Design Submittal: Comply with requirements in Division 1 SECTION 01400 – QUALITY ASSURANCE QUALITY CONTROL.
- H. Submittals Schedule: Comply with requirements in Division 1.
- I. Application for Payment: Comply with requirements in Division 1.
- J. Schedule of Values: Comply with requirements in Division 1.
- K. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use sample form at end of Section.

1.08 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
- 1. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

2. Test and Inspection Reports: Comply with requirements in SECTION 01400 - QUALITY ASSURANCE QUALITY CONTROL.
- B. CONTRACTOR's Construction Schedule: Comply with requirements in SECTION 01310 - PROGRESS SCHEDULES AND MEETINGS.
 - C. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names, and addresses of architects and owners, and other information specified.
 - D. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements.
 - E. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.
 - F. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements and, where required, is authorized for this specific Project.
 - G. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements. Include evidence of manufacturing experience where required.
 - H. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.
 - I. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.
 - J. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
 - K. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements.
 - L. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
 - M. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.

- N. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements in Division 1 SECTION 01770 – CLOSEOUT PROCEDURES.
- O. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- P. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer.
- Q. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections.

1.09 INSURANCE CERTIFICATES AND BONDS

- A. Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

1.10 CONSTRUCTION PHOTOGRAPHS

- A. Comply with requirements in SECTION 01321 – CONSTRUCTION PHOTOGRAPHS.

1.11 QUALITY ASSURANCE AND QUALITY CONTROL SUBMITTALS

- A. Submit quality assurance and quality control submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports, materials test results, field testing and inspection reports, density test results, and other quality-control submittals as required under other Sections of the Specifications.
- B. Certifications: Where other Sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a certification from the manufacturer or responsible Engineer certifying compliance with specified requirements.
 1. Signature: Certification shall be signed by an officer of the corporation or other individual authorized to sign documents on behalf of the company.
- C. Calculations: When required in the technical specifications, calculations shall be prepared and stamped by a Professional Engineer registered in the State of Texas.
- D. Concrete, Controlled Low Strength material, Asphalt Stabilized Base and Hot Mix Asphaltic Concrete Mix Designs and Substantiating Test Data: Requirements for submittal of mix design and substantiating test data are specified in the applicable Technical Specification Section. Each separate batch plant supplying ASB, HMAC, and/or concrete shall submit mix designs to the Owner's Representative for review.

1.12 PREPARATION AND SUBMITTAL OF CONSTRUCTION RECORD DRAWINGS

- A.** The CONTRACTOR's Superintendent will maintain a set of redlines noting any changes in ink during construction of the Project. The following shall be adhered to and provided (as a minimum) for the redline submittal.
 - 1.** General
 - a. Notes shall be sufficiently clear to allow a draftsperson to easily make the necessary changes without the need for field checks and interpretation.
 - b. One complete set of Construction Record redlines will be submitted prior to the final pay request and forwarded to the Owner.
 - 2.** Specific Requirements
 - a. Type, name, and model numbers of all valves (with # of turns to open/close), air release valves, drain and fire hydrants noted at locations installed.
 - b. Installed locations of all assignments, appurtenances and elevations which differ from those indicated on the Drawings.
 - c. Pipe manufacturer type and classification noted in sufficient detail to determine location and extent of each type or classification installed.
 - d. Modification to any standard or special details noted.
 - e. Location and description of pipe closures.
 - f. Thrust blocking locations and restrained pipe lengths, approximate dimensions and quantities noted.
 - g. Location, type, and quantity of all additions and deletions.
 - h. Changes in grade.
 - i. Changes in structure locations.
- B.** The above list is not intended to be complete. Any information noted which could be used for future maintenance, location, and construction projects is encouraged to be noted on the redlines.

1.13 CONSTRUCTION DIARIES

- A.** The CONTRACTOR shall prepare a daily construction diary recording as a minimum the following information concerning events at the site and submit duplicate copies to the OWNER's Representative at weekly intervals. The copies are to be signed by the project Superintendent as defined in the General Conditions.
 - 1.** Work performed.
 - 2.** Approximate count of CONTRACTOR's personnel, by classification, on the site.

3. List of subcontractors and personnel by classification on the site.
4. List of all equipment on the site by make and model.
5. High and low temperatures together with general weather conditions.
6. Start time and finish time of day's work.
7. Accidents and/or unusual events.
8. Meetings and significant decisions made.
9. Stoppages, delays, shortages and/or losses.
10. Meter readings and/or similar recordings.
11. Emergencies procedures that may have been needed.
12. Orders and requests of governing authorities.
13. Change Orders received and implemented.
14. Services connected and/or disconnected.
15. Installed equipment and/or system tests and/or startups and results.
16. Partial completions and/or occupancies.
17. Date of substantial completion certified.

1.14 CONTRACTOR'S REVIEW

- A. Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to ENGINEER.
- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of CONTRACTOR's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

1.15 ENGINEER'S ACTION

- A. General: ENGINEER will not review submittals that do not bear CONTRACTOR's approval stamp and will return them without action.
- B. Action Submittals: ENGINEER will review each submittal, make marks to indicate corrections or modifications required, and return it. ENGINEER will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
 1. No Exceptions Taken
 2. Make Corrections Noted

3. Revise and Resubmit
 4. Action Not Required
- C. Informational Submittals: ENGINEER will review each submittal and will not return it or will reject and return it if it does not comply with requirements. ENGINEER will forward each submittal to appropriate party.
- D. Submittals not required by the Contract Documents will not be reviewed and may be discarded.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01310
PROGRESS SCHEDULES AND MEETINGS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. During construction, the CONTRACTOR will be required to submit monthly progress reports to the OWNER and attend monthly construction meetings at the project location.

1.02 NARRATIVE PROGRESS REPORT

- A. The CONTRACTOR shall prepare and submit to the OWNER a written report, on a monthly basis, to include, as a minimum:
 - 1. Summary of Work completed during the past period between Narrative Progress Reports.
 - 2. Work planned during the next period.
 - 3. Explanation of differences between summary of Work completed and Work planned in previously submitted Narrative Progress Report.
 - 4. Current and anticipated delaying factors and their estimated impact on other activities and completion Milestones.
 - 5. Corrective action taken or proposed.
 - 6. The report format shall be submitted by the CONTRACTOR and approved by the OWNER and ENGINEER.
 - 7. The report shall be submitted to the OWNER at the Monthly Progress Meetings.

1.03 PRECONSTRUCTION MEETING

- A. Schedule: Meeting shall be prior to the start of work at a time and place designated by the CONTRACTOR and agreed upon by OWNER and ENGINEER.
- B. Attendance
 - 1. OWNER Representative.
 - 2. ENGINEER.
 - 3. Project Manager.
 - 4. CONTRACTOR & Key Subcontractors.
- C. Agenda
 - 1. Health & Safety.
 - 2. Roles and Responsibilities.

3. General contract terms.
4. Supervision.
5. Schedules and seasonal limitations.
6. Submittals.
7. Approvals and testing.
8. Clearances and notices.
9. Construction procedures.
10. Payments and estimates.
11. Labor requirements.
12. Construction Completion Documentation.

1.04 PROGRESS MEETINGS

- A. The CONTRACTOR will schedule and administer the progress meetings and specially called meetings throughout the progress of the work.
 1. Prepare or designate preparer of the agenda for the meetings.
 2. Distribute written notice of each meeting four (4) days in advance of meeting date.
 3. Make physical arrangements for meetings.
 4. Preside at meetings.
 5. Record or designate recorder of the minutes; include significant proceedings and decisions.
 6. Reproduce and distribute copies within seven (7) days after each meeting.
 - a. To participants in the meeting.
 - b. To parties affected by decisions made at the meeting.
- B. Schedule: Meetings will be scheduled a minimum of once each month at a time designated by the CONTRACTOR and agreed upon by OWNER and ENGINEER.
- C. Attendance
 1. ENGINEER
 2. CONTRACTOR
 3. Subcontractor's as pertinent to agenda

4. OWNER Representative

D. Agenda

1. Review and approve minutes of previous meeting.
2. Review of work progress since previous meeting.
3. Field observations, problems, and conflicts.
4. Problems which impede constructing schedule.
5. Review of off-site fabrication and delivery schedules.
6. Corrective measures and procedures to regain projected schedule.
7. Revisions to construction schedule.
8. Progress schedule during the succeeding work period.
9. Coordination of schedules.
10. Review of submittal schedules.
11. Review of Request for Information Status.
12. Review of proposed changes for effect on construction schedule and on completion date.
13. Review of Quality Assurance / Quality Control (QA/QC) reports.
14. Review of Punch List.
15. Safety report.
16. Review new business.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01321
CONSTRUCTION PHOTOGRAPHS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Photographic requirements for construction photographs and submittals.

1.02 DEFINITIONS

- A. Pre-construction Photographs: Photographs taken, in sufficient numbers and detail, prior to date of commencement of the Work, to show original construction site conditions.
- B. Progress Photographs: Photographs, taken throughout the duration of construction at regular intervals and from fixed vantage points, pre-approved by the ENGINEER, that document progress of the Work.
- C. Finished Photographs: Photographs, taken by a professional photographer near Date of Substantial Completion and before OWNER'S acceptance of the Work, that are suitable for framing and for use in brochures or on the Internet.
- D. Aerial Photographs: Photographs, taken from an aircraft by a professional aerial photographer near Date of Substantial Completion and before OWNER'S acceptance of the Work, that are suitable for framing and for use in brochures or on the Internet.

1.03 SUBMITTALS

- A. Format and Media. Digital photography shall be used. Submit color photographs, unless otherwise specified.
 1. Prints. Submit each Pre-construction Photograph print in a three-hole plastic pocket or sleeve, bound in a three-ring notebook. Submit each Progress Photograph print in a three-ring folder with fasteners. Produce prints on photographic-quality paper approved by Project Manager. Minimum size for Pre-construction Photograph prints shall be 4 in. by 6 in. Progress Photograph prints shall be 4 in. by 6 in.
 2. Digital Photography. Use 10.1-megapixel density or greater for photographs. Scanned photographs must equal or exceed 600 dots per inch when scanned from 4 in. by 6 in. prints. Submit digital photographic files on USB Flash Drives (min. 3 copies) to OWNER, ENGINEER, and CONTRACTOR. Format disks for Windows operating system and in JPEG (Joint Photographic Experts Group) format.
- B. Submittal Quantities and Frequencies
 1. Pre-construction Photographs
 - a. A preconstruction video recording of the entire project site, access points, perimeter fencing, features adjacent to access roads, and all access roads, including roads, within 1 mile of the plant site shall be required.

- b. A minimum of 60 photos shall be taken prior to any work being done. These photos will be taken at all areas and surround areas where construction will take place.
 - c. Submit two sets (one digital; one hard copy) of Pre-construction Photographs prior to first Application for Payment.
2. Progress Photographs
- a. Each month, a minimum of 30 exposures shall be taken as directed by ENGINEER. Plan a minimum of two photo events per month (once every two weeks), more as required per construction progress.
 - b. Submit two sets (one digital; one hard copy) of Progress Photographs with each Application for Payment. Monthly Applications for Payment shall be deemed incomplete if not accompanied by the required Progress Photographs. The CONTRACTOR'S failure or election to not submit a monthly Application for Payment shall not affect the requirement for monthly Progress Photographs.
3. Finished Photographs
- a. All photos and videos that were taken at the beginning (pre-construction) shall be taken from the same vantage point after all work (including re-vegetation) has been completed.
 - b. Submit four (one digital; three hard copy) sets of Finished Photographs after Date of Substantial Completion and prior to final payment. Each hard copy set shall contain one 11 in. by 14 in. matte finish color photographic print from each of the vantage points pre-approved by the ENGINEER. Vantage points for Finished Photographs will be approved separately from vantage points approved for Progress Photographs.
4. Final Aerial Photograph
- a. Upon completion of the project, the CONTRACTOR shall have made a color aerial photograph of the project as directed by the OWNER/ENGINEER. The photograph shall be of such view and angle and shall be taken at such time as directed by the OWNER/ENGINEER. Three (3) 11 in. by 14 in. or 16 in. by 20 in. (as determined by OWNER) color prints shall be provided to the OWNER.
- C. Labeling. Place a label on the back of each photographic print, applied so as to not to show through on the front. Digital photographs shall be provided with an electronic file (Microsoft Office compatible or PDF) photo log containing the same information. Labels shall contain the following information:
1. Name of Project, address of Project and Job Number.
 2. Name and address of CONTRACTOR.
 3. Date photograph was taken.

4. Location photo was taken from, direction of view (i.e. N, S, NW, etc.), and short description of photo subject.
 5. Name and address of professional photographer who took the photograph, if applicable.
- D. Hand-deliver or transmit prints in standard photographic mailers marked "Photographs - Do Not Bend".
- E. Photographic prints, photographic files and disks shall become the property of the OWNER. Photographs specified herein shall not be published without written consent by the OWNER. Photos shall remain copyrighted by photographer.

1.04 QUALITY ASSURANCE

- A. CONTRACTOR shall be responsible for the quality of and timely execution and submittal of photographs.
- B. For Finished Photographs, CONTRACTOR shall use a professional photographer, with five years minimum professional experience in the Central Texas area. CONTRACTOR shall submit name, address, and credentials of professional photographer for Project Manager's review and approval.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 PRE-CONSTRUCTION PHOTOGRAPHS

- A. Prior to commencement of construction operations, photograph the site to show original site and surrounding area conditions including initial construction corridor, detour routes, staging or storage areas, and outfall location.
- B. Pre-construction Photographs shall indicate condition of the following:
 1. Roads, streets, highways.
 2. Yards (near side and far side of street).
 3. House walks and sidewalks.
 4. Curbs.
 5. Areas between walks and curbs.
 6. Particular features (e.g. yard lights, shrubs, fences, trees).

- C. Show the location of vantage points and direction of shots on a key plan of the site.

3.02 PROGRESS PHOTOGRAPHS

- A. Progress Photographs document monthly advancement of the Work. Select vantage points for each shot to best show status of construction and progress since last photograph submittal.

Select camera stations that will require little or no movement or adjustment over the duration of construction.

- B. Take monthly Progress Photographs at regular intervals to coincide with cutoff dates associated with each Application for Payment.

3.03 FINISHED PHOTOGRAPHS

- A. Finished Photographs shall be "staged" and taken by a professional photographer to depict the most flattering images of a finished facility. Two vantage points, from which Finished Photographs will be taken, shall be agreed to in advance by the ENGINEER. Photographer shall consider lighting, time of day, height of eye, landscaping and placement of vehicles, people, and other props in each picture. Filters and post-photography processing may be utilized to achieve a finished product acceptable to the ENGINEER.

3.04 LOCATION

- A. Vantage points, times and conditions for camera stations and photography for Progress and Finished Photographs shall be mutually agreed upon by the OWNER, ENGINEER, CONTRACTOR, and Photographer. Progress Photograph vantage points may be changed by mutual agreement as the Work progresses, at no additional cost to the OWNER.

END OF SECTION

SECTION 01400
QUALITY ASSURANCE QUALITY CONTROL

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve CONTRACTOR of responsibility for compliance with the Contract Document requirements.
 - 1. Specified tests, inspections, and related actions do not limit CONTRACTOR'S quality-control procedures that facilitate compliance with the Contract Document requirements.
 - 2. Requirements for CONTRACTOR to provide quality-control services required by ENGINEER, OWNER, or authorities having jurisdiction are not limited by provisions of this Section.
- C. See Divisions 2 through 16 Sections for specific test and inspection requirements.

1.02 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and ensure that proposed construction complies with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that completed construction complies with requirements. Services do not include contract enforcement activities performed by ENGINEER.
- C. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

1.03 DELEGATED DESIGN

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of CONTRACTOR by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to ENGINEER.

1.04 SUBMITTALS

- A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

- B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement, signed, and sealed by the responsible design professional, for each product and system specifically assigned to CONTRACTOR to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.
- C. Reports: Prepare and submit certified written reports that include the following:
 - 1. Revise list below to suit Project.
 - 2. Date of issue.
 - 3. Project title and number.
 - 4. Name, address, and telephone number of testing agency.
 - 5. Dates and locations of samples and tests or inspections.
 - 6. Names of individuals making tests and inspections.
 - 7. Description of the Work and test and inspection method.
 - 8. Identification of product and Specification Section.
 - 9. Complete test or inspection data.
 - 10. Test and inspection results and an interpretation of test results.
 - 11. Ambient conditions at time of sample taking and testing and inspecting.
 - 12. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - 13. Name and signature of laboratory inspector.
 - 14. Recommendations on retesting and reinspecting.
- D. Permits, Licenses, and Certificates: For OWNER'S records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

- C. If more detailed requirements are needed, add this information to specific individual Sections. Examples include Installer employing workers trained and approved by manufacturer, Installer being acceptable to manufacturer, and Installer being an authorized representative of manufacturer for both installation and maintenance.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance.
- F. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.
- G. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
 - 1. Requirement for specialists shall not supersede building codes and similar regulations governing the Work, nor interfere with local trade-union jurisdictional settlements and similar conventions.
- H. Testing Agency Qualifications: An agency with the experience and capability to conduct testing and inspecting indicated, as documented by the latest ASTM standards that specializes in types of tests and inspections to be performed.

1.06 QUALITY CONTROL

- A. OWNER Responsibilities: Where quality-control services are indicated as OWNER'S responsibility, OWNER will engage a qualified testing agency to perform these services.
 - 1. OWNER will furnish CONTRACTOR with names, addresses, and telephone numbers of testing agencies engaged and a description of the types of testing and inspecting they are engaged to perform.
 - 2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to CONTRACTOR.
- B. CONTRACTOR Responsibilities: Unless otherwise indicated, provide quality-control services specified and required by authorities having jurisdiction.
 - 1. Where services are indicated as CONTRACTOR'S responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. CONTRACTOR shall not employ the same entity engaged by OWNER, unless agreed to in writing by OWNER.
 - 2. Notify testing agencies at least 48 hours in advance of time when Work that requires testing or inspecting will be performed.

3. Where quality-control services are indicated as CONTRACTOR'S responsibility, submit a certified written report, in duplicate, of each quality-control service.
 4. Testing and inspecting requested by CONTRACTOR and not required by the Contract Documents are CONTRACTOR'S responsibility.
 5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Special Tests and Inspections: OWNER will engage a testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of OWNER.
1. Testing agency will notify ENGINEER and CONTRACTOR promptly of irregularities and deficiencies observed in the Work during performance of its services.
 2. Testing agency will submit a certified written report of each test, inspection, and similar quality-control service to ENGINEER with copy to CONTRACTOR and to authorities having jurisdiction.
 3. Testing agency will submit a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 4. Testing agency will interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 5. Testing agency will retest and reinspect corrected work.
- D. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing.
- E. Retesting/Reinspecting: Regardless of whether original tests or inspections were CONTRACTOR'S responsibility, provide quality-control services, including retesting and reinspecting, for construction that revised or replaced Work that failed to comply with requirements established by the Contract Documents.
- F. Testing Agency Responsibilities: Cooperate with ENGINEER and CONTRACTOR in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify ENGINEER and CONTRACTOR promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 3. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through CONTRACTOR.
 4. Do not release, revoke, alter, or increase requirements of the Contract Documents or approve or accept any portion of the Work.
 5. Do not perform any duties of CONTRACTOR.

G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field-curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.07 PAYMENT FOR LABORATORY TESTING SERVICES

A. Testing to be paid by CONTRACTOR. All standard testing to be paid in this manner. All additional testing required due to a CONTRACTOR failure shall be paid by CONTRACTOR.

1. The CONTRACTOR shall furnish, at his own expense, materials, or specimens for testing.
2. The CONTRACTOR shall furnish at his own expense, suitable evidence that the materials he proposes to incorporate into the work are in accordance with the specifications. Mill tests for reinforcing steel and cement will be acceptable if it is definite that the test sheets apply to the material being furnished. Manufacturers or supplier's test results will be acceptable for such items as pipe, valves, etc. when it is definite that the material being furnished is in accordance with the manufacturers or supplier's specifications to which the test results apply. Supplier's evidence of quality will be acceptable as long as the material is secured from the sources to which the evidence applies.

B. The ENGINEER may have further inspection and tests made by the laboratory or may make tests himself, to ensure that the CONTRACTOR is complying with the specifications. The correction or removal of such unsatisfactory work and the replacement with satisfactory work shall be performed by the CONTRACTOR at his own expense and is understood to be fully included in his CONTRACTOR requirements, without any additional compensation or claims upon the OWNER.

- C. Tests indicating non-compliance with the Contract Documents shall be paid for by the CONTRACTOR.
- D. Inspection or testing performed exclusively for the CONTRACTOR'S convenience shall be borne by the CONTRACTOR.
- E. The CONTRACTOR shall submit to the ENGINEER, for approval, the name of the testing company to be used by the CONTRACTOR. The testing company and its subcontractors shall be certified by AASHTO or U.S. Army Corps of Engineers.
- F. No separate payment will be made for testing.

1.08 EQUIPMENT TESTING

- A. Upon completion of the Work and prior to final acceptance and payment, test equipment as specified or required for compliance with Contract Documents. Manufacturer's authorized representative(s) shall be present at site to inspect, check and approve equipment and installation prior to start-up and test; and to supervise testing of equipment.
- B. Adjust or replace equipment which does not meet requirements of Contract Documents during test at no additional cost to OWNER.
- C. Include costs of equipment testing in the price of equipment to be installed when applicable.

1.09 MATERIAL TESTING

- A. Representatives of the testing laboratory shall have access to the Work at all times. Provide facilities for access in order that laboratory may perform its functions properly.
- B. Testing Schedules
 - 1. Consult testing laboratory in advance to determine time required to perform tests and issue each of the findings. Include required time within construction schedule.
 - 2. When changes of the construction schedule are necessary, coordinate such changes with the testing laboratory as required.
- C. All samples for testing, unless otherwise provided elsewhere in these Specifications, shall be taken by the testing laboratory. All sampling equipment and personnel shall be provided by the testing laboratory unless otherwise specified. All deliveries of samples to the testing laboratory shall be performed by the testing laboratory unless otherwise specified.

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

- A. This section covers the Project requirements for field offices, utilities, site security, access roads and parking, and related items to be provided by the CONTRACTOR throughout the duration of the Project.
- B. The CONTRACTOR shall obtain and pay for all permits required for the Field Offices specified herein including any utilities or communication requirements. The Contractor shall pay all costs associated with maintaining the Field Offices, including utility costs and all insurance.
- C. The CONTRACTOR's bid cost shall include communication with all utility companies, applications, permits, fees, equipment, installation of all required materials, removal of materials after construction, etc. required for temporary facilities to the acceptance of the OWNER.
- D. Water and electricity supply for construction shall be acquired by the CONTRACTOR from service providers Guadalupe Valley Electric Cooperative (GVEC) for electrical supply and Springs Hill Water Supply Corporation (WSC) for potable water and usage will be paid by the CONTRACTOR. The CONTRACTOR shall coordinate and install, at his expense, any meters required for water and electrical service and remove them at the end of construction. Services shall be independent of OWNER's existing services.
- E. The CONTRACTOR shall prepare and install Project Signs.
- F. Temporary utilities include, but are not limited to, the following:
 - 1. Sewers and drainage.
 - 2. Water service and distribution.
 - 3. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.
 - 4. Heating and cooling facilities.
 - 5. Ventilation.
 - 6. Electric power service.
 - 7. Lighting.
 - 8. Telephone service.
 - 9. Internet service.
- G. Support facilities include, but are not limited to, the following:
 - 1. Temporary roads and paving.

2. Dewatering facilities and drains.
3. Project identification and temporary signs.
4. Waste disposal facilities.
5. Field offices.
6. Storage and fabrication sheds.
7. Temporary stairs.
8. Construction aids and miscellaneous services and facilities.
9. Safety facilities required per OSHA requirements, for the safe access by OWNER and ENGINEER. Representatives to inspect all facilities and structures as determined by the ENGINEER. The CONTRACTOR shall provide any and all required personnel lifting devices, cranes, hoists, scaffolding, safety cages, ladders (tied-off), temporary walkways, etc. or other equipment for OWNER representatives to access all facilities as required by ENGINEER. It is the ENGINEER's decision on facilities that require inspection and the proximity of personnel to the inspected facilities. CONTRACTOR shall provide all safe access per OSHA for these requirements.

H. Security and protection facilities include, but are not limited to, the following:

1. Environmental protection.
2. Stormwater control.
3. Tree and plant protection.
4. Site enclosure fence.
5. Security enclosure and lockup.
6. Barricades, warning signs, and lights.
7. Fire protection.

1.02 QUALITY ASSURANCE

- A. Standards: Comply with ANSI A10.6, NECA's "Temporary Electrical Facilities," and NFPA 241.
1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.
 2. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.03 PROJECT CONDITIONS

- A. Temporary Utilities: At earliest feasible time, when acceptable to OWNER, change over from use of temporary service to use of permanent service.
 - 1. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before OWNER'S acceptance, regardless of previously assigned responsibilities.
- B. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the work:
 - 1. Keep temporary services and facilities clean and neat.
 - 2. Relocate temporary services and facilities as required by progress of the Work.

1.04 USE CHARGES

- A. General: Cost or use charges for temporary facilities are not chargeable to OWNER or Engineer and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:
 - 1. OWNER'S construction forces.
 - 2. Occupants of Project.
 - 3. Engineer.
 - 4. Testing agencies.
 - 5. Personnel of authorities having jurisdiction.
 - 6. Owner's inspectors.

1.05 TEMPORARY OFFICES

- A. Temporary offices shall be furnished and installed on the job site by the CONTRACTOR for use by the CONTRACTOR, OWNER and ENGINEER as herein described. The offices and related facilities shall be in service prior to any construction activities and shall remain in service until the project is closed out with the OWNER. Offices shall be adequately furnished, and maintained in a clean, orderly condition by the CONTRACTOR. The CONTRACTOR'S representative shall be present in the field office at all times while work is in progress. Instructions received there from the ENGINEER shall be considered as delivered to the CONTRACTOR.
- B. Meeting/Conference Building:
 - 1. Provide a separate temporary building of at least 600 sq. ft. with 8 ft. ceiling height, for use of the OWNER, CONTRACTOR, and ENGINEER to be used exclusively for meetings and conferences throughout the period of construction. The temporary building shall be weathertight, have a tight floor at least 8 in. off the ground, be insulated all around with rigid insulation board not less than 1/2 in. thick, and be suitably ventilated. It

shall have adequate (as determined by ENGINEER) electric heating and air conditioning, paid for, and maintained by the CONTRACTOR. It shall have at least five (5) screened windows capable of being opened, six (6) keys, two (2) solid wood exterior doors that include a screen door. Doors shall be provided with cylinder lock and six (6) keys. It shall be equipped with potable water with sink, toilet, water heater, refrigerator, and fire extinguisher. The CONTRACTOR shall pay for all required costs associated with the building, including any and all maintenance required and electricity usage for the building.

2. The meeting/conference building shall have the following minimum furniture and equipment:

- a. Two (2) plan tables (3 ft. x 5 ft.) and two stools.
- b. Shelves, four (4), 72" high x 48" wide x 18" deep.
- c. Two (2) four-drawer, legal size, metal filing cabinets with locks and keys.
- d. Coat rack and hooks.
- e. Water heater (30 gal. mim.).
- f. Air conditioner/heater (to maintain the building at 72°F).
- g. Six (6) conference tables (6 ft.).
- h. Twenty (20) folding chairs.
- i. First aid kit suitable for ten people with manual, American White Cross No. K10 or equal.
- j. Eyewash kit.
- k. Refrigerator and microwave.
- l. Printer/fax/scan/copier.
- m. Wall mounted erasable white board, min 4 ft. x 6 ft.
- n. Exterior light for all doorways

C. OWNER/ENGINEER Office

1. Provide a separate temporary building of at least 600 sq. ft. with 8 ft. ceiling height, for the exclusive use of the OWNER and ENGINEER throughout the period of construction. The temporary building shall be weathertight, have a tight floor at least 8 in. off the ground, be insulated all around with rigid insulation board not less than 1/2 in. thick, and be suitably ventilated. It shall have adequate (as determined by ENGINEER) electric heating and air conditioning, paid for, and maintained by the CONTRACTOR. It shall have at least five (5) screened windows capable of being opened, six (6) keys, two (2) solid wood exterior doors that include a screen door. Doors shall be provided with cylinder lock and six (6) keys. It shall be equipped with potable water with sink, toilet, water heater, refrigerator, and fire extinguisher. The CONTRACTOR shall pay for all

required costs associated with the building, including any and all maintenance required and electricity usage for the building.

2. The OWNER/ENGINEER'S office shall have the following furniture and equipment:

- a. Two (2) plan table (3 ft. x 5 ft.) and two (2) stools.
- b. Two (2) desks (3 ft. x 5 ft.) with a desk chair for each.
- c. Three (3) additional chairs.
- d. Plan rack.
- e. Shelves.
- f. Two (2) four-drawer, legal size, metal filing cabinets with locks and keys.
- g. Coat rack and hooks.
- h. Water heater (30 gal. mim.).
- i. Air conditioner/heater (to maintain the building at 72°F).
- j. Two (2) conference tables (6 ft.).
- k. Ten (10) folding chairs.
- l. First Aid Kit suitable for ten people with manual, American White Cross No. K10 or equal.
- m. Eyewash kit.
- n. Refrigerator and microwave.
- o. Printer/fax/scan/copier.
- p. Wall mounted erasable white board, min 4 ft. x 6 ft.
- q. Exterior light for all doorways.

D. The CONTRACTOR shall supply all fuel for heating and pay all utility bills.

E. Parking and Fencing: Provide an all-weather driveway (from Seitz Road) and parking area for the sole use of vehicles for the temporary offices unless otherwise shown on the plans. Situate the parking area near the temporary office at an acceptable location. Maintain the parking area until the project is completed and restore the area to a condition acceptable to the ENGINEER upon project completion. Enclose the field office and the parking area with a 6-ft. chain-link fence, a top-mounted 3-strand barbed wire, and a 12-ft. gate.

F. Temperature Control: All buildings shall have adequate air conditioning and heating, automatically controlled by thermostat, to maintain 76 degrees in summer months and 68 degrees in winter months.

G. Cleaning Service: The CONTRACTOR shall provide cleaning services for all temporary offices to include as a minimum dusting, sweeping, vacuuming, mopping, trash removal, restroom cleaning, etc. The cleaning frequency shall be every two (2) weeks for the construction period duration.

1.06 DATA/CABLE SERVICE

A. Provide one of the following data services for the duration of the project. The CONTRACTOR shall pay installation and monthly charges and is responsible for all maintenance of service and hardware for the duration of the project. Data service shall be dedicated to the OWNER/ENGINEER and not shared with any other party, and shall be located in the temporary OWNER/ENGINEER office. The CONTRACTOR shall provide a durable and weather tight system for connecting the OWNER/ENGINEER'S office to the service provider's facilities at the jobsite boundary:

1. Provide high-speed Internet access (DSL, fiber optic or cable modem); with a minimum 15-megabit per second download/10-megabit per second upload. This access must have a minimum of eight (5 usable) IP addresses. In addition, it must provide an average round-trip delay of less than 100 ms. to the ENGINEER'S Internet gateway.

B. Provide new data service hardware corresponding to above options. The CONTRACTOR is responsible for all maintenance of service and hardware.

C. Provide the following to create a local area network for the OWNER/ENGINEER:

1. Provide Category 5e patch cables for all networking equipment as directed by the OWNER/ENGINEER.

1.07 TEMPORARY LIGHT AND POWER

A. The CONTRACTOR shall make temporary service connection for their construction needs that is independent of the City's connection, including but not limited to:

1. Set up an account with GVEC in the CONTRACTOR's name. All bills from GVEC will be sent to the CONTRACTOR for payment.
2. Make all contact with GVEC, prepare service application as needed and pay all application, service, and installation costs.
3. Through GVEC, install electric meter to provide all electric usage for temporary services during construction, including OWNER / ENGINEER office.
4. Pay all usage costs for installed meter during construction.
5. Following construction, remove meter and all systems related to temporary service to the satisfaction of the OWNER and GVEC. Pay all bills owed to GVEC.

B. The CONTRACTOR shall furnish all temporary light and power, complete with wiring, lamps, and similar equipment as required to adequately light all work areas and with sufficient power capacity to meet the needs of the OWNER and ENGINEER. The CONTRACTOR shall make all necessary arrangements with the temporary construction facilities for the OWNER for temporary electric service and pay all expenses in connection therewith.

- C. Provide properly configured NEMA polarized outlets to prevent insertion of 110-120 volt plugs into higher voltage outlets. For connection of power tools and equipment, provide outlets equipped with ground-fault circuit interrupters, reset button and pilot light.
- D. Provide grounded extension cords. Use "hard-service" cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if more than one length is required.
- E. Provide general service incandescent lamps as required for adequate illumination. Provide guard cages or tempered glass enclosures, where exposed to breakage. Provide exterior fixtures where exposed to moisture.

1.08 TEMPORARY AIR AND WATER

- A. The CONTRACTOR shall provide all air and water, including temporary piping and appurtenances, as may be required for the cleaning and testing of pipelines and equipment necessary for the work. Temporary piping and appurtenances shall be removed upon approval of equipment being tested.
- B. For construction water, the CONTRACTOR shall install a temporary water connection to the 2" water main on Seitz Road on the East side of the plant property, including but not limited to:
 1. Setup an account in the CONTRACTOR's name with Springs Hill WSC. All bills from the WSC will be sent to the CONTRACTOR for payment.
 2. Make contact with Springs Hill WSC for temporary service, to include application submittal and payment of all associated fees and installation cost for the connection to the main.
 3. Install or have installed by the WSC the water meter and any other facilities required by the WSC.
 4. Install a Reduced Pressure Zone (RPZ) valve assembly to prevent backflow in the event of a pressure failure.
 5. Temporary water service will be for CONTRACTOR's use and for the temporary office buildings, including the OWNER / ENGINEER's office.
 6. Contractor Note that the 2" water supply must be sufficient for all construction needs by the CONTRACTOR. If a 2" supply is insufficient or if the water provider does not allow connection, the CONTRACTOR must deliver (truck in) the required water to the site, both for potable and non-potable needs, at NO additional cost to the OWNER. There are no additional potable water supplies near the Geronimo Creek WWTP site.
 7. Following construction, remove the water meter and all systems related to the temporary service to the satisfaction of the OWNER and Springs Hill WSC. Pay all bills owed to Spring Hill WSC.
- C. The CONTRACTOR shall supply all necessary tools, hose and pipe, and shall make necessary arrangements for securing and transporting such water and shall take water in such a manner, and at such times, that will not produce a harmful drain or decrease of pressure in the WSC's water system. Temporary lines shall be removed when no longer required.

1.09 TEMPORARY SANITARY FACILITIES

- A. The CONTRACTOR may discharge domestic sanitary sewage from the temporary offices to the existing plant drain system. Note the majority of the drain system is located on the North side of the site, as shown on the site drawings. All temporary piping and connections are the CONTRACTOR's responsibilities and shall be removed by the CONTRACTOR following its use, to the satisfaction of the OWNER. Any temporary connection to the drain system shall be approved by the OWNER.
- B. The CONTRACTOR shall furnish temporary sanitary facilities at the site, as provided herein, for the needs of all construction workers and others performing Work or furnishing services on the Project.
- C. Provide temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.
 - 1. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.
 - 2. Toilets: Install self-contained toilet units.
- D. Sanitary facilities shall be of reasonable capacity, properly maintained throughout the construction period, and obscured from public view to the greatest practical extent. If toilets of the chemically treated type are used, at least one toilet shall be furnished for each twenty (20) employees. The CONTRACTOR shall enforce the use of such sanitary facilities by all personnel at the site.
- E. At no time shall the CONTRACTOR or subcontractors use the sanitary facilities for the OWNER/ENGINEER'S Field Office.

1.10 FIRE EXTINGUISHERS

- A. Provide portable UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide portable UL-rated Class ABC dry chemical extinguishers or a combination of NFPA recommended Classes for the exposure. Comply with NFPA 10 and 241 for classification, extinguishing agent and size required by location and class of fire exposure.

1.11 LAYOUT OF TEMPORARY FACILITIES

- A. Before starting the work, the CONTRACTOR shall submit to the ENGINEER his requirements for space for temporary structures and storage of materials. The CONTRACTOR shall submit to the ENGINEER for approval, his proposed plan and layout for all temporary offices, sanitary facilities, temporary construction roads, storage buildings, storage yards, temporary water service and distribution, temporary power service and distribution, and temporary telephone service.

1.12 STORAGE BUILDINGS

- A. The CONTRACTOR shall erect, or provide as approved, temporary storage buildings as required for the protection of mechanical and electrical equipment and materials as recommended by manufacturers of such equipment and materials. The buildings shall be

provided with environmental control systems that meet recommendations of manufacturers of all equipment and materials stored in the buildings. The buildings shall be of sufficient size and so arranged or partitioned to provide security for their contents and provide ready access for inspection and inventory. At or near the completion of the work, and as directed by the ENGINEER, the temporary storage buildings shall be dismantled, removed from the site, and remain the property of the CONTRACTOR.

- B. Combustible materials (paints, solvents, fuels, etc.) shall be stored in a well-ventilated building removed from other buildings.

1.13 STORAGE YARDS

- A. The CONTRACTOR shall construct temporary storage yards for the storage of materials that are not subject to damage by weather conditions. Materials such as pipe and reinforcing and structural steel shall be stored on pallets or racks, off the ground, and in a manner that allows ready access for inspection and inventory.

1.14 CONTRACTOR'S WORK AREA

- A. The CONTRACTOR shall limit his operations and storage of equipment and materials to the areas designated and as directed by the ENGINEER.
- B. The CONTRACTOR shall erect a suitable fence around each tree or group of trees shown as "protected" or "to be saved" on the plans. Any such trees damaged shall be repaired or replaced, as directed by the ENGINEER, at the CONTRACTOR'S expense.
- C. Except as provided herein, no private property, or other area adjacent to the plant site shall be used for storage of the CONTRACTOR'S equipment and materials unless prior written approval is obtained from the legal owner.
- D. The CONTRACTOR shall maintain the area during construction and shall proceed with his work in an orderly manner, maintaining the construction site free of debris and unnecessary equipment or materials.
- E. At all times, maintain areas covered by the Contract and public properties free from accumulations of waste, debris, and rubbish caused by construction operations.
- F. Cleaning and disposal operations shall comply with local ordinances and antipollution laws. Do not burn or bury rubbish and waste materials on the project site. Do not dispose of volatile wastes such as mineral spirits, oil, chemicals, or paint thinner in storm or sanitary drains. Do not dispose of wastes into streams or waterways.
- G. Wet down dry materials and rubbish to minimize dust and prevent blowing dust.
- H. Provide approved containers for collection and disposal of waste materials, debris, and rubbish and make arrangements for appropriate periodic emptying of the containers.

1.15 PROTECTION OF PUBLIC AND PRIVATE PROPERTY

- A. The CONTRACTOR shall protect, shore, brace, support and maintain all underground pipes conduits, drains, and other underground construction uncovered or otherwise affected by the CONTRACTOR'S operations. All pavement, surfacing, driveways, curbs, walks, buildings, utility poles, guy wires, fences, and other surface structures affected by construction operations,

together with all sod and shrubs in yards, parkways, and medians, shall be restored to their original condition, whether within or outside the easement/right-of-way. All replacements shall be made with new materials.

- B. The CONTRACTOR shall be responsible for all damage to streets, roads, curbs, sidewalks, highways, shoulders, ditches, embankments, culverts, bridges, or other public or private property, which may be caused by transporting equipment, materials, or men to or from the Work, whether by him or his Subcontractors. The CONTRACTOR shall make satisfactory and acceptable arrangements with the OWNER of, or the agency having jurisdiction over, the damaged property concerning its repair or replacement, or payment of costs incurred in connection with the damage.
- C. All fire hydrants and water control valves shall be kept free from obstruction and available for use at all times.

1.16 TEMPORARY ACCESS ROADS AND PARKING SPACE

- A. The CONTRACTOR shall construct temporary construction access roads and detours as are required to execute the work. The roads shall meet with the approval of the ENGINEER and be maintained in good condition until no longer needed; at which time the temporary roads shall be removed and the area left in a condition satisfactory to the ENGINEER.
- B. The CONTRACTOR shall construct temporary parking facilities for his employees, his Subcontractor's employees, other employees, and the ENGINEER.

1.17 PROTECTION OF THE FINISHED CONSTRUCTION

- A. The CONTRACTOR shall assume the responsibility for the protection of all finished construction and shall repair and restore any and all damage to finished work to its original or better state.
- B. Where responsibility can be determined, the cost for replacement or repair of damaged work shall be charged to the party responsible. If responsibility cannot be fixed, the cost shall be borne by the CONTRACTOR.
- C. Wheeling of any loads over finished floors, either with or without plank protection, shall not be permitted in anything except rubber-tired wheelbarrows, buggies, trucks, or dollies. This applies to all finished floors and to all exposed concrete floors as well as those covered with composition tile or other applied surfacing and shall apply to all trades.
- D. Where structural concrete has the finished surface, care shall be taken to avoid marking or damaging those surfaces.

1.18 TEMPORARY SIGNS

- A. Furnish and install the project signs indicated in the Contract Documents. Signs shall be placed as directed by the ENGINEER; and shall be maintained in good condition for the life of the construction period.
- B. Remove signs at final acceptance, unless otherwise directed.

1.19 SECURITY

- A. The CONTRACTOR shall be responsible for protection of the site, and all work, materials, equipment, and existing facilities thereon, against vandals and other unauthorized persons.
- B. No claim shall be made against the OWNER by reason of any act of an employee or trespasser, and CONTRACTOR shall make good all damage to the OWNER'S property resulting from CONTRACTOR'S failure to provide security measures.

1.20 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.
 2. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to OWNER.
- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate to support loads and to withstand exposure to traffic during construction period. Locate temporary roads and paved areas within construction limits indicated on Drawings.
 1. Provide a reasonably level, graded, well-drained subgrade of satisfactory soil material, compacted to not less than 95 percent of maximum dry density in the top 6 in.
- C. Dewatering Facilities and Drains: Comply with requirements in applicable DIVISION 2 - SITE CONSTRUCTION sections for temporary drainage and dewatering facilities and operations not directly associated with construction activities included in individual sections. Where feasible, use same facilities. Maintain Project site, excavations, and construction free of water.
 1. Dispose of rainwater in a lawful manner that will not result in flooding project or adjoining property nor endanger permanent work or temporary facilities.
 2. Before connection and operation of permanent drainage piping system, provide temporary drainage where roofing or similar waterproof deck construction is completed.
- D. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste.
- E. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate. Cover finished, permanent stairs with protective covering of plywood or similar material so finishes will be undamaged at time of acceptance.
- F. Fuel Storage: Temporary fuel storage will comply with TCEQ regulations. Tank size shall be 1,320 gallons or less. Provide secondary containment.
- G. Worker Housing: The CONTRACTOR shall not be allowed to provide temporary housing of their workforce on the job site or other City of Seguin property.

1.21 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near Project site.
- B. Stormwater Control: Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of stormwater from heavy rains.
- C. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from construction damage. Protect tree root systems from damage, flooding, and erosion.
- D. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
- E. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.
- F. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install, and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
 - 1. Provide fire extinguishers, installed on walls on mounting brackets, visible and accessible from space being served, with sign mounted above.
 - a. Field Offices: Class A stored-pressure water-type extinguishers.
 - 2. Store combustible materials in containers in fire-safe locations.
 - 3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for firefighting. Prohibit smoking in hazardous fire-exposure areas.
 - 4. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition.

1.22 REMOVAL OF TEMPORARY FACILITIES AND UTILITIES

- A. At such time or times any temporary construction facilities and utilities are no longer required for the work, the CONTRACTOR shall notify the ENGINEER of his intent and schedule for removal of the temporary facilities and utilities and obtain the ENGINEER'S approval before removal. As approved, the CONTRACTOR shall disconnect and/or dismantle the temporary facilities and utilities and remove them from the site as his property. Leave the site in such condition as specified, as directed by the ENGINEER, and/or as shown on the Plans.

- B. In unfinished areas, the condition of the site shall be left in a condition that will restore original drainage, evenly graded, seeded or planted as necessary, and left with an appearance equal to, or better than original.
- C. Maintain facilities in good operating condition until removal. Protect from damage caused by freezing temperatures and similar elements.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
 - 2. Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.
- D. Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 - 1. Materials and facilities that constitute temporary facilities are the property of CONTRACTOR.
 - 2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
 - 3. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements in the Contract Documents.

1.23 PAYMENT

- A. The work specified in this Section shall be considered incidental and payment will be included as part of the appropriate lump sum or unit prices stated in the Proposal.

END OF SECTION

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SECTION 01570
STORMWATER POLLUTION PREVENTION PLAN

PART 1 - GENERAL

1.01 PREPARATION AND NOTIFICATION PHASE

A. Stormwater Pollution Prevention Plan (SWP3)

1. The CONTRACTOR shall be responsible for preparation of the Stormwater Pollution Prevention Plan (SWP3) and submitting the plan to the Texas Commission on Environmental Quality (TCEQ). The CONTRACTOR shall incorporate as a part of the SWP3 all necessary erosion control details and notes required by applicable law and as shown on the drawings, **including all necessary materials and labor necessary to construct the items called for in the SWP3.** The SWP3 shall include all elements required by TPDES General Permit No. TXR150000 as issued by TCEQ, effective date, January 28, 2022. The SWP3 must be retained on-site at all times during the construction of the project. The CONTRACTOR shall complete the document in Attachment 1 and insert into the SWP3.

B. Notice of Intent and Construction Site Notice

1. The CONTRACTOR shall submit a Notice of Intent (NOI) to the Texas Commission on Environmental Quality. The application fee and annual Water Quality Fee shall be paid for by the CONTRACTOR. A Construction Site Notice and NOI are required for areas where the land disturbed is equal to or greater than five (5) acres. For disturbed areas where the acreage is between one (1) and five (5) acres, only a Construction Site Notice is required. A copy of the NOI (and/or Construction Site Notice) shall be given to the City. Both forms shall be posted at the project site in a location where it is readily available for viewing by the general public, local, state, and federal authorities.
2. An Authorized Representative of the CONTRACTOR shall sign the NOI and/or Construction Site Notice, and Attachment 1. The authorized representative must be someone at or near the top of the management chain, such as the president, vice president, or a general partner, who has been delegated the authority to sign and certify this type of document. See 30 TAC, 305.44 of the TCEQ Rules and Regulations for requirements related to Application for Permit.
3. A NOI must be postmarked at least seven (7) days before construction begins. If the NOI form is submitted electronically via the STEERS Program, construction may begin the same day as the NOI is submitted.

1.02 MEASUREMENT

- A. The NOI, SW3P and all erosion control measures called for in the SW3P (e.g., rock berms, silt fence, construction entrances, etc.) shall be measured as a Lump Sum. All incidental erosion, sediment and water pollution control devices and measures required, both temporary and permanent, shall be considered subsidiary to the bid item "Stormwater Pollution Prevention Plan" and no direct measurement will be made. Preparation and updating of the "Stormwater Pollution Prevention Plan" including all reports and records to be maintained shall not be measured but shall be considered subsidiary to the bid item "Stormwater Pollution Prevention Plan."

1.03 PAYMENT

- A. All erosion, sediment and water pollution control devices and measures required, both temporary and permanent, shall be bid as a lump sum price for the bid item "Stormwater Pollution Prevention Plan." Preparation and updating of the "Stormwater Pollution Prevention Plan" including all reports and records to be maintained shall be included in the lump sum price for the bid item "Stormwater Pollution Prevention Plan." The lump sum bid price for the "Stormwater Pollution Prevention Plan" will be full compensation for furnishing all labor, materials and equipment necessary to install, maintain, and remove (if required) all items and actions necessary to maintain and complete the "Stormwater Pollution Prevention Plan" requirements for this project.
- B. Costs for the CONTRACTOR'S Application Fee for the NOI and the annual Water Quality Fee shall be included in the lump sum bid for the "Stormwater Pollution Prevention Plan."
- C. Costs for personnel to inspect the protective measures that are a part of the "Stormwater Pollution Prevention Plan" shall be included in the lump sum bid for the "Stormwater Pollution Prevention Plan."
- D. Pollution control measures may be applicable to CONTRACTOR operations outside the right of way and easement area where such work is necessary as a result of roadway related construction such as construction and haul roads, field offices, equipment and supply areas, and material sources. Pollution control measures outside the right of way will not be measured for payment but shall be performed at the CONTRACTOR'S expense.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 CONSTRUCTION/IMPLEMENTATION PHASE

- A. Once the NOI has been mailed, the CONTRACTOR may start construction of the project as early as seven (7) days after the NOI is postmarked, or immediately if the NOI is submitted electronically through STEERS. The CONTRACTOR must: (a) implement the controls, (b) inspect and maintain the controls, (c) maintain records of construction activities, (d) update/change the plan to keep it current, and (e) have plans accessible as outlined in the SWP3.

1. Implement Controls

- a. The first action that should be taken is to construct or perform the controls that were selected for the SWP3. The controls must be installed and/or constructed in the order indicated in the sequence of major activities. Stabilization measures must be applied within the time frame specified in the permit.
- b. To ensure that controls are adequately implemented, it is important that the work crews who install the measures are experienced and/or adequately trained. Improperly installed controls can have little or no effect and may actually increase the pollution of stormwater. It is also important that all other workers on the construction site be made aware of the controls so that they do not inadvertently disturb or remove them.

2. Inspect and Maintain Controls

- a. Inspection and maintenance of the protective measures that are part of this plan are as important to pollution prevention as proper planning, design/selection, and installation. The CONTRACTOR shall provide for the systematic inspection of the SWP3 Controls.
 - b. Inspection - Inspection shall be at least every fourteen (14) days and within 24-hours after the end of a storm of 0.5 in. or more, or every seven (7) days. All disturbed areas of the site, areas for material storage, locations where vehicles enter or exit the site, and all of the erosion and sediment controls that were identified as part of the plan must be inspected. Controls must be in good operating condition until the area they protect has been completely stabilized and the construction activity is complete. The inspector for the CONTRACTOR shall sign all inspection reports.
 - c. Maintenance/repairs - The inspector must record any damages or deficiencies in the control measures on an inspection report form provided for this purpose. These reports document the maintenance and repair and to prove that inspection and maintenance were performed. The CONTRACTOR shall correct damages or deficiencies as soon as practicable after the inspection but in no case later than seven (7) days after the inspection. Any changes that may be required to correct deficiencies in the SWP3 shall also be completed and dated in the document as soon as practicable after the inspection but in no case later than seven (7) days after the inspection.
3. Maintain Records of Construction Activities
- a. In addition to the inspection and maintenance reports, the inspector shall keep records of the construction activity on the site. In particular, the inspector shall keep a record of the following information:
 - 1) The dates when major grading activities occur in a particular area.
 - 2) The dates when construction activities cease in an area, temporarily or permanently.
 - 3) The dates when an area is stabilized, temporarily or permanently.
 - b. These records can be used to make sure that areas where there is no construction activity will be stabilized within the required time frame.
4. Update/Change the Plan
- a. For a construction activity to be in full compliance with its TPDES Construction General Permit, and for the SWP3 to be effective, the plan must accurately reflect site features and operations. When it does not, the plan must be changed. The plan must also be changed if the operators observe that it is not effective in minimizing pollutant discharge from the site.
5. Provide for Plan Location and Access
- a. The General Permit has specific requirements regarding plan location and access.

- b. Plan location: A copy of the SWP3 must be kept at the construction site from the time construction begins until the site is finally stabilized.
- c. Access: Although plans and associated records are not necessarily required to be submitted to the State, these documents must be made available upon request to the State or local agency who is approving erosion and sediment control plans, or stormwater pollution prevention plans. If site stormwater runoff is discharged to a municipal separate storm sewer system, the plans must be made available upon request to the municipal operator of the system.

3.02 FINAL STABILIZATION/TERMINATION PHASE

- A. Operators of a construction site must continue to comply with permit conditions until:
 - 1. They no longer meet the definition of an Operator of a construction site; or
 - 2. The construction activity is complete, all disturbed soils have been finally stabilized, and temporary erosion and sediment controls have been or will be removed.
- B. A permittee should submit a Notice of Termination (NOT) to inform TCEQ that he/she is no longer an Operator of the construction activity.
- C. Final Stabilization
 - 1. Final stabilization is defined by the General Permit as meaning that all soil disturbing activities at the site have been completed, and that a uniform perennial vegetative cover with a density of 70 percent of the native background vegetated cover (i.e., original conditions) for unpaved areas not covered by permanent structures has been established or equivalent permanent stabilization measures (such as the use of riprap, gabions, or geotextiles) have been employed.
- D. Notice of Termination
 - 1. A notice shall be completed and submitted to TCEQ and the OWNER when the site has been finally stabilized or when an Operator of a construction activity changes. Information to be included on the notice includes the location of the construction site; the name, address, and telephone number of the Operator terminating coverage; the TPDES General Permit number; an indication of why coverage under the permit should be terminated for the Operator; and a signed certification statement.
 - 2. Note that when there is a change in operators of a construction activity, the new Operator must submit a NOI to be covered by the permit at least seven (7) days before the change in Operator.
- E. Record Retention
 - 1. Following the termination of construction activities, the permittees must keep a copy of the SWP3, all reports and actions required by the General Permit, and all the data used to complete the NOI for a period of at least three years following final stabilization. Prior to submitting the NOT, the CONTRACTOR shall furnish the OWNER copies of all NOIs, certificates, and inspection forms for record retention purposes.

ATTACHMENT 1
Stormwater Pollution Prevention Plan
Roles and Responsibilities

STORMWATER POLLUTION PREVENTION PLAN

ROLES AND RESPONSIBILITIES

This is a shared Stormwater Pollution Prevention Plan (SWP3) between the below Primary Operators. The role of each Operator is listed below.

PRIMARY OPERATOR (CITY OF SEGUIN):

SIGNATURE: _____
PRINTED NAME: _____
ADDRESS:

RESPONSIBILITIES:

- Operational control over plans and specifications, including the ability to make modifications to those plans.
- Day-to-day operational control of activities necessary to ensure compliance with the SWP3 for the site.

PRIMARY OPERATOR (CONTRACTOR):

SIGNATURE: _____
PRINTED NAME: _____
ADDRESS:

RESPONSIBILITIES:

- Operational control over plans and specifications, including the ability to make modifications to those plans.
- Day-to-day operational control of activities necessary to ensure compliance with the SWP3 for the site.

END OF SECTION

SECTION 01600
MATERIALS AND EQUIPMENT

PART 1 - GENERAL

1.01 DESCRIPTION

- A. All materials, appliances and types of construction shall be in accordance with the Specifications and shall, further, conform to the requirements of applicable laws, ordinances, and codes.
- B. All materials and equipment shall be new, unused, and designed as specified. They shall be of standard first-grade quality, produced by expert workmen, and be intended for the use for which they are offered. Materials or equipment which are inferior or of a lower grade than indicated, specified, or required will not be accepted.
- C. The quality of workmanship and materials entering into the Work under each Section shall conform to the requirements of pertinent sections, clauses, paragraphs, and sentences, both directly and indirectly applicable thereto, of the Specifications.
- D. Equipment and appurtenances shall be designed in conformity with AWWA, NSF, ASME, AIEE, and NEMA standards and shall be of rugged construction and of sufficient strength to withstand all stresses, which may occur during fabrication, test, transportation, installation, and all conditions of operation. Protect bearings and moving parts against wear by bushings or other approved means and fully lubricate readily accessible devices. Design details for appearance as well as utility. Protruding members, joints, corners, gear covers, and the like shall be finished in appearance. Grind exposed welds smooth. Miter corners of structural shapes.

1.02 MANUFACTURER

- A. Submit names of proposed manufacturers, material men and dealers who are to furnish materials, fixtures, equipment, appliances, or other appurtenances for review as early as possible to afford proper investigation and checking. No manufacturer will be approved for materials or equipment to be furnished under this Contract unless he shall be of good reputation and have a plant of ample capacity suited to the efficient production of the materials or equipment offered. He shall, upon request, be required to submit evidence that he has manufactured a similar product to the one specified and that it has been previously used for a like purpose for a sufficient length of time to demonstrate that it will fulfill all requirements of the Project.
- B. The availability of the manufacturer's service facilities for the maintenance of equipment offered will be considered in the evaluation.
- C. All transactions with the manufacturers or subcontractors shall be through the CONTRACTOR.
- D. Any two (2) or more pieces of material or equipment of the same kind, type or classification being used for identical types of service, shall be made by the same manufacturer.

1.03 SAMPLES

- A. When required, the CONTRACTOR shall submit for approval typical samples of materials and appliances. Identify samples by tags and submit sufficiently in advance of the time when they

are to be incorporated into the work so rejections will not cause delay. A letter of transmittal, in triplicate, from the CONTRACTOR requesting approval shall accompany all such samples.

1.04 EQUIVALENT QUALITY

- A. As required in other sections for these specifications, certain equipment items and materials must be "pre-approved" prior to bid for use on this project.
- B. For those items not requiring pre-bid approval, whenever in the Contract Documents an article, material, apparatus, equipment, or process is called for by trade name of a patentee, manufacturer or dealer, or by reference to catalogue of a manufacturer or dealer, it shall be understood as intending to mean and specify the article, material, apparatus, equipment or process designated, or any approved equal in quality, finish, design, efficiency, and durability and equally serviceable for the purpose for which it is intended. Upon rejection of material or equipment submitted as the equivalent of that specifically named in the Contract, the CONTRACTOR shall proceed immediately to furnish the designated material or equipment.

1.05 DELIVERY, STORING, CARE AND PROTECTION

- A. 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. The CONTRACTOR shall also coordinate deliveries in order to avoid delay in or impediment of the progress of the work of any related contractor. Shipment by weights shall show the weights. Under no circumstances shall equipment be delivered to the site more than one month prior to anticipated installation without written authorization from the ENGINEER.
- B. The CONTRACTOR shall be solely responsible for properly storing and providing protection of all materials, equipment and the entire work furnished under this Contract from the time such materials and equipment are delivered at the site of the work until final acceptance of the entire work. He shall at all times take necessary precautions to prevent injury or damage by water or by inclemency of weather to such materials, equipment, and work. All injury or damage to materials, equipment or work shall be corrected by the CONTRACTOR.
- C. Factory assembled parts and components shall not be disassembled for shipment unless permission is received in writing from the ENGINEER. Finished surfaces of all exposed parts shall be properly protected against adverse conditions that may prevail from time of shipment until ready for operation.
- D. All finished surfaces of all exposed flanges shall be protected by wooden blank flanges, stoutly built, and securely bolted.
- E. Finished iron and steel surfaces not painted shall be protected against rust and corrosion.
- F. After hydrostatic or other tests, all entrapped water shall be drained, and care taken to prevent the entrance of water during shipment, storage, and handling.
- G. Each box or package shall be legibly marked to show its net weight and contents.
- H. At the time of shipment, the shipping list, original bill of lading, shipping memorandum and invoice shall be mailed in triplicate to the ENGINEER. Each shipping list shall give the description and net weight of each item, and gross weight of the shipment. Shipment will not be accepted until the list has been received.

- I. Demurrage, or other charges resulting from failure to furnish these items, shall be absorbed by the CONTRACTOR.
- J. The CONTRACTOR shall make suitable provision for the handling and delivery of all equipment and material at the site.
- K. Stack materials in an approved manner for convenience in counting. Do not place materials directly on the ground.
- L. Box, crate or otherwise completely enclose and protect equipment during shipment, handling, and storage. Protect equipment from exposure to the elements and keep thoroughly dry at all times.
- M. Protect painted surfaces against impact, abrasion, discoloration, and other damage. Repaint painted surfaces which are damaged prior to acceptance of equipment in accordance with SECTION 09915 – PROTECTIVE COATINGS.
- N. Protect electrical equipment, controls and insulation against moisture or water damage. Connect space heaters provided in the equipment storage areas and operate at all times until equipment is placed in service. Store pumps, motors, electrical equipment, and other equipment having antirification or sleeve bearings in weathertight buildings that are maintained at a minimum temperature of 60°F.

1.06 SPARE PARTS

- A. Spare parts shall be packed in wooden crates with the contents clearly marked on the outside of the crate. Crates shall not exceed 24"x24"x24" in dimension. Equipment shall be lubricated for long term storage per manufacturer's recommendation.

1.07 TOOLS

- A. Any special tools (including grease guns or other lubricating devices) which may be necessary for the adjustment, operation, and maintenance of any equipment shall be furnished with the respective equipment.
- B. Only one toolbox shall be provided as part of this project. The CONTRACTOR shall provide one Knack Model 4830 steel toolbox of sufficient capacity for all tools and special tools provided.

1.08 WARRANTY

- A. Unless specified otherwise, all equipment and materials furnished under this contract shall be warranted for a period of two (2) years following testing, start-up, and final acceptance by the ENGINEER and OWNER.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 INSTALLATION OF EQUIPMENT

- A. The CONTRACTOR shall have on hand equipment and machinery of ample capacity to facilitate this work and to handle emergencies normally encountered in work of this character.

- B. Erect equipment on the foundations at the locations and elevations shown on the Drawings, unless otherwise directed during installation.
- C. Furnish, install, and protect necessary anchor and attachment bolts and other appurtenances needed for the installation of the devices included in the equipment specified. Anchor bolts shall be of ample size and strength for the purpose intended. Furnish templates and working drawings for installation.
- D. The CONTRACTOR shall, at his own expense, furnish all materials and labor for, and shall properly bed in cement grout as specified, each piece of equipment of its supporting base resting on masonry or concrete foundations. Grout shall completely fill the space between the equipment base and the foundation.

END OF SECTION

SECTION 01666
TESTING OF PIPELINES

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, tools, equipment, and related items required to perform exfiltration testing and deflection testing of facility piping systems and to perform pressure and leakage testing of pressure pipelines.
- B. All testing shall meet minimum TCEQ requirements. TCEQ requirements shall govern and supersede requirements herein.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 GENERAL

- A. Hydrostatic pressure and leakage tests shall be made on all pressure pipelines carrying water or wastewater.
- B. All labor and equipment, including test pump with regulated by-pass meters and gauges required for conducting pipeline tests, temporary pipe connections or fittings, plugs, etc. shall be furnished by the CONTRACTOR. The CONTRACTOR shall furnish equipment and necessary piping as required to transport water used in testing from source to test location.
- C. Time and sequence of testing shall be scheduled by the CONTRACTOR, subject to observation and approval by the OWNER. The CONTRACTOR shall provide adequate labor, tools, and equipment to operate valves and to locate and repair any leaks discovered during the initial filling of the pipeline prior to actual testing or during the course of the tests.
- D. Testing shall meet all TCEQ requirements.

3.02 CLEANING

- A. At the conclusion of the work, thoroughly clean all pipelines by flushing with water or other means to remove all dirt, stones, pieces of wood, or other material that may have entered the pipes during the construction period. Debris cleaned from the lines shall be removed from the low end of the pipeline. If after this cleaning, obstructions remain, they shall be removed. After the pipelines are cleaned and if the groundwater level is above the pipe or following a heavy rain, the ENGINEER will examine the pipes for leaks. If any defective pipes or joints are discovered, they shall be repaired.

3.03 TEST PROCEDURES FOR GRAVITY PIPELINES

- A. Gravity pipelines shall be installed and backfilled and then tested using either Exfiltration Water Testing or Low-Pressure Air Testing. In addition, flexible pipes shall be tested using an Allowable Deflection Test.
 1. Exfiltration Water Testing

- a. The section of pipe to be tested shall be filled with water and allowed to stand for such time as is required for the pipeline to adsorb such water as it will and for the escape of all air from the line. The sections undergoing test shall be carefully examined for leakage. All known leaks shall be repaired, regardless of these test requirements.
 - b. The line shall then be filled to a reference level in manhole or in a reservoir of sufficient capacity to allow for a reference level to be established. The reservoir must be of sufficient capacity as to not allow the water level to drop below the crown of the pipe during the 24-hour test period. If the water level drops below the crown of the pipe, the test shall be voided and run again or until such time the water level is maintained above the crown throughout the duration of the test.
 - c. At the end of a 24-hour period, water, if needed, shall be added to the line to bring the water level back to the referenced line. All water added shall be accurately measured by an approved water meter so that an exfiltration rate can be established.
 - d. Leakage during the above test shall not exceed a rate equal to 25 gallons per inch of internal diameter per mile per twenty-four hours.
 - e. All observed leaks shall be repaired regardless of the measured leakage rate.
2. Low Pressure Air Testing
 - a. This test shall conform to the procedure described in ASTM C828, ASTM C924 or other appropriate procedures. For safety reasons, air testing of sections of pipe shall be limited to lines less than 36 in. average inside diameter. Lines 36 in. average inside diameter and larger may be air tested at each joint. The minimum time allowable for the pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch gauge during a joint test, regardless of pipe size, shall be 20 seconds. For sections of pipe less than 36 in. average inside diameter, the maximum time allowable for the pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch gauge shall be computed by the following equation:
$$T = 0.085(D)(K)/(Q)$$
where T = time for pressure to drop 1.0 pounds per square inch gauge in seconds
$$K = 0.00049DL$$
, but not less than 1.0
$$D = \text{average inside diameter in inches}$$
$$L = \text{length of line of same pipe size being tested in feet}$$
$$Q = \text{rate of loss, assume } 0.0015 \text{ ft}^3/\text{min}/\text{sq. ft. internal surface}$$
 - b. All observed leaks shall be repaired regardless of the air test results.

3. Allowable Deflection Test

- a. Pipe deflection testing shall be conducted on all gravity pipes constructed of flexible materials (PVC or other plastic materials).
- b. Pipe deflection measured not less than ninety (90) days after the backfill has been completed as specified shall not exceed five (5.0) percent. Deflection shall be computed by multiplying the amount of deflection (nominal diameter less minimum diameter when measured) by 100 and dividing by the nominal diameter of the pipe.
- c. Deflection shall be measured with a rigid mandrel device cylindrical in shape and constructed with a minimum of nine evenly spaced legs. The outer diameter of the legs shall be 95 percent of the pipe's actual internal diameter. Drawings of the mandrel with complete dimensions shall be submitted to the ENGINEER for each diameter of pipe to be tested. The mandrel shall be hand pulled by the CONTRACTOR through all sewer lines.
- d. Any section of sewer not passing the mandrel shall be uncovered at the CONTRACTOR'S expense and the bedding and backfill replaced to prevent excessive deflection. Repaired pipe shall be retested.

3.04 MANHOLE TESTING

- A. The contractor shall perform the testing for all sanitary sewer manholes in accordance with the following:
 1. All manholes must pass a leakage test.
 2. The contractor shall test each manhole for leakage, separate and independent of all other sanitary sewer piping, by means of vacuum test, as follows:
 - a. The lines entering the manhole shall be temporarily plugged with the plugs braced to prevent them from being drawn into the manhole.
 - b. The plugs shall be installed in the lines beyond drop connections, gas sealing connections, etc.
 - c. Prior to performing the test, the Contractor shall plug all lift holes and exterior joints with a non-shrink grout and plug all pipes entering the manhole.
 - d. Contractor shall use a minimum 60 inch-lb. torque wrench to tighten the external clamps that secure the test cover to the top of the manhole.
 - e. The test head shall be inflated in accordance with the manufacturer's recommendations.
 - f. A vacuum of 10 inches of mercury shall be drawn, and the vacuum pump will be turned off.
 - g. With the valve closed, the level vacuum shall be read after the required test time.
 - h. If the drop in the level is less than 1 inch of mercury (final vacuum greater than 9 inches of mercury), the manhole will have passed the vacuum test.

- i. The required test time is 2 minutes.
3. Acceptance: Any manhole which fails the initial test must be repaired with a non-shrink grout or other suitable material based on the material of which the manhole is constructed.
4. The manhole shall be retested as described above until a successful test is attained.
5. After a successful test, the temporary plugs will be removed.

3.05 TEST PROCEDURES FOR PRESSURE PIPELINES

A. General

1. After the pipe has been laid and backfilled and the backfill has been otherwise consolidated, all newly laid pipe, or any valved section thereof, shall be subjected to the hydrostatic pressure and leakage tests specified below for that particular type of pipe. The duration of each hydrostatic pressure test shall be at least one hour and each leakage test at least four hours, unless otherwise specified or noted on the Drawings. All meters, fixtures, devices or appliances which are connected to the pipeline system, and which might be damaged if subjected to the specified test pressure shall be disconnected and the ends of the branch lines plugged or capped during the testing procedures.
2. Each valved (capped or plugged) section of pipe shall be filled slowly with water and all air shall be expelled. If permanent air vents are not located at all high points, the CONTRACTOR shall install corporation or blow-off cocks at such points so that air can be expelled as filling takes place. After verification that all air has been expelled, the cocks shall be closed, and the pipe kept filled until tested. All exposed pipe, fittings, valves, hydrants, and joints shall be examined while under test pressure and all visible leaks shall be stopped. Any cracked or defective pipe, fittings, valves, or hydrants discovered during testing shall be removed and replaced by the CONTRACTOR. Replacement shall be with sound material and the test shall be repeated until satisfactory to the OWNER.

B. Special Requirements. Where any section of pipeline is provided with concrete thrust blocking, the hydrostatic pressure test shall not be made until at least five (5) days have elapsed after installation of the blocking. However, if high-early-strength cement is used in the concrete, two (2) days shall have elapsed prior to testing.

C. Hydrostatic Pressure Tests

1. After compliance with all applicable procedures described above, pressure of 150 percent of the pipe's normal operating pressure shall be applied, unless another test pressure is specified for the type of pipe being tested or as shown in the Table below. This pressure, based on the lowest point of the line or section under test, shall be corrected to the relative elevation of the test gauge and the pressure maintained for a period of not less than one (1) hour. CONTRACTOR shall coordinate all test pressures with ENGINEER.
2. Pipe Test Pressure Summary Schedule

Pipe ID	Test Pressure, psi
All Flanged Ductile Iron Piping	150
All restrained mechanical joint ductile iron piping	150
All bell and spigot, gravity, ductile iron piping	25
All PVC solid wall piping	100
Process Air Piping	15
HDPE Force main	130

D. Leakage Tests

1. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain the specified leakage test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.
2. Leakage shall be determined by recording the quantity of water pumped into the pipeline through a standard water meter of a size appropriate to secure an accuracy of ± 2 percent at the average rate of flow pumped. Leakage rate shall be calculated by extrapolation of the total leakage during the testing period to a 24-hour period. Leakage test pressure shall be coordinated with ENGINEER and test pressure shall be maintained for a period of four (4) hours.
3. Allowable leakage for the types of pipe used shall be as follows:
 - a. Cast Iron and Ductile Iron. Allowable as permitted by AWWA Standard C-600-82, "Installation of Gray and Ductile Cast-Iron Water Mains and Appurtenances", which is not to exceed that determined by the formula:

$$L = (SD\sqrt{P})/133,200$$
 - 1) Where L is the allowable leakage in gallons per hour, S is the length of pipeline tested in feet, D is the nominal diameter of the pipe in inches, and P is the average test pressure during the leakage tests in pounds per square inch gauge.
 - b. PVC and HDPE – No leakage allowed.
 - c. Stainless steel Air Piping – No leakage allowed.
4. In the event any section of the line tested fails to meet the above specified requirements for water tightness, the cause of the excessive leakage shall be determined and remedied at the expense of the CONTRACTOR, including retesting if required.

3.06 SUBMITTALS TO ENGINEER

- A. Provide test report for each pipe segment tested. Each test report shall be submitted to the ENGINEER for approval and shall include the following minimum information: date of test, location of test, manholes related to test, pipe section ID number, manhole number, pipe diameter, pipe material, pipe length, and whether the test passed or failed. Additionally, any explanatory comments related to the testing shall be noted. A representative from the OWNER shall be onsite to witness testing procedures and provide a signature of acceptance for each test report.

3.07 FINAL ACCEPTANCE

- A. No pipe installation will be accepted until all known leaks have been repaired whether or not leakage is within allowable limits. Locating and repairing of leaks shall be performed by the CONTRACTOR at no additional cost to the OWNER.
- B. The OWNER will certify that all required pressure and leakage tests have been successfully completed before the pipeline is accepted.

3.08 WATER SOURCE

- A. Water shall be available on this project as specified in other sections. The CONTRACTOR shall install temporary connections to the supply pipe, including supply/installation of RPZ backflow preventer and meter. Any additional water, if necessary, shall be provided at CONTRACTOR'S expense.

END OF SECTION

SECTION 01740
WARRANTIES AND BONDS

PART 1 - GENERAL

1.01 CONTRACTOR REQUIREMENTS INCLUDED, BUT NOT LIMITED TO:

- A. Compile specified warranties and bonds.
- B. Co-execute submittals when so specified.
- C. Review submittals to verify compliance with Contract Documents.
- D. Submit to the ENGINEER for review and transmittal to OWNER.

1.02 RELATED REQUIREMENTS

- A. SECTION 00 21 00 - INSTRUCTIONS TO BIDDERS
- B. Conditions of the Contract: SECTION 00 61 13.13 – PERFORMANCE BOND and SECTION 00 61 13.16 – PAYMENT BOND.
- C. SECTION 00 52 00 – STANDARD FORM OF AGREEMENT: Contract Agreement.
- D. SECTION 01770 - CLOSEOUT PROCEDURES.

1.03 SUBMITTAL REQUIREMENTS

- A. Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers, and subcontractors.
- B. One (1) electronic copy in Portable Document Format (PDF) of all submittals and re-submittals shall be submitted suitable for distribution over electronic mail or File Transfer Protocol (FTP). For final approved submittals provide PDF and two (2) hard copies.
- C. Table of Contents: Neatly typed, in orderly sequence. Provide complete information for each item.
 1. Product or work item.
 2. Firm, with name of principal, address, and telephone number.
 3. Scope.
 4. Date of beginning of warranty, bond or service and maintenance contract.
 5. Duration of warranty, bond, or service 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, name of responsible principal, address, and telephone number.

1.04 FORMS OF SUBMITTALS

- A. Prepare in duplicate packets.
- B. Format:
 - 1. Size 8-1/2 in. x 11 in., punch sheets for standard 3-post binder.
 - a. Fold larger sheets to fit into binders.
 - 2. Cover: Identify each packet with typed or printed title "WARRANTIES AND BONDS".
List:
 - a. Title of Project.
 - b. Name of CONTRACTOR.
- C. Binders: Commercial quality, three-post binder, with durable and cleanable plastic covers and maximum post width of two (2) inches.

1.05 WARRANTY SUBMITTAL REQUIREMENTS

- A. For all major pieces of equipment, submit a warranty from the equipment manufacturer. The manufacturer's warranty period shall be concurrent with the CONTRACTOR'S for two (2) years, unless otherwise specified, commencing at the time of final acceptance of entire project by the OWNER.
- B. The CONTRACTOR shall be responsible for obtaining certificates for equipment warranty for all major equipment specified under DIVISION 11 - EQUIPMENT, DIVISION 13 - SPECIAL CONSTRUCTION, DIVISION 14 - CONVEYING SYSTEMS, DIVISION 15 - MECHANICAL and DIVISION 16 - ELECTRICAL and which has a 1 HP or larger motor or which lists for more than \$1,000. The ENGINEER reserves the right to request warranties for equipment not classified as major. The CONTRACTOR shall still warrant equipment not considered to be "major" in the CONTRACTOR'S two (2) years warranty period even though certificates of warranty may not be required.
- C. For certain pieces of equipment, the OWNER may require a warranty of longer duration. The requirement for a warranty of longer duration shall be specified in individual sections of the Specifications.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01770
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Drawings and general provisions of the Contract, including General Conditions and other DIVISION 1 - GENERAL REQUIREMENTS sections, apply to this Section.
- B. Provide operation and maintain information as described in Table 1 - Submittal and O&M Summary at the end of SECTION 01782 – OPERATION AND MAINTENANCE DATA.

1.02 RELATED WORK

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 1. Inspection procedures.
 2. Project Record Documents.
 3. Operation and maintenance manuals.
 4. Warranties.
 5. Instruction of OWNER'S personnel.
 6. Final cleaning.
- B. Related Sections include the following:
 1. SECTION 01782 - OPERATION AND MAINTENANCE DATA for operation and maintenance manual requirements.
 2. SECTION 01740 – WARRANTIES AND BONDS for warranty and bond requirements.
 3. DIVISION 2 through DIVISION 16 sections for specific closeout and special cleaning requirements for products of those Sections.

1.03 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
 1. Address issues on the ENGINEER'S punch list that have not been completed and corrected, the value of items on the list, and reasons why the Work is not complete.
 2. Advise OWNER of pending insurance changeover requirements.
 3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.

4. Obtain and submit releases permitting OWNER unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 5. Prepare and submit Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
 6. Deliver tools, spare parts, extra materials, and similar items to location designated by OWNER. Label with manufacturer's name and model number where applicable.
 7. Make final changeover of permanent locks and deliver keys to OWNER. Advise OWNER'S personnel of changeover in security provisions.
 8. Complete startup testing of systems.
 9. Submit test/adjust/balance records.
 10. Terminate and remove temporary facilities from Project site, along with construction tools, and similar elements.
 11. Advise OWNER of changeover in utilities.
 12. Submit changeover information related to OWNER'S occupancy, use, operation, and maintenance.
 13. Complete final cleaning requirements, including touchup painting.
 14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, ENGINEER will either proceed with inspection or notify CONTRACTOR of unfulfilled requirements. ENGINEER will prepare the Certificate of Substantial Completion after inspection or will notify CONTRACTOR of items, either on CONTRACTOR'S list or additional items identified by ENGINEER, that must be completed or corrected before certificate will be issued.
1. Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for Final Completion.

1.04 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
1. Submit a final Application for Payment in accordance with the requirements of the Special Conditions.

2. Submit copy of ENGINEER'S Substantial Completion inspection list of items to be completed or corrected (punch list). The copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Instruct OWNER'S personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, ENGINEER will either proceed with inspection or notify CONTRACTOR of unfulfilled requirements. ENGINEER will prepare a final Certificate for Payment after inspection or will notify CONTRACTOR of construction that must be completed or corrected before certificate will be issued.
1. Request re-inspection when the work identified in previous inspections as incomplete is completed or corrected.

1.05 PROJECT RECORD DOCUMENTS

- A. General: Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for ENGINEER'S reference during normal working hours.
- B. Record Drawings: Maintain and submit one set of blue- or black-line white prints of Contract Drawings and Shop Drawings.
1. Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
 - a. Give particular attention to information on concealed elements that cannot be readily identified and recorded later.
 - b. Accurately record information in an understandable drawing technique.
 - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
 - d. Mark Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked, show cross-reference on Contract Drawings.
 2. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
 3. Mark important additional information that was either shown schematically or omitted from original Drawings.
 4. Note Construction Change Directive numbers, Change Order numbers, alternate numbers, and similar identification where applicable.

5. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.
- C. Electronic Data: Submit to ENGINEER electronic data of all buried/exposed utilities, basin structures, and buildings including elevations of buried pipe fittings, electrical duct banks, and electrical conduit.
- D. Miscellaneous Record Submittals: Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

1.06 OPERATION AND MAINTENANCE MANUALS

- A. Reference SECTION 01782 – OPERATION AND MAINTENANCE DATA.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.01 DEMONSTRATION AND TRAINING

- A. Instruction: Instruct OWNER'S personnel on how to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 1. Provide instructors experienced in operation and maintenance procedures.
 2. Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at the start of each season.
 3. Schedule training with OWNER with at least seven (7) days' advance notice.
 4. Coordinate instructors, including providing notification of dates, times, length of instruction, and course content.
- B. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections. For each training module, develop a learning objective and teaching outline. Include instruction for the following:
 1. System design and operational philosophy.
 2. Review of documentation.
 3. Operations.

4. Adjustments.
5. Troubleshooting.
6. Maintenance.
7. Repair.

3.02 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - g. Sweep concrete floors broom clean in unoccupied spaces.
 - h. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - i. Remove labels that are not permanent.
 - j. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - 1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

- k. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - l. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - m. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - n. Clean ducts, blowers, and coils if units were operated without filters during construction.
 - o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
 - p. Leave Project clean and ready for occupancy.
- B. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on OWNER'S property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION

SECTION 01782
OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Drawings and general provisions of the Contract, including General and Special Conditions and other DIVISION 1 - GENERAL REQUIREMENTS sections, apply to this Section.
- B. Submit O&M Manuals for equipment and processes as described in Table 1 - Submittal and O&M Summary at end of this Section.

1.02 RELATED WORK

- A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 1. Operation and maintenance documentation directory.
 2. Emergency manuals.
 3. Operation manuals for systems, subsystems, and equipment.
 4. Maintenance manuals for the care and maintenance of systems and equipment.
- B. Related Sections include the following:
 1. SECTION 01770 - CLOSEOUT PROCEDURES for submitting operation and maintenance manuals.
 2. DIVISION 2 through DIVISION 16 sections for specific operation and maintenance manual requirements for products in those Sections.
- C. O&M Requirements
 1. O&M data, submittals and related documentation shall be included for the specific materials as described in Table 1 at the end of this Section.
 2. Number of Copies:
 - a. One (1) electronic copy in Portable Document Format (PDF) of all submittals and re-submittals shall be submitted suitable for distribution over electronic mail or File Transfer Protocol (FTP). Other file formats may be used upon approval of Owner and Engineer.
 - b. Final approved submittals, provide PDF and two (2) hard copies.

1.03 COORDINATION

- A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

1.04 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

PART 2 - PRODUCTS

2.01 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Organization: Include a section in the directory for each of the following:
 1. List of documents.
 2. List of systems.
 3. List of equipment.
 4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with the same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.02 MANUALS, GENERAL

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 1. Title page.
 2. Table of contents.
 3. Manual contents.

- B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
1. Subject matter included in manual.
 2. Name and address of Project.
 3. Name and address of OWNER.
 4. Date of submittal.
 5. Name, address, and telephone number of CONTRACTOR.
 6. Name and address of ENGINEER.
 7. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2 in. by 11 in. paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
 - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
 3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software CD's for computerized electronic equipment.
 4. Supplementary Text: Prepared on 8-1/2 in. by 11 in., 20 lb./sq. ft. white bond paper.
 5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

- a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold, and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.
- 2.03 EMERGENCY MANUALS (NOT USED)
- 2.04 OPERATION MANUALS
- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
- 1. System, subsystem, and equipment descriptions.
 - 2. Performance and design criteria.
 - 3. Operating standards.
 - 4. Operating procedures.
 - 5. Operating logs.
 - 6. Wiring diagrams.
 - 7. Control diagrams.
 - 8. Piped system diagrams.
 - 9. Precautions against improper use.
 - 10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
- 1. Product name and model number.
 - 2. Manufacturer's name.
 - 3. Equipment identification with serial number of each component.
 - 4. Equipment function.
 - 5. Operating characteristics.
 - 6. Limiting conditions.
 - 7. Performance curves.
 - 8. Engineering data and tests.

9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
 2. Equipment or system break-in procedures.
 3. Routine and normal operating instructions.
 4. Regulation and control procedures.
 5. Instructions on stopping.
 6. Normal shutdown instructions.
 7. Seasonal and weekend operating instructions.
 8. Required sequences for electric or electronic systems.
 9. Special operating instructions and procedures.
- D. Source Information: List each product included in manual, identified by product name, and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- E. Product Information: Include the following, as applicable:
1. Product name and model number.
 2. Manufacturer's name.
 3. Color, pattern, and texture.
 4. Material and chemical composition.
 5. Reordering information for specially manufactured products.
- F. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
 2. Types of cleaning agents to be used and methods of cleaning.
 3. List of cleaning agents and methods of cleaning detrimental to product.
 4. Schedule for routine cleaning and maintenance.
 5. Repair instructions.
- G. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.
- I. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- J. Piped Systems: Diagram piping as installed and identify color-coding where required for identification.

PART 3 - EXECUTION

3.01 MANUAL PREPARATION

- A. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
 - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by OWNER'S operating personnel.
- B. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
 - 1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- C. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.
 - 1. Do not use original Project Record Documents as part of operation and maintenance manuals.
- D. Comply with SECTION 01770 - CLOSEOUT PROCEDURES for the schedule for submitting operation and maintenance documentation.

Table 1 - Submittal and O&M Summary
(Additional requirements may be described in individual specification sections)

Item Description	Submittal Required	O&M Manual Required	Working Drawing Required	O&M Instruction Required
Structural Concrete	X			
Reinforcing Steel	X			
Misc. & Structural Steel	X		X	
Pumps	X	X	X	X
Mixers	X	X	X	X
Chemical Feed Equipment	X	X	X	X
Thickener Equipment	X	X	X	X
Belt Filter Press	X	X	X	X
Screening Equipment	X	X	X	X
Conveyor Equipment	X	X	X	X
Grit Removal Equipment	X	X	X	X
Parshall Flume	X	X	X	
Aeration Equipment	X	X	X	X
Sludge Collection Equipment	X	X	X	X
Tertiary Filter Equipment	X	X	X	X
Blowers	X	X	X	X
Air Compressors	X	X	X	X
Pipe Systems	X			
Motors	X	X	X	X
Valves	X	X		X
Process Control Gates	X	X		X
NPW System	X	X	X	X
Motor Controls, Instrumentation and SCADA	X	X	X	X
Electrical Equipment	X	X	X	X
Chain Link Fencing	X	X		
Building Fixtures, Etc.	X	X		
Metal Roof Components	X	X		
Protective Coating Systems	X	X		
Ventilation/Heating System	X	X		X
Platforms and Stairways	X			
Miscellaneous Equipment	X	X	X	X
Flow Meters	X	X		X
Gas Scrubber Systems	X	X	X	X
Basin Covers	X	X	X	
Hoists and Cranes	X	X		X
Building Components	X		X	
Security Systems	X	X	X	X

END OF SECTION

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SECTION 02211
ROUGH GRADING FOR ROADWAYS AND PAVING

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. This section includes preparation of subsoil for paving operations.
- B. Requirements of the Geotechnical reports, project drawings and other specifications shall govern over the requirements in this specification.

1.02 RELATED WORK

- A. SECTION 02511 – HOT MIX ASPHALTIC PAVING

1.03 REFERENCES

- A. AASHTO T180 - Moisture-Density Relations of Soils Using a 10 lb. (4.54 kg) Rammer and an 18 in. (457 mm) Drop.
- B. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb. (2.49 Kg) Rammer and 12 in. (304.8 mm) Drop.
- C. ANSI/ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.
- D. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. (4.54 Kg) Rammer and 18 in. (457 mm) Drop.
- E. ASTM D2167 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
- F. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- G. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

1.04 JOB CONDITIONS

A. Dust Control

1. Use all means necessary to control dust on the Work area or if resulting from the condition in which the CONTRACTOR leaves the site.
2. Thoroughly moisten all surfaces as required to prevent dust being a nuisance.

1.05 PROTECTION

- A. Protect all reference points, bench marks and monuments from damage or dislocation. Replace or repair immediately all points damaged, destroyed, or dislocated.
- B. Sprinkle and dampen all dusty material from the beginning of work to its completion.

- C. Provide, erect, and maintain all lights, barricades, warning signs, temporary chain link fences, and guards as necessary for the protection of roads, parking lots, sidewalks, and all adjoining structures.
- D. To prevent caving of earth banks and side walls of trenches, shoring and sheet piling, trench box, or other OSHA approved methods may be used for safety. Trench walls may be laid back at 2:1 slopes for temporary use, 3:1 slopes for uses requiring the trench to remain open for longer than two (2) days.
- E. Cover holes and trenches when work is not in progress. Fence or barricade any changes of grade.
- F. Remove shoring, sheet piling and protection as work progresses. Temporary wood shall not be left in concrete or fill.
- G. Keep trenches and excavated areas free from water by pumping or draining. Grade to drain surface water away from excavations, distributing discharge to prevent excessive erosion.
- H. Protect adjacent surface areas outside the construction limits from damage. If damaged as a result of construction operations or storage of materials, clear off debris and restore to original grades and condition, or better, subject to approval by the OWNER'S Representative.
- I. Protect finished subgrade from erosion, as directed by the OWNER'S Representative, by the use of organic erosion netting or fabric and/or the use of silt fence barricades. All areas of erosion to be repaired, compacted, subject to approval by OWNER'S Representative.

1.06 CLASSIFICATION OF EXCAVATION

- A. No consideration will be given to the nature of the materials, and all excavation will be designated as unclassified excavation.

1.07 DEFINITIONS

- A. Satisfactory Materials: Materials classified in Unified Soil Classification System as GW, GP, GC, GM, SW, SP, SM, SC, CL, and CH, as determined by the OWNER'S testing laboratory.
- B. Unsatisfactory Materials: Materials classified in Unified Soil Classification System as PT, OH, OL, ML and MH, as determined by the OWNER'S testing laboratory.
- C. Cohesionless and Cohesive Materials: cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Cohesionless materials include materials classified in Unified Soil Classification System as GW, GP, SW, and SP. Materials classified as GM and SM will be identified as cohesionless only when the fines have a plasticity index of zero. Testing required for classifying materials shall be in accordance with ASTM C136, D422 and D1140.
- D. Degree of Compaction: Degree of compaction is a percentage of the maximum density obtained by the test procedure presented in ASTM D698.
- E. Topsoil: Topsoil shall be defined as natural, friable surface soil possessing the characteristics of representative soils in the vicinity that produce heavy growth of crops, grass, or other vegetation.

1.08 BLASTING

- A. Blasting shall not be permitted as part of this project.

1.09 UTILIZATION OF EXCAVATED MATERIALS

- A. All unsatisfactory materials removed from excavations shall be disposed of off the site or on-site as directed and approved by the ENGINEER. Satisfactory material removed from excavations shall be used, insofar as practicable, in the construction of fills, embankments, subgrades, and for similar purposes. No satisfactory excavated material shall be wasted without specific written authorization. Satisfactory material authorized to be wasted shall be disposed of in designated areas approved for surplus material storage or designated waste areas as directed by the OWNER'S Representative. Newly designated waste areas on the site shall be cleared and grubbed before disposal of waste material thereon. Coarse rock from excavations shall be stockpiled and used for constructing slopes or embankments adjacent to streams, or sides and bottoms of channels, and for protecting against erosion. No excavated material shall be disposed of in such a manner as to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

1.10 FIELD TESTING CONTROL

- A. Field density testing shall be performed by an Independent Testing Laboratory. The CONTRACTOR shall submit the proposed laboratory to the ENGINEER for approval. Should the material fail to meet the specified density, material shall be scarified, recompacted and tested until specified densities are obtained. Costs of all testing shall be paid by the CONTRACTOR.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Topsoil: Unclassified top 4 in. to 12 in. from within limits of construction.
- B. Compacted Fill: Unless otherwise described in the contract drawings or specifications, clayey sand or sandy clay material consisting of suitable earth material meeting the following requirements:
 1. Free of organics and debris
 2. Between thirty (30) and seventy (70) percent of total sample retained on No. 200 sieve
 3. Plasticity Index of 5 to 20 on minus No. 40 material
 4. Sixty (60) percent or more of the total sample passes the No. 4 sieve
 5. Gravel/stones no larger than 3 in. in their greatest dimensions

PART 3 - EXECUTION

3.01 GENERAL

- A. Construction surveying, staking and layout shall be performed at the CONTRACTOR'S expense supervised by a surveyor licensed in the State of Texas.
- B. The rough grading shall be performed to the lines and elevations indicated on the drawings in accordance with these specifications. Should the CONTRACTOR, through negligence or other fault, excavate below the designated lines, he shall replace the excavation materials approved by the ENGINEER, in an approved manner and condition, at his own expense. The OWNER'S Representative shall have complete control over the excavation, moving, placing and disposition of all materials and shall determine the suitability of material to be placed in embankments. All material determined unsuitable shall be disposed of off-site or as shown on the contract drawings. Topsoil shall not be used in fills or in subgrades but shall be handled and placed as directed.
- C. The CONTRACTOR shall inform and satisfy himself as to the character, quantity, and distribution of all material to be excavated.

3.02 PREPARATION

- A. Except as otherwise permitted, cut areas and other excavation areas shall be excavated in such manner as will afford adequate drainage. Overburden and other fill material shall be transported to designated spoil areas or otherwise disposed of as directed by the OWNER'S Representative. The CONTRACTOR shall insure that excavation of any area or dumping of soil material results in minimum detrimental effects on natural environmental conditions and/or all manmade features to remain.

3.03 EXCAVATION

- A. Perform excavation of every type of material encountered within the limits of the project to the lines, grades and elevations indicated and as specified herein. Grading shall be in conformity with the drawings and the tolerances specified in paragraph 3.08 - Finishing. Satisfactory excavated materials shall be transported to and placed in fill or embankment within the limits of the work. Unsatisfactory materials encountered shall be replaced with satisfactory materials as directed. Surplus satisfactory excavated material not required for fill or embankment shall be disposed of off-site or as shown on the contract drawings at CONTRACTOR provided areas approved for surplus material storage or designated spoil areas. Unsatisfactory excavated material shall be disposed of off-site in CONTRACTOR provided designated spoil areas approved by the OWNER'S Representative. During construction, excavation and fill shall be performed in a manner and sequence that will provide proper drainage at all times. Material required for fill or embankment in excess of that produced by excavation within the grading limits shall be obtained from CONTRACTOR provided borrow areas.
- B. Ditches, Gutters, and Channel Changes: Excavation of ditches, gutters and channel changes shall be accomplished by cutting accurately to the cross sections, grades and elevations shown. Care shall be taken not to excavate ditches and gutters below grades shown. Excessive open ditch or gutter excavation shall be backfilled with satisfactory thoroughly compacted material or with suitable stone or cobble to grades shown at no additional cost to the OWNER. Material excavated shall be disposed of as shown or directed, except that in no case shall material be deposited less than 4 ft. from the edge of a ditch. The CONTRACTOR shall maintain all

excavations free from detrimental quantities of leaves, brush, sticks, trash, and other debris until final acceptance of the work.

- C. Excavate subsoil from areas to be further excavated, re-landscaped, or re-graded, over the entire site.
- D. Do not excavate wet subsoil.
- E. When excavating through roots of trees that are to remain, perform work by hand and cut roots with sharp axe.

3.04 BACKFILL

- A. Unless otherwise described in these specification or shown on the contract drawings, backfill adjacent to any and all types of structures shall be placed in 8 in. thick uncompacted lifts and compacted to at least 95 percent of maximum density in accordance with ASTM D698 in such a manner as to prevent wedging action or eccentric loading upon or against any structure. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment well suited to the materials being compacted.

3.05 PREPARATION OF GROUND SURFACE FOR FILLS OR EMBANKMENTS

- A. Clearing and Grubbing: Ground surface on which fill is to be placed shall be stripped of live, dead, or decayed vegetation, rubbish, debris, and other unsatisfactory material; plowed, disked, or otherwise broken up; pulverized; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 95 percent of maximum density in accordance with ASTM D698.
- B. Proof Rolling: Compacted fill area subgrade shall be proof rolled to detect any areas of weakness. Areas of weakness shall be undercut to firm soils and recompacted to at least 90 percent of maximum density in accordance with ASTM D698. The proof rolling equipment shall consist of not less than four pneumatic tired wheels, running on axles carrying not more than two wheels, and mounted in a rigid frame and provided with loading platform or body suitable for ballast loading. All wheels shall be arranged so that they will carry approximately equal loads when operating on uneven surfaces. The proof roller under working conditions shall have a rolling width of from 8 ft. to 10 ft., and shall be so designed that, by ballast loading, the gross load may be varied uniformly from 25 tons to 50 tons. The tires shall be capable of operating under the various loads with variable air pressure up to 150 lbs. per square inch. Tires shall be practically full of liquid. (Tires shall be considered as being practically full of liquid, when liquid will flow from the valve stem of a fully inflated tire with the stem in the upper-most position). The proof roller shall be drawn by a suitable crawler type tractor or rubber tired tractor of adequate tractive effort, or may be of self-propelled type, and the roller unit when drawn or propelled by either type of equipment shall be considered a heavy pneumatic tire proof roller unit. There shall be a sufficient quantity of ballast available to load the equipment to a maximum gross weight of 50 tons. In lieu of the rolling equipment specified, the CONTRACTOR may, upon written permission from the OWNER'S Representative, operate other compacting equipment that will produce equivalent results in the same period of time as the specified equipment. If the substituted compaction equipment fails to produce the desired results within the same period of time as would be expected of the specified equipment, and determined by the OWNER'S Representative, its use shall be discontinued.

- C. Preparation: The prepared ground surface shall be scarified and moistened or aerated as required just prior to placement of fill or embankment materials to assure adequate bond between fill or embankment material and the prepared ground surface.

3.06 FILLS OR EMBANKMENTS

- A. Earth Fills or Embankments: Unless otherwise shown on the contract drawings or required by these specifications, earth fills or embankments shall be constructed from satisfactory materials free of organic or frozen material and rocks with any dimension greater than 8 in. and the material shall be placed in successive horizontal layers of loose material not more than 8 in. in depth. Each layer shall be spread uniformly on a soil surface that has been moistened or aerated as necessary and scarified or otherwise broken up in such a manner that the fill will bond with the surface on which it is placed. After spreading, each layer shall be plowed, disked, or otherwise broken up; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 95 percent of maximum density in accordance with ASTM D698 (at optimum moisture). Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment will suited to the type of material being compacted.

3.07 RAW SUBGRADE PREPARATION

- A. Construction: Raw subgrade shall be shaped to line, grade and cross section and proof rolled with at least a 15 ton pneumatic roller to detect weak areas. Weak areas shall be removed and replaced with soils of similar classification, moisture content and adjacent in-situ soils. Raw subgrade preparation operation may include plowing, disk and any moistening or aerating required to contain specified compaction. Soft or other unsatisfactory material shall be removed and replaced with satisfactory excavated material or other approved material as directed. Rock encountered in the cut section shall be excavated to a depth of 6 inches below finished grade for the raw subgrade and all loose fragments removed. Low areas resulting from removal of unsatisfactory material or excavation of rock shall be brought up to required grade with satisfactory materials, and the entire subgrade shall be shaped to line, grade and cross section and compacted as specified.
- B. Compaction: Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment well suited to the type of material being compacted. Subgrade shall be compacted to at least 95 percent of maximum density at minus one (1) to plus three (3) of the optimum moisture content in accordance with ASTM D698, for a minimum depth of 6 in.

3.08 FINISHING

- A. The surface of all excavations, fills, embankments, and raw subgrades shall be finished to a smooth and compact surface in accordance with the lines, grades and cross sections or elevation shown. The degree of finish for all graded areas shall be within 0.10 ft. of the grades and elevations indicated on the drawings.

3.09 RAW SUBGRADE AND FILL OR EMBANKMENT PROTECTION

- A. During construction, fills, embankments, and excavations shall be kept shaped and drained. Ditches and drains along raw subgrade shall be maintained in such a manner as to drain effectively at all times. The finished raw subgrade shall not be disturbed by traffic or other

operation and shall be protected and maintained by the CONTRACTOR in a satisfactory condition, subject to approval by the OWNER'S Representative.

3.10 TRENCHING

A. General

1. Perform all trenching required for the installation of items where the trenching is not specifically described in other sections of these Specifications.
2. Make all trenches open vertical construction with sufficient width to provide free working space at both sides of the trench and around the installed item as required for caulking, joining, backfilling, and compacting.

B. Depth: Trenching as required to provide the elevations shown on the Drawings.

C. Correction of faulty grades: Where trench excavation is inadvertently carried below proper elevations, backfill with material approved by the OWNER'S Representative, and then compact to provide a firm unyielding subgrade and/or foundation to the approval of the OWNER'S Representative and at no additional cost to the OWNER.

END OF SECTION

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SECTION 02223
STRUCTURAL EXCAVATION, BACKFILL, AND COMPACTION

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all work, materials, equipment, and related items required to remove all earth, rock, water, and other materials to the extent required for the construction of the facilities shown on the Drawings; to prepare the subgrade or subbase for the foundation of the facilities to the lines and grades established on the Drawings.
- B. Requirements of the Geotechnical reports, project drawings and other specifications shall govern over the requirements in this specification.

1.02 QUALITY ASSURANCE

- A. The specifications of the American Society for Testing and Materials (ASTM) referred to in this Section listed below shall apply to this Section to the extent applicable in each reference:
 1. C 136 Sieve or Screen Analysis of Fine and Coarse Aggregates.
 2. D 423 Test for Liquid Limit of Soils.
 3. D 424 Test for Plastic Limit and Plasticity Index of Soils.
 4. D 1557 Test for Moisture-Density Relations of Soils.
 5. D 2922 Test for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Concrete: All concrete shall comply with the requirements of SECTION 03300 – CAST-IN-PLACE CONCRETE, with the Class as specified or indicated on the Drawings.
- B. Backfill Material
 1. Select Fill: As defined in the Geotechnical Reports.
 2. General Fill: As defined in the Geotechnical Reports.

PART 3 - EXECUTION

3.01 EXCAVATION

- A. General
 1. Excavations shall be of such dimensions as to permit the construction of the work in the manner, shape and size shown on the Drawings. Excavation shall extend a sufficient

- distance from walls to allow for placing and removal of forms, installation of piping and inspection.
2. Structures having 6 in. or more of select subbase may be excavated by plowing, scraping or machine digging to obtain the finished subgrade elevation.
 3. Authorized Additional Excavation: Where the proposed subgrade material on which the foundation, footing or slab is to be placed is deemed unsatisfactory by the ENGINEER, carry the excavation to an additional depth specified by the ENGINEER and fill the excavated space with select subbase material, as directed by the ENGINEER.
 4. Unauthorized Excavation: Whenever the excavation is carried beyond or below the lines or grades shown on the Drawings, refill all such excavated space below the structure foundation with Class "C" concrete. This work shall be done at no additional cost to the OWNER.
 5. Material Storage: Stockpile excavated materials classified as satisfactory soil material where directed by the OWNER until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage. CONTRACTOR shall sample
 6. Shoring, Sheeting and Bracing. Excavations shall be properly shored, sheeted and braced as the nature of the ground may require, to prevent shifting of material with possible damage to existing or uncompleted structures.

3.02 DEWATERING

- A. Commencing sufficiently in advance of excavation, during the excavation period and as long thereafter as the condition of the work may require, provide, and maintain in good operation such equipment as may be required to prevent all water from entering any excavation. This shall include, but is not limited to: surface water which would drain into the excavation; seepage water which would enter as a result of the excavation and a high ground water table; and the water which could penetrate the excavation due to the anticipated piezometric head coupled with the removal of overburden, should the CONTRACTOR not lower the water table in advance of the excavation. Complete backfilling operations before dewatering operations are suspended. Water removed from the excavation shall be disposed of in such a manner as to prevent damage to adjacent property or to other work under construction. Damage of whatever nature caused by dewatering the work or failure to dewater the work satisfactorily shall be promptly repaired or remedied by the CONTRACTOR at his own expense. Provision shall be made for the satisfactory disposal of water pumped from excavations so as to prevent damage to public or private property. In all cases, accumulated water in the trench shall be removed before placing embedment, laying pipe, placing any concrete, or backfilling.

3.03 BACKFILLING

- A. Materials. Materials for backfilling around structures shall be select fill, as described in the geotechnical report, unless otherwise described in these specifications or shown in the drawings.
- B. Placement of Backfill.
 1. Concrete in walls shall have attained the required twenty-eight (28) day compressive strength before any backfill is placed.

-
2. If a floor or structural system frames into a floor, no backfill shall be placed against walls until floors at the top and bottom have been in place fourteen (14) days unless authorization has been received from the OWNER in writing.

3.04 EXISTING UTILITIES

- A. Locate existing underground utilities in the areas of work. Provide adequate means of protection during excavation operations.
- B. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult the utility OWNER immediately for directions. Cooperate with the OWNER and public and private utility companies in keeping their respective services and facilities in operation. Repair damaged utilities to the satisfaction of the utility OWNER.
- C. Do not interrupt existing utilities serving facilities occupied and used by the OWNER or others, except when permitted in writing by the OWNER, and then only after acceptable temporary utility services have been provided.

END OF SECTION

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SECTION 02230
SITE CLEARING

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. This section includes the following:
 - 1. Protecting existing trees and grass to remain.
 - 2. Removing existing trees, plants, and grass.
 - 3. Clearing and grubbing.
 - 4. Stripping and stockpiling topsoil.
 - 5. Removing above- and below-grade site improvements.
 - 6. Disconnecting, capping, or sealing, and removing or abandoning site utilities.
 - 7. Temporary erosion and sedimentation control measures.

1.02 RELATED SECTIONS:

- A. Drawings and general provisions of the Contract, including General and Special Conditions and DIVISION 1 - GENERAL REQUIREMENTS sections, apply to this Section.
- B. SECTION 01500 – TEMPORARY FACILITIES AND CONTROLS for temporary utilities, temporary construction and support facilities, temporary security, and protection facilities,
- C. SECTION 01570 – STORMWATER POLLUTION PREVENTION PLAN for temporary erosion and sedimentation control procedures.
- D. SECTION 02300 – EARTHWORK for soil materials, excavating, backfilling, and site grading.

1.03 DEFINITIONS

- A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 in. diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.
- B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.04 MATERIAL OWNERSHIP

- A. Except for stripped topsoil or other materials indicated to remain OWNER'S property, cleared materials shall become CONTRACTOR'S property and shall be removed from Project site.

1.05 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from OWNER and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining OWNER'S property will be obtained by OWNER before award of Contract.
 - 1. Do not proceed with work on adjoining property until directed by ENGINEER.
- C. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on OWNER'S premises where indicated.
- D. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
- E. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

- A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in SECTION 02300 – EARTHWORK.
 - 1. Obtain approved borrow soil materials on-site, when satisfactory soil materials are not available in designated borrow areas request borrow area expansion.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly flag trees and vegetation to remain or to be relocated.
- C. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to OWNER.

3.02 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion and sedimentation control measures in accordance with SECTION 01570 – STORMWATER POLLUTION PREVENTION PLAN to prevent soil erosion and

discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.

B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

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

3.03 TREE PROTECTION

A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.

1. Do not store construction materials, debris, or excavated material within fenced area.
2. Do not permit vehicles, equipment, or foot traffic within fenced area.
3. Maintain fenced area free of weeds and trash.

B. Do not excavate within tree protection zones, unless otherwise indicated.

C. Where excavation for new construction is required within tree protection zones, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

1. Cover exposed roots with burlap and water regularly.
2. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
3. Coat cut faces of roots more than 1-1/2 in. diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
4. Backfill with soil as soon as possible.

D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by ENGINEER.

1. Employ an arborist, licensed in jurisdiction where Project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.
2. Replace trees that cannot be repaired and restored to full-growth status, as determined by ENGINEER.

3.04 UTILITIES

A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.

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

- B. Existing Utilities: Do not interrupt utilities serving facilities occupied by OWNER or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify ENGINEER not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without ENGINEER'S written permission.
- C. Excavate for and remove underground utilities indicated to be removed.
- D. Removal of underground utilities is included in DIVISION 2 - SITE CONSTRUCTION sections covering site utilities.

3.05 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction.
 - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 - 2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
 - 3. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18 in. below exposed subgrade, unless noted otherwise.
 - 4. Use only hand methods for grubbing within tree protection zone.
 - 5. Chip removed tree branches and stockpile in areas approved by ENGINEER.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
 - 1. Place fill material in horizontal layers not exceeding a loose depth of 8 in. and compact each layer to a density equal to adjacent original ground.

3.06 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
 - 1. Remove subsoil and nonsoil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Limit height of topsoil stockpiles to 72 in.
 - 2. Do not stockpile topsoil within tree protection zones.

3. Dispose of excess topsoil as specified for waste material disposal.
4. Stockpile surplus topsoil to allow for re-spreading deeper topsoil.

3.07 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
 2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.08 DISPOSAL

- A. Disposal: Remove surplus soil material and unsuitable topsoil and dispose of on site as directed by the ENGINEER. Obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off OWNER'S property.
 1. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

END OF SECTION

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SECTION 02235

DEMOLITION

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. CONTRACTOR shall provide all labor, materials, equipment, and superintendence to provide the demolition work.
- B. Demolition shall be as described herein and as shown on the project drawings.

1.02 PROTECTION

- A. Perform demolition in such a manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities, and structures or interruption of use of such utilities; and to provide free passage to and from such adjacent areas of site.
- B. Provide safeguards, including warning signs, barricades, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition and removal operations.
- C. Maintain fences, barricades, lights, and other similar items around exposed excavations until such excavations have been completely filled.
- D. Prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to ice, flooding, or pollution.
- E. Before beginning any demolition work, the CONTRACTOR shall survey the site and examine the drawings and specifications to determine the extent of the work. The CONTRACTOR shall take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain the property of the OWNER; any damaged items shall be repaired or replaced as approved by the ENGINEER.
- F. The work shall comply with the requirements of SECTION 01110 – ENVIRONMENTAL PROTECTION PROCEDURES.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 GENERAL

- A. CONTRACTOR shall comply with all applicable laws, codes, ordinances, and regulations and shall obtain and pay for all necessary permits.
- B. All materials on the project that are identified to be disposed of, shall be disposed of legally, off the site, by CONTRACTOR, who will, upon removal from the site, have the rights of salvage of materials.

- C. CONTRACTOR shall visit the site of the work and examine the premises to fully understand all the existing conditions relative to the work. No increase in cost or extension of performance time will be considered for failure to know the conditions of the site and structures.
- D. The OWNER assumes no responsibility for the actual condition of the structures to be demolished or modified.
- E. No fires will be permitted on site.
- F. The use of explosives will not be permitted on the project.
- G. CONTRACTOR is responsible for protection of persons and property, including safe working conditions throughout work progress. Provide safeguards, including warning signs, barricades, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition and removal operations. Erect fences, barricades, guardrails, lights, and other similar items around exposed excavations. Maintain safeguards until excavations have been completely filled.
- H. The OWNER and ENGINEER do not guarantee the accuracy of the demolition drawings provided herein nor do they guarantee that drawings are furnished for all structures. The CONTRACTOR shall inspect the existing sites and perform any investigations needed to determine the actual field conditions for preparation of his bid.
- I. All above ground structures, piping, access, equipment and electrical will be removed and disposed of offsite in accordance with the regulations of the Texas Commission on Environmental Quality (TCEQ). Submit landfill manifests to the OWNER.
- J. Remove abandoned pipe that would interfere with installation of new pipe and new construction.
- K. Salvage Rights
 - 1. CONTRACTOR shall have salvage rights to materials.
- L. Unless noted otherwise in the Geotechnical reports, for areas where facilities are demolished, all installed backfill material shall be placed in maximum 8" lifts achieving minimum densities of 95%. A density test shall be obtained from each lift, one for every 400 SF of installed backfill, and a minimum of two densities per lift for any structure.

END OF SECTION

SECTION 02260
EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.01 SUMMARY

- A. This section includes the requirements for trench excavation support and protection.
- B. It is the sole duty, responsibility, and prerogative of the CONTRACTOR, not the OWNER or ENGINEER, to determine the specific applicability of a trench safety system to each field condition encountered on the project. It will be the CONTRACTOR'S responsibility to identify the soil type and to accurately adjust his trench safety methods according to the OSHA requirements.
- C. Section Includes:
 - 1. Trench safety system for the construction of trench excavations.
 - 2. Trench safety system for structural excavations which fall under provisions of State and Federal trench safety laws.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices

- 1. Measurement for trench safety systems used on trench excavations is on a linear foot basis measured along the centerline of the trench, including manholes and other line structures.
 - 2. No payment will be made under this section for trench safety systems for structural excavations, tunnel shafts, auger pits, or excavation for trenchless installations, and also for any necessary non trenchless installations included in the aforementioned methods of construction unless included as a bid item. Include payment for trench safety systems in applicable structural or utility installation sections.
- B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.
- C. THE BID ITEM FOR "OSHA TRENCH SAFETY" SHALL INCLUDE PAYMENT FOR THE ACTUAL TRENCH WALL SUPPORT. DAMAGES TO ADJACENT EXISTING UTILITIES AND IMPROVEMENTS OF ANY KIND THAT OCCUR WHEN THE TRENCH WALLS MOVE SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE.

1.03 DEFINITIONS

- A. A trench shall be defined as a narrow excavation (in relation to its depth) made below the surface of the ground.
- B. The trench safety system requirements will apply to larger open excavations if the erection of structures or other installations limits the space between the excavation slope and these installation to dimensions equivalent of a trench as defined.

- C. Trench Safety Systems include but are not limited to sloping, sheeting, trench boxes or trench shields, sheet piling, cribbing, bracing, shoring, dewatering, or diversion of water to provide adequate drainage.
- D. Trench Safety Program is the safety procedures governing the presence and activities of individuals working in and around trench excavations.

1.04 SUBMITTALS

- A. Submit in accordance with SECTION 01300 – SUBMITTALS.
- B. Submit a safety program specifically for the construction of trench excavation. Design the trench safety program to be in accordance with OSHA 29CFR standards governing the presence and activities of individuals working in and around trench excavations.
- C. Construction and shop drawings containing deviations from OSHA standards or special designs shall be sealed by a licensed Engineer retained and paid by CONTRACTOR.
- D. Review of the safety program by the ENGINEER will only be in regard to compliance with this specification and will not constitute approval by the ENGINEER nor relieve CONTRACTOR of obligations under State and Federal trench safety laws.
- E. Submit certification that trench safety system will not be subjected to loads exceeding those which the system was designed to withstand according to the available construction and geotechnical information.

1.05 REGULATORY REQUIREMENTS

- A. Install and maintain trench safety systems in accordance with the detail specifications set out in the provision of Excavations, Trenching, and Shoring, Federal Occupation Safety and Health Administration (OSHA) Standards, 29CFR, Part 1926, Subpart P, as amended, including Final Rule, published in the Federal Register Vol. 54, No. 209 on Tuesday, October 31, 1989. The sections that are incorporated into these specifications by reference include Sections 1926-650 through 1926-652.
- B. A reproduction of the OSHA standards included in "Subpart P - Excavations" from the Federal Register Vol. 54, No. 209 is available upon request to CONTRACTOR'S bidding on OWNER projects. The OWNER assumes no responsibility for the accuracy of the reproduction. The CONTRACTOR is responsible for obtaining a copy of this section of the Federal Register.
- C. Legislation that has been enacted by the Texas Legislature with regard to Trench Safety systems, is hereby incorporated, by reference, into these specifications. Refer to Texas Health and Safety Code Ann., §756.021 (Vernon 1991).
- D. Reference materials, if developed for a specific project, will be issued with the Bid Documents, including the following:
 1. SECTION 00320 – GEOTECHNICAL DATA for use in design of the trench safety system.

1.06 INDEMNIFICATION

- A. CONTRACTOR shall indemnify and hold harmless the OWNER, his employees, and agents, from any and all damages, costs (including, without limitation, legal fees, court costs, and the cost of investigation), judgements or claims by anyone for injury or death of persons resulting from the collapse or failure of trenches constructed under this Contract.
- B. CONTRACTOR acknowledges and agrees that this indemnity provision provides indemnity for the OWNER in case the OWNER is negligent either by act or omission in providing for trench safety, including, but not limited to safety program and design reviews, inspections, failures to issue stop work orders, and the hiring of the CONTRACTOR.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install and maintain trench safety systems in accordance with provisions of OSHA 29CFR.
- B. Install specially designed trench safety systems in accordance with the CONTRACTOR'S trench excavation safety program for the locations and conditions identified in the program.
- C. A competent person, as identified in the CONTRACTOR'S Trench Safety Program, shall verify that trench boxes and other premanufactured systems are certified for the actual installation conditions.

3.02 INSPECTION

- A. CONTRACTOR, or CONTRACTOR'S independently retained consultant, shall make daily inspections of the trench safety systems to ensure that the installed systems and operations meet OSHA 29CFR and other personnel protection regulations requirements.
- B. If evidence of possible cave-ins or slides is apparent, CONTRACTOR shall immediately stop work in the trench and move personnel to safe locations until the necessary precautions have been taken by CONTRACTOR to safeguard personnel entering the trench.
- C. Maintain a permanent record of daily inspections.

3.03 FIELD QUALITY CONTROL

- A. CONTRACTOR shall verify specific applicability of the selected or specially designed trench safety systems to each field condition encountered on the project.

END OF SECTION

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SECTION 02300
EARTHWORK

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Drawings and general provisions of the Contract, including General and Special Conditions and DIVISION 1 - GENERAL REQUIREMENTS sections, apply to this Section.
- B. Requirements of the Geotechnical reports, project drawings and other specifications shall govern over the requirements in this specification.

1.02 RELATED WORK

- A. This Section includes the following:
 1. Preparing subgrades for slabs-on-grade, walks, and pavements.
 2. Excavating and backfilling for buildings and structures.
 3. Subbase course for concrete walks and pavements.
 4. Subsurface drainage backfill for walls and trenches.
 5. Excavating and backfilling for utility trenches.
 6. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.
- B. Related Sections include the following:
 1. SECTION 01500 – TEMPORARY FACILITIES AND CONTROLS for temporary controls, utilities, and support facilities.
 2. SECTION 02230 – SITE CLEARING for temporary erosion and sedimentation control measures, site stripping, grubbing, stripping, and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
 3. DIVISION 2 - SITE CONSTRUCTION, DIVISION 15 - MECHANICAL, and DIVISION 16 - ELECTRICAL sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.

1.03 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
- B. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
- C. Final Backfill: Backfill placed over initial backfill to fill a trench.

- D. Base Course: Course placed between the subbase course and hot-mix asphalt paving.
- E. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.
- F. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- G. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
- H. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by ENGINEER. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- I. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by ENGINEER. Unauthorized excavation, as well as remedial work directed by ENGINEER, shall be without additional compensation.
- J. Fill: Soil materials used to raise existing grades.
- K. Spoil Material: Satisfactory excavated material in excess of the amount required for backfill or site grading.
- L. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- M. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- N. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- O. Topsoil: On-site material, 4 in. in depth (unless otherwise described in drawings or other specification sections) stripped from designated borrow areas as shown by ENGINEER. If no approved material is available, CONTRACTOR shall import material approved by ENGINEER.
- P. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.04 SUBMITTALS

- A. Product Data: For the following:
 - 1. Each type of plastic warning tape.
 - 2. Geotextile.
 - 3. Controlled low-strength material, including design mixture.
- B. One (1) electronic copy in Portable Document Format (PDF) of all submittals and re-submittals shall be submitted suitable for distribution over electronic mail or File Transfer Protocol (FTP). For final approved submittals provide PDF and two (2) hard copies.

1.05 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.

1.06 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by OWNER or others unless permitted in writing by ENGINEER and then only after arranging to provide temporary utility services according to requirements indicated.
 1. Notify ENGINEER not less than four (4) days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without ENGINEER'S written permission.
 3. Contact utility-locator service for area where Project is located before excavating.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies or OWNER to shut off services if lines are active.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

- A. General: Provide all borrow soil materials from on-site borrow areas if available and approved by ENGINEER. Off-site material, if necessary, shall be imported by the CONTRACTOR, as approved by ENGINEER.
- B. Satisfactory Soils: ASTM D 2487 Soil Classification Groups SC, GW, GP, GM, SW, SP, and SM, or a combination of these groups; free of rock or gravel larger than 3 in. dimension in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification Groups GC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487 or a combination of these groups.
 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Reconditioned Fill: Reference the Geotechnical Reports.
- E. General Fill: Reference the Geotechnical Reports.
- F. Pipe Bedding Course: #57 crushed stone per ASTM C-33, unless shown otherwise on the drawings. This material shall be used in the entirety of the pipe bedding envelope and where shown on the plans.
- G. Select Fill: Reference the Geotechnical Reports.
- H. Drainage Course: ASTM C-33 #57 crushed stone completely wrapped in Mirifi 140N or 160N filter fabric. The drainage course shall be installed where shown on the plans and accordance with the details provided.

- I. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.

2.02 CONTROLLED LOW-STRENGTH MATERIAL (FLOWABLE FILL)

- A. Controlled Low-Strength Material: Low-density, self-compacting, flowable concrete material as follows:

1. Portland Cement: ASTM C 150, Type [II].
2. Fly Ash: ASTM C 618, Class C or F.
3. Fine Aggregate: All fine aggregate shall conform to the grading and quality requirements of ASTM C33.
4. Coarse Aggregate: Coarse aggregate shall conform to the grading and quality requirements of ASTM C33 for size No. 476, No. 57, or No. 67.
5. Water: The batch mixing water and mixer washout water shall conform to the requirements of ASTM C94.
6. Chemical admixtures that do not contain calcium chloride and conform to ASTM C494/C494M for concrete may be used in the CLSM mix.
7. All chemical admixtures shall be compatible with the cement and all other admixtures in the batch.

- B. Produce low-density, controlled low-strength material with the following physical properties:

1. Strength: CLSM shall have a minimum twenty-eight (28) day compressive strength of three hundred (300) psi when molded and cured as in conformance with ASTM D4832.
2. The CLSM shall have a minimum cement content of eighty (80) pounds per cubic yard. The water-cementitious materials ratio of the mix shall not exceed three and one-half to one (3.5:1).
3. Air-Entrainment: All CLSM shall be air entrained to a total air content of approximately five percent (5%).
4. Slump: The minimum slump shall be seven (7) inches and the maximum slump shall be nine (9) inches when tested in accordance with ASTM D6103.
5. Aggregate: Fine aggregate shall be between fifty percent (50%) and sixty percent (60%) by volume of the total aggregates in the CLSM mix.
6. The consistency of the CLSM slurry shall be such that the material flows easily into all openings between the pipe and the lower portion of the trench.
 - a. When trenches are on a steep slope, a stiffer mix of slurry may be required to prevent CLSM from flowing down the trench.
 - b. When a stiffer mix is used, vibration shall be performed to ensure that the CLSM slurry completely fills all spaces between the pipe and the lower portion of the trench.

2.03 ACCESSORIES

- A. Detectable Warning Tape: Acid and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 in. wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 in. deep; colored as follows:
 - 1. Red: Electric.
 - 2. Yellow: Gas, oil, steam, and dangerous materials.
 - 3. Orange: Telephone and other communications.
 - 4. Blue: Water systems.
 - 5. Green: Sewer systems.
 - 6. Purple: Non-potable water systems

PART 3 - EXECUTION

3.01 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in SECTION 02230 - SITE CLEARING.
- C. Protect and maintain erosion and sedimentation controls, which are specified in SECTION 02230 - SITE CLEARING, during earthwork operations.
- D. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.
- E. Dust Control
 - 1. Use all means necessary to control dust on the Work area or if resulting from the condition in which the CONTRACTOR leaves the site.
 - 2. Thoroughly moisten all surfaces as required to prevent dust being a nuisance to the neighbors.

3.02 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
 2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.
- C. Seepage waters may be encountered in portions of the work area. The CONTRACTOR shall design and construct temporary dewatering systems to such extend that the required construction can be accomplished.
- D. The CONTRACTOR shall not be allowed to dam the existing drainage ditch or alter the movement of water within the drainage ditch.
- E. Impacted water, as deemed by the OWNER or ENGINEER, shall be collected, and contained. The CONTRACTOR shall remove impacted water offsite in accordance with local, state, and federal requirements.

3.03 EXPLOSIVES

- A. Explosives: Do not use explosives.

3.04 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
 2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
 - a. 24 in. outside of concrete forms other than at footings.
 - b. 12 in. outside of concrete forms at footings.
 - c. 6 in. outside of minimum required dimensions of concrete cast against grade.
 - d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - e. 6 in. beneath bottom of concrete slabs on grade.
 - f. 6 in. beneath pipe in trenches, and the greater of 24 in. wider than pipe or 42 in. wide.

3.05 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 in. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of 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 1 in. Do not disturb bottom of excavations intended as bearing surfaces.

3.06 EXCAVATION FOR WALKS AND PAVEMENTS

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

3.07 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line. CONTRACTOR shall confirm frost line with ENGINEER prior to excavation.
- B. Excavate trenches to uniform widths to provide the clearance indicated on Drawings.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

3.08 SUBGRADE INSPECTION

- A. Notify ENGINEER when excavations have reached required subgrade.
- B. If ENGINEER determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 1. Completely proof-roll subgrade in one direction repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
 2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by ENGINEER, and replace with compacted backfill or fill as directed.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by ENGINEER, without additional compensation.

1. Remove damaged subgrade material to depth specified by ENGINEER. Backfill with select fill (as described in the Geotechnical report) and compacted in maximum 8 in. lifts as specified in Section 3.15.

3.09 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by ENGINEER.
 1. Fill unauthorized excavations under other construction or utility pipe as directed by ENGINEER.

3.10 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
- B. Stockpile soil materials away from edges of excavations. Do not store within drip line of remaining trees.
- C. CONTRACTOR shall dispose off-site all stockpile soil materials that are not required for fill, grading, etc., in accordance with local and state regulations, unless otherwise directed by ENGINEER.

3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 1. Construction below finish grade including, where applicable, subsurface drainage, dampproofing, and waterproofing.
 2. Surveying locations of underground utilities for Record Documents.
 3. Testing and inspecting underground utilities.
 4. Removing concrete formwork.
 5. Removing trash and debris.
 6. Removing temporary shoring and bracing, and sheeting.
 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Install bedding and backfill according to the dimensions shown in the Drawings.

- C. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- D. Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in SECTION 03300 – CAST-IN-PLACE CONCRETE.
- E. Place and compact initial backfill of #57 crushed stone meeting ASTM C-33 to a height of 12 in. over the utility pipe or conduit, unless otherwise indicated in Drawings.
 - 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.
- F. Backfill voids with satisfactory soil while installing and removing shoring and bracing.
- G. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- H. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.
- I. Install warning tape directly above utilities, 12 in. below finished grade, except 6 in. below subgrade under pavements and slabs.
- J. Reference drawings for requirements to concrete encase piping under structures.

3.13 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than one (1) vertical to four (4) horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use satisfactory soil material.
 - 3. Under steps and ramps, use select fill.
 - 4. Under building slabs, use select fill.
 - 5. Under footings and foundations, use select fill.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.
- D. For landscape berms
 - 1. From on-site borrow area.
 - 2. Topsoil from on-site stripping.

3.14 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILL AND FILL

- A. Place backfill and fill soil materials in layers not more than 8 in. in loose depth for material compacted by heavy compaction equipment, and not more than 4 in. in loose depth for material compacted by hand-operated tamps.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
 - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 in. of existing subgrade and each layer of backfill or fill soil material at 95 percent.
 - 2. Under walkways, scarify and recompact top 6 in. below subgrade and compact each layer of backfill or fill soil material at 95 percent.
 - 3. Under unpaved areas, scarify and recompact top 4 in. below subgrade and compact each layer of backfill or fill soil material at 95 percent.
 - 4. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

3.16 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - 1. Provide a smooth transition between adjacent existing grades and new grades.
 - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Unpaved Areas: Plus or minus 1 in.
 - 2. Walks: Plus or minus 1 in.

3. Pavements: Plus or minus 1/2 in.
 4. Sidewalks and buildings entrance requiring ADA/Accessibility shall meet TDLR requirements.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 in. when tested with a 10 ft. straightedge.

3.17 SUBBASE AND BASE COURSES

- A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase and base course under pavements and walks as follows:
 1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 2. Place base course material over subbase course under hot-mix asphalt pavement.
 3. Shape subbase and base course to required crown elevations and cross-slope grades.
 4. Place subbase and base course 6 in. or less in compacted thickness in a single layer.
 5. Place subbase and base course that exceeds 6 in. in compacted thickness in layers of equal thickness, with no compacted layer more than 6 in. thick or less than 3 in. thick.
 6. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.
- C. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 12 in. wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.18 DRAINAGE COURSE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place, and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
 1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 2. Place drainage course 6 in. or less in compacted thickness in a single layer.
 3. Place drainage course that exceeds 6 in. in compacted thickness in layers of equal thickness, with no compacted layer more than 6 in. thick or less than 3 in. thick.
 4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.19 FIELD QUALITY CONTROL

- A. Testing Agency: CONTRACTOR will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing, as approved by ENGINEER.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by ENGINEER.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
 1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one (1) test for every 2,000 sq. ft. or less of paved area or building slab, but in no case fewer than three (3) tests.
 2. Foundation Wall Backfill: At each compacted backfill layer, at least one (1) test for each 100 ft. or less of wall length, but no fewer than three (3) tests.
 3. Trench Backfill: At each compacted initial and final backfill layer, at least one (1) test for each 100 ft. or less of trench length, but no fewer than two (2) tests.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify, and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.20 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to the specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 1. Scarify or remove and replace soil material to depth as directed by ENGINEER; reshape and recompact.
 2. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 3. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove waste material and spoil material from the OWNER'S property.

1. Remove waste material, including but not limited to unsatisfactory soil, trash, equipment, pipe, concrete, electrical components, and pavement material, and legally dispose of it at a registered landfill per regulatory requirements.
2. CONTRACTOR shall remove all surplus material and dispose of off-site in accordance with local and state regulations. This cost shall be included in the CONTRACTOR'S bid price including but not limited to:
 - a. Any and all permitting costs.
 - b. Transporting the spoil material and installing the material at the disposal site.
 - c. Negotiations and communications with the owner of the disposal site.
 - d. Payment to landowner for disposal.
 - e. Maintenance of access roads at the disposal site as directed by the landowner.
 - f. Repair of any damage to landowner's property.
 - g. Providing any insurance required by the landowner.
 - h. Any other requirements of the landowner.
3. The location and placement of spoil material shall comply with the requirements of all regulatory agencies, including but not limited to TCEQ, EPA, FEMA, and TxDOT, as applicable. No material shall be placed in a FEMA designated floodway or floodplain.
4. For the convenience of the CONTRACTOR, the OWNER has located a potential spoil disposal site located at 1050 Schneider Road. The contact for the site is Joseph Rangel at 830-556-1617. The OWNER does not warrant or guarantee that this site is available to accept spoil material or that it can accept all the spoil material. It shall be the CONTRACTOR'S responsibility to make this determination. The CONTRACTOR is not required to use this site for any or all spoil disposal. The CONTRACTOR has the option to locate other site(s) at his discretion and will be fully responsible for site selection.
5. The OWNER will not be held responsible for any liability associated with the CONTRACTOR'S transportation of the spoil material or his performance at the disposal site(s) or spoil disposal means.

END OF SECTION

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SECTION 02420
WATER MAIN CONSTRUCTION

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. These specifications for construction of water mains are intended to be so written that only first-class workmanship and finish of the best grade and quality will result. The fact that the following specifications may fail to be so complete as to cover all details will not relieve the Contractor of full responsibility for providing a complete project of high-quality, first-class finish and appearance and satisfactory for operation.
- B. The Contractor shall furnish all materials, labor, and equipment for constructing the work included in these specifications and as detailed on the plans.
- C. This project is funded through the Texas Water Development Board (TWDB) and shall include all requirements of the TWDB, including, but not limited to, the American Iron and Steel (AIS) requirements of 33 U.S.C. § 1388. The Contractor's bid costs shall reflect these requirements.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PROTECTION OF WORK

- A. When construction is stopped temporarily and at the end of the day's work, tight fitting stoppers or bulkheads shall be securely placed in or across the ends of all pipes.
- B. The Contractor will be held responsible for the care of all work until final completion and acceptance, and he will be required to make good, at his own expense, any damage or injury it may sustain for any cause. He shall assume all risks from floods and casualties of every description and make no charge for damages from such cause.

3.02 MATERIALS

- A. The Contractor shall furnish and place materials meeting the requirements of these specifications, of the dimensions and types at the locations and elevations shown on the plans or established by the Engineer. All materials shall be approved by the Engineer before being installed and any of these materials placed before they are so approved shall be removed and replaced with approved materials.

3.03 STORAGE OF MATERIALS

- A. Materials delivered to the site of the work prior to their use shall be stored to cause the least inconvenience to the public, and in a manner satisfactory to the Engineer.
- B. Materials that will deteriorate such as cement and mortar shall be stored in weather-tight buildings.

3.04 DESIGN PRESSURES

- A. Pipe and fittings for water lines shall be designed to withstand minimum internal working pressures of 150 pounds per square inch unless otherwise noted on the plans or in the bid proposal.

3.05 TRENCHING AND BACKFILL FOR WATER MAIN CONSTRUCTION

- A. This item consists of excavating all necessary trenches for the water main and system construction and backfilling after the pipe has been properly laid, inspected, and tested.
- B. This work shall include the furnishing of all labor, materials, tools, equipment, and machinery necessary for clearing and removing from the site of the work, wherever located, all obstructions, trees, stumps, brush, vegetation and debris, and all earth, rock, and other materials to be excavated; the removal of existing structures except where specifically paid for as separate contract pay items; the stripping or removal of top soil or sod to be piled separately from other excavated materials and later to be restored to its original place after backfilling is completed; the furnishing, placing, and maintaining of all sheeting, shoring and bracing necessary to protect the work and adjacent properties, all pumping, bailing, and draining necessary to keep the excavation free from seepage water, water from sewers, drains, ditches, creeks, and other sources; provision for the uninterrupted flow of sewers and surface waters during progress of the construction; the removal, after completion of the work, of all sheeting, shoring, and bracing not necessary to support the sides of the excavation; the satisfactory disposal of excess and unsuitable materials not required or which cannot be used for backfilling, tamping, compacting, and refilling after settlement of all excavated areas; the restoring of all streets, alleys, fences, rights-of-way, and other lands or structures, private or public, damaged or occupied by the Contractor in the performance of the contract, to as good a condition as they were prior to the beginning of the work.

3.06 CLASSIFICATION

- A. Excavation in trenches for water line construction will be unclassified and will not be paid for separately but shall be included in the lump sum bid.

3.07 CONSTRUCTION METHODS

- A. Trenches shall be excavated by trenching machine, backhoe, or dragline, except in locations where hand trenching is required. The banks of trenches shall be vertical, to a point 1 foot above the top of the pipe.
- B. Trenches will be excavated to the lines and grades laid out by the Engineer or as shown on the plans. No change in locations of the lines is contemplated, but should any changes be made in the lines not materially altering the amount of character of the trenching to be done, the Contractor shall proceed with the changed alignment at the unit bid price. In case any change involves greater construction difficulties than the original alignment, the Owner and the Engineer will agree with the Contractor for extra compensation therefor, prior to the construction of the changed line or lines.
- C. The width of the trench shall be 6" minimum and 8" maximum on each side of the pipe bell.
- D. Trenches for water pipe shall be of such depth as to provide a minimum of 42" of cover unless otherwise shown on the plans.

- E. The excavation shall not advance more than 300 feet ahead of the completed and backfilled pipeline. Pipe shall be laid in all trenches that has been opened at the end of each day's work unless the Contractor secures written permission to do otherwise from the Engineer.
- F. If the bottom of the trench becomes an unstable foundation for the pipe through the neglect of the Contractor to adequately shore or dewater, the Contractor will be required to remove the unstable material and backfill the trench to the proper grade with approved compacted gravel, and no extra compensation will be granted for this material or work.
- G. Also, if the trench is inadvertently excavated deeper than necessary it shall be backfilled to the proper grade with approved compacted gravel at the Contractor's expense.
- H. However, if the undisturbed material encountered at the grade depth constitutes, in the opinion of the Engineer, an unstable foundation for the pipe, the Contractor will be required to remove such unstable material and backfill the trench to the proper grade with approved compacted material.
- I. The Contractor shall excavate all trenches, including work necessary in working around existing pipelines or other obstructions. The Contractor shall give notice to the Owners of any such lines or obstructions in order that they may have time to take the necessary precautions for protecting their property. The Contractor shall be responsible for protecting the Owner from any damage from his operations in such work.
- J. In rock, excavation shall be carried 3" below the bottom of the pipe, and loose earth or gravel, thoroughly tamped, shall be used for backfilling to the grade of the bottom of the pipeline.
- K. After inspection of pipelines has been finished on any completed portion of the work the trench may be backfilled. Backfilling shall be accomplished in compliance with the applicable portions of these specifications.

3.08 PUMPING, BAILING AND DRAINING

- A. The Contractor shall immediately remove all surface or seepage water from sewers, drains, ditches, and other sources which may accumulate during the excavation and construction work by providing the necessary underdrains or otherwise and by doing the necessary pumping, bailing, or draining. The Contractor shall always have available sufficient equipment in proper working order for doing the work herein required. All water removed from excavations shall be disposed of in an approved manner so as not to create unsanitary conditions nor to interfere unduly with the use of streets, private driveways, or entrances. Pumping, bailing, draining, underdrains, ditches, etc., shall be considered as incidental work and will not be bid for as separate items but their cost shall be included in the contract prices bid in the Proposal for the various units of measure.

3.09 SUPPORT OF EXISTING PIPES ACROSS TRENCH

- A. It shall be the responsibility of the Contractor to protect and support all water, sewer, gas, and other conduits crossed by the excavation or work to be performed by him or to arrange for their temporary removal and subsequent replacement. All expense incidental to this phase of the work shall be borne by the Contractor.

3.10 DISPOSAL OF EXCAVATED MATERIALS

- A. Excavated materials, so far as needed and of a suitable character, shall be piled adjacent to the work to be used for backfilling as required. Excavated materials unsuitable for the backfilling or in excess of that required for backfilling shall be disposed of in an approved manner at locations designated on the plans or approved by the Engineer. Desirable topsoil, sod, etc. shall be carefully piled separately and replaced in its original position when required. Excavated materials shall be always handled in such a manner as to cause a minimum of inconvenience to public travel and to permit safe and convenient access to private and public property adjacent to or along the line of the work. In parkways and easements where it is necessary to deposit excavated materials on lawns during the work, burlap or canvas shall be placed on the lawn to prevent contact between excavated materials and the lawn.

3.11 USE OF EXPLOSIVES

- A. Explosives or blasting shall not be allowed on this project.

3.12 JACKING, BORING OR TUNNELING

- A. Tunneling under highways, streets, or railroads, when required and shown on the plans, shall be accomplished by means of jacking, boring or tunneling equipment which has been approved by the Engineer prior to starting tunneling operations. Tunnels shall be backfilled as completely as practicable with selected materials and compacted by means of mechanical tampers. The remainder of the tunnel backfill shall be of coarse sand, gravel or crushed rock hydraulically placed in such manner that no voids remain between the backfilled material and the roof of the tunnel.

3.13 CROSSINGS TO BE KEPT OPEN

- A. At such street, railroad, and all other crossings as may be designated by the Engineer, the trenches are to be filled in such a manner as to prevent any serious interruption of traffic upon the roadway or sidewalks. The cost thereof shall be borne by the Contractor.

3.14 PROTECTION OF UNFINISHED WORK

- A. Before leaving work for the night, during a storm, or at other times, care must be taken to protect and securely close the unfinished end of the pipe. Any earth or other materials that may find entrance into the pipe through any such open or unplugged end of the pipe must be removed at the Contractor's expense.

3.15 BACKFILL

- A. Excavation shall be backfilled only with approved materials. The placing of backfill material shall not begin until approval has been given by the Engineer and shall be done immediately when so ordered by the Engineer.
- B. Backfilling shall be brought up to an elevation slightly above the original ground level to allow for subsequent settlement. The top surface or slopes of all backfill shall be neatly graded off in a workmanlike manner, and where select topsoil, sod, or other material is removed and piled separately, such material shall be carefully replaced in a manner satisfactory to the Engineer.

3.16 BACKFILL MATERIAL

- A. Unless otherwise noted on the drawings, backfilling shall be done with good sound earth. Broken concrete, rock, bituminous pavement, or other lumpy material shall not be used in the backfill except as the lumps are small and their dispersal in the backfill is made in the upper section in a manner satisfactory to the Engineer. Materials of a perishable, spongy, or otherwise improper nature shall not be used in backfilling. Pipe bedding and the initial backfill to a point 12" above the top of the pipe shall be #57 crushed stone meeting ASTM C-33. Gravel cushion and/or granular backfill material will not be required when concrete encasement is specified or used around the pipe. No backfill shall be made until it is authorized by the Engineer. All debris shall be removed. Sheeting, shoring and bracing shall be pulled and removed during the progress of the backfilling in a manner satisfactory to the Engineer.

3.17 CONCRETE ENCASEMENT

- A. Concrete encasement, when required, shall be composed of a free-flowing material consisting of small stone, pea gravel, limestone chat, or pit run sand and gravel and shall always consist of at least 60% sand. The material shall all pass a three-quarter 3/4" screen and be free from sticks, lumps, stones, and organic matter. The material shall be mixed with Portland Cement in the proportions of one (1) part cement to ten (10) parts of the above-described granular material, by volume measurement. Concrete encasement shall be poured either wet or dry as may be directed by the Engineer.
- B. When concrete encasement backfill material is specified or ordered by the Engineer to be poured UDRYU, the Contractor shall place this material on each side of the pipe for the full width of the trench using shovels to cut the material back under the pipe and shall be tamped to a height of 6" above the pipe to receive final backfill. Care must be exercised not to dislocate or disturb the grade and alignment of the pipe. If ordered by the Engineer to be poured UWETU, caution and care must be used not to float the pipe out of place. In the event pipes are floated out of proper position they shall be removed and re-laid at the expense of the Contractor.

3.18 GRAVEL CUSHION OR BACKFILL

- A. On water line construction when, in the opinion of the Engineer, the subgrade material encountered at grade is soft, spongy, and unsuitable, it shall be removed to such a depth that the replacement thereof with firmly tamped gravel or crushed stone will provide an unyielding, stable foundation. The gravel used in cushion or backfill shall be pit run gravel or crushed stone and shall be free from silt, loam, or vegetable matter and shall be of a gradation suitable to the Engineer.
- B. Gravel cushion or backfill, when required by the plans or the Engineer, will be paid for at the contract unit price and shall be the total compensation for furnishing all labor materials, tools, and equipment for performing this phase of work.
- C. Subgrades that have been allowed to become unstable by neglect of the Contractor, by improper drainage or lack of drainage, and when in the opinion of the Engineer, the condition was caused by the neglect or fault of the Contractor, the Engineer shall order the Contractor to remove the unstable subgrade and replace the same with gravel at the expense of the Contractor, and no extra compensation will be allowed.

3.19 CEMENT STABILIZED BACKFILL

- A. Where backfill material shown or called for on the plans to be used in the pipe zone is cement stabilized sand, the material shall extend from a point 6" below the pipe to a point 6" above the top of the pipe. The backfill material shall be deposited simultaneously on both sides of the pipe and worked carefully around and under the pipe with the point of a shovel. Payment for this bedding material shall be included in the unit price bid per linear foot of cement stabilized backfill material. Cement stabilized backfill shall contain a minimum of one (1) sack mix (per yard of pit run sand).

3.20 INSTALLATION OF BURIED VALVES

- A. All valves shall be installed as shown on the plans. For each valve, the Contractor shall furnish and install a valve box.
- B. Valve boxes shall be three (3) piece screw type cast iron of the extension type and shall be similar to Mueller No. H-10360 or an approved equal. For 14" and 16" valves Mueller No. H-10357 with No. 160 base or equal shall be furnished and installed. For 18" and larger valves manholes 5 feet in diameter will be required. Lids shall be lockable and have water, sewer, or NPW cast into them. Valve box lockable lids shall be by Trumbull Item No. 367-5045 or approved equal.
- C. Valves shall be carefully handled and lowered into position in such a manner as to prevent damage to any parts of the valve.
- D. Valves shall be placed in such positions as indicated on the plans with the stem in a vertical position and securely held until all connections have been made.
- E. Cast iron valve boxes shall be firmly supported and maintained centered and plum over the wrench nut of the valve. The box cover shall be set flush with the surface of the ground or at such other level as may be directed.

3.21 INSPECTION

- A. During the process of unloading, all pipe and accessories shall be inspected by the Contractor for loss or damage in transit. No shipment shall be accepted by the Contractor until notation of any lost or damaged material shall have been placed on the bill of lading by the agent of the carrier.
- B. All pipe and accessories shall be laid, jointed, tested for defects and for leakage with pressure, and chlorinated in the manner herein specified in the presence of the Engineer or his authorized Inspector and subject to their approval.
- C. All material found during the progress of the work to have cracks, flaws, or other defects will be rejected by the Engineer, and the Contractor shall promptly remove from the site of the work such defective material.
- D. The Contractor shall be responsible for all material furnished to him or by him and shall replace at his own expense all such material that is found to be defective in manufacturing or that has become damaged in handling after delivery by the manufacturer. The Contractor shall be responsible for the safe storage of material furnished by or to him until it has been incorporated in the completed project.
- E. Pipe fittings, valves and other accessories shall be unloaded at the point of delivery, hauled to, and distributed at the site of the project by the Contractor. They shall, always, be handled with

care to avoid damage. In loading and unloading they shall be lifted by hoists, slid, or rolled on skidways in such a manner as to avoid shock. Under no circumstances shall they be dropped. Pipe handled on skidways must not be skidded or rolled against pipe already on the ground.

- F. In distributing the material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench. Pipe shall be handled in such a manner that a minimum amount of damage to the coating will result. Damaged coating shall be replaced in a manner satisfactory to the Engineer.
- G. Pipe shall be placed on the site of the work parallel with the trench alignment and with bell ends facing the direction on which the work will proceed unless otherwise directed. The interior of all pipe, fittings, and other accessories shall be always kept free from dirt and foreign matter.

3.22 PIPE HANDLING

- A. Proper implements, tools, and facilities shall be provided and used by the Contractor for the safe and convenient prosecution of the work. All pipe, fittings, and valves shall be carefully lowered into the trench piece by piece by means of derrick ropes or other suitable tools or equipment in such a manner as to prevent damage to pipe or pipe coating. Under no circumstances shall pipe or accessories be dropped into the trench.
- B. At all times when pipe laying is not in progress, the open ends of the pipe shall be closed by approved means. No trench water shall be permitted to enter the pipe. All foreign matter or dirt shall be removed from the pipe, and it shall be kept clean by approved means during and after laying. No pipe shall be laid in water or when trench conditions are unsuitable for such work.
- C. Cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat workmanlike manner without damage to the pipe. Concrete pressure pipe shall not be cut on the job without the approval of the Engineer.

3.23 JOINTING PIPE

- A. Materials: All component parts are to be furnished with and included in the price bid for pipe. The materials consist of a circular rubber gasket of modified bulb shape in cross section.
- B. Procedure: Remove any foreign matter in the gasket seat of the socket, wipe gasket clean, flex gasket and place in socket with the large round end or bulb end entering first. Seat gasket evenly around inside of the socket with the groove fitted over the bead. Remove any bulges. Apply a thin film of lubricant furnished by the pipe manufacturer to the inside surface of gasket. No lubricant other than that furnished with the pipe by the pipe manufacturer will be allowed to be used. Wipe plain end of pipe to be entered, clean and place in approximate alignment with the bell of the pipe to which it is to be joined. Apply a thin film of the lubricant to the outside of the plain end for about 1" back from the end. Align the pipe and carefully enter the plain end into the socket until it just makes contact with the gasket. Complete joint assembly by forcing the plain end of the entering pipe past the gasket until it contacts the bottom of the socket. For pipe in sizes 10" and larger, a jack-type tool will be used to make up the joint and complete the assembly of the joint in forcing the plain end of the pipe past the gasket.
- C. Deflection of Joints: The maximum deflection at each joint will not exceed 5 degrees for sizes through 12", 4 degrees for 14" and 16", and 3 degrees for 18", 20" and 24" pipe sizes. If a profile is shown on the plans, the Contractor will be required to lay the line to conform to the grades shown. If it is necessary that water line shall have over 42" of cover in order not to exceed the

manufacturer's recommendations for deflection of the pipe, the Contractor shall excavate the ditch with no extra compensation. Regardless of the depth of ditch necessary, the Contractor shall, under no condition, exceed the manufacturer's recommendations for deflection of the pipe at joints. The Contractor will receive no extra compensation for extra depth necessary to cross existing utility lines.

3.24 CLEARANCE FROM OTHER PIPES

- A. Water lines and sanitary sewers shall be installed no closer to each other than 9 feet. Where this cannot be achieved, the sanitary sewer shall be constructed of pressure type cast iron pipe or the equivalent of 150 psi pressure pipe with watertight joints used in water main construction for the 9 feet clearance. No physical connection shall be made between a drinking water supply, public or private, and the sewer or any appurtenances.
- B. Any facilities for permitting discharge of drinking water into the sewer or any appurtenance thereof shall be constructed to prevent any possibility of sewage entering the drinking water system.
- C. All portions of non-potable water pipe within 4 feet of a potable water pipe must be embedded in cement stabilized sand that has a minimum content of 10% cement, based on loose dry weight volume and is installed a minimum of 6 inches above and one quarter of the pipe diameter on either side and below the non-potable water pipe.

3.25 CONNECTION TO EXISTING WATER MAINS

- A. Where indicated on the plans and/or hereinafter specified, the Contractor shall connect the new main with existing mains or lines. The Contractor shall furnish all labor, materials, equipment, or services required for the locating and uncovering of the existing line, the making of cuts in the existing line, the removal, relocation, and lowering of existing lines as required, dewatering of the trench, connecting of the existing line into the new main and all appurtenant work required for a complete connection. Relocated mains or lines shall be laid so that all valves so relocated or installed shall be set vertically.
- B. Connections to existing water mains shall be made at the locations shown, as specified, and/or as directed by the Engineer. All such connections shall be made in a most expeditious and workmanlike manner to cause the least inconvenience to water customers and to traffic and shall be made at night unless otherwise approved by the Engineer. The detailed schedule of operations for making each connection shall be approved by the Engineer or his inspector before any work thereupon is commenced.

3.26 STERILIZATION OF WATER MAINS

- A. During the construction operations workmen shall be required to use utmost care to see those parts of the structures, inside of pipes, fittings, jointing materials, valves, etc., the surface of which come in contact with City water are maintained in a sanitary condition.
- B. Every effort must be made to keep the inside of the pipe, fittings, and valves free of all foreign matter, sticks, dirt, rocks, etc. As each joint of pipe is being laid it must be effectively swabbed so that all foreign matter is removed. All fittings and exposed open ends of pipe must be blocked or capped until the line is completed.

- C. When the entire pipeline or certain selected sections thereof have been completed, tested, and made ready for turning over to the Owner ready for use, the line or section of line shall be thoroughly sterilized according to AWWA C-651 and the following procedure:
1. The line shall be flushed out, completely replacing its entire volume with water from the Owner's mains.
 2. Chlorine will be injected into the section of line being sterilized so that its entire capacity will be filled with water containing chlorine in the amount of 50 p.p.m. or in such other quantity as determined by the Engineer. The sterilizing agent shall be introduced at one end of the section and the water released from the opposite end until the sterilizing agent is present at the discharge end in such quantity as to indicate a residual-chlorine of 50 p.p.m. or as otherwise determined by the Engineer. All valves shall be opened and closed several times and the sterilizing solution permitted to remain in the pipeline section for not less than 24 hours.
 3. At the end of the sterilizing period the sterilizing solution shall be discharged from the pipe and replaced with water direct from a main of the Owner.
 4. A sample of water from the sterilized main shall be taken (not through a fire hydrant) from a suitable tap under the supervision of the Engineer or his Inspector and submitted to an approved testing laboratory or the State Health Department for analysis. If the test shows a satisfactory quality of water, the line so sterilized shall then be placed in service by the Contractor who shall notify and assist the Water Superintendent in location and operation of all valves installed by the Contractor. If the sample shows unsatisfactory quality of water, the process of sterilization shall be repeated until a satisfactory water is obtained.
- D. Sterilization of the line or any section thereof shall not be commenced until the Engineer's approval of the method, apparatus, sterilizing agent, and the section of the line has been obtained.

3.27 CONCRETE BACKING

- A. Concrete having compressive strength of not less than 2,000 pounds per square inch shall be used as a cradle or backing where shown on the plans or where directed by the Engineer. All materials including aggregates, cement, and water, as well as the mixing and placing of the concrete, shall be approved by the Engineer. Bends of 22-1/2 degrees and greater, plugs, and all tees, crosses, etc. shall be placed between solid ground and the fitting to be anchored; the area of bearing on pipe and on ground in each instance shall be that required by the Engineer. The backing shall, unless otherwise directed, be placed so that the pipe and fitting joints will be accessible for repair.
- B. Concrete shall be composed of normal Portland Cement, coarse aggregate, fine aggregate, and water proportioned and mixed properly in a concrete mixer. Transit mix concrete will be allowed. Portland Cement shall be Type 1 and shall be fully protected until incorporated in this work. Gravel to be used for coarse aggregate shall consist of clean hard, durable grains, and shall be free from an excess of salt or alkali and foreign materials. Concrete shall have a compressive strength of not less than 2,000 pounds per square inch at 28-days and shall not have less than three (3) sacks of cement nor more than 6 and 6-3/4 gallons of water per cubic yard of concrete.

3.28 CLEAN-UP

- A. During construction, the Contractor shall maintain the premises in an orderly, neat, and presentable manner. Scraps and debris shall not be left scattered but shall be assembled and such as are

unusable shall be moved from the premises or disposed of to the satisfaction of the Engineer. When construction of the contract has been otherwise completed, the Contractor shall remove all left-over construction materials, equipment, scraps, debris, and rubbish. Earthwork shall be smoothed and graded to the lines shown on the plans. Backfill over all trenches shall be left in a uniform and neat condition.

3.29 MEASUREMENT AND PAYMENT

- A. The bid items include the work of every nature required for the completion of the job in every respect except as may be otherwise provided for in these specifications. The Contractor shall include the furnishing of all materials and labor, including any incidental labor, in his lump sum bid.

3.30 SANITARY SEWER AND WATER MAIN SEPARATION DISTANCES

- A. The following separation distances shall be maintained between potable water and wastewater treatment plants, and waterlines and sanitary sewers.

1. Water line/new sewer line separation. When new sanitary sewers are installed, they shall be installed no closer to waterlines than 9 feet in all directions. All separation distances shall be measured from the outside surface of each of the respective pieces. Sewers that parallel waterlines must be installed in separate trenches. Any appurtenance shall be designed and constructed to prevent any possibility of sewage entering the drinking water system. Where the 9 feet separation distance cannot be achieved, the following guidelines will apply:

- a. Where a sanitary sewer parallels a waterline, the sewer shall be constructed of cast iron, ductile iron, or PVC meeting ASTM specifications with a pressure rating for both the pipe and joints of 150 psi. The waterline shall be located at least a minimum of 2 feet above the wastewater main or lateral, measured vertically, and at least a minimum of 4 feet away, measured horizontally, from the wastewater main or lateral. The sewer shall be located below the waterline.
- b. Where a sanitary sewer crosses a waterline, and the sewer is constructed of cast iron, ductile iron, or PVC with a minimum pressure rating of 150 psi. The potable waterline shall be at least a minimum of 6" above the wastewater main or lateral. Whenever possible, the crossing shall be centered between the joints of the wastewater main or lateral.
- c. Where a sewer crosses under a waterline and the sewer is constructed of ABS truss pipe, similar semi-rigid plastic composite pipe, clay pipe or concrete pipe with gasketed joints, the potable waterline shall be at least a minimum two (2') feet above the wastewater main or lateral. The initial backfill shall be from one quarter diameter below the centerline of the pipe to one (1) pipe diameter (but not less than 12") above the top of the pipe.
- d. Where a sewer crosses over a waterline all portions of the sewer within 9 feet of the waterline shall be constructed of cast iron, ductile iron, or PVC pipe with a pressure rating of at least 150 psi using appropriate adapters. In lieu of this procedure the new conveyance may be encased in a joint of 150 psi pressure class pipe at least 18 feet (or longer) and two (2) nominal sizes larger than the new conveyance. The space around the carrier pipe shall be supported at 5 feet intervals

with spacers or be filled to the springline with washed sand. The encasement pipe should be centered on the crossing, and both ends sealed with cement grout or manufactured seal.

2. Waterline/manhole separation. Unless sanitary sewer manholes and the connecting sewer can be made watertight and tested for no leakage, they must be installed to provide a minimum of 9 feet of horizontal clearance from an existing or proposed waterline. Where the nine (9') foot separation distance cannot be achieved, a carrier pipe as described in subsection A (1) of this section may be used where appropriate.

END OF SECTION

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SECTION 02421
SANITARY SEWER CONSTRUCTION

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. These specifications for sanitary sewer construction are intended to be so written that only first class workmanship and finish of the best grade and quality will result. The fact that the following specifications may fail to be so complete as to cover all details will not relieve the CONTRACTOR of full responsibility for providing a complete project of high quality, first class finish and appearance, and satisfactory for operation.
- B. The CONTRACTOR will be held responsible for the care of all work until final completion and acceptance, and he will be required to make good at his own expense any damage or injury it may sustain for any cause. He shall assume all risks from floods and casualties of every description and make no charge for damages for such cause.
- C. This specification shall apply to the wastewater treatment plant drain system, unless noted otherwise on the drawings.
- D. This project is funded through the Texas Water Development Board (TWDB) and shall include all requirements of the TWDB, including, but not limited to, the American Iron and Steel (AIS) requirements of 33 U.S.C. § 1388. The Contractor's bid costs shall reflect these requirements.
- E. Pipe material shall be as shown on the drawings.

1.02 RELATED WORK

- A. SECTION 01666 – TESTING OF PIPELINES.
- B. SECTION 02260 – EXCAVATION SUPPORT AND PROTECTION.
- C. SECTION 02422 – MANHOLES.
- D. SECTION 02300 – EARTHWORK.
- E. DIVISION 23 – MECHANICAL.

1.03 DELIVERY, STORAGE AND HANDLING

- A. Materials shall conform to the detail specifications stated herein and/or shown on the plans.
- B. Materials delivered to the site of the work in advance of their use shall be stored in a manner satisfactory to the ENGINEER.
- C. Cement shall be stored in a suitable weather-tight building which will protect the cement from dampness.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 TRENCHING AND BACKFILL

- A. This item consists of excavating all necessary trenches for the sanitary sewer system and backfilling the same after the pipe has been properly laid, inspected, and tested.
- B. This work shall include the furnishing of all labor, materials, tools, equipment, and machinery necessary for clearing and removing from the site of the work, wherever located, all obstructions, trees, stumps, brush, vegetation, and debris, and all earth, rock, and other materials to be excavated; the removal of existing structures except where specifically paid for as separate contract pay items; the stripping or removal of top soil or sod to be piled separately from other excavated materials and later to be restored to its original place after backfilling is completed; the furnishing, placing, and maintaining of all sheeting, shoring, and bracing necessary to protect the work and adjacent properties; all pumping, bailing, and draining necessary to keep the excavation free from seepage water, water from sewers, drains, ditches, creeks, and other sources; provision for the uninterrupted flow of sewers and surface waters during progress of the construction; the removal, after completion of the work, of all sheeting, shoring, and bracing not necessary to support the sides of the excavation; the satisfactory disposal of excess and unsuitable materials not required or which cannot be used for backfilling, tamping, compacting and refilling after settlement of all excavated areas; the restoring of all streets, alleys, fences, rights-of-way, and other lands or structures, private or public, damaged or occupied by the CONTRACTOR in the performance of the contract, to as good a condition as they were prior to the beginning of the work.

3.02 CLASSIFICATION

- A. Excavation in trenches for sewer line construction shall be unclassified and shall not be paid for separately but shall be included in the lump sum price bid for the project unless specific provision for separate payment is called for in the Special Provisions and on the Proposal Form.
- B. Where no separate classification is provided, the price bid shall be based on unclassified trenching, and the CONTRACTOR shall satisfy himself as to the material and conditions to be encountered.
- C. "Unclassified" excavation shall include all materials and conditions encountered in the excavation.

3.03 CONSTRUCTION METHODS

- A. Trenches shall be excavated by a trenching machine, backhoe, or dragline, except in locations where hand trenching is required. The banks of trenches shall be vertical, to a point 1 ft. above the top of the pipe.
- B. Trenches shall be excavated to the lines and grades laid out by the ENGINEER or as shown on the plans. No change in locations of the lines is contemplated, but should any changes be made in the lines not materially altering the amount or character of the trenching to be done, the CONTRACTOR shall proceed with the changed alignment. In case any change involves greater construction difficulties than the original alignment, the OWNER and the ENGINEER shall

agree with the CONTRACTOR for extra compensation thereof, prior to the construction of the changed line or lines.

- C. The width of the trench shall be as shown on the drawings.
- D. Trenches for sanitary sewer lines shall be of such depth so that the pipe may be laid at the invert elevation shown on the plans and/or established by the grade stakes set by the CONTRACTOR. Horizontal and vertical control points shall be furnished by OWNER.
- E. The excavation shall not advance more than 300 ft. ahead of the completed backfilled line. Pipe shall be laid in all trenches that have been opened at the end of each day's work unless the CONTRACTOR secures written permission to do otherwise from the ENGINEER.
- F. If the bottom of the trench becomes an unstable foundation for the pipe through the neglect of the CONTRACTOR to adequately shore or dewater the trench, the CONTRACTOR shall be required to remove the unstable material and backfill the trench to the proper grade with approved compacted gravel, and no extra compensation shall be granted for this material or work.
- G. Also, if the trench is inadvertently excavated deeper than necessary, it shall be backfilled to the proper grade with approved compacted gravel at the CONTRACTOR'S expense.
- H. However, if the undisturbed material encountered at the grade depth constitutes, in the opinion of the ENGINEER, an unstable foundation for the pipe, the CONTRACTOR shall be required to remove such unstable material and backfill the trench to the proper grade with approved compacted gravel. Compensation shall be made to the CONTRACTOR in accordance with the unit price bid for extra granular embedment or backfill.
- I. The CONTRACTOR shall remove any water which collects in the trenches while sewer pipes are being laid. In no case shall water be allowed to run over the invert or foundation or through the sewer without permission from the ENGINEER. Water encountered shall be disposed of by the CONTRACTOR in a manner satisfactory to the ENGINEER.
- J. The bottoms of the trenches for all sewers shall be carefully and truly graded, formed, and lined according to the grades and dimensions furnished by the ENGINEER. They shall be approved by the ENGINEER before any sewer pipe is laid therein. Bell holes shall be excavated by hand.
- K. The CONTRACTOR shall excavate all trenches, including work necessary in working around existing pipelines or other obstructions. The CONTRACTOR shall give notice to the Owners of any such lines or obstructions in order that they may have time to take the necessary precautions for protecting their property. The CONTRACTOR shall be responsible for protecting the OWNER from any damage from his operations in such work.
- L. In rock, excavation shall be carried 3 in. below the bottom of the pipe, and loose earth or gravel, thoroughly tamped, shall be used for backfilling to the grade of the bottom of the pipeline.
- M. After inspection of pipelines has been finished on any completed portion of the work, the trench may be backfilled. Backfilling shall be accomplished in compliance with the applicable portions of these specifications.

3.04 PUMPING, BAILING AND DRAINING

- A. The CONTRACTOR shall immediately remove all surface or seepage water from sewers, drains, ditches, and other sources which may accumulate during the excavation and construction work by providing the necessary underdrains or otherwise and by doing the necessary pumping, bailing, or draining. The CONTRACTOR shall have available at all times sufficient equipment in proper working order for doing the work herein required. All water removed from excavations shall be disposed of in an approved manner to not create unsanitary conditions nor to interfere unduly with the use of streets, private driveways, or entrances. Pumping, bailing, draining, underdrains, ditches, etc., shall be considered as incidental work and will not be paid for as separate items, but their cost shall be included in the contract prices bid in the Proposal for the various units of excavation measure.

3.05 SUPPORT OF EXISTING PIPES ACROSS TRENCH

- A. It shall be the responsibility of the CONTRACTOR to protect and support all water, gas, and other conduits crossed by the excavation or work to be performed by him or to arrange for their temporary removal and subsequent replacement. All expense incidental to this phase of the work shall be borne by the CONTRACTOR.

3.06 DISPOSAL OF EXCAVATED MATERIALS

- A. Excavated materials, so far as needed and of a suitable character, shall be piled adjacent to the work to be used for backfilling as required. Excavated materials unsuitable for the backfilling or more than that required for backfilling shall be disposed of in an approved manner at locations designated on the plans or approved by the ENGINEER. Desirable topsoil, sod, etc., shall be carefully piled separately and replaced in its original position when required. Excavated materials shall be always handled in such a manner as to cause a minimum of inconvenience to public travel and to permit safe and convenient access to private and public property adjacent to or along the line of the work. In parkways and easements where it is necessary to deposit excavated materials on lawns during the work, burlap or canvas shall be placed on the lawn to prevent contact between excavated materials and the lawn.

3.07 PROTECTION OF TREES, PLANTS, SHRUBBERY, ETC.

- A. Where trees, plants, shrubbery, etc., are adjacent to the line of the work and are not to be removed or are to be removed and replaced, the CONTRACTOR shall protect such trees, plants, shrubbery, etc., by substantial wooden boxes and guards and shall not permit machinery or employees to scrape, tear the limbs from, damage or attach guy cables to them and if, in the opinion of the ENGINEER, such trees, plants, shrubbery, etc., would be damaged by machinery, etc., hand excavation may be required. The CONTRACTOR shall be responsible for all damages to adjacent trees, plants, shrubbery, etc.

3.08 USE OF EXPLOSIVES

- A. The use of explosives on this project is strictly prohibited.

3.09 TUNNELING AND CASING

- A. Tunneling under highways, streets, or railroads shall be accomplished by means of jacking, boring or tunneling equipment which has been approved by the ENGINEER prior to starting tunneling operations. Tunnels shall be backfilled as completely as practicable with selected

materials and compacted by means of mechanical tampers. The remainder of the tunnel backfill shall be of coarse sand, gravel, or crushed rock hydraulically placed in such manner that no voids remain between the backfilled material and the roof of the tunnel.

3.10 PROTECTION OF BUILDINGS

- A. The CONTRACTOR shall, at his own expense, shore up and otherwise protect any building or other structure which may, in the opinion of the ENGINEER, be endangered during the work, and he shall restore all buildings, culverts, fences, walls, or other properties disturbed during his work to a condition similar or equal to that existing before his operations.
- B. The CONTRACTOR shall be responsible for any injuries to persons and property, for all damages to any pipe, conduit, sewer, or other structures injuriously affected by the work. The OWNER shall not be liable, therefore.

3.11 CROSSING TO BE KEPT OPEN

- A. At such streets, railroad, and all other crossings as may be designated by the ENGINEER, the trenches are to be filled in such a manner as to prevent interruption of traffic upon the roadway or sidewalks. The cost thereof shall be borne by the CONTRACTOR.

3.12 PROTECTION OF UNFINISHED WORK

- A. Before leaving work for the night, during a storm, or at other times, care must be taken to protect and securely close the unfinished end of the pipe. Any earth or other materials that may find entrance into the pipe through any such open or unplugged end of the pipe must be removed at the CONTRACTOR'S expense.

3.13 LIGHTS AND GUARDS

- A. The CONTRACTOR must provide and maintain adequate detours around the work under construction. The CONTRACTOR must provide lights, warning signs, and watchmen to try to provide for the safety of the public.

3.14 BACKFILL

- A. Excavation shall be backfilled only with approved materials. The placing of backfill material shall not begin until approval has been given by the ENGINEER and shall be done immediately when so ordered by the ENGINEER.
- B. Backfilling shall be brought up to an elevation slightly above the original ground level to allow for subsequent settlement. The top surface or slopes of all backfill shall be neatly graded off in a workmanlike manner, and where select topsoil, sod, or other material is removed and piled separately, such material shall be carefully replaced in a manner satisfactory to the ENGINEER.

1. Backfill Material

- a. Unless otherwise noted on the drawings, backfilling shall be done with good sound earth. Broken concrete, rock, bituminous pavement, or other lumpy material shall not be used in the backfill except as the lumps are small and their dispersal in the backfill is made in the upper section in a manner satisfactory to the Engineer. Materials of a perishable, spongy, or otherwise improper nature shall not be used in backfilling. Pipe bedding and the initial backfill to a point 12" above the top of

the pipe shall be #57 crushed stone meeting ASTM C-33. Gravel cushion and/or granular backfill material will not be required when concrete encasement is specified or used around the pipe. No backfill shall be made until it is authorized by the Engineer. All debris shall be removed. Sheeting, shoring and bracing shall be pulled and removed during the progress of the backfilling in a manner satisfactory to the Engineer.

2. Concrete Encasement

- a. Concrete encasement, when required, shall be as shown in the plans as described in the specifications. Care must be exercised not to dislocate or disturb the grade or alignment of the pipe. Caution and care must be used not to float the pipe out of place. In the event pipes are floated out of proper position, they shall be removed and re-laid at the expense of the CONTRACTOR.

3. Pipe Bedding and Envelope Material

- a. The CONTRACTOR shall provide pipe bedding and envelope material as shown in the plans and as described in the specifications. The pipe shall be laid to grade, joints made and allowed to set, before the initial backfilling operation.
- b. Subgrades that have been allowed to become unstable by neglect of the CONTRACTOR by improper drainage or lack of drainage, and when in the opinion of the ENGINEER, the condition was caused by the neglect or fault of the CONTRACTOR, the ENGINEER shall order the CONTRACTOR to remove the unstable subgrade and repair or replace the same to the satisfaction of the ENGINEER and at the expense of the CONTRACTOR. No extra compensation shall be allowed.

3.15 PIPE LAYING

- A. This part shall include the furnishing of all labor and materials including pipe which shall meet the requirement of these specifications and shall be of dimensions and types at the locations and elevations shown on the plans or established by the ENGINEER. Connections between pipe joints shall be per manufacturer's recommendations.
- B. The construction of all sewers shall begin at the outlet or lower end, unless otherwise directed by the ENGINEER.
- C. Appurtenances shall be constructed as soon as the sewer of which they are a part is constructed to their locations. Upon request by the CONTRACTOR, the ENGINEER may permit postponement of the construction of manholes on sewers, and the CONTRACTOR shall, without additional cost to the OWNER, lay the pipe continuously through the manhole location.
- D. The construction of appurtenances in advance of the construction of the sewer line shall not be permitted.
- E. The appurtenances to sewers shall be constructed in accordance with the plans and these specifications. This work shall be done in such manner as not to damage any of the structure involved. No connecting sewer shall project beyond the inside surface of the sewers or appurtenances.

- F. The grade line shown on the profile is the elevation of the invert or flow line of the sewer. The CONTRACTOR shall establish the grade line in the trench or excavation from the grade stakes established by the ENGINEER. Sufficient batter-boards and a string line shall be erected all along the trench and the final grading done from this string line. Each joint of pipe shall be laid from this string line so that the pipe is laid true to grade. Pipe shall be laid in a straight line in the trench with no kinks or curves between manholes. The ENGINEER may require a string line in the bottom of the trench if this seems necessary to produce a good alignment of the sewer. The bottom of the trench shall be fine graded and bell holes provided such that the pipe will be supported on the entire length of the barrel.
- G. When construction is stopped temporarily and at the end of the day's work, tight fitting stoppers or bulkheads shall be securely placed in or across the ends of all pipes, such closures need not be watertight, but are to prevent trash and debris from entering the pipes. For all other structures, the CONTRACTOR shall make adequate provisions to prevent the entrance of trash and debris into the sewer.

3.16 PIPE FITTINGS

- A. All pipe fittings shall be placed in the trench by a derrick or rolled in with rope, and in no case shall the above materials be dumped into the trench. Before lowering and while suspended, the pipe shall be checked to detect flaws. All dirt and trash that may be in the barrel of the pipe shall be removed before the pipe is finally lowered into place in the trench.
- B. Connections between different types of pipe shall be accomplished by use of a rubber adapter ring such as manufactured by CAN-TEX, Dickey or an approved equal encased with concrete. The adapters furnished shall be either the insert type or the banded coupling type. The adapter and band material shall be of materials which will pass the strength and chemical requirements of the current A.S.T.M. Designation C 594, except for elongation. All banded couplings and adapters shall bear the manufacturer's identifying mark and size. Adapters as specified above shall also be used in connecting new ductile iron from lines to existing concrete lines of type and size shown on the plans.
- C. Every reasonable precaution shall be taken to insure the construction of an absolute watertight sewer line. In case of excessive infiltration repairs will be required of the CONTRACTOR to correct the defective joints.

3.17 FOR FINAL ACCEPTANCE

- A. The CONTRACTOR shall make a final cleanup of all parts of the work before final acceptance by the OWNER. This cleanup shall include, among other things, removal of all objectionable rocks, pieces of concrete, and other construction materials and in general preparing the site of the work in an orderly manner true to original grade and appearance.
- B. Disposal is not to be made on adjacent private or public property without written permission filed with the ENGINEER. If permission is granted by the property owners, the material so disposed of is to be leveled and left in a condition satisfactory to the ENGINEER.

3.18 INFILTRATION

- A. Tests for water tightness shall, when required by the ENGINEER, be made by the CONTRACTOR in the presence of the ENGINEER.

3.19 MAINTENANCE

- A. All sewers and sewer structures shall be thoroughly cleaned and maintained in a workable condition until final acceptance.

END OF SECTION

SECTION 02422

MANHOLES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This Section shall govern construction of manholes, complete in place, and the materials used therein, including excavation, installation, and backfilling. It shall also include furnishing and installing rings, covers, and appurtenances, as well as anything ancillary to completing the work.
- B. The CONTRACTOR shall submit descriptive information and evidence that the materials and equipment the CONTRACTOR proposes for incorporation in the Work are of the kind and quality that satisfies the specified functions and quality as specified or presented in the Drawings.
- C. All new and existing manholes shall receive internal concrete coatings per specification SECTION 09950 – INTERNAL STRUCTURE COATINGS.
- D. This project is funded through the Texas Water Development Board (TWDB) and shall include all requirements of the TWDB, including, but not limited to, the American Iron and Steel (AIS) requirements of 33 U.S.C. § 1388. The Contractor's bid costs shall reflect these requirements

1.02 RELATED WORK

- A. SECTION 09950 – INTERNAL STRUCTURE COATINGS.
- B. SECTION 03300 - CAST-IN-PLACE CONCRETE.

1.03 SUBMITTALS

- A. Conform to requirements of SECTION 01300 – SUBMITTALS.
- B. Submit manufacturer's data and details of following items for approval:
 1. Shop drawings of manhole sections, base units and construction details, including reinforcement, jointing methods, materials and dimensions.
 2. Summary of criteria used in manhole design including, as minimum, material properties, loadings, load combinations, and dimensions assumed. Include certification from manufacturer that precast manhole design is in full accordance with ASTM C 478 and design criteria as established in this Specification.
 3. Frames, grates, rings, and covers.
 4. Materials to be used for pipe connections at manhole walls.
 5. Materials to be used for stubs and stub plugs.
 6. Materials and procedures for corrosion-resistant liner and coatings.

7. Plugs to be used for sanitary sewer hydrostatic testing.
 8. Hydrostatic testing plan.
 9. Manufacturer's data for pre-mix (bag) concrete, if used for channel inverts and benches.
- C. Seal submittal drawings by Professional Engineer registered in State of Texas.
- D. Submittal of test records is required and shall include as a minimum the following items. The test records shall also be included as part of the Project records turned in with the acceptance package.
1. Name of the manhole manufacturer
 2. Interior surface coating type and application method for wastewater manholes
 3. Hydrostatic testing report
 4. Date tested/date re-tested
 5. Passed/failed and state what was done to correct the problem
 6. Test Method Used
 7. Location/station of manhole
 8. Precast/cast-in- place bottom
 9. Any repairs made to the joints
- E. One (1) electronic copy in Portable Document Format (PDF) of all submittals and re-submittals shall be submitted suitable for distribution over electronic mail or File Transfer Protocol (FTP). For final approved submittals provide PDF and two (2) hard copies.

PART 2 - PRODUCT

2.01 MATERIALS AND COMPONENTS

- A. Provide manhole sections, base sections, and related components conforming to ASTM C 478. Provide base lower section with integral floors, unless shown otherwise. Provide adjustment rings which are standard components of manufacturer of manhole sections. Mark date of manufacture and name or trademark of manufacturer on inside of barrel.
- B. Construct barrels for precast manholes from standard reinforced concrete manhole sections of diameter indicated on Drawings. Use various lengths of manhole sections in combination to provide correct height with fewest joints. Design wall sections for depth and loading conditions as detailed and specified. Base section shall have minimum thickness of 24 in. under invert.
- C. Provide tops to support the applicable portions of AASHTO M-306 and H-20 loading, and receive manhole frame & covers, as indicated on Drawings.
- D. Provide precast base sections with flat slab top precast sections used to transition to manhole access riser sections as shown in Drawings. Transition shall be concentric unless otherwise

shown on Drawings. Locate transition to provide minimum of 5-1/2 ft. head clearance from base to underside of transition unless otherwise approved by the ENGINEER.

- E. Design Loading Criteria: Manhole walls, transition slabs, cone tops, and manhole base slab shall be designed, by manufacturer, to requirements of ASTM C 478 for depth as shown on Drawings and to resist following loads.
 - 1. AASHTO M-306 and H-20 loading, applied to manhole cover and transmitted down to transition and base slabs.
 - 2. Unit soil weight of 120 pcf located above portions of manhole, including base slab projections.
 - 3. Lateral soil pressure based on saturated soil conditions producing an at-rest equivalent fluid pressure of 100 pcf.
 - 4. Internal liquid pressure based on unit weight of 63 pcf.
 - 5. Dead load of manhole sections fully supported by transition and base slabs.
- F. Design: Manhole walls, transition slabs, cone tops, and manhole base slab shall be designed according to requirements of ASTM C 478 and following:
 - 1. Design additional reinforcing steel to transfer stresses at openings. Area of steel to be no less than shown on Drawings.
 - 2. Wall Loading Conditions
 - a. Saturated soil pressure acting on empty manhole.
 - b. Manhole filled with liquid to a halfway depth as measured from invert to cover, with no balancing external soil pressure.
- G. Provide joints between sections with o-ring gaskets conforming to ASTM C 443.
- H. When base is cast monolithic with portion of vertical section, extend reinforcing in vertical section into base.
- I. Precast Concrete Base: Provide suitable cutouts or holes to receive pipe and connections.
- J. Cast-In-Place Concrete Bases
 - 1. Channel Inverts: Use five (5) sack premix (bag) concrete or Class A concrete for inverts not integrally formed with manhole base, with minimum compressive strength of 4,000 psi.
 - 2. Concrete Foundation: Provide Class A concrete with minimum compressive strength of 4,000 psi for concrete foundation slab under manhole base section where indicated on Drawings.
- K. Cast-in-place reinforcement steel shall conform to the Drawing Details.

L. Rings and covers shall conform to the requirements of the Drawing Details. All openings shall be 32 in. clear openings. Manholes located within the 100-year FEMA Flood Plain shall be bolted (stainless steel bolts) and gasketed.

M. Precast Base Sections, Riser Sections, and Cones

1. Precast concrete base sections, riser sections, and cones shall conform to the requirements of ASTM C 478. The width of the invert shall be specifically sized for the connecting pipes. Inverts shall be "U" shaped with a minimum depth as follows:

Largest Pipe Size	Invert Channel Depth at Bench
< 15"	Equal to at least half of the largest pipe diameter.
15" to 24"	Equal to at least three-fourths of the largest pipe diameter.
> 24"	Equal to at least the largest pipe diameter.

2. Joints for wastewater base sections, riser sections, and cones shall conform to the requirements of ASTM C 443. Precast bases shall have performed inverts. Inserts acceptable to the ENGINEER or designated representative shall be embedded in the concrete wall of the manhole sections to facilitate handling; however, through-wall holes for lifting will not be permitted. Any voids between the pipe and boot shall be filled to the springline with a product recommended by the manhole manufacturer to prevent solids collection.

N. Pipe-to-Manhole Assemblies

1. Precast bases shall have flexible, resilient, and non-corrosive boot connectors as shown on the Drawings.

O. Precast Grade Rings

1. Rings shall be reinforced Class A concrete. This adjustment ring shall be used for all new manhole construction with 32 in. lids. Inside to outside diameter dimension of ring shall be 6 in. with a thickness of suitable for grade adjustment.

P. Final Adjustment to Grade

1. Final adjustment to grade shall be per Drawing Details. For new manhole construction, the maximum vertical allowable ring adjustment, including the depth of the ring casting, shall be limited to 12 in.

Q. Waterproofing Joint Materials

1. O-rings and wedge seals for the joints of all wastewater manholes, when indicated on the Drawings, shall conform to the requirements of ASTM C443. The connections between reinforced concrete wastewater manhole structures and pipes shall meet the requirements of ASTM C923.

R. All manholes shall have an interior coating with a 100-mil epoxy coating, Raven 405 or equal. Storm sewer manholes shall not be internally coated.

PART 3 - EXECUTION

3.01 CONSTRUCTION

- A. Manholes shall be founded at the established elevations shown on the Drawings. All manhole foundations shall be over-excavated a minimum of 24 in. and backfilled with aggregate material shown on the Drawings.
- B. Cast-in-place foundations shall have a minimum depth of 12 in. at the invert flowline. The widths of all manhole inverts shall be specifically sized for the connecting pipes. Inverts shall be "U" shaped. The lowermost riser section may be set in the Portland cement concrete, while still green, after which the foundation shall be cured a minimum of 24-hours prior to proceeding with construction of the manhole up to 12 ft. in depth. The foundation shall be cured an additional 24-hours prior to continuing construction above the 12 ft. level. Manhole depth shall be measured from the invert flowline to the finish surface elevation.
- C. Wastewater lines, except reinforced concrete pipe, set in cast-in-place foundations, shall require a waterstop seal or gasket acceptable to the ENGINEER or designated representative around the outside perimeter of the pipe. It shall be approximately centered under the manhole section wall.
- D. Cast-in-place manhole foundations, junction boxes and flat-slab transitions shall be reinforced, Class A concrete (Reference SECTION 03300 - CAST-IN-PLACE CONCRETE).
- E. Backfilling for manholes shall conform to the Drawings.
- F. After rings and covers are set to grade, the inside and outside of the concrete rings shall be wiped with mortar so placed as to form a durable water-tight joint smooth and even with the manhole cone section. No grouting shall be performed when the atmospheric temperature is at or below 40°F (50°C), and when necessary, because of a sudden drop in temperature, joints shall be protected against freezing for at least 24-hours.

3.02 ACCEPTANCE TESTING OF WASTEWATER MANHOLES

- A. Manholes shall be tested separately and independently of the wastewater lines. All testing shall meet the requirements of TCEQ.
- B. Hydrostatic Exfiltration Testing
 - 1. All backfilling and compaction shall be completed prior to the commencement of testing. The procedures for the test shall include the following:
 - a. Manhole section interiors shall be carefully inspected; units found to have through-wall lift holes, or any penetration of the interior surface by inserts provided to facilitate handling, will not be accepted. Coating shall be applied after the testing unless coating is applied before field assembly, or at the factory. All lift holes and exterior joints shall be plugged with an acceptable non-shrink grout. No grout shall be placed in horizontal joints.
 - b. After cleaning the interior surface of the manhole, the CONTRACTOR shall place and inflate pneumatic plugs in all of the connecting pipes to isolate the manhole; sealing pressure within the plugs shall be as recommended by the plug manufacturer.

- c. Concrete manholes shall be filled with water or otherwise thoroughly wetted for a period of 24-hours prior to testing.
- d. At the start of the test, the manhole shall be filled to the top with water. The test time shall be one hour (60 minutes). The Construction Inspector must be present for observation during the entire time of the test. Permissible loss of water in the one (1) hour test time is 0.025 gallons per diameter foot, per foot of manhole depth.

C. Failure to Pass the Test - Records of Tests

1. If the manhole fails to pass the initial test method as described, the CONTRACTOR shall locate the leak, if necessary, by disassembly of the manhole. The CONTRACTOR shall check the gaskets and replace them if necessary. The CONTRACTOR may re-lubricate the joints and re-assemble the manhole, or the CONTRACTOR may install an acceptable exterior joint sealing product on all joints and then retest the manhole. If any manhole fails the exfiltration test twice, the CONTRACTOR shall consider replacing that manhole. If the CONTRACTOR chooses to attempt to repair that manhole, the manhole must be retested until it passes. In no case shall cold applied preformed plastic gaskets be used for repair. Records of all manhole testing shall be made available to the ENGINEER or designated representative at the close of each working day, or as otherwise directed by the ENGINEER or designated representative. Any damaged or visually defective products, or any products out of acceptable tolerance shall be removed from the site.

D. Inspection

1. The ENGINEER or designated representative shall make a visual inspection of each manhole after it has passed the testing requirements and is considered to be in its final condition. The inspection shall determine the completeness of the manhole; any defects shall be corrected to the satisfaction of ENGINEER or designated representative.

END OF SECTION

SECTION 02511
HOT MIX ASPHALT PAVING

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes hot-mix asphalt paving, patching, and paving overlay.
- B. Requirements of the Geotechnical reports, project drawings and other specifications shall govern over the requirements in this specification.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
- B. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
- C. Material certificates.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer shall be registered with and approved by authorities having jurisdiction or TxDOT.
- B. Regulatory Requirements: Comply with TxDOT's Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges (Standard Specifications) for asphalt paving work.
- C. Asphalt-Paving Publication: Comply with AI MS-22, "Construction of Hot Mix Asphalt Pavements," unless more stringent requirements are indicated.

1.04 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:
 1. Tack Coat: Minimum surface temperature of 60 deg F.
 2. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
 3. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

PART 2 - PRODUCTS

2.01 AGGREGATES

- A. Coarse Aggregate: Coarse aggregate stockpiles must have no more than 20% material passing the No. 8 sieve. Aggregates from sources listed in TxDOT's Bituminous Rated Source Quality

Catalog (BRSQC) are preapproved for use. Use only the rated values for hot-mix listed in the BRSQC. Rated values for surface treatment (ST) do not apply to coarse aggregate sources used in hot-mix asphalt. For sources not listed on TxDOT's BRSQC:

1. Build an individual stockpile for each material;
 2. Request TxDOT test the stockpile for specification compliance; and
 3. Once approved, do not add material to the stockpile unless otherwise approved.
- B. Provide aggregate from non-listed sources only when tested by the Engineer and approved before use. Allow 30 calendar days for the ENGINEER to sample, test, and report results for non-listed sources. Provide coarse aggregate with at least the minimum SAC shown on the plans. SAC requirements only apply to aggregates used on the surface of travel lanes. SAC requirements apply to aggregates used on surfaces other than travel lanes when shown on the plans. The SAC for sources on TxDOT's Aggregate Quality Monitoring Program (AQMP) (Tex-499-A) is listed in the BRSQC.
- C. Fine Aggregate: Fine aggregates consist of manufactured sands, screenings, and field sands. Fine aggregate stockpiles must meet the gradation requirements in Table 2. Supply fine aggregates that are free from organic impurities. The Engineer may test the fine aggregate in accordance with Tex-408-A to verify the material is free from organic impurities. No more than 15% of the total aggregate may be field sand or other uncrushed fine aggregate. Use fine aggregate, with the exception of field sand, from coarse aggregate sources that meet the requirements shown in Table 1 unless otherwise approved. Test the stockpile if 10% or more of the stockpile is retained on the No. 4 sieve and verify that it meets the requirements in Table 1 for crushed face count (Tex-460-A) and flat and elongated particles (Tex-280-F).

Table 1
Aggregate Quality Requirements

Property	Test Method	Requirement
Coarse Aggregate		
SAC	Tex-499-A (AQMP)	As shown on the plans
Deleterious material, %, Max	Tex-217-F, Part I	1.5
Decantation, %, Max	Tex-217-F, Part II	1.5
Micro-Deval abrasion, %	Tex-461-A	Note ¹
Los Angeles abrasion, %, Max	Tex-410-A	40
Magnesium sulfate soundness, 5 cycles, %, Max	Tex-411-A	30 ²
Crushed face count, ³ %, Max	Tex-460-A, Part I	85
Flat and elongated particles @ 5:1, %, Max	Tex-280-F	10
Fine Aggregate		
Linear Shrinkage % Max	Tex-107-E	3
Combined Aggregate⁴		
Sand equivalent, %, Min	Tex-203-F	45

1. Not used for acceptance purposes. Used by the Engineer as an indicator of the need for further investigation.
2. Unless otherwise shown on the plans.
3. Only applies to crushed gravel.
4. Aggregates, without mineral filler or additives, combined as used in the job-mix formula (JMF).

Table 2
Gradation Requirements for Fine Aggregate

Sieve Size	% Passing by Weight or Volume
3/8"	100
#8	70-100
#200	0-15

- D. Mineral Filler: Mineral filler consists of finely divided mineral matter such as agricultural lime, crusher fines, hydrated lime, or fly ash. Mineral filler is allowed unless otherwise shown on the plans. Use no more than 2% hydrated lime or fly ash unless otherwise shown on the plans. The plans may require or disallow specific mineral fillers. Provide mineral filler, when used, that:
1. Is sufficiently dry, free-flowing, and free from clumps and foreign matter as determined by the Engineer;
 2. Does not exceed 3% linear shrinkage when tested in accordance with Tex-107-E; and
 3. Meets the gradation requirements in Table 3.

Table 3
Gradation Requirements for Mineral Filler

Sieve Size	% Passing by Weight or Volume
#8	100
#200	55-100

2.02 ASPHALT MATERIALS

- A. Asphalt Binder: Per TxDOT Standard Specification Item 300 "Asphalts Oils, and Emissions."
- B. Tack Coat: Furnish CSS-1H, SS-1H, or a performance-graded (PG) binder with a minimum high temperature grade of PG 58 for tack coat in accordance with Item 300, "Asphalts, Oils, and Emulsions." Specialized or preferred tack coat materials may be allowed or required when shown on the plans. Do not dilute emulsified asphalts at the terminal, in the field, or at any other location before use. OWNER may sample the tack coat to verify specification compliance.

2.03 AUXILIARY MATERIALS

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

2.04 MIXES

- A. Design Requirements: Use the typical weight design example given in Tex-204-F, Part I to design a paving mixture that consists of a uniform mixture of aggregate, asphalt material, primer, additives, and water, if allowed, which meets the requirements shown in Tables 4 and 5, unless otherwise shown on the plans. Ensure that the mixture leaves the plant in a workable condition. Provide materials that remain workable in a stockpile for at least 6 months. Submit a

new mixture design at any time during the project. The Engineer must approve all mixture designs before the CONTRACTOR can begin production.

- B. Job-Mix Formula Approval: The job-mix formula (JMF) is the combined aggregate gradation and target asphalt percentage used to establish target values for mixture production. JMF1 is the original laboratory mixture design used to produce the trial batch. The Engineer will verify JMF1 based on plant-produced mixture from the trial batch unless otherwise approved. The Engineer may accept an existing mixture design previously used on a Department project and may waive the trial batch to verify JMF1. Provide the Engineer with split samples of the mixtures and blank samples used to determine the ignition oven correction factors. The Engineer will determine the aggregate and asphalt correction factors from the ignition oven using Tex-236-F.

Table 4
Master Gradation Limits (%Passing by Weight or Volume) and VMA Requirements

Sieve Size	A Base Course	B Fine Course	C Coarse Surface	D Fine Surface	F Fine Mixture
2"	100.0 ¹				
1 1/2"	98-100	100.0 ¹			
1"	78-94	98-100	100.0 ¹		
3/4"	64-85	84-98	95-100	100.0 ¹	
1/2"	50-70			98-100	100.0 ¹
3/8"		60-80	70-85	85-100	98-100
#4	30-50	40-60	43-63	50-70	70-90
#8	22-36	29-43	32-44	35-46	38-48
#30	8-23	13-28	14-28	15-29	12-27
#50	3-19	6-20	7-21	7-20	6-19
#200	2-7	2-7	2-7	2-7	2-7
Design VMA, ² % Minimum					
	12.0	13.0	14.0	15.0	16.0
Production (Plant Produced) VMA, ² % Minimum					
	11.5	12.5	13.5	14.5	15.5

1. Not used for acceptance purposes. Used by the Engineer as an indicator of the need for further investigation.
2. Unless otherwise shown on the plans.

Table 5
Laboratory Mixture Design Properties

Property	Test Method	Requirement
Target laboratory-molded density, % ¹	Tex-207-F	92.5 +- 1.5
Hveem stability, Min	Tex-208-F	35
Hydrocarbon-volatile content, %, Max	Tex-213-F	0.6
Moisture content, %, Max ²	Tex-212-F	1.0
Boil test, %, Max ³	Tex-530-C	10

1. Unless otherwise shown on the plans.
2. Unless otherwise approved
3. Limit may be increased or eliminated when approved.

PART 3 - EXECUTION

3.01 COLD MILLING

- A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.
 - 1. Mill to a depth of 2 inches.

3.02 PATCHING

- A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompat existing unbound-aggregate base course to form new subgrade.
- B. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd.
- C. Patching: Fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact flush with adjacent surface.

3.03 SURFACE PREPARATION

- A. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.
- B. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
 - 1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.
- C. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
- D. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.04 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 - 1. Spread mix at minimum temperature of 250 deg F.

2. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.05 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.
 1. Complete compaction before mix temperature cools to 185 deg F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
 1. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- F. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.06 INSTALLATION TOLERANCES

- A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 1. Base Course: Plus or minus 1/2 inch.
 2. Surface Course: Plus 1/4 inch, no minus.
- B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
 1. Base Course: 1/4 inch.

2. Surface Course: 1/8 inch.
3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.07 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.
- B. Additional testing and inspecting, at CONTRACTOR's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- C. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.08 DISPOSAL

- A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

END OF SECTION

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SECTION 02612
REINFORCED CONCRETE PIPE

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals necessary to install and test reinforced concrete pipe and fittings for sewers complete as shown on the Drawings and as specified herein.
- B. All pipe shall be manufactured for this project and no pipe shall be furnished from stock.
- C. This project is funded through the Texas Water Development Board (TWDB) and shall include all requirements of the TWDB, including, but not limited to, the American Iron and Steel (AIS) requirements of 33 U.S.C. § 1388. The Contractor's bid costs shall reflect these requirements.

1.02 SUBMITTALS

- A. Submit to the OWNER'S Representative, within thirty (30) days of the Effective Date of the Agreement, the name of the pipe and fitting suppliers and a list of materials to be furnished.
- B. Submit to the OWNER'S Representative, as provided in SECTION 01300 - SUBMITTALS, shop drawings showing layout and details of reinforcement, joint, method of manufacture and installation of pipe, specials and fittings and a schedule of pipe lengths (including the length of individual pipes by diameter) for the entire job.
- C. Prior to each shipment of pipe, submit certified test reports that the pipe for this Contract was manufactured and tested in accordance with the ASTM and AWWA Standards specified herein.
- D. One (1) electronic copy in Portable Document Format (PDF) of all submittals and re-submittals shall be submitted suitable for distribution over electronic mail or File Transfer Protocol (FTP). For final approved submittals provide PDF and two (2) hard copies.

1.03 QUALITY ASSURANCE

- A. The manufacturer shall be responsible for the performance of all acceptance tests as specified in Paragraph 5.1.2 of ASTM C76. In addition, all reinforced concrete pipe to be installed under this Contract may be inspected at the plant for compliance with these Specifications by an independent testing laboratory provided by CONTRACTOR and approve by the OWNER and ENGINEER. The manufacturer's cooperation in these inspections shall be required. The cost of inspection of all pipe approved for this Contract, plus the cost of inspection of a reasonable amount of disapproved pipe will be borne by the CONTRACTOR.
- B. Inspection of the pipe will also be made by the OWNER'S Representative after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the Specification requirements, even though pipes may have been accepted as satisfactory at the place of manufacture. Pipe rejected after delivery shall be marked for identification and shall immediately be removed from the job.

1.04 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM C33 - Standard Specification for Concrete Aggregates.
 - 2. ASTM C76- Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewers Pipes.
 - 3. ASTM C150 - Standard Specification for Portland Cement.
 - 4. ASTM C443 - Standard Specification for Circular Concrete Sewer and Culver Pipe, Using Rubber Gaskets.
 - 5. ASTM E329- Standard Practice for Use in the Evaluation of Testing and Inspection Agencies as Used in Construction.
- B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

PART 2 - PRODUCTS

2.01 REINFORCED CONCRETE PIPE

- A. Except as otherwise specified herein, pipe shall conform to ASTM C76, Class III, Wall B. The pipe interior shall be smooth and even, free from roughness, projections, indentations, offsets, or irregularities of any kind. The concrete mass shall be dense and uniform.
- B. Non-air-entraining Portland cement conforming to ASTM C150, Type II shall be used. The use of a non-bleeding, water-reducing, dispersing agent may be permitted subject to the specific approval of the OWNER'S Representative. The use of any other admixture will not be permitted.
- C. Fine aggregate shall consist of washed inert natural sand conforming to the requirements of ASTM C33, except for gradation, with a maximum loss of 8 percent when subjected to five (5) cycles of the soundness test using magnesium sulfate. Coarse aggregate shall consist of well-graded crushed stone or washed gravel conforming to the requirements of ASTM C33, except for gradation, with a maximum loss of 8 percent when subjected to five (5) cycles of the soundness test using magnesium sulfate. Documentation that the aggregates to be used in the manufacture of reinforced concrete pipe meet these requirements shall be submitted to the OWNER'S Representative as stated in Paragraph 1.04 above.
- D. The twenty-eight (28) days compressive strength of the concrete, as indicated by cores cut from the pipe shall be not less than 6,000 psi. The concrete mass shall be dense and uniform. The average absorption shall not exceed 5.5 percent of the dry weight and no specimen shall exceed 6.0 percent. Reinforcement shall be circular for all concrete pipe. Quadrant steel shall not be used. Reinforcement shall be installed in both the bell and the spigot. At least one circumferential reinforcement wire shall be in both the bell and spigot area and reinforcement in the bell and spigot shall be adequate to prevent damage to concrete during shipping, handling and after installation. Cores indicating reinforcing steel having less than 85 percent bond shall be cause for rejection of the lot of pipes.
- E. Pipe may be rejected for any of the following reasons:

1. Exposure of any wires, positioning spacers or chairs used to hold the reinforcement case in position, or steel reinforcement in any surface of the pipe, except for ends of longitudinal reinforcing.
2. Transverse reinforcing steel found to be in excess of 1/4 in. out of specified position after the pipe is molded.
3. Any shattering or flaking of concrete at a crack.
4. Voids, with the exception of a few minor bugholes, on the interior and exterior surfaces of the pipe exceeding 1/4 in. depth unless properly and soundly pointed with mortar or other approved material.
5. Unauthorized application of any wash coat of cement or grout.
6. A deficiency greater than 114 in. from the specified wall thickness of pipe 30 in. or smaller in internal diameter.
7. A deficiency greater than 6 percent from the specified wall thickness of pipe larger than 30 in. in internal diameter, except that the deficiency may be 8 percent adjacent to the longitudinal form joint, provided that the additional deficiency does not lie closer than 20 percent of the internal diameter of the pipe. The deficiencies in wall thickness permitted herein do not apply to gasket contact surfaces in gasketed joint pipe.
8. A variation from the specified internal diameter in excess of 1 percent, or interior surfaces which have been reworked after placing of concrete. The variation in internal diameter permitted herein does not apply to gasket contact surface in gasketed joint pipe.
9. A hollow spot (identified by tapping the internal surface of the pipe) which is greater than 30 in. length or wider than three (3) times the specified wall thickness. Repair of such defective areas not exceeding these limitations may be made as specified in Paragraph 2.01, R.
10. Defects that indicate imperfect molding of concrete; or any surface defect indicating honeycomb or open texture (rock pockets) greater in size than area equal to a square with a side dimension of twenty-two (22) times the wall thickness or deeper than two times the maximum graded aggregate size; or local deficiency of cement resulting in loosely bonded concrete, the area of which exceeds in size the limits of area described in Paragraph 2.01, E9 above when the defective concrete is removed. Repair of such defects not exceeding these limits may be made as specified in Paragraph 2.01, R.
11. Any of the following cracks:
 - a. A crack having a width of 0.005 in. to 0.01 in. throughout a continuous length of 36 in. or more.
 - b. A crack having a width of 0.01 in. to 0.03 in. or more throughout a continuous length of 1 ft. or more.
 - c. Any crack greater than 0.005 in. extending through the wall of the pipe and having a length in excess of the wall thickness.

- d. Any crack showing two visible lines of separation for a continuous length of 2 ft. or more, or an interrupted length of 3 ft. or more anywhere in evidence, both inside and outside.
 - e. Cracks anywhere greater than 0.03 in. width.
- F. The pipe shall be clearly marked as required by ASTM C76 in a manner acceptable to the OWNER'S Representative. The markings may be at either end of the pipe for the convenience of the manufacturer, but for any one size shall always be at the same end of each pipe length. Pipe shall not be shipped until the compressive strength of the concrete has attained 4,000 psi and not before five (5) days after manufacture and/or repair, whichever is the longer.
- G. Pipe shall have a minimum laying length of approximately 8 ft., except for closure and other special pieces as approved by the OWNER'S Representative. Have available at the site of the work sufficient pipe of various lengths to affect closure at manholes or structures that cannot be located to accommodate standard lengths. Short lengths of pipe made for closure etc. may be used in the pipeline at the end of construction if properly spaced. The length of the incoming and outgoing concrete pipe at each structure shall not exceed 4 ft., except where the joint is cast flush with the exterior wall of the structure, where steel wall fittings are provided or where otherwise noted on the Drawings. Maximum laying length shall not exceed 16 ft., but the installation of 16 ft. lengths will depend upon the ability to handle such lengths of pipe in sheeted trenches, comply with trench width requirements, maintain the integrity of the sheeting and avoid disturbance to adjacent ground. If in the opinion of the OWNER'S Representative the use of 16 ft. lengths is impracticable, shorter lengths shall be used.
- H. After manufacture, each length of pipe shall be checked against the length noted on the shop drawings. Pipe more than 12 in. longer than that shown on the shop drawings shall not be used on this project. Variations in length of the same pipe shall not exceed ASTM C76 requirements.
- I. During manufacturing, measuring devices shall be used to assure joint assembly is within the tolerance of ASTM C76 and these Specifications.
- J. The OWNER'S Representative shall have the right to cut cores from such pieces of the finished pipe as he/she desires for such inspection and tests as he/she may wish to apply. Holes left by the removal of cores shall be filled in an approved manner by and at the expense of the CONTRACTOR. Core drilling shall be carried out by the pipe manufacturer at his/her expense.
- K. The OWNER'S Representative shall also have the right to take samples of the concrete after it has been mixed, or as it is being placed in the forms or molds and to make such inspection and tests thereof as he/she may wish.
- L. At the start of the work, a set of test cylinders shall be taken each day on which pipe is manufactured for the project or more often if required. This may ultimately be reduced to one set of three specimens for every 50 cu. yds. of concrete placed, if the uniformity of results warrants and if approved by the OWNER'S Representative. At the start of the work, a relationship shall be established between ultimate strength of test cylinders stored in a standard manner as compared to cylinders steam cured with the pipe and as compared to cores taken from the corresponding finished pipe. At least five (5) sets of tests shall be made.
- M. Test cores may be taken for every 500 linear feet of pipe manufactured, but not less than once each day on which pipe is manufactured for the project. Cores may be reduced to one set of two per week (or possibly fewer, but not less than one set for every 1,500 linear feet), if a

satisfactory relationship is established between cores and cylinders made and cured in the standard manner. This relationship shall not vary by more than 10 percent more or less from the average ratio. Cores may be drilled in any manner which will provide a smooth core face. All pipe cylinders and cores shall be 4 in. diameter. Cores shall be carefully saw-trimmed and capped in a vertical position with a sulfur cap of minimum thickness, at least one day before being tested.

- N. Core testing shall conform to Standard ASTM Methods.
- O. At the time of inspection, the pipe will be carefully examined for compliance with the appropriate ASTM and project specifications and shop drawings. All pipes shall be inspected for general appearance, dimension, "scratch-strength," blisters, cracks, roughness, soundness, etc. All pipes will be checked for soundness by being tapped and scratched over a reasonable portion of the area, at least once on every 50 sq. in. of pipe surface. The surface shall be dense and close-textured. Cores also shall serve as a basis for rejection of pipe, particularly if lamination or poor bond of reinforcement is apparent.
- P. The manufacturer shall use measuring devices to assure joint assembly is within tolerances of ASTM C76 and these Specifications. If, during construction, the pipes cannot be satisfactorily joined, the manufacturer shall pre-join the pipe at the plant.
- Q. Unsatisfactory or damaged pipe will be either permanently rejected or returned for minor repairs. Only that pipe actually conforming to the specifications and accepted will be listed for approval, shipment, and payment. Approved pipe will be so stamped or stenciled on the inside before it is shipped. All pipe which has been damaged after delivery will be rejected and if such pipe already has been laid in the trench, it shall be acceptably repaired, if permitted, or removed and replaced, entirely at the CONTRACTOR'S expense.
- R. Pits, blisters, rough spots, breakage, and other imperfections may be repaired, subject to the approval of the OWNER'S Representative, after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final approval. Non-shrink cement mortar used for repairs shall have a minimum compressive strength of 6,000 psi at the end of seven (7) days and 7,000 psi at the end of twenty-eight (28) days, when tested in 3 in. cylinders stored in the standard manner. Epoxy mortar may be utilized for repairs subject to the approval of the OWNER'S Representative.

2.02 JOINTS FOR CONCRETE PIPE

- A. Joints shall be the bell and spigot type of joint with provisions for using a round rubber "O-Ring" gasket in a recess in the spigot end of the pipe. The bevel on the bell of the pipe shall be between 12 degrees and 22 degrees. The diameters of the joint surfaces which compress the gasket shall not vary from the true diameters by more than 1/16 in.
- B. The round rubber "O-Ring" gaskets shall conform to ASTM C443 except as otherwise specified herein. Two gaskets shall be submitted to the OWNER'S Representative for tests at least thirty (30) days before joining any the pipe.
- C. Specimens shall be heated in a dry oven to 150EF for six (6) hours duration and five specimens shall be tested by immersion, one each as follows:
 1. Two (2) hours immersion in petroleum ether:

- a. Seventy-two (72) hours immersion in saturated Hydrogen Sulfide solution.
 - b. Seventy-two (72) hours immersion in 1 percent NaOH solution.
 - c. Seventy-two (72) hours immersion in standard soap solution (80 percent alcohol).
 - d. Seventy-two (72) hours immersion in 10 percent NaCl solution.
 2. The specimens shall show no detrimental change in color, texture, or feeling upon completion of the above tests. Specimens of the gaskets shall be subjected to tensile tests of approximately 100 psi before and after immersion and heating tests and shall show an elongation of at least 25 percent. Upon release from the tensile tests, each specimen shall return to its original length. The manufacturer shall supply test data and affidavits showing compliance with these requirements. Tests shall have been conducted within six months of the start of manufacture of the pipe.
- D. The gaskets shall be designed and manufactured so that the completed joint will withstand an internal water pressure in excess of 13 psi for a period of ten minutes without showing any leakage by the gasket or displacement of it, see ASTM C443. The pipe manufacturer shall provide facilities for testing the effectiveness of the joints against leakage and one such test may be required for each 500 ft. of pipe for each type of joint manufactured. Such tests shall be made by an internal or external pressure against the joint of at least 13 psi for a period of ten minutes. The completed joint, when installed in place in the work, shall be capable of withstanding a groundwater pressure of 13 psi without exceeding the allowable leakage specified for the pipe testing.
- E. The pipe manufacturer shall furnish information and supervise the installation of at least the first five joints installed. The ends of the pipe shall be made true to form and dimension and the bell shall be made by casting against steel forms.
- F. The manufacturer shall inspect all pipe joint surfaces for out-of-roundness and pipe ends for squareness. The manufacturer shall furnish to the OWNER'S Representative a notarized affidavit stating all pipe meets the requirements of ASTM C76, these Specifications and the joint design.

PART 3 - EXECUTION

3.01 LAYING CONCRETE PIPE

- A. Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe or fittings and the joint surfaces. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before laying and no piece shall be installed which is found to be defective.
- B. As soon as the excavation is completed to the normal grade of the bottom of the trench, place the Pipe Bedding Course in the trench. The pipe shall be firmly bedded in this course to conform accurately to the lines and grades indicated on the Drawings. Pipe Bedding Course shall conform to the requirements of the Drawings and Section 02300 – EARTHWORK. Blocking under the pipe will not be permitted.
- C. Sand backfill shall be placed and compacted to give complete vertical and lateral support for the lower section of the pipe as indicated on the Drawings. A depression shall be left in the supporting backfill at the joint to prevent contamination of the rubber gasket immediately

before being forced home. Before the pipe is lowered into the trench, the spigot and bell shall be cleaned and free from dirt. Gasket and bell shall be lubricated by a vegetable lubricant which is not soluble in water, furnished by the pipe manufacturer and harmless to the rubber gasket. The pipe shall be properly aligned in the trench to avoid any possibility of contact with the side of the trench and fouling the gasket. As soon as the spigot is centered in the bell of the previously laid pipe, it shall be forced home with jacks or come-alongs. After the gasket is compressed and before the pipe is brought fully home, each gasket shall be carefully checked for proper position around the full circumference of the joint. Steel inserts shall be used to prevent the pipe from going home until the feeler gauge is used to check the final position of the gasket. The jacks or come-alongs shall be anchored sufficiently back along the pipeline (a minimum of five lengths) so that the pulling force will not dislodge the pieces of pipe already in place. Only a jack or come-along shall be employed to force the pipe home smoothly and evenly and hold the pipe while backfilling is in progress. Under no circumstances shall crowbars be used nor shall any of the motor-driven equipment be used.

- D. As soon as the pipe is in place and before the come-along is released, the Pipe Bedding Course shall be placed as indicated on the Drawings and compacted for at least one-half the length of pipe. Not until this backfill is placed shall the come-along be released. If any motion at joints can be detected, a greater amount of backfill shall be placed before pressure is released. When pipe laying is not in progress, including lunchtime, the open ends of the pipe shall be closed by a watertight plug or other approved means.
- E. Carefully regulate the equipment and construction operations such that the loading of the pipe does not exceed the loads for which the pipe is designed and manufactured. Any pipe damaged during construction operations shall promptly and satisfactorily be repaired or replaced at the CONTRACTOR'S expense.
- F. The interior joints of all pipes, 30 in. and larger shall be filled with non-shrinking grout after the backfilling and testing is completed. Grout shall consist of one part by volume of cement, 12 parts by volume of sand, conforming to ASTM C33 and 1/4 part by volume of EMBECO or equal. The mixture shall have a dry, crumbly consistency and shall be pounded into place and troweled to make a smooth joint.

3.02 TESTING AND CLEANING

- A. Testing and cleaning shall be as specified in SECTION 01666 - TESTING OF PIPELINES.

END OF SECTION

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SECTION 02713
FLEXIBLE BASE

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This item governs furnishing and placing a crushed stone base course for surfacing, pavement, or other base courses. "Flexible Base" shall be constructed on an approved, prepared surface in one or more courses conforming to the typical sections and to the lines and grades, indicated on the Drawings or established by the ENGINEER or designated representative.
- B. This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.
- C. Requirements of the Geotechnical reports, project drawings and other specifications shall govern over the requirements in this specification.

1.02 SUBMITTALS

- A. The submittal requirements of this specification item shall include:
 1. Source, gradation, and test results for the crushed limestone material. The CONTRACTOR shall provide certification from an approved laboratory or supplier that the material meets this specification.
 2. Field density test results for in-place compacted flexible base. The CONTRACTOR shall provide field test results from an approved geotechnical consultant that the material has been compacted according to the Drawings and Specifications.
 3. One (1) electronic copy in Portable Document Format (PDF) of all submittals and re-submittals shall be submitted suitable for distribution over electronic mail or File Transfer Protocol (FTP). For final approved submittals provide PDF and two (2) hard copies.

PART 2 - PRODUCTS

2.01 MATERIAL

- A. Mineral Aggregate
 1. The material shall be crushed argillaceous limestone meeting the requirements specified herein. The material shall be from sources approved by the ENGINEER and shall consist of durable crushed stone that has been screened to the required gradation.
- B. Flexible base materials shall be tested according to the following TxDOT standard test methods:

Preparation for Soil Constants and Sieve Analysis	Tex-101-E
Liquid Limit	Tex-104-E
Plastic Limit	Tex-105-E
Plasticity Index	Tex-106-E

Sieve Analysis	Tex-110-E
Wet Ball Mill	Tex-116-E
Triaxial Test	Tex-117-E, Part II

- C. Base material shall be stockpiled after crushing, then tested by an ENGINEER approved laboratory prior to being hauled to the Project.
- D. The material shall be well graded and shall meet the following requirements:

Sieve Designation		Other Requirements	% Retained	
US	SI			
1 3/4"	45 mm		0	
7/8"	22.4 mm		10-35	
3/8"	9.5 mm		30-50	
#4	4.75 mm		45-65	
#40	425 mm		70-85	
		Maximum Plasticity Index		10
		Maximum Wet Ball Mill		42
Maximum Increase in passing #40 (425 mm) sieve from Wet Ball Mill Test			20	

- E. Minimum compressive strength when subjected to the triaxial test shall be 35 psi at 0 psi lateral pressure [240 kiloPascal (kPa) at 0 kPa lateral pressure] and 175 psi at 15 psi lateral pressure [1200 kiloPascal (kPa) at 100 kPa lateral pressure].

PART 3 - EXECUTION

3.01 CONSTRUCTION METHODS

- A. Preparation of Subgrade
 - 1. Flexible base shall not be placed until the CONTRACTOR has verified that the subgrade has been prepared and compacted to 95 percent based on density testing. Any deviation shall be corrected prior to placement of the flexible base material.
 - 2. The CONTRACTOR shall not place flexible base until the subgrade has cured to the satisfaction of the ENGINEER or designated representative. As a minimum, this will be after the surface displays no damp spots and there is no evidence of "sponginess" in the subgrade.
- B. First Lift
 - 1. Immediately before placing the flexible base material, the subgrade shall be checked for conformity with grade and section. The thickness of each lift of flexible base shall be equal increments of the total base depth. No single lift shall be more than 6 in. (150 mm) or less than 3 in. (75 mm) compacted thickness.
 - 2. The material shall be delivered in approved vehicles. It shall be the responsibility of the CONTRACTOR to deliver the required amount of material. If it becomes evident that insufficient material was placed, additional material as necessary shall be delivered and the entire course scarified, mixed and compacted.

3. Material deposited upon the subgrade shall be spread and shaped the same day unless otherwise approved by the ENGINEER or designated representative. In the event inclement weather or other unforeseen circumstances render spreading of the material impractical, the material shall be spread as soon as conditions allow.
4. Additionally, if the material cannot be spread and worked the same day it is deposited, the CONTRACTOR shall "close up" the dump piles before leaving the job site. "Closed up" shall be defined as the use of a motor grader to blade all dump piles together, leaving no open space between piles.
5. The material shall be spread, sprinkled, if required, then thoroughly mixed; bladed, dragged and shaped to conform to the typical sections indicated on the Drawings.
6. All areas and "nests" of segregated coarse or fine material shall be corrected or removed and replaced with well-graded material.
7. Each lift shall be sprinkled as required to bring the material to optimum moisture content, then compacted to the extent necessary to provide not less than the percent density specified in the Drawings. In no case shall the material be worked at more than 2 percent above or below optimum moisture as determined by TxDOT Test Method Tex-113-E. In addition to the requirements specified for density, the full depth of flexible base material shall be compacted to the extent necessary to remain firm and stable under construction equipment. After each section of flexible base material is completed, tests, as necessary, will be made by the ENGINEER or designated representative. As a minimum, three in-place density tests per section per day will be taken. If the material fails to meet the density requirements, it shall be reworked as necessary to meet these requirements. All testing will be paid for by the CONTRACTOR.
8. Throughout the entire operation, the surface of the material shall be maintained by blading and, upon completion, shall be smooth and shall conform to the typical section indicated on the Drawings and to the established lines and grades.
9. In that area on which pavement is to be placed, any deviation in excess of 1/4 in. (6.5 mm) in cross section or 1/4 in. in a length of 16 ft. (6.5 mm in a length of 5 meters) measured longitudinally shall be corrected by loosening, adding or removing material, and by reshaping and recompacting. All irregularities, depressions or weak spots shall be corrected immediately by scarifying the areas affected, adding suitable material as required, and by reshaping and recompacting. Should the lift, due to any reason or cause, lose the required stability, density and/or finish before the surfacing is complete, it shall be recompacted and refinished at the CONTRACTOR'S expense.

C. Succeeding Lifts

1. Construction methods for succeeding lifts shall be the same as prescribed for the first lift. For that lift of the flexible base upon which the curb and gutter will be constructed, as well as the last flexible base lift (i.e. top of the flexible base), the CONTRACTOR shall check the surface of the lift for conformity to the lines and grades by setting "blue tops" at intervals not exceeding 50 ft. (15 meters) on the centerline, at quarter points, at curb lines or edge of pavement, and at other points that may be indicated on the Drawings.
2. When the thickness of a particular lift of the flexible base is in question, the CONTRACTOR shall check the surface of the lift for conformity to the lines and grades

by setting "blue tops" at intervals not exceeding 50 ft. (15 meters) on the centerline, at quarter points, at curb lines or edge of pavement, and at other points that may be indicated on the Drawings.

D. Density

1. The flexible base shall be compacted to not less than 100 percent density as determined by TxDOT Test Method Tex-113-E.
2. Field density determination shall be made in accordance with TxDOT Test Method Tex-115-E unless otherwise approved by the ENGINEER or the ENGINEER designated representative.

END OF SECTION

SECTION 02764
PAVEMENT JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 1 - GENERAL REQUIREMENTS sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:

- 1. Expansion and contraction joints within cement concrete pavement.

1.03 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.
- C. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
 - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for sealants.
- E. One (1) electronic copy in Portable Document Format (PDF) of all submittals and re-submittals shall be submitted suitable for distribution over electronic mail or File Transfer Protocol (FTP). For final approved submittals provide PDF and two (2) hard copies.

1.04 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- B. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing of current sealant products within a thirty-six (36) months period preceding the commencement of the Work.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 for testing indicated, as documented according to ASTM E 548.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.06 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
 2. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40°F (4.4°C).
 3. When joint substrates are wet or covered with frost.
 4. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 5. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

2.02 JOINT SEALANTS

- A. Multicomponent Sealant for Concrete: Pourable, chemically curing elastomeric formulation complying with the following requirements for formulation and with ASTM C 920 for type, grade, class, and uses indicated:
 1. Urethane Formulation: Type M; Grade P; Class 12-1/2; Uses T, M, and, as applicable to joint substrates indicated, O.
 - a. Products
 - 1) Pecora Corporation; Urexpan NR-300.
 2. Coal-Tar-Modified Polymer Formulation: Type M; Grade P; Class 25; Uses T and, as applicable to joint substrates indicated, O.

- a. Products
 - 1) Meadows, W. R., Inc.; Sealtight Gardox.
 - 3. Bitumen-Modified Urethane Formulation: Type M; Grade P; Class 25; Uses T, M, and, as applicable to joint substrates indicated, O.
 - a. Products
 - 1) Tremco Sealant/Waterproofing Division; Vulkem 202.
 - B. Single-Component Urethane Sealant for Concrete: Single-component, pourable, coal-tar-modified, urethane formulation complying with ASTM C 920 for Type S; Grade P; Class 25; Uses T, M, and, as applicable to joint substrates indicated, O.
 - 1. Products
 - a. Sonneborn, Div. of ChemRex, Inc.; Sonomeric 1.
 - C. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.
 - 1. Products
 - a. Crafco Inc.; RoadSaver Silicone.
 - b. Dow Corning Corporation; 888.
 - D. Type SL Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.
 - 1. Products
 - a. Crafco Inc.; RoadSaver Silicone SL.
 - b. Dow Corning Corporation; 890-SL.
- 2.03 JOINT-SEALANT BACKER MATERIALS**
- A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.
 - B. Round Backer Rods: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.
 - C. Backer Strips: ASTM D 5249; Type 2; of thickness and width required to control sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.
 - D. Round Backer Rods: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.04 PRIMERS

- A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.03 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of backer materials.
 - 2. Do not stretch, twist, puncture, or tear backer materials.
 - 3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses provided for each joint configuration.

3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 1. Remove excess sealants from surfaces adjacent to joint.
 2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.
- F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.
- G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.04 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

END OF SECTION

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SECTION 03083
PRECAST CONCRETE BOXES AND VAULTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Precast reinforced concrete box structures for water and wastewater service, complete with openings, inserts, ladder rungs (where specifically called for), hardware, drains, covers and frames.
2. Entire box/vault system shall meet H2O Traffic Loading, unless noted otherwise.

B. Related Sections:

1. SECTION 02300 – EARTHWORK

- C. This project is funded through the Texas Water Development Board (TWDB) and shall include all requirements of the TWDB, including, but not limited to, the American Iron and Steel (AIS) requirements of 33 U.S.C. § 1388. The Contractor's bid costs shall reflect these requirements.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM), Standard Specifications:

1. A36 Structural Steel.
2. A48 Gray Iron Castings.
3. C150 Portland Cement.
4. C857 Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
5. C858 Underground Precast Concrete Utility Structures.
6. C890 Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures.
7. C891 Installation of Underground Precast Concrete Utility Structures.
8. C913 Precast Concrete Water and Wastewater Structures.

B. American Association of State Highway and Transportation Officials (AASHTO), Standard Specifications for Highway Bridges.

C. Federal Specification: SS-S-210: Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints.

D. American Iron and Steel Institute (AISI).

1.03 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. One (1) electronic copy in Portable Document Format (PDF) of all submittals and re-submittals shall be submitted suitable for distribution over electronic mail or File Transfer Protocol (FTP). For final approved submittals provide PDF and two (2) hard copies.
- C. Product Data:
 - 1. Descriptive details of the manufacturer's proposed standard products, including:
 - a. Precast tank sections.
 - b. Steps, ladder rungs and other hardware.
 - c. Minimum concrete 28-day compressive strength.
 - d. Cement certification.
 - e. Manhole cover and frame.
 - f. Safety grate.
 - 2. Shop drawings, including:
 - a. Design criteria.
 - b. Reinforcing steel location and concrete cover.
 - c. Layout of all inserts, attachments, and openings.
 - d. Location and type of joints.

1.04 QUALITY ASSURANCE

- A. Provide products of a manufacturer who has been regularly engaged in the design and manufacture of the product.
- B. Demonstrate to the satisfaction of the Engineer that the quality is equal to the product made by those manufacturers specifically named herein, if an alternate product manufacturer is proposed.

PART 2 - PRODUCTS

2.01 DESIGN CRITERIA

- A. General: ASTM C857, C858, C890, C913, and also:
 - 1. Structure live load: AASHTO Loading Class HS 20-44 (HL-93 Equivalent).
 - 2. Backfill material: Structural Backfill.
 - 3. Buoyancy: Design structure for groundwater up to zero (0) feet below grade.

2.02 PRECAST SECTIONS

A. General:

1. Cement: ASTM C150, Type II, low alkali.
2. Roof slab opening: Size to support the manhole cover frame.
3. Lifting eyes: Provide for each section.
4. Shear key: Provide for each joint.

2.03 SEALANT GASKETS

- A. Type: Preformed, continuous rope form plastic material, protected by removable two-piece wrapper, designated for diesel and petroleum service.
- B. Sealing Compound: Reinforced hydrocarbon resins blended with plasticizing compounds and reinforced with inert mineral filler, designated for diesel and petroleum service. No solvents, irritating fumes, or obnoxious odors.
- C. Adhesive and Cohesive Strength: Not dependent on oxidizing, evaporating, or chemical action.
- D. Conform to Federal Specification SS-S-210.
- E. Provide: QUIKSEAL as supplied by Associated Concrete Products, Santa Ana, CA; RAM-NEK as manufactured by K. T. Snyder Company, Inc., Houston, TX; or equal.

2.04 FRAMES AND COVERS

- A. Material: Cast iron; ASTM A48, Class 30B.
- B. Marking: In raised letters, as specified on the Drawings, on manhole cover. Include permanent label to indicate "SANITARY SEWER, INDUSTRIAL WASTEWATER, CONFINED SPACE, DO NOT ENTER" or similar language.
- C. Coating: Bituminous paint, black.
- D. Size: As shown on Drawings.
- E. Pick Hole: Closed.
- F. Protective grating system as noted on the Drawings.
- G. Manufacturer: EJ (East Jordan)

2.05 LADDER RUNGS

- A. Material: Copolymer polypropylene plastic molded on steel reinforcing bar.
- B. Conform to OSHA requirements.

2.06 SOURCE QUALITY CONTROL

A. Precast Sections:

1. Verify concrete compressive strength test results are satisfactory for the sections supplied.
2. State the curing method. Identify the start and end dates for the sections supplied.

B. Frames and Covers:

1. Verify cast test bar tensile strengths are satisfactory.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Temporary Plugs

1. Mechanical expanding type temporary plugs shall be installed and removed as specified herein. Plugs shall be secured by tethering with a one-quarter (1/4) inch nylon rope attached to the top of a wood two (2) feet x four (4) feet of sufficient length to extend from the shelf to a point in the throat within six (6) inches of the underside of the cover.

B. Precast Bases

1. Precast bases shall be placed to the lines and grades shown on the plans as an integral part of the pipe laying operation on a minimum thickness of six (6) inches of Aggregate Base material compacted to ninety-five percent (95%) relative compaction. Where soft ground or water is present, a minimum thickness of nine (9) inches of Crushed Rock material in wrap of Geotextile Fabric shall be placed below the course of Aggregate Base material.
2. Installed in strict conformance with the manufacturer's written instructions, on a well-compacted foundation.

C. Setting Precast Sections

1. Joint surfaces of precast bases, sections shall be thoroughly cleaned and dried prior to setting, and shall be sealed with a preformed plastic sealing gasket at each joint as follows:
 - a. Apply primer to joint surfaces in accordance with manufacturer's instructions. Make joints watertight with sealant gaskets.
 - b. Care shall be taken in the handling of sections after the gasket has been affixed to avoid displacing the gasket or contaminating the joint or gasket with dirt or other foreign material. Displaced or soiled gaskets shall be removed and replaced.
 - c. Care shall be taken to properly align the section with the previously set section before it is lowered into position.
 - d. Fill lifting eye holes with non-shrink grout.
2. Backfill around the box/vault with Structural Backfill material. Compact the backfill material to 95% of relative density from the pipe bedding and base slab up to final finish

grade, over an area defined as being within a distance of four (4) feet from the exterior walls of the box/vault.

D. Frames and Covers

1. Frames and covers shall not be set to final grade until the pavement has been completed, unless otherwise approved by the Engineer. Accurately locate and place the frames to within 1/8-inch vertical elevation in paved areas and to 1/2-inch in other areas. Coordinate the activities of all trades so that this tolerance is achieved.
2. Install the cover in the frame. Machine the cover if necessary to obtain a solid fit, without rattling under load.
3. Openings in box/vault shall be protected from construction loads, debris, and unauthorized entry. Temporary covers shall be used during construction until permanent frames and covers are installed.

E. Connections to precast boxes/vaults shall be made by one of the following:

1. Casting sections of pipe into the item.
2. Core drilling or casting pipe chases into the items. Where core drilled holes or cast-in place chases are used; the annular space between the core-drilled hole or chase and the connecting pipe shall be filled with non-shrink grout or sealed using an approved resilient connector, skirt or reducing coupling, unless otherwise specified on the Drawings. All such connections shall be watertight.

3.02 FIELD QUALITY CONTROL

- A. Verify all precast sections are continuously sealed with gaskets.
- B. Verify all manhole covers fit quietly in the frames.

3.03 TEST FOR TANKS

- A. Prior to testing, all boxes/vaults shall be visually inspected. All defects shall be repaired by the Contractor with non-shrink grout, to the satisfaction of the Engineer.
- B. After all pipe has been laid, backfilling has been completed, and after the testing of the pipes, all pipes entering the box/vault shall be sealed at a point outside the box/vault walls so as to include testing of the pipe-box/vault joints. Safety lines shall be secured to all plugs utilized.
- C. All necessary materials shall be provided by the Contractor, subject to the Engineer's approval. No materials shall be used which would be injurious to the public, personnel, adjacent improvements, or the pipeline. Air test gauges shall be laboratory-calibrated test gauges and shall be recalibrated by a certified laboratory prior to leakage test. Gauge shall be easy to read in no more than one (1) pound per square inch (psi) per increments and have a maximum full-scale range of five (5) psi.
- D. Hydrostatic Testing
 1. Hydraulically test installed boxes/vaults where groundwater elevation is below the bottom of the base.

2. Furnish and dispose of water used for testing.
3. Fill the box/vault with water and measure leakage over a period of not less than one hour. The box/vault shall be filled with water to a level two (2) inches below the top of the frame.
4. After a period of at least one (1) hour to allow the water level to stabilize, the box/vault shall be refilled and the water level shall be checked. The water level shall again be checked after a period of four (4) hours. If the water level drops by more than one (1) inch, the leakage shall be considered excessive.

E. Vacuum Testing

1. Vacuum test installed boxes/vaults where groundwater elevation is above the manhole base.
 2. A vacuum of ten (10) inches of mercury shall be drawn on the box/vault, the valve on the vacuum line of the test hood closed and the vacuum pump shut off. The box/vault shall be deemed to have passed the test if the vacuum drop is less than one (1) inch of mercury during a one (1) minute test period.
- F. When leakage from the box/vault exceeds the above amount, determine the source or sources of the leakage, and repair or replace defective materials and workmanship. Contractor shall re-test after the deficiencies have been corrected.
- G. The completed pipe and box/vault installation shall pass this test before the project can be accepted.

END OF SECTION

SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and DIVISION 1 - GENERAL REQUIREMENTS sections, apply to this Section.

1.02 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes.

1.03 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

1.04 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated.
- B. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
1. Indicate amounts of mix water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.
- D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork. Design and engineering of formwork are Contractor's responsibility.
- E. Welding Certificates: Copies of certificates for welding procedures and personnel.
- F. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials.
- G. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
1. Cementitious materials and aggregates.
 2. Form materials and form-release agents.
 3. Wall ties & wall tie hole sealing process.

4. Steel reinforcement and reinforcement accessories.
5. Admixtures.
6. Waterstops.
7. Curing materials.
8. Floor and slab treatments.
9. Bonding agents.
10. Adhesives.
11. Vapor retarders.
12. Epoxy joint filler.
13. Joint-filler strips.
14. Repair materials.

H. Minutes of preinstallation conference.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed concrete Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
 1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated.
 1. Personnel conducting field tests shall be qualified as ACI Concrete Field-Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.
- E. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."
- F. ACI Publications: Comply with the following, unless more stringent provisions are indicated:
 1. ACI 301, "Specification for Structural Concrete."

2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 SECTION 01310 – PROGRESS SCHEDULES AND MEETINGS.
1. Before submitting design mixes, review concrete mix design and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for testing & concrete design mixes.
 - c. Ready-mix concrete producer.
 - d. Concrete subcontractor.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle steel reinforcement to prevent bending and damage.
1. Avoid damaging coatings on steel reinforcement.

PART 2 - PRODUCTS

2.01 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
1. Plywood, metal, or other approved panel materials.
 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. B-B (Concrete Form), Class 1, or better, mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- E. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 in. by 3/4 in., minimum.
- F. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- G. Form Ties: Factory-fabricated, removable, or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 1. Furnish units that will leave no corrodible metal closer than 1 in. to the plane of the exposed concrete surface.
 2. Furnish ties that, when removed, will leave holes not larger than 1 in. diameter in concrete surface.
 3. Furnish ties with integral water-barrier plates to walls of all fluid containing structures.
 4. Through wall tapered ties are acceptable with the usage of "Greenstreak's P120 X-Plug".

2.02 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Plain-Steel Wire: ASTM A 1064/A 1064M.
- C. Plain-Steel Welded Wire Fabric: ASTM A 1064, fabricated from as-drawn steel wire into flat sheets.

2.03 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:
 1. For concrete surfaces exposed to view where legs of wire bar support contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.
- B. Joint Dowel Bars: Plain-steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.

2.04 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I/II.
 1. Fly Ash: ASTM C 618, Class C or F.
- B. Normal-Weight Aggregate: ASTM C 33, uniformly graded, and as follows:
 1. Class: Severe weathering region, but not less than 3S.
 2. Class: Moderate weathering region, but not less than 3M.
 3. Class: Negligible weathering region, but not less than 1N.
 4. Nominal Maximum Aggregate Size: 1-1/2 in.

5. Nominal Maximum Aggregate Size: 1 in.
6. Nominal Maximum Aggregate Size: 3/4 in.
7. Combined Aggregate Gradation: Well graded from coarsest to finest with not more than 18 percent and not less than 8 percent retained on an individual sieve, except that less than 8 percent may be retained on coarsest sieve and on No. 50 sieve, and less than 8 percent may be retained on sieves finer than No. 50.

C. Water: Potable and complying with ASTM C 94.

2.05 ADMIXTURES

- A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.
- B. Air-Entraining Admixture: ASTM C 260.
- C. Water-Reducing Admixture: ASTM C 494, Type A.
- D. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
- E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
- F. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
- G. Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Catekol 1000CL; Axim Concrete Technologies.
 - b. MCI 2000 or MCI 2005; Cortec Corporation.
 - c. DCI or DCI-S; W. R. Grace & Co., Construction Products Div.
 - d. Rheocrete 222+; Master Builders, Inc.
 - e. FerroGard-901; Sika Corporation.

2.06 WATERSTOPS

- A. Strip Waterstops: Manufactured rectangular or trapezoidal strip.
 1. Products: Subject to compliance with requirements, provide the following:
 - a. Hydrotite CJ-1020-2K-ADH with Leakmaster.

2.07 VAPOR RETARDERS

A. Vapor Retarder: ASTM E 1745, Class C, of one of the following materials; or polyethylene sheet, ASTM D 4397, not less than 10 mil thick:

1. Nonwoven, polyester-reinforced, polyethylene coated sheet; 10 mil thick.

2.08 CURING MATERIALS

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

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

C. Moisture Barrier: ASTM C 171, polyethylene film or white burlap-polyethylene sheet, heavy duty, 10 mil thick minimum.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

F. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

G. Products: Subject to compliance with requirements, provide one of the following:

1. Evaporation Retarder

- a. Cimfilm; Axim Concrete Technologies.
- b. Finishing Aid Concentrate; Burke Group, LLC (The).
- c. Spray-Film; ChemMasters.
- d. Aquafilm; Conspec Marketing & Manufacturing Co., Inc.
- e. Sure Film; Dayton Superior Corporation.
- f. Eucobar; Euclid Chemical Co.
- g. Vapor Aid; Kaufman Products, Inc.
- h. Lambco Skin; Lambert Corporation.
- i. E-Con; L&M Construction Chemicals, Inc.
- j. Confilm; Master Builders, Inc.
- k. Waterhold; Metalcrete Industries.
- l. Rich Film; Richmond Screw Anchor Co.
- m. SikaFilm; Sika Corporation.

- n. Finishing Aid; Symons Corporation.
 - o. Certi-Vex EnvioAssist; Vexcon Chemicals, Inc.
2. Clear, Waterborne, Membrane-Forming Curing Compound:
- a. AH Clear Cure WB; Anti-Hydro International, Inc.
 - b. Klear Kote WB II Regular; Burke Chemicals.
 - c. Safe-Cure & Seal 20; ChemMasters.
 - d. High Seal; Conspec Marketing & Manufacturing Co., Inc.
 - e. Safe Cure and Seal; Dayton Superior Corporation.
 - f. Aqua Cure VOX; Euclid Chemical Co.
 - g. Cure & Seal 309 Emulsion; Kaufman Products Inc.
 - h. Glazecote Sealer-20; Lambert Corporation.
 - i. Dress & Seal WB; L&M Construction Chemicals, Inc.
 - j. Vocomp-20; W. R. Meadows, Inc.
 - k. Metcure; Metalcrete Industries.
 - l. Cure & Seal 150E; Nox-Crete Products Group, Kinsman Corporation.
 - m. Rich Seal 14 percent E; Richmond Screw Anchor Co.
 - n. Kure-N-Seal WB; Sonneborn, Div. of ChemRex, Inc.
 - o. Florseal W.B.; Sternson Group.
 - p. Cure & Seal 14 percent E; Symons Corporation.
 - q. Seal Cure WB 150; Tamms Industries Co., Div. of LaPorte Construction Chemicals of North America, Inc.
 - r. Hydro Seal; Unitex.
 - s. Starseal 309; Vexcon Chemicals, Inc.

2.09 RELATED MATERIALS

- A. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Epoxy Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Shore A hardness of 80 per ASTM D 2240.
- C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

- D. Epoxy-Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:
1. Type II, non-load bearing, for bonding freshly mixed concrete to hardened concrete.
 2. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
 3. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.10 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 in. and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 3. Aggregate: Well-graded, washed gravel, 1/8 in. to 1/4 in. or coarse sand as recommended by underlayment manufacturer.
 4. Compressive Strength: Not less than 4,100 psi at twenty-eight (28) days when tested according to ASTM C 109/C 109M.
- B. Repair Topping: Traffic-bearing, cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 in.
1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 3. Aggregate: Well-graded, washed gravel, 1/8 in. to 1/4 in. or coarse sand as recommended by topping manufacturer.
 4. Compressive Strength: Not less than 5,700 psi at twenty-eight (28) days when tested according to ASTM C 109/C 109M.
- C. Clarifier Trough Repair: Single component, microsilica modified repair mortar with an integral corrosion inhibitor, Eucocrete or approved equal.
1. Primer: Duralprep A.C. or approved equal for both concrete and reinforcing steel.
 2. Compressive Strength: Not less than 8,500 psi at twenty-eight (28) days when tested according to ASTM C 109/C 109M.

2.11 CONCRETE MIXES

- A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:
 1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.
- B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.
- C. Footings, Piers, Foundation Walls, Slab-On-Grade & Containment Walls: Proportion normal-weight concrete mix as follows:
 1. Compressive Strength (28 Days): 4,000 psi.
 2. Minimum Cementitious Materials Content 540 lb./cu. Yd.
 3. Slump for Concrete Containing High-Range Water-Reducing Admixture: 6 to 8 inches
- D. Lean concrete: Proportion normal-weight concrete mix as follows:
 1. Compressive Strength (28 Days): 2,000 psi.
 2. Minimum Cementitious Materials Content 300 lb./cu. Yd.
 3. Slump for Concrete Containing High-Range Water-Reducing Admixture: 6 to 8 inches
- E. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 1. Fly Ash: 20 percent.
- F. Maximum Water-Cementitious Materials Ratio: 0.42 for all concrete (not applicable to lean concrete and flowable fill).
- G. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 2 to 4 percent, unless otherwise indicated.
- H. Do not air entrain concrete for trowel-finished interior floors and suspended slabs. Do not allow entrapped air content to exceed 3 percent.
- I. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- J. Admixtures: Use admixtures according to manufacturer's written instructions.
 1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

3. Use water-reducing admixture in pumped concrete, concrete for all wastewater treatment plan structures, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.12 FABRICATING REINFORCEMENT

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

2.13 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116 and furnish batch ticket information.
 1. When air temperature is between 85°F and 90°F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90°F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.01 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 1. Class A, 1/8 in.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.
 1. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete. Do not chamfer corners where concrete abuts other concrete or asphalt.
- I. Form openings, chases, offsets, sinkages, keyways, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.02 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor bolts, accurately located, to elevations required.

3.03 REMOVING AND REUSING FORMS

- A. General: Formwork, for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50°F for 72 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.
- B. Leave formwork, for beam soffits, joists, slabs, and other structural elements, that supports weight of concrete in place until concrete has achieved the following:
 - 1. Twenty-eight (28) day design compressive strength.
 - 2. Determine compressive strength of in-place concrete by testing representative field- or laboratory-cured test specimens according to ACI 301.
 - 3. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- C. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- D. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by ENGINEER.

3.04 VAPOR RETARDERS

- A. Vapor Retarder: Place, protect, and repair vapor-retarder sheets according to ASTM E 1643 and manufacturer's written instructions.

3.05 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.06 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by ENGINEER.
 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 2. Submit proposed location of construction joints to Engineer for approval prior to beginning of work.
 3. Form from preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 in. into concrete.
 4. Space vertical joints in walls as indicated.
 5. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Use only where shown in the Construction Documents. Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:
 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 in. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8 in. wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Dowel Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated.
 1. Use dowel sleeves or lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.07 WATERSTOPS

- A. Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, bonding or mechanically fastening and firmly pressing into place. Install in longest lengths practicable

3.08 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement, unless approved by Engineer.
- C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.
- D. Deposit concrete in forms in horizontal layers no deeper than 24 in. and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.
 1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
 2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Maintain reinforcement in position on chairs during concrete placement.
 3. Screeed slab surfaces with a straightedge and strike off to correct elevations.
 4. Slope surfaces uniformly to drains where required.
 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to or is expected to fall below 40°F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50°F and not more than 80°F at point of placement.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.
- G. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:
1. Cool ingredients before mixing to maintain concrete temperature below 90°F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.09 FINISHING FORMED SURFACES

- A. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 in. in height.
1. Apply to concrete surfaces not exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, damp proofing, veneer plaster, or painting.
- B. Rubbed Finish: Apply the following to smooth-formed finished concrete that will be exposed to public view:
1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
 2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part Portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white Portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.10 FINISHING FLOORS AND SLABS

- A. General: Comply with recommendations in ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes.
 - 1. Apply scratch finish to surfaces indicated and to surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, Portland cement terrazzo, and other bonded cementitious floor finishes.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- D. Trowel Finish: After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic, or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system
 - 2. Finish and measure surface so gap at any point between concrete surface and an unleveled freestanding 10 ft. long straightedge, resting on two high spots and placed anywhere on the surface, does not exceed the following:
 - a. 1/8 in.
- E. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with ENGINEER before application.

3.11 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.

- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screeed, tamp, and trowel-finish concrete surfaces.

3.12 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing. Moisture cure all fluid containing structures a minimum of 120 hours after placement
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb./sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the following methods:
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than five days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12 in. lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 in., and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.

- c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer recommends for use with floor coverings.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process twenty-four (24) hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.13 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by ENGINEER. Remove and replace concrete that cannot be repaired and patched to ENGINEER's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 in. in any dimension in solid concrete but not less than 1 in. in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by ENGINEER.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 in. wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least fourteen (14) days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 in. to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. Repair defective areas, except random cracks and single holes 1 in. or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4 in. clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least seventy-two (72) hours.
- E. Perform structural repairs of concrete, subject to ENGINEER's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to ENGINEER'S approval.

3.14 FIELD QUALITY CONTROL

- A. Testing Agency: CONTRACTOR will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article. Testing agency shall be approved by ENGINEER
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mix exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40°F and below and when 80°F and above, and one test for each composite sample.
 5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
 6. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of five standard cylinder specimens for each composite sample.
 - a. Cast and field cure one set of five standard cylinder specimens for each composite sample.
 7. Compressive-Strength Tests: ASTM C 39; test two laboratory-cured specimens at seven (7) days, two at twenty-eight (28) days and one at fifty-six (56) days if required.
 - a. Test two field-cured specimens at seven (7) days and two at twenty-eight (28) days.
 - b. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.
- C. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
- D. Strength of each concrete mix will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- E. Test results shall be reported in writing to ENGINEER, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at twenty-eight (28) days, concrete mix proportions and materials, compressive breaking strength, and type of break for both seven (7) and twenty-eight (28) days tests.
- F. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by ENGINEER but will not be used as sole basis for approval or rejection of concrete.
- G. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by ENGINEER. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by ENGINEER.

3.15 CONCRETE STRUCTURE TOLERANCES

A. Variation from the Plumb

1. In the lines and surfaces of columns, walls, and in arises: in 10 ft., 1/4 in.; in any story or 20 ft. maximum, 3/8 in.; in 40 ft. or more, 3/4 in.
2. For exposed corner control-joint grooves and other conspicuous lines: in any bay or 20 ft. maximum, 1/4 in.; in 40 ft. or more, 1/2 in.

B. Variation from the Level or From the Grades Shown

1. In floors, ceilings, and beam soffits: in 10 ft., 1/4 in.; in any bay or 20 ft. maximum, 3/8 in.; in 40 ft. or more, 3/4 in.
2. For exposed horizontal grooves and other conspicuous lines: in any bay or 20 ft. maximum, 1/4 in.; in 40 ft. or more, 1/2 in.

C. Variation of the linear building lines from established position in plan and related position of walls and partitions: in any bay or 20 ft. maximum, 1/4 in.; in 40 ft. or more, 1/2 in.

D. Variation in the sizes and location of sleeves, floor openings and wall openings: 1/4 in.

E. Variation of cross-sectional dimensions in the thickness of slabs and walls: minus, 1/4 in.; plus, 1/2 in.

F. Footings

1. Variation in dimension in plan: minus, 1/2 in.; plus, 2 in.
2. Misplacement or eccentricity: 2 percent of the footing width in the direction of misplacement but not more than 2 in.
3. Reduction in thickness: minus 5 percent of specified thickness.

G. Variation from established lines and grades in sidewalks, plazas, outdoor concrete slabs, curb, and gutter sections: in 10 ft., 1/4 in.; in 1 ft., 1/8 in.

END OF SECTION

SECTION 03301
SUPPLEMENTAL CONCRETE REPAIR

PART 1 - GENERAL

1.01 DEFECTIVE CONCRETE REPAIRS

- A. General: Repair and patch defective areas when approved by ENGINEER. Remove and replace concrete that cannot be repaired and patched to ENGINEER's approval.
- B. Defects: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
- C. Repair Preparations: All repairs shall be completed in compliance with the repair material specified for each repair and shall minimize the time between the placement of the concrete and the placement of the repair. Repairs utilizing epoxy components shall only be completed a minimum of 28 days after placement of concrete. All repairs shall utilize bonding agents. All surfaces marked for repair shall be cleared of any dust, debris, loose concrete, or other elements that may affect the bond strength of the repair. Surface moisture conditions, roughness, and temperature shall per the direction of the repair material manufacturer. In the absence of manufacturer direction, the repair surface conditions shall be per the ENGINEER. In no instance shall any rebar be cut or removed with the prior approval of the ENGINEER.
- D. The repair materials and method of application shall be submitted to the ENGINEER for approval prior to installation.

1.02 REPAIR MATERIALS

- A. All materials and repair procedure shall be submitted for approval by the ENGINEER.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Non-Sag Repair Mortar: Shall be a high strength, polymer modified mortar suitable for application to vertical and overhead repairs. It shall have a minimum 28-day compressive strength of 5,500 psi. Shall be paired with a bonding agent and be applied per the manufacturer instructions.
- D. Non-Shrink Grout: Shall have a 28-day shrinkage of 0.00%. Shall have a 28-day minimum compressive strength of 6,000 psi and shall be paired with an appropriate binding agent.
- E. Epoxy Repair Grout: Flowable 2-part epoxy grout for use in repairs of formable locations or in horizontal applications.
- F. Epoxy Injection: High strength epoxy designed to be injected into crack in concrete structures. All uses of injection epoxy shall be done per the manufacturer's instructions and within their recommended conditions. All injection epoxy materials shall be approved by the ENGINEER before for each specific use case before installation. Epoxy injection repairs shall be conducted by persons specifically trained in the installation of epoxy injection repairs.

- G. FRP: Custom made fiber reinforced pultrusions may be required by the ENGINEER when repairs will be required to carry structural loads or to create effective seals where necessary as determined by the ENGINEER.
- H. Bonding Agent: Required for all repairs. Bonding agents shall be submitted with each repair material for approval by the ENGINEER.

1.03 USE CASES

- A. Cosmetic Repairs: Categorized as repairs of a maximum of 0.5 inches depth with no other function than to create a surface with appearance qualities required by the specification. Patching Mortar shall be utilized for these repairs and applied to create the most visibly uniform surface possible, subject to approval by the ENGINEER.
- B. Horizontal Repairs: Concrete defects found on the upper surface of horizontal concrete. These defects shall be repaired using Epoxy Repair Grout or other material approved by the ENGINEER. Application of Epoxy Grout shall only be allowed where repairs can be self-contained by the parent concrete or can be poured into forms.
- C. Vertical and Overhead Repairs: The materials and application methods shall be decided based upon the depth of the repair, and the surface area of the repair surface. All repairs to fluids containing structures shall incorporate additional waterstop, caulking, or other sealing material to be submitted to the ENGINEER for approval before use.
 - 1. Repairs less than 2" deep
 - a. Shall be repaired by joint use of non-sag repair mortar paired with an appropriate bonding agent. The combination of non-sag repair mortar and bonding agent shall be approved by the ENGINEER prior to use. If the removal of concrete defects in preparation for repair exposes any rebar, then the repair shall utilize a corrosion inhibitor. Repair materials may be applied in lifts if allowed by the repair material instructions provided by the manufacturer.
 - 2. Repairs greater than 2" deep, or larger than 1 ft²
 - a. Shall follow the same procedure as the repair procedure shown above for repairs less than 2" deep except if the repair depth is greater than one third of the wall thickness. In cases where the repair depth is greater than one third of the wall thickness AND/OR the repair area is greater than 1 ft² the contractor shall remove all defective concrete and extend the removal of concrete to the opposite side of the wall/structure being repaired. This penetration shall be repaired using Non-Shrink Grout in conjunction with an ENGINEER approved bonding agent. If the structure is intended for use as a vessel to contain or transport fluids than additional waterstop/sealing elements must be submitted for approval by the ENGINEER for use in the repair. If the removal of concrete defects in preparation for repair exposes any rebar, then the repair shall utilize a corrosion inhibitor.
- D. Structural Repairs and Special Cases: Structural repairs shall utilize FRP as directed by the ENGINEER. Other special case repairs including but not limited to construction joints and waterstops must be decided on a case-by-case basis after thorough review by the ENGINEER.

- E. Crack Repairs: All concrete crack repairs shall be conducted by epoxy injection. In the case of fluid containing structures the epoxy injection product shall be specifically designed for continuous exposure to the contents of the tank. Epoxy injection may be allowable for use on active leaks in concrete tanks as determined by the ENGINEER. All epoxy injection repairs shall be conducted by or under the supervision of a person experienced with application of the repair materials.

END OF SECTION

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SECTION 03605
NON-SHRINK GROUT

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. This section specifies requirements for nonmetallic non-shrink grout for leveling column base plates, steel beams bearing on concrete, machinery, and other equipment, for anchoring handrail posts into sleeves embedded in concrete, and at all other locations shown or reasonably implied by the drawings.

1.02 RELATED WORK

- A. Review DIVISION 5 - METALS and the drawings for non-shrink grout requirements.
- B. Review DIVISION 11 - EQUIPMENT and DIVISION 15 - MECHANICAL and the drawings for non-shrink grout requirements under machinery and equipment baseplates.

1.03 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM C 309 - Liquid Membrane-Forming Compounds for Curing Concrete.
 - 2. ASTM C 33 - Standard Specifications for Concrete Aggregates.
- B. Corps of Engineers (CRD): CRD C-621, Corps of Engineers' Specifications for Non-shrink Grout.

1.04 SUBMITTALS

- A. Submit the following information on proposed products for approval by the ENGINEER before delivery to the project.
 - 1. Manufacturer's technical literature including manufacturer's specifications for mixing and placing of the grout.
 - 2. Test results of test performed by a certified independent testing laboratory showing conformance to the following:
 - a. CRD C-621
 - b. The requirements of this specification.
- B. One (1) electronic copy in Portable Document Format (PDF) of all submittals and re-submittals shall be submitted suitable for distribution over electronic mail or File Transfer Protocol (FTP). For final approved submittals provide PDF and two (2) hard copies.

1.05 MANUFACTURER'S ASSISTANCE

- A.** Manufacturers of proprietary products shall make available, at no additional cost to the OWNER and upon seventy-two (72) hours notification, the service of a qualified, full time employee to aid in assuring proper use of the product under job conditions.

1.06 DELIVERY AND STORAGE

- A.** Non-shrink grout shall be delivered to the project in unopened containers and shall bear intact manufacturer's labels.
- B.** Store all non-shrink grout material in dry shelter and protect from moisture.
- C.** Containers that are torn or damaged such that the non-shrink grout material has been exposed to the elements shall be discarded.

1.07 MEASUREMENT AND PAYMENT

- A.** The exact dimensions for machinery and equipment bases will depend upon the dimensions of the actual machinery and equipment furnished. No change in the contract price will be allowed if the dimensions are different from those shown on the drawings.

PART 2 - PRODUCTS

2.01 MATERIALS

- A.** Non-shrink grout shall be a pre-blended factory-packaged material manufactured, under rigid quality control, specifically for use in transferring heavy loads. The non-shrink grout shall conform to the following requirements:
 1. Grout shall contain nonmetallic natural aggregate and shall be non-staining and non-corrosive.
 2. Acceptable products are Gifford-Hill "Supreme," Master Builders' "Masterflow 713," or approved equal.
 3. Corps of Engineers CRD C-621.
 4. Resist attack by oil and water.
 5. Have a minimum initial setting time of approximately one (1) hour at 70°F.
 6. Have a minimum compressive strength of 6,500 psi at twenty-eight (28) days.
 7. Free of gas-producing or gas-releasing agents.
- B.** Water used for mixing the grout shall be potable.
- C.** Clean pea gravel conforming to ASTM C 33 coarse aggregate graded so that at least 90 percent passes a 3/8 in. sieve and 90 percent is retained by a No. 4 sieve.
- D.** Membrane-Forming Curing Compound: Commercial curing compound conforming to ASTM C 309, which will not permanently discolor the grout.

PART 3 - EXECUTION

3.01 PROCEDURES

- A. Installation methods and procedures shall conform to the printed instructions of the grout manufacturer and these specifications. Where there is a conflict between these specifications and the printed instructions of the grout manufacturer, the printed instructions of the grout manufacturer shall take precedence.

3.02 SURFACE PREPARATIONS

- A. Remove all defective concrete, laitance, dirt, oil, grease, and other foreign material from concrete surfaces by bush-hammering, chipping, or other similar means, until a sound, clean concrete surface is achieved.
- B. Lightly roughen the concrete, but not enough to interfere with the proper placement of grout.
- C. Remove foreign materials from all surfaces in contact with grout.
- D. Align, level, and maintain final positioning of all components to be grouted. Coat shims with a thin film of grease or wax to facilitate removal.
- E. Provide relief holes, if required, to avoid trapping air beneath the base plate.
- F. Take special precautions during extreme weather conditions according to the manufacturer's written instructions.
- G. Saturate all concrete surfaces with clean water for the period of time specified by the manufacturer. Remove excess water and leave none standing.
- H. Immediately before grouting clean any contaminated surfaces.

3.03 FORMWORK

- A. Build leak-proof forms that are strong and securely anchored and shored to withstand grout pressures. Forms shall be built high enough to provide a "head" of grout where it is required to force grout into difficult locations.
- B. Provide enough clearance between the formwork and the area to be grouted to permit proper placement of grout.

3.04 MIXES

- A. For less than a 4 in. clearance, or where size or shape of space makes grouting difficult, grout mix shall consist of grout material and water.
- B. For greater than 4 in. clearances where coarse aggregate will not obstruct free passage of the grout, the grout may be extended by adding clean pea gravel if allowed or recommended by the grout manufacturer. Follow the manufacturer's recommendation for the maximum amount of pea gravel that may be added.
- C. Use the minimum amount of water necessary to produce a flowable grout without causing either segregation or bleeding.

3.05 MIXING

- A. Mixing of non-shrink grout shall be in strict conformance to the recommendations of the grout manufacturer.
- B. Mix grout as close to the work area as possible and transport the mixture quickly and in a manner that does not permit segregation of materials.
- C. After the grout has been mixed, DO NOT add more water for any reason.

3.06 PLACING

- A. Place non-shrink grouting material quickly and continuously by the most practical means permissible: pouring, pumping or under gravity pressure. Do not use either pneumatic-pressure or dry packing methods without written permission of the ENGINEER.
- B. Follow established concreting procedures observing precautions for hot and cold weather concreting.
- C. When practical, apply grout from one side only to avoid entrapping air.
- D. Final installation shall be thoroughly compacted and free from air pockets. To facilitate placement, a 1/2 in. to 1 in. chain or metal strap may be pulled back and forth under the equipment during grouting. Remove chain or strap before initial set takes place.
- E. Do not vibrate the placed grout mixture or allow it to be placed if the area is being vibrated by nearby equipment, except when approved by the grout manufacturer.
- F. Do not remove leveling shims for at least forty-eight (48) hours after grout has been placed. After shims have been removed, fill voids with non-shrink grout.

3.07 CURING

- A. Cure grout for three days after placing by keeping wet and covering with curing paper by coating with a concrete membrane-forming curing compound or by other approved method.

END OF SECTION

SECTION 05120
STRUCTURAL STEEL

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. This Section includes the following:
 - 1. Structural Steel
- B. Materials of construction shown on the contract drawings for fasteners, anchor bolts, hangers, threaded rod, etc. will supersede the materials of construction shown in this section and other specifications herein.

1.02 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Special Conditions and DIVISION 1 - GENERAL REQUIREMENTS sections, apply to this Section.
- B. Related Sections include the following:
 - 1. SECTION 03605 - NON-SHRINK GROUT
 - 2. SECTION 09915 - PROTECTIVE COATINGS
 - 3. SECTION 13050 - METAL ROOF SYSTEMS

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication of structural-steel components.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Include embedment drawings.
 - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
 - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pre-tensioned and slip-critical high-strength bolted connections.
 - 5. For structural-steel connections indicated to comply with design loads, include structural analysis data signed and sealed by the qualified Professional Engineer responsible for their preparation, registered in the State of Texas.
- C. Welding certificates.
- D. Qualification Data: For Installer, fabricator, Professional Engineer, testing agency.

E. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:

1. Structural steel including chemical and physical properties.
2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
3. Direct-tension indicators.
4. Tension-control, high-strength bolt-nut-washer assemblies.
5. Shear stud connectors.
6. Shop primers.

F. Source quality-control test reports.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

B. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category Sbd.

C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

D. Comply with applicable provisions of the following specifications and documents:

1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design or Load and Resistance Factor Design Specification for Structural Steel Buildings."
3. AISC's "Specification for the Design of Steel Hollow Structural Sections."
4. AISC's "Specification for Allowable Stress Design of Single-Angle Members or Specification for Load and Resistance Factor Design of Single-Angle Members."
5. RCSC's "Specification for Structural Joints Using ASTM F 3125/ F 3125M."

1.05 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

1.06 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand ASD-service or LRFD loads indicated and comply with other information and restrictions indicated.

1. Select and complete connections using AISC's "Manual of Steel Construction, Load and Resistance Factor Design," Volume 2, Part 9 or AISC's "Manual of Steel Construction, Allowable Stress Design," Part 4.
2. Engineering Responsibility: Fabricator's responsibilities include using a qualified professional ENGINEER, licensed in the State of Texas, to prepare and provide Texas Professional Engineer seal for structural analysis data for structural-steel connections.

B. Construction

1. Type FR fully restrained.
2. Type 1, rigid frame 2, simple framing 3, semi-rigid framing.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.
1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
 2. DO NOT store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.08 COORDINATION

- A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.01 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992,
- B. Channels, Angles, M, S-Shapes: ASTM A 36.
- C. Plate and Bar: ASTM A 36.
- D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, C, structural tubing.
- E. Corrosion-Resisting Cold-Formed Hollow Structural Sections: ASTM A 847, structural tubing.
- F. Steel Pipe: ASTM A 53, Type E or S, Grade B.
- G. Weight Class: Standard unless noted on contract drawings.
- H. Finish: Hot Dip Galvanized, unless noted otherwise.

- I. Medium-Strength Steel Castings: ASTM A 27, Grade 65-35, carbon steel.
- J. Welding Electrodes: Comply with AWS requirements.

2.02 BOLTS, CONNECTORS, AND ANCHORS

- A. Bolts and connectors shall be hot-dipped galvanized steel and anchors shall be Type 304 stainless steel, unless otherwise shown on the plans or described in these specifications.
- B. High-Strength Bolts, Nuts, and Washers: ASTM F 3125/ F 3125M, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
 - 1. Finish: Hot dip zinc coating, ASTM A 153, Class C.
 - 2. Direct-Tension Indicators: ASTM F 959, Type 325 compressible-washer type.
 - a. Finish: Mechanically deposited zinc coating, ASTM B 695, Class 50.
- C. High-Strength Bolts, Nuts, and Washers: ASTM F 3125/ F 3125M, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers, plain.
 - 1. Finish: Hot dip zinc coating, ASTM A 153, Class C.
 - 2. Direct-Tension Indicators: ASTM F 959, Type 490 Type 10.9, compressible-washer type, plain.
- D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type; AWS D1.1, Type B.
- E. Unheaded Anchor Rods: Stainless steel Type 304 or 316.
 - 1. Configuration: Straight or Hooked.
 - 2. Nuts: Stainless steel Type 304 or 316.
 - 3. Plate Washers: Stainless steel Type 304 or 316.
 - 4. Washers: Stainless steel Type 304 or 316.
- F. Headed Anchor Rods: Stainless steel Type 304 or 316, straight.
 - 1. Nuts: Stainless steel Type 304 or 316.
 - 2. Plate Washers: Stainless steel Type 304 or 316.
 - 3. Washers: Stainless steel Type 304 or 316.
- G. Threaded Rods: Stainless steel Type 304 or 316.
 - 1. Nuts: Stainless steel Type 304 or 316.

2. Washers: Stainless steel Type 304 or 316.
- H. Clevises or Turnbuckles: Stainless steel Type 304 or 316.
- I. Eye Bolts and Nuts: Stainless steel Type 304 or 316.
- J. Sleeve Nuts: Stainless steel Type 304 or 316.

2.03 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design or Load and Resistance Factor Design Specification for Structural Steel Buildings."
 1. Camber structural-steel members where indicated.
 2. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.
 3. Mark and match-mark materials for field assembly.
 4. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, seam marks, roller marks, rolled trade names, and roughness.
 5. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
- C. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
- D. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.
- E. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- F. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning" SSPC-SP 2, "Hand Tool Cleaning" SSPC-SP 3, "Power Tool Cleaning."
- G. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.
- H. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural steel. Straighten as required to provide uniform, square, and true members in completed wall framing.
- I. Welded Door Frames (if applicable): Build up welded door frames attached to structural steel. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk, cross-recessed head machine screws, uniformly spaced not more than 10 in. O.C., unless otherwise indicated.

- J. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
1. Cut, drill, or punch holes perpendicular to steel surfaces. DO NOT enlarge holes by burning.
 2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.04 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM F 3125/ F 3125M" for type of bolt and type of joint specified.
1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
 3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
 - a. Grind butt welds flush.
 - b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

2.05 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/ A 123M.
1. Fill vent holes and grind smooth after galvanizing.
 2. Galvanize lintels and shelf angles attached to structural-steel frame and located in exterior walls.
 3. Reference SECTION 09915 - PROTECTIVE COATINGS for additional requirements.

2.06 SOURCE QUALITY CONTROL

- A. CONTRACTOR will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports. At the minimum, the tests and inspections shall include 100% visual and 25% NDT. The NDTs shall be as noted in D.1 through D.4 below, at the testing agency's option.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- C. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM F 3125/ F 3125M."
- D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:
 1. Liquid Penetrant Inspection: ASTM E 165.
 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 3. Ultrasonic Inspection: ASTM E 164.
 4. Radiographic Inspection: ASTM E 94.
- E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:
 1. Bend tests will be performed if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
 2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify elevations of concrete and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedment, with steel erector present, for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

3.03 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural

Steel Buildings - Allowable Stress Design and Plastic Design or Load and Resistance Factor Design Specification for Structural Steel Buildings."

- B. Base Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials and roughen surfaces prior to setting base plates. Clean bottom surface of base plates.
 - 1. Set base plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of base plate.
 - 3. Snug-tighten Pretension anchor rods after supported members have been positioned and plumbed. DO NOT remove wedges or shims but, if protruding, cut off flush with edge of base plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and base plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel and architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges" Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
- D. Splice members only where indicated.
- E. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.
- F. DO NOT use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1.
- G. DO NOT enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.04 FIELD CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM F 3125/ F 3125M" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
 - 1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design, Load and Resistance Factor Design Specification for Structural Steel Buildings" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.

3.05 FIELD QUALITY CONTROL

- A. If the OWNER and/or ENGINEER, during routine field inspections, find questionable materials or connections, the OWNER may request the CONTRACTOR to show that these materials or connections meet Code requirements, at no cost to the OWNER.
- B. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM F 3125/ F 3125M."
- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.
- D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.06 REPAIRS AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Touchup Painting: After installation, promptly clean, prepare, and prime or re-prime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, and abutting structural steel.
 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
 3. Cleaning and touchup painting are discussed further in SECTION 09915 - PROTECTIVE COATINGS.

END OF SECTION

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SECTION 05205
ACCESS PLATFORMS, STAIRWAYS, AND LADDERS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The work included in this section of the specifications consists of the complete furnishing and installation of access platforms, stairways, and ladders as herein described and as shown on the plans.
- B. To ensure compatibility throughout the entire project, the equipment furnished herein shall be identical to that furnished on other equipment items (clarifiers, tanks, access bridges, etc.). It shall be the CONTRACTOR'S responsibility to ensure this requirement is met.
- C. The structural steel fabricator (or equipment manufacturer) is responsible for the design of the platforms and stairways.
- D. Requirements for grating with embedded frames shown on the mechanical/structural drawings shall supersede this specification.
- E. This project is funded through the Texas Water Development Board (TWDB) and shall include all requirements of the TWDB, including, but not limited to, the American Iron and Steel (AIS) requirements of 33 U.S.C. § 1388. The Contractor's bid costs shall reflect these requirements.

1.02 RELATED WORK

- A. SECTION 09915 - PROTECTIVE COATINGS
- B. SECTION 05120 - STRUCTURAL STEEL
- C. SECTION 05500 - MISCELLANEOUS METALS

1.03 SUBMITTALS

- A. Submit shop drawings for fabrication and erection of metal platforms and stairways showing dimensioned layouts and details and indicating design loads and deflections.
- B. Submit calculations, certification, sealed and signed by a Professional Engineer registered in Texas, certifying the design complies with the requirements of this specification and is in accordance with accepted engineering practices.
- C. One (1) electronic copy in Portable Document Format (PDF) of all submittals and re-submittals shall be submitted suitable for distribution over electronic mail or File Transfer Protocol (FTP). For final approved submittals provide PDF and two (2) hard copies.

PART 2 - PRODUCTS

2.01 GRATING

- A. Grating shall be provided and installed where indicated on the plans. Unless otherwise shown on the drawings, grating shall be hot dipped galvanized, straight, and flat sections of maximum

7'-0" in length, sized 1-1/4 in. x 3/16 in. x 1 in. clear opening (Type W-B weldforged). The platforms shall be provided with a minimum 3'-0" wide (clear opening) walkway designed to allow for an uninterrupted passage along its entire length.

- B. The grating sections shall include intermediate supports of minimum 1/4 in. thick steel plate construction, hot-dipped galvanized after fabrication. The supports shall be sized and located to ensure adequate cross bracing of the grating, as recommended by the grating manufacturer, but in no case shall be greater than 3 ft. – 6 in. on center, unless otherwise shown on the plans. Coordinate grating support locations with equipment manufacturers.
- C. The grating sections with spans of 6 to 12 ft shall include intermediate supports with a minimum section modulus of 5.0 in³, spaced at 4 ft maximum centers. For longer spans, the required supports shall be provided at a spacing of not greater than 4 ft and the pertinent structural calculations shall be submitted for both gratings and supports, considering a distributed live load of 100 psf, for review and approval.
- D. The top of the grating shall be flush with the top of steel sections for a platform or flush with the top of concrete for concrete mounting.
- E. The grating sections shall include stainless steel hold-down clips with stainless steel fasteners, on maximum 4 ft. centers in all directions in each direction. Clips shall ensure easy removal of the grating sections.
- F. For trench design, install grating panels joining clip assembly. Grating panels shall be joined with a saddle clip on top and adjoining bar on bottom, with a bolt to secure both parts together. Install two (2) grating clip assemblies per joint to prevent grating panels from moving. Grating clip assembly shall be stainless steel model GRAT1G08 by ATC Specialty Products LLC.
- G. All Gratings shall be banded on all edges, without exception, including on any proposed pultrusion of pipe or other objects through the grating. Banding shall be installed on the grating prior to it being hot dipped galvanized. Openings between the banded grating and the protruded item shall not exceed 1-1/2".
- H. For grating shown as stainless steel on the drawings, the drawings shall govern over this specification, but the grating shall meet all requirements of ASTM A666.
- I. All grating in traffic areas shall be H20 load traffic rated.

2.02 CONCRETE WALL MOUNT

- A. The supplier shall furnish hot-dipped galvanized grating support angles for attachment to the concrete. Where an embedded angle is not shown, the grating supports shall be galvanized angles 3 in. x 4 in. x 1/4 in. (minimum) LLV. Additional supports shall be as shown on the Drawings. Stainless Steel Epoxy anchors, minimum 1/2 in. diameter shall be provided on maximum 18 in. centers, or as shown on the Drawings.
- B. Grating supports shall be removable without removing concrete anchor bolts.

2.03 HANDRAILING

- A. The handrail system shall be furnished and installed where indicated on the plans. The handrail shall be of 2-rail 6061-T6 aluminum pipe 1.9 in. outside diameter with a .7 mil clear anodized coating. To the rail centerline, the top rail shall be 42 in. high, and the lower rail shall be 21 in.

high. Horizontal pipe sections and vertical posts shall be minimum Schedule 40. The vertical posts shall be positioned at no greater than 6" - 0' on center. The vertical handrail posts shall be shop assembled with cast or machined internal slip fittings and base mounting plates attached to the posts with stainless steel #17 Tek screws, or welding (except for the top fittings at intermediate posts). All base plates shall have 2-bolt mounting using 3/8 in. diameter stainless steel drill-in anchors for concrete mounting, or hex head machine bolts for flange mounting. Horizontal railing shall be shipped in 24 ft. long sections for field cutting and drilling. The horizontal railings shall be attached to the fittings with 1/8 in. diameter stainless steel pop rivets. The finished assembled handrail system shall provide a smooth handrail with the outside diameter remaining a constant 1.9 in. O.D. at the vertical post connections. An expansion joint shall be provided for the top rail at building expansion joints or 24 ft. maximum centers. Handrail mounted on walking surfaces shall include a 4 in. high aluminum toe board or kickplate. The toe board shall be an extruded aluminum AZ shape to provide a straight and rigid assembly and be attached to the walking surface side of the handrail. Toe board shall be attached to each handrail post without exception and shall have means for thermal expansion as recommended by the manufacturer. The handrail system shall comply with all current OSHA Standards. The handrail system shall be as supplied by Golden Railings, Inc. of Golden, Colorado or ENGINEER approved equal. The railing design shall comply with IBC Section 1607.7.

- B. For long horizontal runs, as recommended by the handrail manufacturer, the CONTRACTOR shall install expansion joints in the horizontal runs. The joints shall be the standard design of the manufacturer. The joints shall be spaced as recommended by the manufacturer.
- C. Provide removable chain for handrail openings that are required to provide access to an area.

2.04 PLATFORMS AND STAIRWAYS

- A. Platforms and stairways shall be fabricated of minimum 1/4 in. thick standard structural steel sections, hot dip galvanized after fabrication. The minimum support size for the platforms shall be 3 in. x 3 in. x 1/4 in. steel angles. The platforms and stairways shall be designed and constructed so that the maximum deflection shall not exceed 1/800 of the span at a design loading condition of all dead loads plus a live load of 100 lbs. per square foot of walkway. Platforms and stairways shall include handrail, grating and kickplates as herein specified. Handrail design shall accommodate the live load specified in UBC section 1607. Stairways shall include stair treads to match plant grating, with the exception that the top of the grating shall be serrated and include slip resistant nosing (coated safety yellow per SECTION 09915 - PROTECTIVE COATINGS).
- B. Submittals for platforms and stairways shall include calculations verifying the proposed Items meet the structural requirements specified. The calculations shall be sealed by a registered Professional Engineer in the State of Texas.
- C. The top of all stairways shall have yellow chain spanning between and supported by the handrail, connected to the handrail posts with stainless steel eye bolts and aligning with the top rail of the handrail. The chain shall include stainless steel hasps on each end connected to the eye bolts. A steel sign will be attached to the middle of the chain with stainless steel fasteners. The sign shall be sized 6" tall x 10" long and include the following text: "CAUTION / WATCH YOUR STEP". The signs shall have a yellow background with black lettering, with the exception of the word "CAUTION", which shall have a black boxed-in background with yellow text. The signage shall match the signage specification in the contract documents. Chain shall be McMaster-Carr or equal, polyethylene, sized 7/8" x 2-1/16" inside link with 3/8" link diameter.

2.05 STEEL LADDERS

- A. General: Fabricate ladders for the locations shown, with dimensions, spacings, details and anchorages as indicated. Comply with requirements of ANSI A14.3 and OSHA Federal Regulations 1910.27.
 - 1. Finish: Hot Dip Galvanized unless otherwise indicated.
- B. Siderails: Continuous steel flat bars, 1/2 in. x 2-1/2 in., with eased edges, spaced 18 in. apart.
- C. Bar Rungs: Steel flat bar, 3/8 in. thick x 2 in. spaced 12 in. O.C.
- D. Fit rungs in centerline of side rails, plug weld and grind smooth on outer rail faces.
- E. Support each ladder at top and bottom and at intermediate points (as shown on the drawings) by means of welded or bolted steel brackets.
 - 1. Size brackets to support design dead and live loads indicated and to hold centerline of ladder rungs clear of the wall surface by not less than 7 in.
 - 2. Extend side rails 42 in. above top of vault/bridge/basin/etc. and return rails to wall or structure unless other secure handholds are provided. If the adjacent structure does not extend above the top rung, gooseneck the extended rails back to the structure to provide secure ladder access.
 - 3. Provide Halliday Model L1E ladder extension or equal in locations where ladders do not extend above the top of the vault. Ladder extensions shall extend a minimum of 42 inches above the top of the vault and shall be retractable. Ladder extensions shall be fabricated from aluminum.
- F. Provide non-slip surface on top of each rung, either by coating the rung with aluminum oxide granules set in epoxy resin adhesive, or by using a type of manufactured rung which is filled with aluminum oxide grout (MEBAC by Harsco-IKG or equal).

2.06 STAIRWAYS

- A. Materials
 - 1. Structural Steel Plates, Shapes, and Bars: ASTM A 36.
 - 2. Steel Pipe: ASTM A 53, Grade A, standard weight (Schedule 40).
 - 3. Steel Plates to be Bent: ASTM A 283, Grade C.
 - 4. Standard Nuts and Bolts: ASTM A 307, Grade A, regular hex head.
 - 5. Zinc (Hot Galvanized) Coating: Comply with ASTM A 123 for products fabricated from rolled, pressed, and forged steel shapes, plates, bars, and strips or ASTM A 386 for assembled steel products. Galvanized after fabrication.
 - 6. Stair Treads: 1-1/2 in. x 3/16 in. x 1 in. clear opening, hot dipped galvanized, serrated top with slip resistant nosing (Type W-B weldforged).

B. Fabrication - General

1. Use of materials of the required size and thickness to produce adequate strength and durability in the finished product for the intended use. Work to the dimensions or in accordance with job measurements. Use type of materials shown or specified for the various components of the work.
2. Form exposed work true to line and level, with accurate angles and surfaces, and sharp, straight edges. Ease exposed edges to a radius of approximately 1/32 in. Form bent metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.
3. Weld corners and seams continuously and in accordance with the AWS code. Grind exposed welds smooth and flush to match and blend with adjoining surfaces.
4. Form exposed connections with hairline joints which are flush and smooth, using concealed fasteners wherever possible.
5. Provide for anchorage coordinated with the supporting structure. Fabricate and space anchoring devices as required to provide adequate support of the work.
6. Cut, reinforce, drill, and tap miscellaneous metal work as may be required to receive other items of work.
7. Hot dip galvanize all items shown on the drawings after fabrication.

C. Fabrication and Assembly

1. Use welding or joining pieces together, unless otherwise shown or specified. Fabricate units so that bolts or other fastenings do not appear on finished surfaces. Make joints tight and true. Provide continuous welds ground smooth where exposed.
2. Construct stair units to conform to sizes and arrangements shown. Construct entire assembly to support a live load of 100 lbs. per square foot, unless otherwise shown. Provide metal framing, hangers, column, struts, brackets, bearing plates, or other components as required for the support of stairs and platforms.
3. Provide brackets and bearing surfaces as required to anchor stairs to supporting structure.
4. Fabricate stringers of structural steel channels or plates, or a combination thereof. Provide closures for exposed ends of stringers.
5. Construct platforms of structural steel headers and miscellaneous framing members. Bolt headers to stringers or other framing members.
6. Construct riser and subtread metal pans with steel angle supporting brackets sized as required and welded to strings. Secure metal pans to brackets with rivets or welds.
7. Secure sub-platform metal pans to platform frames and weld.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Platforms, ladders, and stairways shall be installed in accordance with the manufacturer's installation requirements.
- B. Erect stair work to line, plumb, square, and true with runs registering level with finished floor and platform levels.
- C. Perform all cutting, drilling, and installation of stair systems. Fit exposed connections together to form tight hairline joints. Weld connections which are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Grind joints smooth and touch-up shop finish.
- D. Do not weld, cut, or abrade the surfaces of units which have been hot dip galvanized after fabrication are intended for bolted, fitted connections.
- E. Stairs shall be firmly anchored to building structure and braced as required to resist sideway, buckling, and deflection.

3.02 PROTECTIVE COATINGS

- A. Unless otherwise noted on the drawings, all fabricated steel materials that are not stainless steel shall be hot-dip galvanized after fabrication in accordance with SECTION 09915 - PROTECTIVE COATINGS of these specifications.
- B. Cleaning and touch-up of paint and galvanized finish at welds, bolted connections, and abraded areas is specified in SECTION 09915 - PROTECTION COATINGS of these specifications.

3.03 ANCHOR BOLTS AND FASTENERS

- A. Anchor bolts and fasteners shall be stainless steel, unless otherwise noted on the drawings.

END OF SECTION

SECTION 05500
MISCELLANEOUS METALS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Requirements for furnishing and installing miscellaneous metal items. Included are all materials and parts necessary to properly complete each item, even though all materials and parts may not be shown or specified.
- B. Review drawings and other sections of the specifications for the extent of miscellaneous metal work required. All metal work not included under other sections of the specifications shall be furnished and installed under this Section.
- C. Furnish all bolts, anchors, sleeves, and other devices to be built into construction for support of miscellaneous metal items. Where applicable, include placing instructions and templates to ensure proper installation.
- D. Pipe sleeves for mechanical and electrical work are to be provided under DIVISION 15 - MECHANICAL and DIVISION 16 - ELECTRICAL.
- E. Requirements shown on the drawings or in other specifications will supersede requirements shown in this specification.
- F. This project is funded through the Texas Water Development Board (TWDB) and shall include all requirements of the TWDB, including, but not limited to, the American Iron and Steel (AIS) requirements of 33 U.S.C. § 1388. The Contractor's bid costs shall reflect these requirements.

1.02 SUBMITTALS

- A. Submit the following information for review. Do not begin fabrication until after submittals have been reviewed.
 1. Design Calculations: Signed and sealed by a qualified professional engineer registered in the State of Texas. Include the following:
 - a. Structure name.
 - b. Name of manufacturer.
 - c. Name of CONTRACTOR.
 - d. Structure dimensions, including width, length, height, for all parts of the structure.
 - e. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
 - f. Governing building code and year of edition.

- g. Design Loads: Include dead load, live load, collateral loads, deflection, wind loads/speeds and exposure, seismic zone, or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes, etc.).
 - h. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
2. Shop Drawings
- a. Submit shop drawings on all fabricated and cast items. Indicate thickness, type, grade, class, and finish of metal. Show construction details, reinforcement, anchorage interface relation with adjacent construction, and mark numbers. For members to be shop primed, show surface preparation, and brand name and manufacturer's number designation of primer proposed for use.
 - b. The use of reproductions of the contract drawings by any contractor, subcontractor, erector, fabricator, or metal supplier, in lieu of preparation of shop drawings signifies his acceptance of all information shown thereon as correct, and obligates himself to any job expense, real or implied, arising due to any errors that may occur thereon. In addition, all references to ENGINEER including professional seals, must be removed if the reproduction of the contract drawings are used as shop drawings.
3. Manufacturer's Product Data: Manufacturer's product data shall contain sufficient information to evaluate conformance to specifications and produce suitability for intended use. Submit test reports from accredited independent testing laboratories where specified. Submit manufacturer's product data for the following products:
- a. Expansion Anchors: Certified pullout and shear capacities shall be included in the submittal.
 - b. Standard cast products.
4. Test Reports for Foreign Manufactured Material: When foreign manufactured material is proposed for use, the material shall be tested for conformance to ASTM requirements by a certified independent testing laboratory located in the United States. Certification from any other source is not acceptable. Furnish copies of the test reports for review. Do not begin fabrication until the material has been accepted. The cost of testing shall be borne by the supplier.
5. Welding Procedure: Submit written description as required to illustrate each welding procedure for welds that are not prequalified per AWS D1.1, Structural Welding Code - Steel. Submit certification of all welders performing work on project.
6. One (1) electronic copy in Portable Document Format (PDF) of all submittals and re-submittals shall be submitted suitable for distribution over electronic mail or File Transfer Protocol (FTP). For final approved submittals provide PDF and two (2) hard copies.

1.03 MEASUREMENT AND PAYMENT

- A. No separate payment will be made for metal fabrications under this Section.

1.04 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM A 36/A36M - Specification for Structural Steel
 - 2. ASTM A 53 - Specification for Pipe, Steel, Black and Hot Dipped, Zinc-Coated Welded and Seamless
 - 3. ASTM A 123 - Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products
 - 4. ASTM A 153- Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware
 - 5. ASTM A193/A193M - Specification for Alloy-Steel and Stainless-Steel Bolting Materials for High Temperature or High-Pressure Service and other Special Purpose Applications
 - 6. ASTM A 276 - Specification for Stainless and Heat Resisting Steel Bars and Shapes
 - 7. ASTM A283/A283M - Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
 - 8. ASTM A 307 - Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
 - 9. ASTM F3125/F3125M - Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength
 - 10. ASTM A 384 - Standard Practice for Safeguarding against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies
 - 11. ASTM A 480 - Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
 - 12. ASTM A653/A653M - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 13. ASTM A 526 - Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality
 - 14. ASTM A 780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
 - 15. ASTM B221 - Standard Specification for Aluminum and Aluminum Alloy Extrudes Bars, Rods, Shapes, and Tubes

16. ASTM B 633 - Specification for Electro-Deposited Coatings of Zinc on Iron and Steel
 17. ASTM E 488 - Standard Test for Strength of Anchors in Concrete
 18. ASTM A 501 - Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
 19. ASTM F 593 - Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
 20. ASTM F 594 - Specification for Stainless Steel Nuts
- B. American Welding Society (AWS)
1. AWS D1.1- Structural Welding Code - Steel
- C. American Institute of Steel Construction (AISC):
1. Specification for Structural Steel Building Allowable Stress Design (Ninth Edition).
 2. Code of Standard Practice for Steel Buildings and Bridges.
- D. Steel Structures Painting Council (SSPC):
1. SSPC SP3 - Power Tool Cleaning
 2. SSPC SP6 - Commercial Blast Cleaning
 3. SSPC SP10- Near-White Blast Cleaning
- E. Federal Specifications:
1. FS-S-325 - Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry)

1.05 SUBSTITUTIONS

- A. Substitution of rolled sections, details or products is not permitted without prior written approval. If items shown or specified are not readily obtainable, permission to substitute for the specified item may be requested by the CONTRACTOR. Substitutions may be allowed on items of equal or superior properties which conform to design criteria.

1.06 GAUGES

- A. US standard for sheet and plate.

1.07 QUALIFICATION OF WELDERS

- A. Welding must be performed by certified welders. Steel welders must be qualified by procedures of AWS D1.1, Structural Welding Code - Steel, using procedures, materials, and equipment of the type required for the work.

- B. Welders' Certificates: Submit certification of welders employed on the work, verifying AWS qualification within the previous twelve (12) months.

1.08 CODE REQUIREMENTS

- A. Design of steel fabrications shall conform to the requirements of the following codes:
1. AISC Specifications for Structural Steel for Building, Allowable Stress Design (Ninth Edition).
 2. International Building Code.

1.09 INSPECTION AND TESTING

- A. The materials and workmanship covered in this specification may be inspected by the OWNER, the ENGINEER, or the OWNER'S designated testing laboratory. The testing laboratory will be employed and paid by the CONTRACTOR. Inspection may be performed in the mill, shop, or field as deemed necessary. Inspection in no way relieves the CONTRACTOR from his responsibility to furnish satisfactory materials. The right to reject material at any time before final acceptance is reserved if material and workmanship do not conform to drawings and specifications.

1.10 FIELD MEASUREMENTS

- A. Prior to fabrication, take necessary field measurements of previously installed construction so that work will fit properly. Members that do not fit properly must be replaced unless approval for their modification has been obtained from the ENGINEER.

1.11 DELIVERY AND STORAGE

- A. Schedule material delivery so that items may be erected promptly after arrival. If materials must be stored at the project site, they shall be stored above-ground on platforms, skids, or other supports. Material stored at the site shall be kept free of dirt, mud, grease, or oil. Protect stored material from corrosion.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Carbon Steel Shapes, Plates, and Bars
1. Steel shapes and bars shall conform to ASTM A 36 unless otherwise specified or noted on the drawings.
 2. Steel plate, including plate to be bent or formed cold, shall conform to ASTM A 36 with a minimum yield strength of 36,000 psi except that plate conforming to ASTM A 283, Grade C, may be used at steel strap anchors.
 3. Use carbon steel except where otherwise specified or noted on the drawings.
- B. Steel Pipe: Conform to ASTM A 53, Type E, or S, Grade B, welded or seamless, Schedule 40. No hydrostatic tests are required.

- C. Steel Tubing: Conform to ASTM A 500 or ASTM A 501, Grade B.
- D. Stainless Steel: Where indicated on the drawings as "stainless steel," "stn. steel," or "SS," use stainless steel of the type shown. Where the type is not shown, use stainless steel Type 304 for nonwelded items and Type 304L for welded items. Stainless steel shall conform to the following requirements:
 - 1. Bars and Shapes: ASTM A 276.
 - 2. Finish shall conform to ASTM A 480 as follows:
 - a. Sheet - No. 1 finish.
 - b. Strip - No. 1 finish.
 - c. Plate - hot-rolled and annealed or heat treated, and blast cleaned or pickled.
- E. Galvanized Sheet Steel: Conform to ASTM A 653/A653M, Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Drip Process.
- F. Carbon Steel Bolts and Washers: Conform to ASTM A 307 or ASTM A 325, with suitable nuts and washers, as noted on the drawings. Washer bearing on timber shall be malleable iron. Washers bearing on metal shall be cast steel. Where type is not noted on the drawings, provide ASTM A 307. Use carbon steel bolts except where indicated otherwise on the drawings.
- G. Stainless Steel Bolts and Washers: Bolts per ASTM F 593; nuts per ASTM 594, Type 316; wide coarse threads.
- H. Anchor Bolts
 - 1. Stainless steel anchor bolts shall be Type 304 (unless otherwise described in other specifications in this document or as shown on the drawings) conforming to ASTM A 193. Use stainless steel anchor bolts where shown on the drawings as "stainless steel," "stainless steel," or "SS." Provide stainless steel anchor bolts with suitable stainless-steel nuts and oversize washers.
 - 2. Provide anchor bolts for all equipment and machinery when anchor bolts are not furnished by the manufacturer. Anchor bolt type, size, length, projection, etc., shall conform to the requirements of the equipment and machinery manufacturer.
 - 3. Provide templates to accurately position the anchor bolts in the forms.
- I. Concrete Anchors: Concrete anchors are inserted into holes and drilled in hardened concrete and shall be one of the following types, unless noted otherwise on the drawings:
 - 1. Adhesive Epoxy Anchors: Concrete anchors which are submerged, in splash zones, in enclosed spaces over liquids, or anchoring vibrating equipment shall be epoxy adhesive anchors. Adhesive anchors may be used at all locations where concrete anchors are required. Unless noted otherwise on drawings, epoxy systems shall be Sika/FI System with Sikadur Injection Gel Epoxy, Master Builders Concrese Epoxy Cartridge Dispensing System, Concrese Paste LPL, or equal. Threaded rods shall be ASTM F 593, type 316 studs. Where adhesive anchors, or connected metal, are exposed to direct

- sunlight, the anchors shall be certified to maintain at least 90 percent of their rated strength (tested at 73°F) when tested at 160°F.
2. Expansion Anchors: Where concrete anchors are indicated and adhesive anchors are not required, wedge type anchors made with ASTM A 276, Type 316 stainless steel shall be used anchors shall be KWIK Bolt II by Hilti, Inc., or approved equal.
 3. Expansion anchors shall be installed in accordance with the manufacturer's recommendations.
 4. A list of standard materials used in the manufacture of the anchor components, including designated material specification (AISI, ASTM, etc.), as well as pullout and shear values attained from tests performed by a certified independent testing laboratory in accordance with ASTM E 488, shall be submitted to the ENGINEER for review. The submittal shall also include the manufacturer's installation instructions.
- J. Abrasive Cast Aluminum Nosings: All concrete stairs shall have nosings. Nosings for concrete stairs shall be cast aluminum not less than 3 in. from front to back, not less than 5/16 in. thick and 6 in. shorter than the tread width. The top of the nosing shall have a hatched, abrasive surface. The nosing shall have anchors on the underside. Place one anchor at each end and stagger intermediate anchors approximately 13 in. apart. No finish is required. Provide abrasive cast aluminum nosings for all concrete stairs and landings.
- K. Aluminum Grating (unless noted otherwise): Grating shall be fabricated from I-shaped bars, alloy 6063-T6, with swaged cross bars spaced on 4" centers. Bearing bars shall be spaced on 1 - 3/16" centers. Grating shall be minimum 1.5" thick. Top surface of bearing bars shall be serrated to provide a non-slip surface.
- L. Stainless Steel Grating (unless noted otherwise): Grating shall be fabricated from round bars, Type 316 stainless steel with cross bars on 4" centers. Bearing bars shall be on 1 - 3/16" centers. Grating shall be 1- 1/2" thick. Top surface shall be non-serrated.
- M. Lintels (unless noted otherwise): Lintels shall be steel angles with dimensions 5 – 1/2" x 4 – 1/2" with a thickness of 5/16". Lintels shall be painted in accordance with SECTION 09915 – PROTECTIVE COATINGS.
- N. Grout: Conform to the requirements of SECTION 03605, NON-SHRINK GROUT.
- O. Paint for Shop Primer
1. For steel in buildings, use a primer suitable for use with coating system for interior exposure as specified in SECTION 09915 - PROTECTIVE COATINGS.
 2. For steel exposed to the weather, use a primer suitable for use with the paint system as specified in SECTION 09915 - PROTECTIVE COATINGS.
 3. For all submerged steel, use a primer suitable for use with a paint system as specified in SECTION 09915 - PROTECTIVE COATINGS.
- P. Galvanizing Repair Coating: Hot applied zinc-based solder conforming the requirements of ASTM A 780.

2.02 FABRICATION

A. General Fabrication Requirements

1. Assembly: Where practical, fit and assemble items in the shop and deliver to the site ready for installation.
2. Use materials of the size and thicknesses shown, or if not shown, of the required size and thickness to produce adequate strength and durability in the finished product for the intended use. Work to the dimensions shown or in accordance with job measurements. Use type of materials shown or specified for the various components of the work.
3. From exposed work true-to-line and level with accurate angles and surfaces and sharp, straight edges. Ease exposed edges to a radius of approximately 1/32 in. Form bent metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.
4. Joints exposed to the weather shall be formed to exclude water. All joints shall be flush and smooth.
5. All shop connections shall be welded except where welding is not practical or unless shown otherwise on the drawings. Where screws or bolts cannot be avoided, conceal fasteners where possible or countersink heads, screw up tight and nick threads to prevent loosening.
6. Weld joints continuously except where skip welding is permitted as shown on the drawings. In all lapped or “tee” splices or other joints where intermittent filler welds are allowed, the edges of fraying surfaces shall be continuously seal welded in accordance with the required strength weld. Grind exposed welds smooth and flush to match and blend with adjoining surfaces.
7. Welding process and procedures shall be the most suitable process for the connection as selected by the CONTRACTOR and approved by the ENGINEER. The CONTRACTOR'S purpose welding process shall be shown on the shop drawings. All shop and field welding must be performed by qualified welders who hold current welding certificates.
8. Provide for anchorage of the type shown, or as required, coordinated with the supporting structure. Fabricate and space anchoring devices as shown and as required to provide adequate support of the work.
9. Curt, reinforce, drill, and tap miscellaneous metal work as may be required to receive other items of work.
10. Where possible, all cuts shall be cut or flame-cut with automatic guided equipment. Any edges requiring cutting with a handheld torch shall be ground neat, smooth, and straight. Edges shall be ground free of sharp edges, burrs, and weld splatters. All fits shall be accurate and neat.
11. Re-entrant corners shall be free of notches or sharp corners. Provide a 1 in. radius unless noted otherwise on drawings.

12. Bolt holes shall be punched and drilled, or sub-punched and reamed. If holes are flame-cut, they shall be burned undersize and reamed to correct size.

B. Steel Fabrication

1. Fabrication of steel items shall conform to AISC Code of Standard Practice for Steel Buildings and Bridges and AISC Steel Construction Manual.
2. Welding shall conform to the requirements of AWS D1.1, Structural Welding Code - Steel. Welding not governed by the above shall be performed in accordance with best modern practice for strength and durability.
3. Construct steel frames for approved fire doors according to the requirements of authority having jurisdiction for class of opening indicated or specified. Frames which bear Underwriter Laboratories label for class of opening required will be the basis of acceptance. Authorized construction details and requirements for approved fire door frames take precedence over project details or specifications, except where thicker gauges than those required for approval are specified.
4. Loose lintels shall have a minimum bearing of 8 in. on each end unless shown otherwise. All lintels shall be hot dip galvanized.

C. Stainless Steel Fabrication: Carbon steel tools or lifting devices shall not come in direct contact with items being fabricated of stainless steel. Should carbon steel inadvertently come in contact with the stainless steel, the stainless steel must be cleaned of any embedded carbon steel particles.

D. Aluminum Fabrication

1. Fabrication of aluminum items shall conform to the Aluminum Association's "Specifications for Aluminum Structures."
2. Welding shall conform to the requirements of AWS D1.2, Structural welding Code - Aluminum. Welding not governed by the above shall be performed in accordance with best modern practice for strength and durability. When possible, all welding shall be done in the shop.
3. All aluminum surfaces shall have a mill finish free from die markings, scratches, welding discolorations, or other surface blemishes.
4. Aluminum surfaces that will be in contact with concrete or steel shall be given a heavy coat of alkali-resistant bituminous paint, or other coating recommended by the manufacturer that will provide equivalent protection. The coating shall not be visible in the completed installation.

2.03 GALVANIZING

- A. All carbon steel items shown on the drawings to be galvanized or specified to be galvanized shall be hot dip galvanized after fabrication. Galvanize in accordance with ASTM A 123 or ASTM A 153, as applicable.
- B. The CONTRACTOR shall safeguard against warpage and distortion during hot dip galvanizing as specified in ASTM A 384. Any member or assembly that is warped or distorted must be

straightened. Any member or assembly that cannot be straightened must be replaced at no additional cost to the OWNER.

2.04 SHOP PRIME

- A. Shop prime all carbon steel members or assemblies that are not shown or specified to be galvanized or that are not encased in concrete. Stainless steel and aluminum items shall not be shop primed. Before assembly, paint surfaces that will be inaccessible after fabrication. Primer shall be applied in accordance with the paint manufacturer's recommendations and instructions. Surface preparation shall produce the profile recommended by the paint manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Prior to installation, inspect surfaces to which miscellaneous metal items will be attached. Verify that field conditions are acceptable and are ready to receive work. If the condition of the surface is such that it will adversely affect installation, do not proceed with installation until corrective measures have been taken. Beginning of installation means erector accepts existing conditions.
- B. Verify that aluminum surfaces that will be in contact with concrete or steel have been coated as specified.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply items required to be cast into concrete or embedded in masonry with setting templates to appropriate sections.
- C. All stainless-steel threads to be coated with an anti-seizing compound prior to installing the nuts.

3.03 INSTALLATION

- A. Accurately set work to established lines and elevations and securely fasten in accordance with approved shop drawings and provisions of this Section.
- B. The CONTRACTOR shall be fully responsible for furnishing and installing any temporary braces, ties, or shoring necessary to hold secure and safe all items under the action of wind and erection loads imposed thereon until construction is completed.

3.04 WELDING

- A. Welding Steel: Conform to requirements of AWS D1.1, Structural Welding Code - Steel.
- B. Welding Aluminum: Conform to requirements of AWS D1.2, Structural Welding Code - Aluminum.

3.05 ERECTION OF STEEL ITEMS

- A. Erection of steel items must conform to AISC specification, Structural Steel for Buildings. Field-fabricated bolt holes, when required, shall be drilled; or as an alternate, they may be flame-cut undersize and reamed to correct size.

3.06 ERECTION TOLERANCES

- A. Maximum Variation from Plum: 1/4 in. per story, non-cumulative.
- B. Maximum Offset from True Alignment: 1/4 in.

3.07 CONCRETE STEP NOSINGS

- A. Set nosings level and straight and at proper height to finish flush with adjacent concrete surfaces. Nosing shall be centered on tread approximately 3 in. short of each end of the tread. Verify that nosings are firmly anchored in place with anchors attached to the underside.
- B. Clean all cement from the surface of the nosings.

3.08 GROUTING

- A. All bolt-down assemblies shall have grout pads under the base plates. Grout for baseplates, etc., shall be as specified in SECTION 03605 - NON-SHRINK GROUT.

3.09 COATING REPAIRS

- A. Thoroughly clean field welds, abrasions, and damaged or defective areas of shop-primed or galvanized surfaces.
- B. Painted Surfaces: Prepare the surface as previously specified for shop painting. After the surface is prepared, apply a heavy coat of matching shop paint.
- C. Galvanized Surfaces: Prepare the damaged surface and apply a minimum of 2 mils of the specified galvanized repair coating in conformance with the requirements of ASTM A 780. Where the repair coating manufacturer's recommendations are more stringent than ASTM A 780, the manufacturer's recommendations shall be followed.

3.10 FIELD PAINTING

- A. Field painting shall conform to the following. Where practical, final coats may be applied in the shop.
- B. Steel in Buildings: Paint system as specified in SECTION 09915 - PROTECTIVE COATINGS.
- C. Steel Exposed to Weather: Paint system as specified in SECTION 09915 - PROTECTIVE COATINGS.
- D. All Submerged Carbon Steel: Coal-tar paint system as specified in SECTION 09915 - PROTECTIVE COATINGS.

3.11 PROTECTION OF ERECTED MISCELLANEOUS METAL ITEMS

- A. After erection, the miscellaneous metal items must be protected to prevent damage prior to final acceptance of the project. All items shall be free from scratches, nicks, gouges, dents, concrete splatter, paint splatter, or other foreign material. Material damaged in a manner that will affect durability, strength, or appearance which cannot be repaired to the satisfaction of the ENGINEER must be replaced without additional cost to the OWNER.
- B. Stainless steel items shall be cleaned of all rust spots caused by carbon steel embedded particles where carbon steel items have come in contact with the stainless steel. All carbon steel embedded particles shall be removed to prevent further rust spots from forming.

END OF SECTION

SECTION 05550
ACCESS HATCHES

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. This item shall consist of the furnishing and installation of factory fabricated access hatches and associated appurtenances as shown on the Drawings.
- B. The minimum clear opening shown on the drawings must be met, without exception, with the hatch and safety grate in the raised position.
- C. All hatches in the closed position shall be flush with the top of the concrete structure.
- D. All hatches shall have safety grates, unless noted otherwise.

1.02 RELATED WORK

- A. SECTION 01300 – SUBMITTALS.
- B. SECTION 05500 – MISCELLANEOUS METALS.
- C. O&M Data per SECTION 01782 – OPERATION AND MAINTENANCE DATA.
- D. Warranty data per SECTION 01740 – WARRANTIES AND BONDS.

1.03 SUBMITTALS

- A. Submit shop drawings, catalog cuts, technical specifications, warranty information, and other descriptive material for review and approval in accordance with Specifications SECTION 01300 – SUBMITTALS. Submittals shall include the following:
 1. Product Data: Manufacturer's specifications, standard details, and installation recommendations.
 2. Shop Drawings: Submit edited product data or shop drawings, or a combination thereof, as required to accurately describe installation of the products to be provided. Show elevations, field measurements, reinforcement, anchorages, expansion provisions, installation accessories, and detail sections of composite members.
 3. O&M Data per SECTION 01782 – OPERATION AND MAINTENANCE DATA.
 4. Warranty data per SECTION 01740 – WARRANTIES AND BONDS.
- B. One (1) electronic copy in Portable Document Format (PDF) of all submittals and re-submittals shall be submitted suitable for distribution over electronic mail or File Transfer Protocol (FTP). For final approved submittals provide PDF and two (2) hard copies.

1.04 APPLICABLE STANDARDS AND SPECIFICATIONS

- A. The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B. American Society for Testing And Materials (ASTM)
 - 1. ASTM A 36: Standard Specification for Structural Steel.
 - 2. ASTM A193/A193M Standard Specification for Alloy-Steel and Stainless-Steel Bolting Materials for High-Temperature Service.
 - 3. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - 4. ASTM B211 Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire.
 - 5. ASTM B316/B316M Standard Specification for Aluminum and Aluminum-Alloy R and Cold-Heading Wire and Rods.

1.05 PERFORMANCE REQUIREMENTS

- A. Operation of the covers shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
- B. Operation of the covers shall not be affected by temperature.

1.06 OPERATION AND MAINTENANCE MANUALS

- A. Operation and maintenance manuals shall be provided by the equipment manufacturer. Each manual shall be an index binder prepared specifically for this project and submitted in accordance with SECTION 01782 - OPERATION AND MAINTENANCE DATA.
- B. As a minimum the manual shall contain:
 - 1. A complete bill of materials.
 - 2. General arrangement drawings.
 - 3. Detail drawings showing size, anchorages, supports, installation details, and dimensions needed for installation and correlation with other materials and equipment.
 - 4. Cut sheets and product information.
 - 5. Statement of Structural Suitability.
 - 6. Written copy of Manufacturer's standard warranty.
- C. One (1) electronic copy in Portable Document Format (PDF) of all submittals and re-submittals shall be submitted suitable for distribution over electronic mail or File Transfer Protocol (FTP). For final approved submittals provide PDF and two (2) hard copies.

1.07 WARRANTY

- A. The CONTRACTOR shall bear full responsibility for the proper installation of all access covers and hatches within the structures as shown on the plans.
- B. The CONTRACTOR shall guarantee that the equipment furnished and installed shall be free from defects in design, materials, and workmanship for two (2) years from date of final acceptance by the OWNER.
- C. Materials shall be free of defects in material and workmanship for a period of two (2) years from the date of OWNER'S acceptance. Should a part fail to function in normal use within this period, CONTRACTOR shall repair the installation at no charge.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturer: Products of the following manufacturers, provided they comply with requirements of the Contract Documents, will be among those considered acceptable.
 - 1. Halliday Products.
 - 2. Engineer approved equal.

2.02 ACCESS COVERS AND HATCHES

- A. Furnish and install access covers and hatches were indicated and according to the dimensions shown on plans.
- B. Gate shall provide clear opening, matching concrete opening size shown on the drawings, with hatch and safety grate in raised position.
- C. Access covers and hatches shall be pre-assembled from the manufacturer.
- D. All access covers shall be able to be secured by a padlock using a heavy-duty hasp. OWNER will provide padlocks at the time of acceptance of the station. Systems for the padlocks shall not protrude above the hatch (providing a trip hazard).

2.03 FUNCTIONAL REQUIREMENTS

- A. Required Clearances - All access hatches shall be sized large enough for removal of any equipment or piping inside the wet well or vaults.

2.04 MATERIALS

- A. Metal cover: Mill finish sheet aluminum; 6061-T6; alloy and temper to suit specified finishes; minimum 1/4 in. thick, diamond pattern plate to withstand a live load of 300 lb./ft.² with a maximum deflection of 1/150th of the span.
- B. Frame: Minimum 1/4 in. thick extruded aluminum with strap anchors bolted to the exterior. Provide 1 in. NPT drain.
- C. Fasteners

1. For attachment to supporting structure: Type 316 stainless steel.
 2. For aluminum: Made from the following, according to manufacturer's standard practice:
 - a. Stainless steel: ASTM A193, B8 series, Type 316
 - b. Aluminum: ASTM B211, alloy 2024-T4 for threaded fasteners; ASTM B316 for rivets.
 3. For dissimilar metals: Stainless steel, ASTM A193, B8 series, Type 316
- D. Structural Supports and Reinforcements: Aluminum; alloy and temper to suit installation.
- E. Hinges: Shall be specifically designed for horizontal installation and shall be bolted to the underside of covers.
- F. Lifting mechanisms: Cam-action hinges shall pivot on torsion bars to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and to act as a check in retarding downward motion of the cover when closing.
- G. Hold-open arm: set to hold cover at 90 degrees, with detent release.
- H. A removable exterior turn/lift handle with a spring-loaded ball detent shall be provided to open the covers.
- I. Hardware
1. Hinges: Cast steel cam-action hinges which pivot on torsion bars shall be provided.
 2. Covers shall be equipped with a steel hold open arm that automatically locks the cover in the open position.
 3. Covers shall be fitted with the required number and size of torsion bars.
 4. A Type 316 stainless steel snap lock with fixed handle shall be mounted on the underside of the cover.
 5. Miscellaneous Hardware: Stainless steel, Type 316.
 6. All hatches shall have a means to install a padlock to lock shut the hatch. Padlock shall not protrude above the top of the hatch.

2.05 FINISHES

- A. Factory finish shall be mill finish aluminum with bituminous coating applied to the exterior of the frame, with welds cleaned and dressed and exposed welds ground smooth.
- B. Remove oil, grease, dirt, and weld spatter from finished units.

2.06 ISOLATION COATINGS

- A. Zinc molybdate alkyd primer: FS TT-P-645.

- B. Bituminous coating: FS TT-C-494, Type II.

2.07 FALL PREVENTION DEVICES

- A. Safety grates shall be provided for all access hatches.
- B. The safety grates shall be made of 6061-T6 aluminum with a minimum ultimate strength of 38,000 p.s.i. and a minimum yield strength of 35,000 p.s.i. as per ASTM B221. Grate design shall use safety factors as defined in the specifications for aluminum structures. Grating shall be designed to withstand a minimum live load of 300 pounds per square foot. Deflection shall not exceed 1/150th of the span.
- C. The grate openings shall allow for visual inspection and limited maintenance while the safety grate fall through protection is left in place. Each grate shall be provided with the permanent hinging system, which will lock the grate in the 90-degree position once opened.
- D. Grates in the open position shall create a physical barrier around the opening, protecting passing pedestrians. Safety grates shall have an opening arm, with a red vinyl grip handle, which will allow opening of the grate, while providing the grate as a barrier between the operator and the pit. The opening arm shall also be equipped with a controlled confined space entry lock. This locking device will prevent unauthorized entry to the confined space. The grating system will allow anyone to make visual inspection and float adjustments (at the Lift Station) without entering the confined space.
- E. Grate shall be coated with an OSHA type safety orange color, promoting visual awareness of the hazard. The aluminum safety grate shall receive a two-coat powder coat system, applied by the electrostatic spray process. The base coat is a thermosetting epoxy powder coat finish with a minimum thickness of 2-4 mils. The topcoat is a mar-resistant, TGIC polyester powder coating with a minimum thickness of 2-4 mils. Each coat shall be baked at 350°F - 375°F until cured.

PART 3 - EXECUTION

3.01 PRODUCT HANDLING

- A. All materials shall be delivered in manufacturer's original packaging.
- B. Store materials in a dry, protected, well-ventilated area. The CONTRACTOR shall thoroughly inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.

3.02 EXAMINATION

- A. Verify that other trades with related work are complete before installing vault access door(s).
- B. Verify that substrates and openings are rigidly set at proper lines and elevation, properly sized, and ready to receive units.
- C. Do not proceed with installation until conditions detrimental to proper installation have been corrected.
- D. Coordinate installation with other work.

3.03 PREPARATION

- A. Coat contact surfaces of dissimilar metals with one or more coats of isolation coating.
- B. Apply one 15-mil dry film thickness coat of bituminous isolation coating to metal surfaces other than galvanized steel which will be in contact with cementitious materials.

3.04 INSTALLATION

- A. Observe all appropriate OSHA safety guidelines for this work.
- B. Check installation conditions and verify the manufacturer's vault access door details for accuracy to fit the application prior to fabrication. The installer shall comply with the vault access door manufacturer's installation instructions.
- C. Furnish all mechanical fasteners and appurtenances consistent with the vault access door manufacturer's instructions.
- D. Install products in accordance with manufacturer's instructions, except where more stringent requirements are shown or specified, and except where project conditions require extra precautions or provisions to ensure satisfactory performance of the work.
- E. Install products in correct location, plumb and true, without warp or twist.
- F. Provide Schedule 40 PVC piping (minimum 1-1/2" diameter) from the access hatch drain coupling to a discharge point as directed by the Engineer. Unless noted otherwise, the drain piping shall be embedded within the concrete top deck/walls and drain to either the wet well beneath the hatch or the exterior of a dry basin. Combine drain lines of multiple access hatches over a dry basin/structure into a single discharge drain. Refer to structural sheets for requirements on installing piping within concrete slabs and walls.

3.05 CLEANING AND PROTECTION

- A. Install rigid protective cover on access hatch to protect hatch during concrete casting and construction activity.
- B. Touch up marred or abraded areas of finished elements. If satisfactory touch-up cannot be accomplished, remove, and replace element.

END OF SECTION

SECTION 08220
FIBERGLASS (FRP) DOORS AND FRAMES

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. This section describes the requirements for fiberglass reinforced plastic doors, frames, and hardware as shown on drawings.
- B. **Unless noted otherwise, all exterior doors will include electronic access (card readers) and hard key access. Certain interior doors may also require electronic access, as shown on the contract drawings.**

1.02 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General Conditions and DIVISION 1 - GENERAL REQUIREMENTS sections, apply to work of this section.
- B. Finishes are located in SECTION 09915 – PROTECTIVE COATINGS.

1.03 QUALITY ASSURANCE

- A. General: Provide fiberglass reinforced door and frame units made of components of standard construction furnished by one manufacturer as coordinated assemblies.
- B. Manufacturer: Company specializing in the manufacture of fiberglass doors and frames with a minimum of five years documented experience.
- C. Construction: Verify that FRP doors and frames are manufactured utilizing pultruded fiberglass components for flexibility, durability, superior strength, and chemical resistance. Press-molded doors and frames will not be accepted.
- D. Flame Spread Rating: Flame retardant structural shapes meet the minimum flame spread rating less than or equal to 25 when tested according to ASTM E84.
- E. Fire-rated doors and frames to conform to NFPA 252 (2008), CAN4 S104 (1985), UL10C (2001), and UL9 (2005).
- F. Impact Strength: FRP doors and panels 10.32 ft./lbs. per inch of notch, ASTM D-256.
- G. Tensile Strength:
 1. FRP doors and panels 12,000 psi, ASTM D-638.
 2. FRP frames 30,000 psi, ASTM D-638.
- H. Flexural Strength: FRP doors, panels, and frames 25,000 psi, ASTM D-790.
- I. Compressive Strength:
 1. FRP doors and panels 18,000 psi, ASTM D-695.

2. FRP frames 30,000 psi, ASTM D-695.
- J. Water Absorption: FRP doors, panels, and frames .27 percent, ASTM D-570.
- K. Hardware Reinforcements: FRP doors and frames fabricated with a minimum screw holding strength of 1,000 lbs. Tested with a #12 x 1-1/4 in. hinge screw.
- L. Paint Adhesion: Coating for FRP doors, panels, and frames to conform to AAMA 624-07 for color uniformity, film adhesion, specular gloss, direct impact, abrasion resistance, and chemical resistance.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data substantiating that products comply with requirements.
- B. Door Schedule: Provide schedule of doors and frames using same reference numbers for details and openings as those on contract drawings.
- C. Indicate coordinate of glazing frames and stops with glass and glazing requirements.
- D. Label Construction Certification: For door assemblies required to be fire-rated and exceeding sizes of tested assemblies, submit manufacturer's certification that each door and frame assembly has been constructed to conform to design, materials, and construction equivalent to requirements for labeled construction.
- E. One (1) electronic copy in Portable Document Format (PDF) of all submittals and re-submittals shall be submitted suitable for distribution over electronic mail or File Transfer Protocol (FTP). For final approved submittals provide PDF and two (2) hard copies.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames cartoned or crated to provide protection during transit and job storage. Provide additional sealed plastic wrapping for factory-finished doors.
- B. Inspect doors and frames upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to OWNER and ENGINEER; otherwise, remove, and replace damaged items as directed.
- C. Store doors and frames at building site under cover. Place units on minimum 4 in. high wood blocking. Avoid use of non-vented plastic or canvas shelters which could create humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4 in. spaces between stacked doors to promote air circulation.

PART 2 - PRODUCTS

2.01 AVAILABLE MANUFACTURERS

- A. The manufacturer specified is intended to indicate the standard of quality of materials in this section. Manufacturer shall be Chem-Pruf Door Co., Ltd., Brownsville, Texas, or Eliason Corp, Frisco, TX 75035, or ENGINEER approved equal.

2.02 MATERIALS

- A. Doors shall be 1-3/4 in. thick using a polypropylene honeycomb with an integral scrim. Doors shall be fiber reinforced plastic (FRP), using proven resins to achieve superior chemical resistance, strength, and fire retardancy. Edges shall be made of a resin, and fiberglass matrix (nom. thickness .375 in.). Machined to a smooth and accurate finish. A proprietary resin matrix is added to the honeycomb core in critical locations to allow the use of standard wood or machine fasteners. Extra reinforcement is not necessary.
- B. Door plates will be constructed in one continuously molded piece. Using premium grade resins, with hand-layed mat reinforcement (nom. thickness .18 in.). Glass to resin ratio shall be 30 percent glass/70 percent resin. The finish shall be mirror like, 88 or better per ASTM-D523 with a minimum 25 mil gelcoat finish. Door color will be selected by OWNER.
- C. Resin selection will be based on the environmental conditions of the installation location. All reinforcing resins shall contain halogenated additives or co-reactants plus Antimony Trioxide to achieve a flame spread of 25 or less per ASTM E-84 and shall be self-extinguishing per ASTM D-635.
- D. Window frames to be pultruded FRP, casted FRP or stainless steel and attached with stainless steel fasteners. These items will be sealed to stop moisture penetration. Furnish tempered glass.
- E. Frames will conform to SDI dimensions with a solid back and will be comparable in strength to doors. The frames will be made from similar materials to the door's construction.
- F. Provide removable FRP transoms on designated doors. Provide removable fiberglass mullion for each transom. Notch jamb stops to receive mullion. Provide FRP angles to secure mullion to door frame. Provide 16-gauge Type 304 clips to secure transom to door frame.

2.03 HARDWARE

- A. Hardware hinges shall be stainless steel (4.5 in. x 4.5 in.) full mortise. Unless otherwise specified, Butts to be Hager or approved equal.
- B. Closer to be Norton 8501 or approved equal. All doors shall have closers unless otherwise noted.
- C. Kick plates shall be 18-gauge stainless steel with brush finish.
- D. Push/pull handles, passage set of lock sets will be stainless steel. Severe service will be Grade 1 stainless steel. All handles will be heavy duty series.
- E. Hardware (fasteners) will be supplied by the manufacturer unless otherwise noted.
- F. Door stops to be Rockwood No. 442 or approved equal.
- G. Door silencer to be Rockwood No. 608 or approved equal.
- H. Lockset to be Yale, 4700(LN) Series Grade 1 Cylindrical Locks, or approved equal meeting ANSI A156.2 Grade 1. Keys/Lock sets to be selected by OWNER.
- I. Rim exit devices or panic devices shall be No.2828 F by Sargent or approved equal and shall be installed at each location identified in the door schedule. Chlorine Feed and Storage Rooms and

Sulfur Dioxide Feed and Storage Rooms exit doors shall feature marine grade rim exit device, with anodized aluminum bar and black ABS cover on head and push bar.

- J. Panic exit strikes that can be activated by card reader shall be HES 9700-LBM or approved equal.
- K. Card readers:
 - 1. Card reader shall be powered from its associated controller and shall not dissipate more than 5 W.
 - 2. Card reader shall respond to passage requests by generating a signal that is sent to the controller. Response time shall be 800 ms or less.
 - 3. Card readers shall be suitable for surface or weatherproof mounting. Shall be suitable for installation indoors in a controlled or uncontrolled environment, and outdoors.
 - 4. Card readers shall provide visible and audible status indications to indicate whether user passage requests have been accepted or rejected and whether the door is locked or unlocked.
 - 5. Card readers shall be proximity card type and shall read cards in a range from direct contact to at least 6 inches from the reader.
- L. All hardware shall be fitted to a thorough workmanlike manner. All locates to be fitted and removed before painting or finishing and replaced after painting is complete.
 - 1. Fasteners - Hardware shall be complete with all necessary screws, bolts, anchors, or other fasteners for proper application. Such fastenings shall be suitable size and type and shall harmonize with hardware as to material and finish.
 - 2. Finishes - All exposed hardware shall have anodized finish. Closers to be sprayed enamel to match adjacent hardware finish. Butts shall have finish.
- M. Keying – Door shall have keys in addition to electronic entry.
 - 1. Four (4) keys will be furnished with each lock identified with fiber key tags.
 - 2. Ten (10) master keys will be furnished.
 - 3. Master keys will be delivered only to the OWNER or OWNER'S representative and a signed receipt obtained.
- N. Provide and place door thresholds on all doors. Thresholds shall be as recommended by door manufacturer. Provide and place weather strips on exterior doors and access doors to conditioned rooms.
- O. The CONTRACTOR shall install all finish hardware. All butts, locks, plates, strikes, etc., shall be neatly and accurately mortised flush, properly placed and accurately aligned to smooth and quite operation without sticking, binding, handling, or rattling. All doors shall be hung with equal clearance at jambs and heads. Adjust all hardware properly and leave in smooth operating condition. The following dimensions shall be used in the installation of hardware:

1. Distance from floor to center line of doorknobs shall be 40-5/16 in.
 2. Distance from floor to center line of lower base on door pulls shall be 45 in.
 3. Distance from edge of door to center line of pull shall be 6 in.
 4. Distance from floor to center line of dead lock strike will be 60 in.
 5. Any other installation location in question shall be in accordance with NBHA recommended standards.
- P. Refer to the drawing Sheet A-1 for Administration Building hardware requirements.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General: Install doors, frames, and accessories in accordance with final shop drawings, manufacturer's data, and as herein specified.
- B. Place frames prior to construction of enclosing walls and ceilings. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
- C. In masonry construction, locate three (3) wall anchors per jamb at hinge and strike levels. Set frames and secure to adjacent construction with machine screws and masonry anchorage devices. Install fire-rated frames in accordance with NFPA Std. No. 80. Place fire-rated doors with clearances as specified in NFPA Standard No. 80.
- D. CONTRACTOR shall not use OWNER'S locksets during construction. CONTRACTOR shall install OWNER'S locksets at substantial completion.

3.02 GUARANTEE

- A. An unconditional ten (10) year guarantee on fiberglass doors shall be provided against failure due to corrosion, under specified environment.
- B. Guarantee fiberglass doors and frames for a period of ten (10) years against failure due to materials and workmanship from date of substantial completion.
- C. Hardware guarantee shall be covered by the appropriate manufacturer.

END OF SECTION

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SECTION 08331
OVERHEAD COILING DOORS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. This section describes the requirements for overhead coiling doors.
- B. Drawings and general provisions of the Contract, including General and Special Conditions and DIVISION 1 - GENERAL REQUIREMENTS sections, apply to this Section.
- C. All doors shall include motorized operators with stainless steel chain for manual bypass operation.

1.02 RELATED SECTIONS

- A. Related Sections include the following:
 1. SECTION 05120 – STRUCTURAL STEEL for miscellaneous steel supports.
 2. SECTION 09915 – PROTECTIVE COATINGS for field-applied paint finish.

1.03 DEFINITIONS

- A. Operation Cycle: One cycle of a door is complete when it is moved from the closed position to the fully open position and returned to the closed position.

1.04 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide overhead coiling doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:
 1. Wind Load: Minimum uniform pressure (velocity pressure) of 20 lbs./sq. ft., acting inward and outward.

- B. Operation-Cycle Requirements: Provide overhead coiling door components and operators capable of operating for not less than 10,000 cycles.

1.05 SUBMITTALS

- A. Product Data: For each type and size of overhead coiling door and accessory. Include the following:
 1. Summary of forces and loads on walls and jambs.
- B. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's product data.
- C. Samples for Initial Selection: Manufacturer's color charts showing full range of colors available for units with factory-applied finishes.

- D. Samples for Verification: Of each type of exposed finish required, prepared on Samples of size indicated below.
1. Curtain Slats: 12 in. long (maximum.)
 2. Bottom Bar: 6 in. long (3/16 in. Minimum thickness).
 3. Guides: 6 in. long (3/16 in. Minimum thickness).
 4. Brackets: 6 in. cast iron or steel.
 5. Hood: 26-gauge sheet steel, galvanized, cold roll formed.
- E. Qualification Data: For Installer.
- F. Operation and maintenance manuals shall be in accordance with SECTION 01782 – OPERATION AND MAINTENANCE DATA of these Specifications. The manuals shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions that are required to instruct operating and maintenance personnel unfamiliar with such equipment.
- G. One (1) electronic copy in Portable Document Format (PDF) of all submittals and re-submittals shall be submitted suitable for distribution over electronic mail or File Transfer Protocol (FTP). For final approved submittals provide PDF and two (2) hard copies.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
- B. Source Limitations: Obtain overhead coiling doors through one source from a single manufacturer.

1.07 WARRANTY

- A. The manufacturer shall provide a warranty against defective material and workmanship for two (2) years from date of final acceptance of the entire project by the OWNER. Any defective equipment, component, or accessory found to be defective, or malfunctioning shall be repaired or replaced upon notice at no additional cost to the OWNER.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
1. Overhead Door Corp.
 2. Atlas Door; Div. of Clopay Building Products Company, Inc.
 3. Mahon Door Corporation.

4. McKeon Rolling Steel Door Company, Inc.
5. Cornell Iron Works Inc.
6. ENGINEER approved equal.

2.02 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate overhead coiling door curtain of interlocking slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices.
- B. Curtain consists of interlocking IS3 thermal slats cold rolled formed from galvanized steel or baked on polyester enamel coating. Each end of alternate slats are to be assembled with polycast nylon end locks to maintain slat alignment and to act as a wearing surface inside the door guides and reduce noise from metal-to-metal contact. Slats are designed to withstand windloads of 20 psf. Windlocks are furnished for greater windloads and upon request (consult factory). Slat thickness shall be calculated with U.S. gauging with a minimum of 20 ga. for doors up to 30 ft. 0 in. wide and 18 ga. for wider spans. The interlocking 24-gauge protective back slat encloses the insulating core reducing heat and sound transmission. Steel slats are to be galvanized as per A.S.T.M. A653. Each curtain shall receive a bottom bar to maintain slat alignment and posture.
- C. Insulation shall consist of closed cell urethane foam injected insulation a minimum of 1 in. thick, providing a 7.2 R-value and sound barrier protection with a STC 25 rating. Insulation is pressure foamed in place bonding both front and back slats while filling all voids and creating a thermal break.
- D. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
 1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel (SS) sheet; complying with ASTM A 653/A 653M, G90 (Z275) coating designation.
 - a. Minimum Base-Metal (Uncoated) Thickness: 20 Gauge.
 - b. Flat profile slats.
- E. Endlocks: Malleable-iron castings galvanized after fabrication, secured to curtain slats with galvanized rivets or high-strength nylon. Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.
- F. Bottom Bar: Consisting of two (2) angles, each not less than 1-1/2 in. x 1-1/2 in. x 3/16 in. thick; galvanized, to suit type of curtain slats.
- G. Astragal: Provide a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene; for placement between angles or fitted to shape, as a cushion bumper for interior door.
- H. Curtain Jamb Guides: Fabricate curtain jamb guides of steel angles or channels and angles, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Build up units with not less than 3/16 in. thick galvanized steel sections complying with ASTM A 36/A 36M and ASTM A 123/A 123M. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

2.03 MOTORIZED OPERATORS

- A. Commercial Rolling Door and Grille Operator: Model RSX Door Operator by Overhead Door Company, or equal:
 - 1. Application: Rolling Steel Door.
 - 2. Electric Motor: UL listed.
 - a. Rating: minimum 1.0 horsepower single phase with automatic thermal reset overload.
 - b. Motor frame comply with: NEMA 42 for 1.0 hp single phase.
 - c. Construction: TENV
 - d. Reduction: Primary reduction is auto-tension poly-v flex belt. Secondary reduction is by chain and sprocket.
 - e. Duty cycle: Accommodate medium usage, up to 15 cycles per hour.
 - 1) Brake: DC Disc type with selectable Progressive Braking.
 - 2) Clutch: Adjustable torque-limiter type.
 - 3) Limit System: Adjustable linear type synchronized with the door during release operation. Limit activation by opto-sensors.
 - 3. Control System: Microprocessor based with relay motor controls on a single board. System incorporates a Liquid Crystal Display (LCD) to display the system status. System shall include the following:
 - a. A delay-on-reverse operating protocol.
 - b. Maximum run timers in both directions of travel that limit motor run time in the event a clutch slip or some other problem occurs.
 - c. Provisions for the connection of a 2-wire monitored photo-eye or a 2-wire monitored edge sensor, as well as non-monitored 2-wire sensing edges, photo-eyes, or other entrapment protection devices.
 - d. Control action will be constant contact close until a monitored entrapment device is installed, allowing for selection of momentary contact.
 - e. Provisions for connection of a 3-button control station.
 - f. On board open, close and stop control keys for local operation.
 - g. Trolley operator with an inherent secondary reversal system.
 - 4. Mounting
 - a. Coiling Steel doors: Trolley mount chain/sprocket coupling to door.

5. Release: Release shall be a pull and hold type mechanism with single cable operation and an integrated interlock switch on hoist units.
6. Hoist: Chain hoist with chain pocket wheel, chain guard and smooth stainless steel hand chain on hoist units.
7. Chain hoist shall be of sufficient capacity to operate a door at a maximum pull requirement of 20 to 30 lb. The static load on the hand chain to hold the door in any position must not exceed 11 lb.

2.04 HOODS AND ACCESSORIES

- A. Hood: Form to act as weatherseal and entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods and provide fascia for any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sagging.
 1. Fabricate hoods for steel doors of minimum 24 gauge, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A 653/A 653M.
 2. Shape: Round.
- B. Weatherseals: Provide replaceable, adjustable, continuous, compressible weather-stripping gaskets fitted to bottom and top of exterior doors, unless otherwise indicated. At door head, use 1/8 in. thick, replaceable, continuous sheet secured to inside of hood.
 1. In addition, provide replaceable, adjustable, continuous, flexible, 1/8 in. thick seals of flexible vinyl, rubber, or neoprene at door jambs for a weathertight installation.
- C. Chain Lock Keeper: Suitable for padlock.

2.05 COUNTERBALANCING MECHANISM

- A. General: Counterbalance doors by means of adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to door curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.
- C. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Provide cast-steel barrel plugs to secure ends of springs to barrel and shaft.
- D. Fabricate torsion rod for counterbalance shaft of cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Provide mounting brackets of manufacturer's standard design, either cast iron or cold-rolled steel plate.

2.06 FINISHES, GENERAL

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Door color shall be selected by OWNER.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.07 STEEL AND GALVANIZED STEEL FINISHES

- A. Baked Finish: Manufacturer's standard baked finish consisting of primer and topcoat according to coating manufacturer's written instructions for cleaning, pretreatment, application, thermosetting, and minimum dry film thickness.
 - 1. Color and Gloss: Match CMU Building exterior color.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General: Install coiling doors and operating equipment complete with necessary hardware, jamb and head molding strips, anchors, inserts, hangers, and equipment supports.

3.02 ADJUSTING

- A. Lubricate bearings and sliding parts; adjust doors to operate easily, free of warp, twist, or distortion and with weathertight fit around entire perimeter.

3.03 STARTUP SERVICES

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.04 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors. Refer to SECTION 01770 – CLOSEOUT PROCEDURES.

END OF SECTION

SECTION 09915
PROTECTIVE COATINGS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The work included in this section of the specifications consists of the complete furnishing, application and appurtenances for the protective coatings required at the wastewater treatment facility as herein described and as shown on the plans. The objective of these specifications is to provide the material and workmanship necessary to produce a first-class job.
- B. Any items not included in the paint schedules shall be cleaned and painted per the written recommendations of TNEMEC Company, Inc.

1.02 RELATED WORK

- A. Drawings and general provisions of the Contract, including General and Special Conditions and DIVISION 1 - GENERAL REQUIREMENTS sections, apply to this Section.

1.03 SUBMITTALS

- A. Product Data: For each paint system indicated. Include block fillers and primers.
 - 1. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.
 - 2. One (1) electronic copy in Portable Document Format (PDF) of all submittals and re-submittals shall be submitted suitable for distribution over electronic mail or File Transfer Protocol (FTP). For final approved submittals provide PDF and two (2) hard copies.

1.04 QUALITY ASSURANCE

- A. General: Quality assurance procedures and practices shall be utilized to monitor all phases of surface preparation, application, and inspection throughout the duration of the project. Procedures or practices not specifically defined herein may be utilized provided they meet recognized and accepted professional standards and are approved by the ENGINEER.
- B. Surface Preparation: Surface preparation will be based upon comparison with: "Pictorial Surface Preparation Standards for Painting Steel Surfaces: SSPC-VIS 1-89", ASTM Designation D2200-95, "Standard Methods of Evaluating Degree of Rusting on Painted Surfaces", ASTM D 4417-91, Method A and/or Method C or NACE Standard RP0287-87, and ASTM Designation D610 "Visual Standard for Surfaces of New Steel Air blast Cleaned with Sand Abrasive". In all cases the written standard shall take precedence over the visual standard. In addition, NACE Standard SP0178, along with the Visual Comparator, shall be used to verify the surface preparation of welds.
- C. Application: No coating or paint shall be applied when:
 - 1. The surrounding air temperature or the temperature of the surface to be coated or painted is below the minimum surface temperature for the products specified herein.

2. Rain, snow, fog, or mist is present.
 3. The temperature is less than 5°F above the dew point.
 4. Coating shall not be applied to the following:
 - a. Stainless steel.
 - b. Factory finish coated equipment, with the exception of exposed exterior valves.
 - c. PVC.
 - d. Aluminum.
 - e. Galvanized metal unless indicated on the drawings.
 5. The air temperature is expected to drop below the minimum temperature for the products specified within six hours after application of coating. Dew point shall be measured by use of an instrument such as a Sling Psychrometer in conjunction with U.S. Department of Commerce Weather Bureau Psychometric Tables. If any of the above conditions are prevalent, coating or painting shall be delayed or postponed until conditions are favorable. The day's coating or painting shall be completed in time to permit the film sufficient drying time prior to damage by atmospheric conditions.
- D. Coating Thickness: Thickness of coatings and paint shall be measured/checked according to the procedures outlined in SSPC-PA 2 "Measurement of Dry Film Thickness with Magnetic Gauges", May 2012 Edition. Dry film thickness shall be a Level 2 as defined in Paragraph 9.2, excepting that no single gauge reading shall be less than 80 percent of the specified dry film thickness. Areas that fail to meet these criteria shall be corrected at no expense to the OWNER. Use of an instrument such as a Tooke Gauge, precision groove grinder, etc. is permitted if a destructive test is deemed necessary by the ENGINEER and the total DFT is less than 50 mils.
- E. Holiday (Pinhole) Testing: The integrity of coated surfaces scheduled for immersion shall be tested for holidays in accordance with NACE Standard SP0188. For dry films less than 20 mils, a non-destructive holiday detector shall not exceed 67.5 volts, nor shall destructive holiday detector exceed the voltage recommended by the manufacturer of the coating system. A solution of 1 oz. non-sudsing type wetting agent, such as Kodak Photo-Flo, and 1 gal. of tap water shall be used to perform the holiday testing. For coating thickness at 20 mils and greater, a high voltage Tinker & Rasor AP/W holiday tester shall be used. Contact coating manufacturer for voltage recommendations and curing parameters.
1. All pinholes and/or holidays shall be marked and repaired in accordance with the manufacturer's printed recommendations and retested. No pinholes or other irregularities will be permitted in the final coating.
- F. Inspection Devices: The CONTRACTOR shall furnish, until final acceptance of coating and painting is accepted, inspection devices in good working condition for detection of holidays and measurement of dry film thickness of coating and paint. The CONTRACTOR shall also furnish U.S. Department of Commerce, National Bureau of Standards certified thickness calibration plates and/or plastic shims, depending upon the thickness gauge used, to test the accuracy of dry film thickness gauges and certified instrumentation to test the accuracy of holiday detectors. Dry film gauges and holiday detectors shall be made available for the ENGINEER'S use at all times

until final acceptance of application. Holiday detection devices shall be operated in the presence of the ENGINEER.

- G. Inspection: Inspection for this project shall consist of ‘hold point’ inspections. The ENGINEER or his representative shall inspect the surface prior to abrasive blasting, after abrasive blasting but prior to application of coating materials, and between subsequent coats of material. Final inspection shall take place after all coatings are applied, but prior to placing the tank in service. CONTRACTOR will ensure that sufficient rigging is in place so that the ENGINEER or his representative shall be able to conduct the required inspections.
- H. Warranty Inspection: Warranty inspection shall be conducted during the eleventh month following acceptance of all coating and painting work. All defective work shall be repaired in accordance with this specification and to the satisfaction of the ENGINEER and/or OWNER.

1.05 CONTRACTOR

- A. The CONTRACTOR shall have three years practical experience and successful history in the application of specified products to surfaces of the treatment plants. Upon request, he shall substantiate this requirement by furnishing a list of references and job completions.
- B. The CONTRACTOR shall submit with his bid a written statement by the coatings manufacturer stating that the CONTRACTOR is familiar with the materials specified and has workers capable of performing the work specified herein.
- C. The personnel performing the work shall be knowledgeable and have the required experience and skill to adequately perform the work for this project, in accordance with SSPC-PA1, “Shop, Field and Maintenance Painting”.

1.06 SAFETY AND HEALTH REQUIREMENTS

- A. General: In accordance with requirements set forth by regulatory agencies applicable to the construction industry and manufacturer's printed instructions and appropriate technical bulletins and manuals, the CONTRACTOR shall provide and require use of personal protective lifesaving equipment for persons working on or about the project site.
- B. Head and Face Protection and Respiratory Devices: Equipment shall include protective helmets, which shall be worn by all persons while in the vicinity of the work. In addition, workers engaged in or near the work site during sandblasting shall wear eye and face protection devices and air purifying, half-mask, or mouthpiece respirators with appropriate filters. Barrier creams shall be used on any exposed areas of skin.
- C. Ventilation: Where ventilation is used to control hazardous exposure, all equipment shall be explosion-proof. Ventilation shall reduce the concentration of air contaminants to the degree a hazard does not exist. Air circulation and exhausting of solvent vapors shall be continued until coatings have fully cured.
- D. Sound Levels: Whenever the occupational noise exposure exceeds maximum allowable sound levels, the CONTRACTOR shall provide and require the use of approved ear protective devices.
- E. Illumination: Adequate illumination shall be provided while work is in progress, including explosion-proof lights and electrical equipment. Whenever required by the ENGINEER, the

CONTRACTOR shall provide additional illumination and necessary supports to cover all areas to be inspected. The ENGINEER and/or Inspector shall determine the level of illumination.

- F. **Temporary Ladders and Scaffolding:** All temporary ladders and scaffolding shall conform to applicable safety requirements. They shall be erected where requested by the ENGINEER to facilitate inspection and be moved by the CONTRACTOR to locations requested by the ENGINEER.

1.07 PRODUCT DELIVERY, STORAGE & HANDLING

- A. All materials shall be brought to the jobsite in original sealed containers. They shall not be used until the ENGINEER has inspected the contents and obtained data from information on containers or label. Materials exceeding storage life recommended by the manufacturer shall be rejected.
- B. All coatings and paints shall be stored in enclosed structures to protect them from weather and excessive heat or cold. Flammable coatings and paints must be stored to conform with City, County, State and Federal safety codes for flammable coating or paint materials. At all times coatings and paints shall be protected from freezing.

1.08 DEFINITIONS

- A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
 2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
 3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
 4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Unless noted otherwise, the protective coatings products used on this project shall be furnished by **TNEMEC Company, Inc.** without exception.
- B. Manufacturer's color charts shall be submitted to the ENGINEER at least thirty (30) days prior to coating and/or paint application. General Contractor and Painting Contractor shall coordinate work so as to allow sufficient time (normally seven to ten days) for paint to be delivered to the job site.
- C. Any paint systems not covered in this specification shall be as recommended by TNEMEC Company, Inc.

2.02 GENERAL REQUIREMENTS

- A. All materials shall be lead-free as defined by the Consumer Product Safety Act, Part 1303.

- B. All zinc dust pigment contained in any zinc-rich material shall meet the requirements of ASTM D 520 Type III as regards zinc content and purity.
- C. No coatings shall contain Methylene Dianiline (MDA). All coatings, including all colors, shall be lead-free.
- D. All catalyzed polyurethane products shall meet the minimum requirements of SSPC Paint Specification Number 36, Level 3 Performance Level.

2.03 HOT DIP GALVANIZING

- A. This section applies to all equipment items and related appurtenances specified to be hot dip galvanized, as described herein or as shown on the plans.
- B. Galvanizing shall conform to the Standard Specifications of ASTM A-123, A-386-73, and A-120-72A, as applicable latest edition of Zinc (Hot-Galvanized) Coating on Structural Steel Shapes, Plates and Bars and their products. Zinc used for hot dipped galvanizing shall conform to ASTM Designation B-6-70. Galvanizing shall be performed after components are completely fabricated.
- C. Pieces shall be fabricated in maximum sizes suitable for shipping and galvanizing. The equipment shall be designed and fabricated per ASTM A-143, A-384, and A-385 for bolt-together field assembly. No field welding on hot dipped galvanized equipment will be permitted.
- D. Minor defects in the hot dipped galvanizing coating caused by shipping; handling or installation shall be repaired after equipment installation. The defects shall be thoroughly cleaned, and wire brushed to remove all foreign substances, wiped clean with a suitable solvent, thoroughly dried, and coated with at least 3 mils of a zinc rich compound specifically formulated for touch-up galvanizing and conforming to USN Specification MIL-P-21035 or USAF Specification MIL-P-26915A.
- E. All galvanized members delivered to the job site shall be stored by the CONTRACTOR in a position whereby they are raised off the ground and separated with strip spacers to provide free access of air to all parts of the surface. Stored members shall also be inclined in such a manner as to give maximum drainage. Resinous wood may not be used for spacers or packing of hot dip galvanized members.

2.04 PAINT COLORS

- A. Buildings - Colors for buildings, including Interior, Exterior, and Trimwork, shall be as selected by the OWNER prior to application.
- B. Piping - All exposed piping for the project shall be uncoated as delivered from the supplier. No asphalt coatings will be accepted for exposed piping. All exposed piping shall be painted as specified herein. The colors for piping shall be as follows:

PIPE USAGE	COLOR OF PIPE
Potable Water (Hot or Cold)	Lt. Blue (Cold); Lt. Blue with 6 in. red bands spaced 30 in. apart (Hot)
Non-Potable Water or Reuse Water (Hot or Cold)	Safety Purple

PIPE USAGE	COLOR OF PIPE
Chlorine Solution	Safety Yellow with Red Bands*
Chlorine Gas	Safety Yellow
Sulfur Dioxide Solution	Lime Green with Yellow Bands*
Sulfur Dioxide Gas	Lime Green
Polymer	White with Safety Green Bands*
Waste Activated Sludge	Med. Brown
Thickened Waste Activated Sludge	Med. Brown
Return Activated Sludge (RAS)	Med. Brown
Grease (Lubrication)	Black with Yellow Bands*
Secondary Scum	Med. Gray
Drain Lines	Med. Gray
Valve Wheels and Tops	Safety Red
Compressed Air	Lt. Green
Power Conduit	Safety Orange
Reclaimed Water Lines	Safety Purple w/ black lettering
Raw Sewage	Med. Grey
Effluent after Clarification	Dark Green
Potable Water Valve Cast Iron Covers	Lt. Blue
Sewer/NPW Cast Iron Covers	Safety Purple w/ black lettering

* Bands are six (6) inches wide and spaced five (5) feet apart. The lines that are less than five (5) feet long will have the band centered on the pipe.

- C. Provide a complete color-coding system consisting of preprinted labels and banding as manufactured by Brady, Seton or equal.
- D. Colors listed are general. Actual colors will be selected based on a comparison to the existing plant color codes, except as otherwise indicated; samples shall be furnished for all pipe paint colors; with chips from existing piping where new service lines are connecting.
- E. Pipe Identification
 - 1. Piping system identification shall comply with the requirements of ANSI A13.1.
 - 2. Location. Locate lettering, pipe markers and flow discretion arrows where piping is exposed in finished spaces; in machine rooms; in accessible maintenance spaces such as shafts, tunnels, and plenums; and in exterior nonconcealed locations such as rooftops and chiller yards, as follows:
 - a. Near each valve and control device.
 - b. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - c. Near penetrations through walls, floors, ceilings, and nonaccessible enclosures.
 - d. At access doors, manholes, and similar access points that permit view of concealed piping.

- e. Near major equipment items and other points of origination and termination.
 - f. Spaced at maximum intervals of 50 ft. along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - g. On piping above removable acoustical ceilings.
 - h. Two labels minimum each room, crawl space or compartment, unless otherwise approved.
3. Metal Tags. Where the outside diameter of pipe or pipe covering is 5/8 in. or smaller, aluminum, or stainless-steel tags shall be provided instead of lettering. Tags shall be stamped as specified and shall be fastened to the pipe with suitable chains. Pipe identified with tags shall be color coded as specified.
4. Labels and directional arrows. Lettering shall be painted or stenciled on piping or shall be applied as snap-on markers. Snap-on markers shall be plastic sleeves, Brady "Bradysnap-On B-915" or Seton "Setmark". Letter size shall be as follows:

OUTSIDE DIAMETER OF PIPE OR COVERING	MINIMUM HEIGHT OF LETTERS
5/8 in. and smaller	Metal tags – 1/4 in.
3/4 in. to 4 in.	3/4 in.
5 in. and larger	2 in.

- a. At each label, arrows indicating direction of flow shall point away from label. If flow may be in both directions, use double headed arrows.
- b. Lettering shall bear the full pipe system name as scheduled.

- F. Miscellaneous – Colors for components not described above shall be as selected by the OWNER prior to application.

2.05 PAINTING

- A. The work proposed herein shall consist of all labor, materials, equipment, etc. necessary to provide the painting system specified herein for those components which require a paint system, as described herein and as shown on the plans. The work shall consist primarily of cleaning the surfaces of all scale, loose paint, and sediment, and painting to the treatment unit steel components to the specifications which follow herein.
- B. The objective of these specifications is to provide the material and workmanship necessary to produce a first-class job. All painting shall be done strictly in accordance with the manufacturer's instructions and shall be performed in a manner satisfactory to the ENGINEER.

C. CONTRACTOR responsibilities

1. The CONTRACTOR is required to submit the following upon selection:
 - a. CONTRACTOR qualifications certifying experience and references for the work contemplated.

- b. Safety Program in writing and a schedule of regularly scheduled safety orientation meetings.
 - c. Detailed work schedule.
 - d. Quality Control program.
- D. Factory Coatings
- 1. All exposed valves and operators shall be cleaned and painted, regardless of if the manufacturer applied a finish coat, per the specifications.
 - 2. All items factory prime coated shall be cleaned and painted per these specifications.

2.06 COATING REQUIREMENTS

A. REFERENCE SPECIFICATIONS AND STANDARDS

- 1. Without limiting the general aspects of other requirements of these specifications, all surface preparation, coating and painting of interior and exterior surfaces and inspection shall conform to the applicable requirements of SSPC (Society for Protective Coatings), NACE International, ASTM (American Society for Testing and Materials), AWWA and the manufacturer's printed instructions.
 - a. ASTM (American Society for Testing and Materials)
 - 1) ASTM D 520; Standard Specification for Zinc Dust Pigment
 - 2) ASTM D 4417; Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel
 - 3) ASTM E 337; Standard Practice Test Method for Measuring Humidity with a Psychrometer
 - 4) ASTM D2200; Standard Methods of Evaluating Degree of Rusting on Painted Surfaces
 - b. ANSI (American National Standards Institute)
 - 1) ANSI/ASC 29.4 Exhaust Systems Abrasive; Blasting Operations - Ventilation and Safe Practice
 - c. Consumer Product Safety Act, Part 1303
 - d. ICRI (International Concrete Restoration Institute)
 - 1) Guideline No. 03732; Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays
 - e. NACE International

- 1) NACE Publication TPC2; Coatings and Linings for Immersion Service: Chapter 1 Safety, Chapter Surface Preparation, Chapter 3 Curing, and Chapter 4 Inspection
 - 2) NACE Standard SP0178; Standard Recommended Practice – Fabrication Details, Surface Finish Requirements and Proper Design Considerations for Tanks and Vessels to be lined for Immersion Service
 - 3) NACE Standard SP0188; Standard Recommended Practice – Discontinuity (Holiday) Testing of Protective Coatings
 - 4) NACE Standard RP0287; Field Measurement of Surface Profile of Abrasive Blast-Cleaned Steel Surfaces Using a Replica Tape
 - 5) NACE Standard RP0288; Standard Recommended Practice, Inspection of Linings on Steel and Concrete
- f. OSHA (Occupational Safety & Health Administration)
- 1) 1915.35; Standards – 29 CFR – Painting
- g. SSPC (Society for Protective Coatings)
- 1) SSPC-SP2; Hand Tool Cleaning
 - 2) SSPC-SP3; Power Tool Cleaning
 - 3) SSPC-SP13; Surface Preparation of Concrete
 - 4) SSPC-PA-1; Shop, Field, and Maintenance Painting
 - 5) SSPC-PA-2; Measurement of Dry Film Thickness with Magnetic Gauges
 - 6) SSPC-PA-3; Guide to Safety in Paint Application
 - 7) SSPC-Guide 12; Guide for Illumination of Industrial Painting Project
 - 8) SSPC-VIS 1-89; Pictorial Surface Preparation Standards for Painting Steel Surfaces
 - 9) SSPC Paint Spec 36; Two-Component Weatherable Aliphatic Polyurethane Topcoat, Performance-Based
- h. SSPC/NACE Joint Standards
- 1) SSPC-SP5/NACE 1; White Metal Blast Cleaning
 - 2) SSPC-SP6/NACE 3; Commercial Blast Cleaning
 - 3) SSPC-SP7/NACE 4; Brush-Off Blast Cleaning
 - 4) SSPC-SP10/NACE 2; Near-White Metal Blast Cleaning

- 5) SSPC-SP13/NACE 6; Surface Preparation of Concrete
 - i. NAPF (National Association of Pipe Fabricators)
 - 1) NAPF 500-03-01; Solvent Cleaning
 - 2) NAPF 500-03-04; Abrasive Blast Cleaning for Ductile Iron Pipe
 - 3) NAPF 500-03-05; Abrasive Blast Cleaning for Cast Ductile Iron Fittings
 2. The ENGINEER'S decision shall be final as the interpretation and/or conflict between any of the referenced specifications and standards contained herein.

2.07 MATERIAL PREPARATION

- A. Mix and thin materials according to manufacturer's latest printed instructions.
- B. Do not use materials beyond manufacturer's recommended shelf life.
- C. Do not use mixed materials beyond manufacturer's recommended pot life.
- D. Do not split kits of multi-component products.

2.08 SUBMERGED & INTERMITTENTLY SUBMERGED COATING SCHEDULE

- A. The number of coats called for in this schedule shall be considered minimum. If more coats are required for complete coverage and uniform appearance, they shall be applied. The OWNER from standard manufacturer's color samples will select colors.
 1. Steel pipes, fittings, pumps (not described to be hot dipped galvanized) (not in lift station or headworks).
 - a. Surface Preparation Prior to Abrasive Blast Cleaning: Weld flux and spatter shall be removed by power tool cleaning. Sharp projections shall be ground to a smooth contour. All welds shall be ground to a smooth contour as per NACE Standard SP0178, Designation D.
 - b. Surface Preparation: SSPC-SP10 Near-White Metal Blast Cleaning. Anchor profile shall be angular with a 2.0 mil profile as per ASTM D 4417, Method C or NACE Standard RP0287.
 - c. Coating System
 - 1) First Coat: TNEMEC Series 66 Hi-Build Epoxoline applied at 6.0 to 8.0 dry mils.
 - 2) Second Coat: TNEMEC Series 141 Epoxoline applied at 10.0 to 12.0 dry mils.
 - d. Total minimum dry film thickness shall be 16.0 mils
 2. Ductile Iron Piping, Valves & Fittings in Immersion (not in lift station or headworks)

- a. Surface Preparation
 - 1) Clean all surfaces as per NAPF 500-03-01 Solvent Cleaning to remove all oil, grease, factory-applied tars and/or bitumastic coatings and all other soluble contaminants.
 - 2) Prepare ductile iron pipe as per NAPF 500-03-04 Abrasive Blast Cleaning for Ductile Iron Pipe providing a minimum 1.5 mil angular anchor profile.
 - 3) Prepare ductile iron valves and fittings as per NAPF 500-03-05 Abrasive Blast Cleaning for Cast Ductile Iron Fittings.
 - 4) If existing ductile is factory coated with TNEMEC Series N140, please follow recoat windows listed on the current product data sheet.
- b. Coating System
 - 1) First Coat: TNEMEC Series 66 Hi-Build Epoxoline applied at 6.0 to 8.0 dry mils.
 - 2) Second Coat: TNEMEC Series 141 Epoxoline applied at 10.0 to 12.0 dry mils.
- c. Total minimum dry film thickness shall be 16.0 mils.
3. Steel pipes, fittings, pumps (not described to be hot dipped galvanized) (In lift station or headworks).
 - a. Surface Preparation Prior to Abrasive Blast Cleaning: Weld flux and spatter shall be removed by power tool cleaning. Sharp projections shall be ground to a smooth contour. All welds shall be ground to a smooth contour as per NACE Standard SP0178, Designation D.
 - b. Surface Preparation: SSPC-SP10 Near-White Metal Blast Cleaning. Anchor profile shall be angular with a 2.0 mil profile as per ASTM D 4417, Method C or NACE Standard RP0287.
 - c. Coating System
 - 1) First Coat: TNEMEC Series 66 Hi-Build Epoxoline applied at 6.0 to 8.0 dry mils.
 - 2) Second Coat: TNEMEC Series 435 Perma-Glaze applied at 20.0 to 25.0 dry mils.
 - d. Total minimum dry film thickness shall be 26.0 mils
4. Ductile Iron Piping, Valves & Fittings in Immersion (In lift station or headworks)
 - a. Surface Preparation

- 1) Clean all surfaces as per NAPF 500-03-01 Solvent Cleaning to remove all oil, grease, factory-applied tars and/or bitumastic coatings and all other soluble contaminants.
- 2) Prepare ductile iron pipe as per NAPF 500-03-04 Abrasive Blast Cleaning for Ductile Iron Pipe providing a minimum 1.5 mil angular anchor profile.
- 3) Prepare ductile iron valves and fittings as per NAPF 500-03-05 Abrasive Blast Cleaning for Cast Ductile Iron Fittings.
- 4) If existing ductile is factory coated with TNEMEC Series N140, please follow recoat windows listed on the current product data sheet.

b. Coating System

- 1) First Coat: TNEMEC Series 66 Hi-Build Epoxoline applied at 6.0 to 8.0 dry mils.
- 2) Second Coat: TNEMEC Series 435 Perma-Glaze applied at 20.0 to 25.0 dry mils.

c. Total minimum dry film thickness shall be 26.0 mils.

2.09 NON-SUBMERGED PAINTING SCHEDULE

- A. The number of coats called for in this schedule shall be considered minimum. If more coats are required for complete coverage and uniform appearance, they shall be applied. The OWNER from standard manufacturer's color samples will select colors.

1. Exterior Exposed Ferrous Metal

- a. Surface Preparation Prior to Abrasive Blast Cleaning: Weld flux and spatter shall be removed by power tool cleaning. Sharp projections shall be ground to a smooth contour. All welds shall be ground to a smooth contour as per NACE Standard SP0178, Designation D.

- b. Surface Preparation: SSPC-SP6 Commercial Blast Cleaning. Anchor profile shall be angular with a 1.5 to 2.0 mil profile as per ASTM D 4417, Method C or NACE Standard RP0287.

c. Coating System

- 1) First Coat: TNEMEC Series 90G-1K97 Tneme-Zinc applied at 2.5 to 3.5 dry mils.
- 2) Stripe Coat: TNEMEC Series 27WB Typoxy applied by brush and scrubbed into all weld seams. In addition to weld seams, all edges, corners, bolts, rivets, pits, etc. shall receive a stripe coat.
- 3) Second Coat: TNEMEC Series 27WB Typoxy applied at 4.0 to 6.0 dry mils.

- 4) Third Coat: TNEMEC Series 1094 Endura Shield applied at 3.0 to 5.0 dry mils. (Application by brush or roller may require two coats to achieve specified film thickness.)
 - d. Total minimum dry film thickness shall be 10.0 mils.
2. Interior Exposed Structural & Miscellaneous Steel, Piping, Valves, Etc. (Not described as hot dipped galvanized)
 - a. Surface Preparation Prior to Abrasive Blast Cleaning: Weld flux and spatter shall be removed by power tool cleaning. Sharp projections shall be ground to a smooth contour. All welds shall be ground to a smooth contour as per NACE Standard SP0178, Designation D for Lap, Butt & Fillet Welds.
 - b. Surface Preparation: SSPC-SP6 Commercial Blast Cleaning. Anchor profile shall be angular with a 1.5 to 2.0 mil profile as per ASTM D 4417, Method C or NACE Standard RP0287.
 - c. Coating System
 - 1) First Coat: TNEMEC Series 90G-1K97 Tneme-Zinc applied at 2.5 to 3.5 dry mils.
 - 2) Second Coat: TNEMEC Series 66 Hi-Build Epoxoline applied at 4.0 to 6.0 dry mils.
 - 3) Third Coat: TNEMEC Series 66 Hi-Build Epoxoline applied at 4.0 to 6.0 dry mils.
 - d. Total minimum dry film thickness shall be 10.5 mils.
3. Exterior Exposed Ductile Piping, Valves & Fittings
 - a. Surface Preparation
 - 1) Clean all surfaces as per NAPF 500-03-01 Solvent Cleaning to remove all oil, grease, factory-applied tars and/or bitumastic coatings and all other soluble contaminants.
 - 2) Prepare ductile iron pipe as per NAPF 500-03-04 Abrasive Blast Cleaning for Ductile Iron Pipe providing a minimum 1.5 mil angular anchor profile.
 - 3) Prepare ductile iron valves and fittings as per NAPF 500-03-05 Abrasive Blast Cleaning for Cast Ductile Iron Fittings.
 - 4) If existing ductile is factory coated with TNEMEC Series N140, please follow recoat windows listed on the current product data sheet.
 - b. Coating System
 - 1) First Coat: TNEMEC Series 66 Hi-Build Epoxoline applied at 6.0 to 8.0 dry mils.

- 2) Second Coat: TNEMEC Series 66 Hi-Build Epoxoline applied at 6.0 to 8.0 dry mils.
 - 3) Third Coat: TNEMEC Series 1094 Endura Shield applied at 3.0 to 5.0 dry mils.
 - c. Total minimum dry film thickness shall be 15.0 mils.
4. Interior Exposed Ductile Piping, Valves & Fittings
- a. Surface Preparation
 - 1) Clean all surfaces as per NAPF 500-03-01 Solvent Cleaning to remove all oil, grease, factory-applied tars and/or bitumastic coatings and all other soluble contaminants.
 - 2) Prepare ductile iron pipe as per NAPF 500-03-04 Abrasive Blast Cleaning for Ductile Iron Pipe providing a minimum 1.5 mil angular anchor profile.
 - 3) Prepare ductile iron valves and fittings as per NAPF 500-03-05 Abrasive Blast Cleaning for Cast Ductile Iron Fittings.
 - 4) If existing ductile is factory coated with TNEMEC Series N140, please follow recoat windows listed on the current product data sheet.
 - b. Coating System
 - 1) First Coat: TNEMEC Series 66 Hi-Build Epoxoline applied at 6.0 to 8.0 dry mils.
 - 2) Second Coat: TNEMEC Series 66 Hi-Build Epoxoline applied at 6.0 to 8.0 dry mils
 - c. Total minimum dry film thickness shall be 12.0 mils.
5. Exterior Exposed Factory Primed Metal
- a. Surface Preparation: All surfaces shall be dry, clean, and free of all contaminants. Clean all surfaces as per SSPC-SP2 or SP3 Hand or Power Tool Cleaning. Apply a test patch to ensure compatibility.
 - b. Coating System
 - 1) First Coat: TNEMEC Series 1 Omnithane applied at 2.5 to 3.5 dry mils.
 - 2) Second Coat: TNEMEC Series 1094 Endura Shield applied at 3.0 to 5.0 dry mils.
 - c. Total minimum dry film thickness shall be 6.0 mils.
6. Interior Exposed Factory Primed Metal

- a. Surface Preparation: All surfaces shall be dry, clean, and free of all contaminants. Clean all surfaces as per SSPC-SP2 or SP3 Hand or Power Tool Cleaning. Apply a test patch to ensure compatibility.
 - b. Coating System
 - 1) First Coat: TNEMEC Series 1 Omnidthane applied at 2.5 to 3.5 dry mils.
 - 2) Second Coat: TNEMEC Series 66 Hi-Build Epoxoline applied at 4.0 to 6.0 dry mils.
 - c. Total minimum dry film thickness shall be 7.0 mils.
7. Existing Exterior Brick Walls
- a. Surface Preparation: Allow new mortar and masonry to cure 14 days. Level all protrusions and mortar spatter. Prepare as per SSPC-SP13/NACE 6 for "Light Service". Fill voids and bugholes with TNEMEC Series 215 Epoxy Surfacer or Series 218 MortarClad.
 - b. Coating System
 - 1) First Coat: TNEMEC Series 130 Envirofill applied at 60 to 80 square feet per gallon, finished to provide a pinhole-free surface.
 - 2) Second Coat: TNEMEC Series 156 Enviro-Crete applied at 6.0 to 8.0 dry mils.
 - 3) Third Coat: TNEMEC Series 156 (smooth texture) or Series 157 (sand texture) Enviro-Crete applied at 7.0 to 9.0 dry mils.
 - c. Total minimum dry film thickness shall be 14.0 mils.
 - d. The exterior coating shall apply to existing Operations Building.
8. Exterior CMU Walls
- a. Surface Preparation: Allow new mortar and masonry to cure twenty-eight (28) days. Level all protrusions and mortar spatter. Fill voids and bugholes with TNEMEC Series 215 Epoxy Surfacer or Series 218 MortarClad.
 - b. Coating System
 - 1) First Coat: TNEMEC Series 660 Prime- A – Pell 200 applied at a rate of 75-125 sq. ft. per gallon.
 - 2) Second Coat: TNEMEC Series 660 Prime- A – Pell 200 applied at a rate of 75-125 sq. ft. per gallon.
 - c. The exterior coating shall apply to all CMU buildings, including the Administration Building.
9. Interior CMU Walls

- a. Surface Preparation: Allow new mortar and masonry to cure twenty-eight (28) days. Level all protrusions and mortar spatter. Fill voids and bugholes with TNEMEC Series 215 Epoxy Surfacer or Series 218 MortarClad.
 - b. Coating System
 - 1) First Coat: TNEMEC Series 660 Prime- A – Pell 200 applied at a rate of 75-125 sq. ft. per gallon.
 - 2) Second Coat: TNEMEC Series 660 Prime- A – Pell 200 applied at a rate of 75-125 sq. ft. per gallon.
 - c. The interior coating shall be applied to all CMU buildings.
10. Interior and Exterior Concrete Ceilings (Including Hollow Core)
- a. Surface Preparation: Allow new concrete shall cure 28 days before being coated. All surfaces shall be dry, clean, and free of all dust dirt, oil, grease, laitance, efflorescence, and other contaminants.
 - b. Underside (internal and external) and vertical sides of hollow core panels shall be coated.
 - c. Coating System
 - 1) Sealer: TNEMEC Series 151-1051 Elasto-Grip FC applied at 1.0 to 1.5 dry mils.
 - 2) First Coat: TNEMEC Series 1026 Enduratone applied at 2.0 to 3.0 dry mils.
 - 3) Second Coat: TNEMEC Series 1026 Enduratone applied at 2.0 to 3.0 dry mils.
 - d. Total minimum dry film thickness shall be 6.0 mils.
11. Interior Wood Doors, Framing, Window Sash, and Woodwork
- a. Surface Preparation: Sand rough areas smooth. Seal knots and pitch pockets. Fill cracks and nail holes after primer is dry. All surfaces must be dry clean and free of all oil, grease, dust, dirt, and other contaminants.
 - b. Coating System
 - 1) First Coat: TNEMEC Series 151-1051 Elasto-Grip applied at 1.0 to 1.5 dry mils.
 - 2) Second Coat: TNEMEC Series 1029 Enduratone applied at 2.0 to 3.0 dry mils.
 - 3) Third Coat: TNEMEC Series 1029 Enduratone applied at 2.0 to 3.0 dry mils.
 - c. Total minimum dry film thickness shall be 6.0 mils.

12. Exterior Wood Walls, Trim and Wood Siding.

 - a. Surface Preparation: Sand rough areas smooth. Seal knots and pitch pockets. Fill cracks and nail holes after primer is dry. All surfaces must be dry clean and free of all oil, grease, dust, dirt, and other contaminants.
 - b. Coating System

 - 1) First Coat: TNEMEC Series 151-1051 Elasto-Grip applied at 1.0 to 1.5 dry mils.
 - 2) Second Coat: TNEMEC Series 1029 Enduratone applied at 2.0 to 3.0 dry mils.
 - 3) Third Coat: TNEMEC Series 1029 Enduratone applied at 2.0 to 3.0 dry mils.
 - c. Total minimum dry film thickness shall be 6.0 mils.
13. Hot-Dipped Galvanized Metal (if required on drawings)

 - a. Surface Preparation:

 - 1) Abrade bare galvanized metal as per ASTM D6386, providing a minimum 2.0 mil angular profile.
 - b. Coating System

 - 1) First Coat: TNEMEC Series 66HS Hi-Build Epoxoline applied at 3.0 to 5.0 dry mils.
 - 2) Second Coat: TNEMEC Series 290 applied at 2.0 to 3.0 dry mils.
 - c. Total minimum dry film thickness shall be 6.0 mils.
14. Stair Tread Nosing

 - a. Surface Preparation:

 - 1) Abrade (sand) bare or previously coated concrete to provide tooth and anchor.
 - 2) Abrade bare galvanized or aluminum metal as per ASTM D6386, providing a minimum 2.0 mil angular profile.
 - b. Coating System

 - 1) First Coat: TNEMEC Series 280 Tneme-Glaze blended with 24-36 grit aluminum oxide applied with a phenolic core roller to produce a heavy texture. Verify texture with a mock-up and adjust as necessary before proceeding.
 - 2) Second Coat: TNEMEC Series 290 Safety Yellow applied at 2.0 to 3.0 dry mils.

- c. Stair Nosing shall be painted 2 in. on top of tread and 2 in. on top of riser.
- 15. Fire Lane No Parking Pavement Coating
 - a. Surface Preparation:
 - 1) Clean all loose materials and dirt from asphalt and concrete pavement surfaces. Surface shall be dry before application.
 - 2) New asphalt surfaces must be given a minimum of 4 weeks to cure.
 - b. Coating System
 - 1) First Coat: TNEMEC Series 66HS Hi-Build Epoxoline applied at 3.0 to 5.0 dry mils.
 - 2) Second Coat: TNEMEC Series 290 applied at 2.0 to 3.0 dry mils.
 - c. Total minimum dry film thickness shall be 100.0 mils.
- 16. Fiberglass (FRP) Duct – Interior and Exterior
 - a. Surface Preparation:
 - 1) Hand sand to roughen surface.
 - 2) Clean as per SSPC-SP1 solvent clean with a suitable solvent to remove all inked numbers and provide a surface profile.
 - b. Coating System
 - 1) First Coat: TNEMEC Series 66HS Hi-Build Epoxoline applied at 3.0 to 5.0 dry mils.
 - 2) Second Coat: TNEMEC Series 1074 Endura-Shield II applied at 2.0 to 3.0 dry mils.
 - c. Total minimum dry film thickness shall be 6.0 mils.

B. WARNING

- 1. The CONTRACTOR is responsible for any and all claims for creating a nuisance and/or paint damage during the progress of the surface preparation and/or painting and is especially forewarned of this responsibility so that he may exert all possible precaution and care for protection of property.
- 2. The CONTRACTOR shall observe all the applicable parts of the Williams-Steiger Occupational Safety and Health Act of 1970 and ALL its subsequent amendments and revisions while coating the tank.

C. INSPECTION

1. Testing methods for holidays and dry film thickness are explained above. The CONTRACTOR shall furnish and have on site one Holiday Detector and one Mikrotest Gauge to use on this project. The CONTRACTOR shall provide such scaffolding or hanging chairs necessary for the ENGINEER to make routine inspection of all the CONTRACTOR'S work.

PART 3 - EXECUTION

3.01 GENERAL

- A. All surface preparation, coating and painting shall conform to applicable standards of the Society for Protective Coatings, and the manufacturer's printed instructions. Material applied prior to approval of the surface by the ENGINEER, shall be removed and re-applied to the satisfaction of the ENGINEER at the expense of the CONTRACTOR.
- B. All work shall be performed by skilled craftsmen qualified to perform the required work in a manner comparable with the best standards of practice. Continuity of personnel shall be maintained, and transfers of key personnel shall be coordinated with the ENGINEER.
- C. The CONTRACTOR shall provide a supervisor at the work site during cleaning and application operations. The supervisor shall have the authority to sign change orders, coordinate work and make decisions pertaining to the fulfillment of the contract.
- D. Dust, dirt, oil, grease, or any foreign matter that will affect the adhesion or durability of the finish must be removed by washing with clean rags dipped in an approved cleaning solvent and wiped dry with clean rags.
- E. Coating and painting systems include surface preparation, prime coating, and finish coatings. Unless otherwise approved in writing by the ENGINEER, prime coating shall be field applied. Where prime coatings are shop applied, the CONTRACTOR shall instruct suppliers to provide the prime coat compatible with the finish coat specified. Any off-site work, which does not conform to this specification, is subject to rejection by the ENGINEER. Shop applied prime coatings, which are damaged during transportation, construction or installation shall be thoroughly cleaned and touched up in the field as directed by the ENGINEER. The CONTRACTOR shall use repair procedures, which insure the complete protection of all adjacent primers. The specified repair method and equipment may include wirebrushing, hand or power tool cleaning or dry air blast cleaning. In order to prevent injury to surrounding painted areas, blast cleaning may require use of lower air pressure, smaller nozzle and abrasive particle sizes, or shorter blast nozzle distance or uneconomical to touch-up, then the item shall be re-cleaned and coated or painted as directed by the ENGINEER.
- F. The CONTRACTOR'S coating and painting equipment shall be designed for application of materials specified and shall be maintained in first class working condition. Compressors shall have suitable traps and filters to remove water and oils from the air. The CONTRACTOR'S equipment shall be subject to approval of the ENGINEER.
- G. Application of the first coat shall follow immediately after surface preparation and cleaning and stripe coat, if applicable, before rust bloom occurs or the same day, whichever is less. Any cleaned areas not receiving first coat within this period shall be re-cleaned prior to application of first coat. Use of dehumidification equipment shall be first reviewed by the ENGINEER prior to deviating from this provision.

- H. Prior to assembly, all surfaces made inaccessible after assembly shall be prepared as specified herein and shall receive the coating or paint system specified.

3.02 SURFACE PREPARATION

- A. The latest version of the following surface preparation specifications of the Society for Protective Coatings shall form a part of this specification:
1. Solvent Cleaning (SSPC-SP1): Removal of oil, grease, soil, and other contaminants by use of solvents, emulsions, cleaning compounds, steam cleaning or similar materials and methods, which involve a solvent or cleaning action.
 2. Hand Tool Cleaning (SSPC-SP2): Removal of loose rust, loose mil scale and other detrimental foreign matter to degree specified by hand chipping, scraping, sanding and wirebrushing.
 3. Power Tool Cleaning (SSPC-SP3): Removal of loose rust, loose mil scale and other detrimental foreign matter to degree specified by hand chipping, scraping, sanding and wirebrushing.
 4. White Metal Blast Cleaning (SSPC-SP5/NACE 1): Blast cleaning to a gray-white uniform metallic color until each element of surface area is free of all visible residues.
 5. Commercial Blast Cleaning (SSPC-SP6/NACE 3): The removal of all visible oil, grease, dirt, dust, mil scale, rust, paint, oxides, corrosion products and other foreign matter by compressed air nozzle blasting centrifugal wheels or other specified method. Discoloration caused by certain stains shall be limited to no more than 33 percent of each square inch of surface.
 6. Brush-Off Blast Cleaning (SSPC-SP7/NACE 4): Blast cleaning to remove loose rust, loose mil scale and other detrimental foreign matter degree specified.
 7. Near White Blast Cleaning (SSPC-SP10/NACE 2): The removal of all visible oil, grease, dirt, dust, mil scale, rust, paint, oxides, corrosion products and other foreign matter by compressed air nozzle blasting, centrifugal wheels, or other specified method. Discoloration caused by certain stains shall be limited to no more than 5 percent of each square inch of surface area.
 8. Power Tool Cleaning to Bare Metal (SSPC-SP11): Power tool cleaning to produce a bare metal surface and to retain or produce a minimum 1.0 mil surface profile. This standard is suitable where a roughened, clean, bare metal surface is required, but where abrasive blasting is not feasible or permissible.
 9. Surface Preparation of Concrete (SSPC-SP13/NACE 6): Surface preparation of concrete by mechanical, chemical, or thermal methods prior to the application of bonded protective coating or lining systems.
- B. Slag, weld metal accumulation and spatters not removed by the Fabricator, Erector or Installer shall be removed by chipping and/or grinding. All sharp edges shall be peened, ground, or otherwise blunted as required by the ENGINEER. All grinding and finishing of welds, edges, etc. shall be performed prior to solvent cleaning and abrasive blasting. Welds shall be prepared as per

NACE Standard SP0178 for all interior and exterior surfaces. Minimum acceptable level of finish shall be Designation "D" unless specified otherwise.

- C. Concrete surfaces shall be abrasive blasted to produce a minimum surface profile of equal to 40-grit sandpaper with no loose concrete remaining. This preparation will be followed by vacuum cleaning to remove all dust, dirt or friable substances leaving clean, dust free surfaces for resurfacing. Concrete surfaces rubbed smooth shall not be considered an acceptably prepared surface.
 - 1. Prepare concrete surfaces in accordance with manufacturer's instructions, SSPC-SP 13/NACE 6 and ICRI 03732.
 - 2. Allow concrete to cure for a minimum of twenty-eight (28) days.
 - 3. Test concrete for moisture in accordance with ASTM D 4263 and F 1869.
 - 4. Abrasive blast surface to remove laitance and solid contaminants and to provide clean, sound substrate with uniform anchor profile.
 - 5. Fill holes, pits, voids, and cracks with TNEMEC Series 215 Epoxy Surface or Series 218 MortarClad.
 - 6. Ensure surfaces are clean, dry, and free of oil, grease, chalk, form release agents, and other contaminants.
- D. Field blast cleaning for all surfaces shall be by dry method unless otherwise directed. Blast nozzles shall be venturi-type nozzles with a minimum pressure at the nozzle of 90 psi.
- E. Particle size of abrasives used in blast cleaning shall be that which will produce a 1.5 – 3.0 mil (37.5 microns - 65.0 microns) surface profile or in accordance with recommendations of the manufacturer of the specified coating or paint system to be applied.
- F. If the profile of the blasted steel exceeds the profile specified above, the CONTRACTOR shall be required to do one or both of the following:
 - 1. Re-blast the surface using a finer aggregate in order to produce the required profile.
 - 2. Apply a thicker prime coat, if possible, given the limitations of the products being applied, in order to adequately cover the blast profile
- G. Abrasive used in blast cleaning operations shall be new, washed, graded and free of contaminants that would interfere with adhesion of coating or paint and shall not be reused unless specifically approved in writing by the ENGINEER.
- H. During blast cleaning operations, caution shall be exercised to ensure that existing coatings or paint are not exposed to abrasion from blast cleaning.
- I. The CONTRACTOR shall keep the area of his work and the surrounding environment in a clean condition. He shall not permit blasting materials to accumulate as to constitute a nuisance or hazard to the accomplishment of the work, the operation of the existing facilities or to the surrounding environment.

- J. Blast cleaned surfaces shall be cleaned prior to application of specified coatings or paint. All surfaces shall be free of dust, dirt, and other residue resulting from the abrasive blasting operation. No coatings or paint shall be applied over damp or moist surfaces.
- K. All welds shall be neutralized with a suitable chemical compatible with the specified coating or paint.
- L. Pitted areas on ferrous metal scheduled for immersion shall be repaired by either filling with TNEMEC Series 215 Epoxy Surfacer or by welding. Pit filler shall be installed after the prime (first) and stripe coats but prior to finish coats. Epoxy filler shall be feathered smooth. No protrusions or spatter will be allowed. Pits deeper than 1/8 in. shall be filled by welding.
- M. Specific Surface Preparation: Surface preparation for the specific systems shall be as noted in Sections 2.08 and 2.09 under the specific systems.

3.03 GENERAL APPLICATION

- A. Coating and paint application shall conform to the requirements of the Society for Protective Coatings Paint Application Specification SSPC-PA1, latest revision, for "Shop, Field and Maintenance Painting", the American Water Works Association and the manufacturer of the coating and paint materials.
- B. Thinning shall be permitted only as recommended by the manufacturer and approved by the ENGINEER.
- C. Each application of coating or paint shall be applied evenly, free of brush marks, sags, runs, with no evidence of poor workmanship. Care shall be exercised to avoid lapping on glass or hardware. Coatings and paints shall be sharply cut to lines. Finished surfaces shall be free from defects or blemishes.
- D. Protective coverings or drop cloths shall be used to protect floors, fixtures, and equipment. Care shall be exercised to prevent coatings or paints from being spattered onto surfaces, which are not to be coated or painted. Surfaces from which materials cannot be removed satisfactorily shall be recoated or repainted as required to produce a finish satisfactory to the ENGINEER.
- E. When two coats of coating or paint are specified, where possible, the first coat shall contain sufficient approved color additives to act as an indicator of coverage or the two coats must be of contrasting color.
- F. Film thickness per coat specified in Sections 2.08 and 2.09 are the minimum required. If brush or roller application is deemed necessary, the CONTRACTOR shall apply additional coats as to achieve the specified thickness.
- G. All materials shall be applied as specified.

3.04 COATING SYSTEM APPLICATION

- A. After completion of surface preparation as specified for the specific system, materials shall be applied as noted in Sections 2.08 and 2.09.
- B. Care shall be taken so as to eliminate overspray and dry spray. Where such conditions are encountered, the surface shall be cleaned of all over spray and dry spray prior to the application of the succeeding coat.

- C. Areas rendered inaccessible after erection shall receive the full coating system prior to erection and/or assembly.
- D. Structures within One-Half Mile of Coast: Exterior surfaces that have been coated on a previous day shall be rinsed with clean potable water and allowed to dry before applying subsequent coat(s). Cleaned surfaces, which are not coated the day of cleaning shall be re-cleaned prior to applying coatings.

3.05 COLOR SCHEME

- A. The ENGINEER shall select colors for the project. The CONTRACTOR shall submit current charts of the manufacturer's available colors to the ENGINEER thirty-days (30) prior to the start of coating and painting.

3.06 SOLVENT VAPOR REMOVAL

- A. All solvent vapors shall be completely removed by suction-type exhaust fans and blowers before placing closed structures in operating service.
- B. All solvent vapors will be exhausted both during and after coating application as per AWWA D 102 to allow the proper curing of the coating material.
- C. Ventilation shall be continued until such time as the coating has reached "full cure" as specified by the coating manufacturer.

3.07 REPAIRS

- A. After the interior coating system has been installed and holiday tested, repair pinholes and voids as follows:
 1. Abrasive blasting shall be in accordance with SSPC-SP10/NACE No.2 Near White Blast Cleaning obtaining a minimal surface profile as specified herein.
 2. Power tool cleaning shall be in accordance with SSPC-SP11 Power Tool Cleaning to Bare Metal. Surface profile shall be angular and not less than the surface profile as specified herein.
 3. All edges of remaining sound, tightly adhering coating shall be feathered back (beveled) to create a smooth transition from the substrate to the coatings surface. The coating may be considered tightly adhering if an edge cannot be lifted with a dull putty knife.
 4. Install the coating system as specified herein to provide a complete and monolithic system, free of voids and pinholes.
- B. For exterior surfaces, repair as follows:
 1. Hand or Power Tool Sand as per SSPC-SP2 or SP3 to remove the defect. In cases where the defect extends to the substrate, prepare the surface as per SSPC-SP11 Power Tool Cleaning to Bare Metal, obtaining a minimum anchor profile as specified herein.
 2. All edges of remaining sound, tightly adhering coating shall be feathered back (beveled) to create a smooth transition from the substrate to the coatings surface. The coating may be considered tightly adhering if an edge cannot be lifted with a dull putty knife.

3. Install the coating system as specified herein to provide a complete and monolithic system, free of voids and pinholes.

3.08 CLEAN-UP

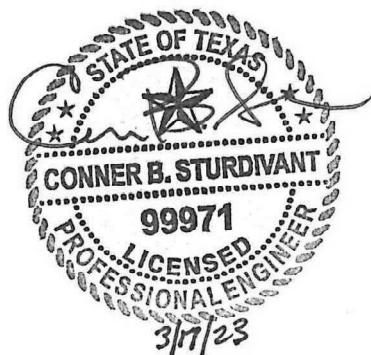
- A. Upon completion of the work, all staging, scaffolding, and containers shall be removed from the site or destroyed in a manner approved by the ENGINEER. Coating or paint spots, oil or stains upon adjacent surfaces shall be removed and the jobsite cleaned. All damage to surfaces resulting from the work of this section shall be cleaned, repaired, or refinished to the satisfaction of the ENGINEER at no cost to the OWNER.

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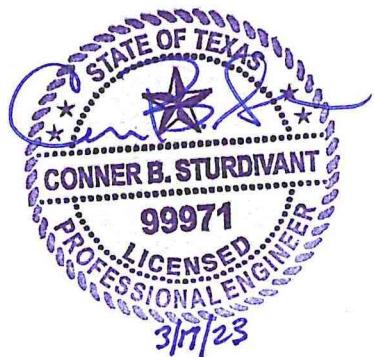
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SECTION 230100
SPECIAL CONDITIONS FOR ALL MECHANICAL WORK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. This section covers the general provisions of the mechanical specifications applicable to the following systems:
 1. Heating, air conditioning, and ventilation.
- B. The use of the word mechanical in the body of the various specifications sections shall be interpreted to include all the aspects of all of the systems referenced in Mechanical Specifications.

1.2 DRAWINGS

- A. These specifications are accompanied by drawings of the building and details of the installations showing the locations of equipment, piping, ductwork, etc. The drawings and these specifications are complementary to each other; requirements described in one or the other shall be considered binding as if described in both.
- B. If any departures from the drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted to the Owner's Representative for approval. No departures shall be made without prior written approval by the Owner's Representative.
- C. There are intricacies of construction which are impractical to specify or indicate in detail; means and methods for performing such work shall adhere to commonly accepted industry standards.
- D. It is the Contractor's responsibility to properly use all information found on the Architectural, Structural, Mechanical, and Electrical drawings and applicable shop drawings where such information affects his work.
- E. For new buildings, all final dimensions shall be scaled from the Architectural drawings, unless otherwise noted. For work associated with existing buildings (renovations and additions), all final dimensions shall be field verified.

1.3 CONSTRUCTION REQUIREMENTS

- A. The architectural, civil, structural, electrical, plumbing, fire protection and mechanical drawings, and specifications are all part of the Contract Documents. In many instances there are details described on another trade=s drawings that are not necessarily included or referenced in the mechanical drawings. It is the Contractor=s responsibility to review in detail all parts of the Contract Documents prior to submitting a bid. Failure to comply with this requirement shall not relieve the Contractor of responsibility or be used as cause for additional compensation because architectural, structural, or electrical details were not included in the mechanical drawings.
- B. It is the intent of the Contract Documents to provide complete and fully functional installation in every respect. Material and/or construction details not specifically described in the Contract Documents, but commonly considered incidental to the industry, are required by the Contractor.

- C. The Contractor shall be responsible for fitting his material and apparatus into the building and shall carefully lay out his work at the site to conform to the structural conditions, to avoid all obstructions, to comply with Codes, to facilitate the work of other trades, to conform to the details of the installation supplied by the manufacturer of the equipment to be installed, and thereby to provide an integrated satisfactory operating installation.
- D. The mechanical, electrical and plumbing drawings are schematic in nature and do not show every connection in detail or every pipe or conduit in its exact location. These details are subject to the requirements of ordinances and structural and architectural conditions.
- E. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be laid out so that it will be concealed in furred chases and above suspended ceilings, etc. in finished portions of the building, unless specifically noted to be exposed. Work shall be installed to avoid compromising structural members; therefore, inserts to accommodate hangers shall be set before concrete is poured, and proper openings through floor, walls, beams, etc. shall be provided as hereinafter specified or as otherwise indicated or required. All work shall be installed parallel or perpendicular to building lines unless otherwise noted.
- F. When the mechanical drawings do not give exact details as to the elevation of pipe or ducts, physically arrange the systems to fit in the space available at the elevations intended with the proper grades for the functioning of the system involved. Piping, exposed conduit, and duct systems are generally intended to be installed true and square to the building construction and located as high as possible against the structure in a neat and workmanlike manner. The plans do not show all required offsets, control lines, pilot lines, and other location details. Work shall be concealed in all finished areas. Piping specified to be insulated shall be supported in a manner that will allow the insulation to be installed without gaps. Insulated piping in concealed areas shall be offset with fittings as necessary to permit installation of insulation. Bending of pipes or installing pipes in a strain to insulate will not be permitted.
- G. Final placement of serviceable equipment shall be carefully coordinated with all other trades to ensure sufficient clearance for maintenance according to manufacturer=s recommendations. Lubricating orifices and adjustable components shall be easily accessible. Piping, conduit, valve stems, cabling and other building systems shall not interfere with service space.
- H. Location of Exposed Devices
 - 1. All exposed devices (grills, registers, diffusers, sprinkler heads, medical gas outlets, plumbing rough-ins, lights, outlets, communication devices, etcetera) shall be referenced to fixed data points that are coordinated with all trades; shall be located to present symmetrical arrangements with respect to the fixed data point; and shall facilitate the proper arrangements of acoustical ceiling tiles. Fixed data points shall include such features as wall and ceiling lines, soffits, balanced border widths, masonry joints, etc. Devices located in acoustical ceiling tiles shall occur symmetrically in tile joints or in the centers of whole tiles. The final determination of the exact location of each outlet and the arrangements to be followed shall be acceptable to the Owner=s Representative.
 - 2. The drawings schematically indicate locations of the exposed devices. Final locations shall be determined by carefully coordinating the drawings pertaining to each trade. Where conflicts are identified, Owner=s Representative shall determine final location. The Owner reserves the right to make any reasonable change in location of any device before installation, without additional cost.

1.4 QUALIFICATIONS

- A. Contractor must have minimum of five years experience installing commercial heating, ventilation and air conditioning systems, plumbing and piping systems similar to those described in these Contract Documents.

- B. Contractor must be licensed and hold a current contracting license that has been valid for a minimum of five years in the State of Texas.
- C. Contractor must be able to bond work for payment and performance of work being bid. Contractor=s bonding agency shall have a Best=s insurance rating of A or A+.

1.5 MATERIAL AND EQUIPMENT REQUIREMENTS

- A. Manufacturer=s Instructions: The manufacturer=s published instructions shall be followed for preparing, assembling, installing, erecting, and cleaning manufacturer materials or equipment, unless otherwise indicated. The Contractor shall promptly notify the Owner=s Representative in writing of any conflict between the requirements of the Contract Documents and the manufacturer=s direction and shall obtain the clarification of the Owner=s Representative before proceeding with the work. Should the Contractor perform any such work that does not comply with the manufacturer=s directions or such clarification by the Owner=s Representative, he shall bear all costs arising in connection with the correction of the deficiencies.
- B. Storage at Site: The Contractor shall not receive material or equipment at the jobsite until there is suitable space provided to properly protect equipment from rust, drip, humidity, and dust damage and from surrounding work.
- C. Capacities shall be not less than those indicated and shall be such that no component or system becomes inoperative or is damaged because of startup or other overload conditions.
- D. Conformance to Agency Requirements: Where materials or equipment are specified to be approved, listed, tested, or labeled by the Underwriters Laboratories, Inc., ETL listed or constructed and/or tested in accordance with the standards of the American Society of Mechanical Engineers or the Air Moving and Conditioning Association, the Contractor shall submit proof that the items furnished under this section of the specifications conform to such requirements. The label of the Underwriters Laboratories, Inc. or ETL applied to the item will be acceptable as sufficient evidence that the items conform to such requirements. The ASME stamp or the AMCA label will be acceptable as sufficient evidence that the items conform to the respective requirements.
- E. Nameplates: Each major component of equipment shall have the manufacturer=s name, address, and model-identification number on a plate securely attached to the item of equipment. All data on nameplates shall be legible at the time of Final Inspection.
- F. Prevention of Rust: Standard factory finish will be acceptable on equipment specified by model number otherwise surfaces of ferrous metal shall be given a rust-inhibiting coating. The treatment shall withstand 200 hours in salt-spray fog test, in accordance with Method 6061 of Federal Standard No. 141. Immediately after completion of the test, the specimen shall show no signs of wrinkling or cracking and no signs of rust creepage beyond 1/8 inch on either side of the scratch mark. Where rust inhibitor coating is specified hereinafter, any treatment that will pass the above test is acceptable unless a specific coating is specified, except that coal tar or asphalt-type coatings will not be acceptable unless so stated for a specific item. Where steel is specified to be hot-dip galvanized, mill-galvanized sheet steel may be used provided all raw edges are painted with a zinc-pigmented paint conforming to Military Specification MIL-P-26915.
- G. Protection from Moving Parts: Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts located so that any person can come in close proximity thereto, shall be fully enclosed or properly guarded.
- H. Drive Guards: For machinery and equipment, provide guards as shown in AMCA 410 for belts, chains, couplings, pulleys, sheaves, shafts, gears, and other moving parts regardless of height above the floor. Drive guards may be excluded where motors and drives are inside factory-

fabricated air handling units casings. Guards shall be constructed of sheet steel, cast iron, expanded metal, or wire mesh rigidly secured so as to be removable without disassembling pipe duct or electrical connection to equipment. Provide a 1-inch diameter hole in each drive guard at each shaft center to allow access for speed measurement.

- I. Verifications of Dimensions: The Contractor shall be responsible for the coordination and proper relation of his work to the building structure and to the work of all trades. The Contractor shall visit the premises and thoroughly familiarize himself with all details of the work and working conditions, to verify all dimensions in the field, and to advise the Owner=s Representative of any discrepancy before performing any work. Adjustments to the work required in order to facilitate a coordinated installation shall be made at no additional cost to the Owner, Architect, or Engineer.
- J. Standard Products: Materials and equipment to be provided shall be the standard catalog products of manufacturers regularly engaged in the manufacture of products conforming to these specifications, and shall essentially duplicate materials and equipment that have been in satisfactory use at least two years.
- K. Spare Parts Data: As soon as practicable after approval of materials and equipment and, if possible, not later than four months prior to the date of beneficial occupancy, the Contractor shall furnish spare parts data for each different item of equipment listed. The data shall include a complete list of parts and supplies with current unit prices and sources of supply, a list of parts and supplies that are either normally furnished at no extra cost with the purchase of the equipment or specified hereinafter to be furnished as part of the Contract, and a list of additional items recommended by the manufacturer to assure efficient operation for a period of 120 days at the particular installation. The foregoing shall not relieve the Contractor of any responsibilities under the warranty specified.

1.6 INSPECTION OF THE SITE

- A. The Contractor shall visit the site, verifying all existing items indicated on drawings and/or specified, and familiarize himself with the existing work conditions, hazards, grades, actual formations, soil conditions, structures, utilities, equipment, systems, facilities, and local requirements. The submission of bids shall be deemed evidence of such visits. All proposals shall take these existing conditions into consideration, and the lack of specific information shall not relieve the Contractor of any responsibility.

1.7 UTILITY LOCATIONS AND ELEVATIONS

- A. Locations and elevations of the various utilities included within the scope of this work have been obtained from substantially reliable sources and are offered separately from the Contract Documents, as a general guide only, without guarantee as to accuracy. Examine the site, the locations, and availability of all utilities and services required for their relation to the work. Verify the location of all existing site utilities with each responsible utility company or applicable party. The Contractor shall repair all damage to existing utilities, whether indicated on the drawings or not, at his sole expense.

1.8 PERMITS, UTILITY CONNECTIONS, AND INSPECTIONS

- A. Permitting Fees: Contractor shall pay for all fees associated with permits required by municipal authorities having jurisdiction.
- B. Tapping and Impact Fees: Contractor shall pay for all fees associated with tapping into municipal utility mains, including sanitary sewer, natural gas and domestic water. Impact fees will be paid for by the Owner.

- C. Compliance: The Contractor shall comply in every respect with all requirements of local authorities having jurisdiction, including building inspections, fire marshal, local ordinances and codes, and utility company requirements. In no case does this relieve the Contractor of the responsibility of complying with these specifications and drawings where specified conditions are of a higher quality than the requirements of the above-specified authorities. Where requirements of the specifications and drawings are below the requirements of the above offices having jurisdiction, the Contractor shall make installations in compliance with the requirements of the above authorities.
- D. Utilities: The Contractor shall coordinate with the various utility companies involved in this project and shall provide required utility relocations, extensions, modifications, and/or changes (complete in all respects) as described in the Contract Documents. Contractor shall verify the location of all existing utilities with the applicable Utility Company. The Contractor shall be responsible for all damages to existing utilities, whether indicated on drawings or not, and repair all damage to existing utilities as acceptable to the affected Utility Company.
- E. Certification: Prior to final acceptance, the Contractor shall furnish a certificate of acceptance from the inspection departments having jurisdiction over the work for any and all work installed under this Contract. Any additional labor costs incurred as a result of a substitution shall be the Contractor=s responsibility.

1.9 EXISTING FACILITIES

- A. The Contractor shall be responsible for loss or damage to the existing facilities caused by him and his workmen and shall be responsible for repairing or replacing such loss or damage. The Contractor shall send proper notices, make necessary arrangements, and perform other services required for the care, protection, and in-service maintenance of all plumbing, heating, air conditioning, and ventilating services for the new and existing facilities. The Contractor shall erect temporary barricades, with necessary safety devices, as required to protect personnel from injury, removing all such temporary protection upon completion of the work.
- B. The Contractor shall provide temporary or new services to all existing facilities as required to maintain their proper operation when normal services are disrupted as a result of the work being performed under this project.
- C. Where existing construction is removed to provide working and extension access to existing utilities, Contractor shall remove doors, piping, conduit, outlet boxes, wiring, light fixtures, air conditioning ductwork and equipment, etc. to provide this access and shall reinstall same upon completion of work in the areas affected.
- D. Where partitions, walls, floors, or ceilings of existing construction are indicated to be removed, all Contractors shall remove and reinstall in locations approved by the Architect/Engineer all devices required for the operation of the various systems installed in the existing construction. This is to include but is not limited to temperature controls system devices, electrical switches, relays, fixtures, piping, conduit, etc.
- E. Outages of services as required by the new installation will be permitted but only at a time approved by the Owner. The Contractor shall allow the Owner two weeks in order to schedule required outages. The time allowed for outages will not be during normal working hours unless otherwise approved by the Owner. All costs of outages, including overtime charges, shall be included in the contract amount.

1.10 DEMOLITION AND RELOCATION

- A. The Contractor shall modify, remove, and/or relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be

conducted in a manner as to produce maximum salvage. Salvage materials shall remain the property of the Owner and shall be delivered to such destination or otherwise disposed of as directed by the Owner. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition. The Contractor may, at his discretion, and upon the approval of the Owner, substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

- B. All items which are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean and repair and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.
- C. When items scheduled for relocation and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner to such items and receive further instructions before removal. Items damaged in repositioning operations are the Contractor=s responsibility and shall be repaired or replaced by the Contractor as approved by the Owner, at no additional cost to the Owner.
- D. Service lines and wiring to items to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner. Service lines and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied off or disconnected in a safe manner acceptable to the Owner. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities which must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner as hereinbefore specified.

1.11 SUBSTITUTION OF MATERIALS AND EQUIPMENT

- A. No substitution of materials or equipment herein specified or called for on the drawings will be permitted, except by written permission of the Owner=s Representative. Where several makes of equipment or material are mentioned, any item named may be bid upon provided it meets space, capacity specifications, and other requirements.

1.12 SUBMITTALS

- A. Submittals for Review:
 1. As soon as practical or within 30 days after the date of contract award or notice to proceed, and before purchasing or starting installation of any materials or equipment, the Contractor shall submit for review sufficient material and equipment data to indicate that all requirements of the specifications have been met and samples shall be furnished when requested. All manufacturer=s data used as part of the submittal shall have all non-applicable features crossed out or deleted in a manner that will clearly indicate exactly what is to be furnished.
 2. Four (4) copies of the submittal list and detailed submittals (for the Owner=s and A/E=s use) shall be submitted to the Owner=s Representative. The Contractor is requested to include a minimum of three (3) additional copies for insertion in the project=s Owner=s Manuals at the completion of the project, and the number of additional copies the Contractor requires for his and his subcontractor=s use during the project=s construction. The detailed submittals shall be accompanied by the same number of sets of pictorial and descriptive data derived from the manufacturer=s catalogs and sales literature or

incorporated in the shop drawings. The Contractor may provide a detailed submittal on any item even though not required by the Owner=s Representative.

B. Format

1. Submittals shall be in pdf format. The first page shall have a cover sheet inserted with the title AMECHANICAL SUBMITTALS@ centered in large print. Below the title shall be printed the name of the project, the date, the project location, the name and address of the contractor, the name and address of the subcontractor and the name and address of the engineer(s) in smaller print.
2. Provide a Table of Contents at the beginning of the binder that summarizes the information being submitted according to specification section.
3. Submittals shall be tab divided by specification section; **all sections** identified in the project specifications shall have a tab. When no information is being provided concerning a particular specification section, insert a single dated sheet that explains the circumstances.
4. **Loose-leaf or piecemeal submittals are not acceptable and subject to rejection unless prior approval has been granted by the Engineer.**

C. Content:

1. The Contractor shall prepare or cause to be prepared shop drawings, product data, materials and equipment lists, diagrams, data, samples, and other submittals as required by the contract documents, hereinafter referred to as ASubmittal Data.@ The Contractor shall review and approve all submittal data for compliance with the contract documents, manufacturer=s recommendations, adequacy, clearances, code compliance, safety, and coordination with associated work.
2. The Contractor shall submit approved submittal data to the Owner=s Representative for review and comment as to general conformance with the design concept and general compliance with information given in the contract documents. Owner=s Representative=s review shall not include review of quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with other trades or work, or construction safety and precautions, all of which are the sole responsibility of the Contractor.
3. The Contractor shall clearly and specifically identify and call to the attention of the Owner=s Representative any deviation from the contract documents for which Owner acceptance is desired. The responsibility for such a deviation accepted by the Owner shall remain with the Contractor.
4. Timeliness: The burden of timeliness in the complete cycle of submittal data is on the Contractor. The Contractor shall allow a minimum of four (4) weeks= time frame for review of each submission by the Owner=s Representative. The Contractor is responsible for allowing sufficient time in the construction schedule to cover the aforementioned cycles of data processing, including time for all re-submission cycles on nonconforming materials, equipment, etc. covered by the data submitted. Construction delays and/or lack of timeliness in the above regard are the responsibility of the Contractor and will not justify any request for scheduled construction time extensions or extra compensation.
5. Work performed in accordance with approved submittal date that is not in accordance with the Contract Documents and did not have the specific acceptance of the Owner=s Representative shall be replaced at Contractor=s cost.

D. Re-submittals

1. Re-submit entire submittal in accordance with afore mentioned format and content requirements. **Loose-leaf or piecemeal re-submittals are not acceptable.** New and/or revised data for each section shall be prefaced with a colored (yellow, pink, orange, etc) cover sheet that identifies (in a word or two) the materials and/or equipment being re-submitted. Typeset the words REVISED SUBMITTAL NO. 1 (or 2, 3 as applicable)@ centered at the bottom of the cover sheet.
2. Subsequent re-submittals (second and third, if necessary) shall have different colored cover sheets to distinguish between the various re-submittals.

3. Include a cover letter at front of binder that specifically responds to each AREVISE AND RE-SUBMIT COMMENT@ or AREJECTED@ comment by number. Example responses would include the following:
 - a. RESPONSE: APlease see attached re-submittal.@
 - b. RESPONSE: AWill be re-submitted at a later date.@
 - c. RESPONSE: ARequirement for (xxxxxx) was deleted in Addendum No. 2.@
 - d. RESPONSE: AException requested based on Section xx, Paragraph x.x.x.
- E. These paragraphs related to Mechanical submittal data supersede any conflicting requirements contained in Division 01 sections.

1.13 CONTRACTOR CERTIFICATION OF SUBMITTAL DATA

- A. The Contractor shall provide the following certification with all submittal data furnished to the Owner=s Representative for review and comment.

Project Title:

Description of Submittal Data:

This is to certify that the above-described submittal data has been reviewed and is approved for compliance with the Contract Documents, manufacturer=s recommendation, adequacy, clearances, code compliance, safety, and coordination with other trades and/or work except as follows: (list Anone@ or itemize and explain). In addition, the Contractor shall submit to the Owner=s Representative a signed statement from each representative certifying as follows:

I certify that the materials and/or equipment listed below have been personally inspected by the undersigned authorized manufacturer=s representative and is properly installed and operating in accordance with the manufacturer=s recommendations and are asbestos free.@

Name and Company

1.14 ACCEPTANCE OF MATERIALS AND EQUIPMENT

- A. All equipment installed on this project shall have **local (within 125 miles)** representation, local factory-authorized service, and a local stock of repair parts. This requirement is essential and will be strictly reviewed by the Owner=s Representative prior to concurrence with the Contractor=s approval for all submittals covered by Mechanical sections of this Specification.
- B. NOTICE: The Contractor is responsible for providing materials and equipment that conform to the requirements of the project manual in every respect unless a deviation has been Aaccepted@ in writing. Removal of any nonconforming materials and equipment and the replacement with conforming materials and equipment shall be at the Contractor=s sole expense, regardless of when nonconformance was discovered.
- C. Approval of materials and equipment shall be based on manufacturer=s published data and shall be tentatively subject to the submission of complete shop drawings which comply with the contract documents. Approval is also dependent upon the existence of adequate and acceptable clearances for entry, servicing, and maintenance.

- D. Approval of materials and equipment under this provision shall not be construed as authorizing any deviations from the specifications, unless the attention of the Owner=s Representative has been directed in writing to the specific deviations. Data submitted shall not contain unrelated information unless all pertinent information is properly identified.
- E. Physical Size of Equipment: Space is critical; therefore, equipment of larger sizes than shown, even though of approved manufacturer, will not be acceptable unless it can be demonstrated that ample space exists for proper installation, operation, and maintenance.

1.15 SHOP DRAWINGS

- A. As soon as practicable after the award of contract and approval of materials and equipment, but prior to installation, complete and detailed shop drawings of the following shall be submitted for review and comment:
 - 1. Equipment arrangements.
 - 2. Duct layouts.
 - 3. Piping layouts.
 - 4. Layouts of equipment spaces indicating ductwork and piping larger than 2 inches.
 - 5. Typical fittings and connections.
 - 6. Equipment foundations.
 - 7. Factory-fabricated equipment and materials.
 - 8. Anchors.
 - 9. Control.
 - 10. Interlock.
 - 11. Sprinkler locations.
 - 12. Other details as directed by the Owner=s Representative. Composite drawings of areas requiring coordination between trades shall be provided and expedited to eliminate conflicts and to ensure maximum cooperation and work progress.
- B. Work performed without benefit of reviewed and approved shop drawings **will not be recommended for payment by the Engineer** until such time as the shop drawings are submitted, reviewed, and approved. Any work performed without the benefit of reviewed and approved shop drawings may require removal, relocation, and/or replacement at the Contractor=s sole expense in order to resolve conflicts between the various systems and provide the performance specified.
- C. All installation of equipment, fixtures, terminal devices, etc. shall be made in accordance with approved composite shop drawings. The Contractor shall modify installation and relocate installed work to provide code clearances, service access, and eliminate conflict with other systems.
- D. Submit one print of shop drawings for each area, floor, system, etc. The print will be marked with the A/E=s comments and returned to the Contractor. Contractor shall revise shop drawings, incorporate revisions in field and submit revised shop drawings at project close out.

1.16 SITE OBSERVATION

- A. Site observation by the Architect, Engineer, and/or Owner=s Representative is for the express purpose of verifying compliance by the Contractor with the contract documents, and shall not be construed as construction supervision nor indication of approval of the manner or location in which the work is being performed as being a safe practice or place.

1.17 SUPERVISION

- A. In addition to the Superintendent required under the conditions of the contract, each subcontractor shall keep a competent superintendent or foreman on the job at all times.
- B. It shall be the responsibility of each superintendent to study all plans and familiarize himself with the work to be done by other trades. He shall coordinate his work with other trades and, before material is fabricated or installed, make sure that his work will not cause an interference with another trade. Where interferences are encountered, they shall be resolved at the jobsite by the superintendents involved. Where interferences cannot be resolved without major changes to the plans, the matter shall be referred to the Owner=s Representative for comments.

1.18 OPERATION PRIOR TO COMPLETION

- A. When any piece of mechanical equipment is operable and it is to the advantage of the Contractor to operate the equipment, he may do so, providing that he properly supervises the operation and has the written permission of the Owner=s Representative to do so. The warranty period shall not commence, however, until such time as the equipment is operated for the beneficial use of the Owner or date of substantial completion, whichever occurs first.
- B. Regardless of whether or not the equipment has or has not been operated, the Contractor shall properly clean the equipment, install clean filter media, properly adjust, and complete all deficiency list items before final acceptance by the Owner. The date of acceptance and the start of the warranty may not be the same date.

1.19 MANUFACTURER=S RECOMMENDATIONS

- A. The manufacturer=s published directions shall be followed in the delivery, storage, protection, installation, piping, and wiring of all equipment and material. The Contractor shall promptly notify the Owner=s Representative, in writing, of any conflict between the requirements of the contract documents and the manufacturer=s directions, and shall obtain the Owner=s Representative=s comments before proceeding with the work. Should the Contractor perform any such work that does not comply with the manufacturer=s directions or applicable comments from the Owner=s Representative, he shall bear all costs arising in connection with the correction of such deficiencies.

1.20 CHECKING AND TESTING MATERIALS AND/OR EQUIPMENT

- A. Before final acceptance of the work, an authorized representative of the manufacturer of the installed materials and/or equipment shall personally inspect the installation and operation of his materials and/or equipment to determine that it is properly installed and in proper operating order. Testing and checking shall be accomplished during the course of the work where required by work being concealed, and at the completion of the work otherwise. In addition, the Contractor shall submit to the Owner=s Representative a signed statement from each representative certifying as follows:

AI certify that the materials and/or equipment listed below have been personally inspected by the undersigned authorized manufacturer=s representative and is properly installed and operating in accordance with the manufacturer=s recommendations and are asbestos free.@

- B. Check inspections shall include plumbing, heating, air conditioning, ventilating, mechanical control and electrical equipment, and such other items hereinafter specified or specifically designated by the Owner=s Representative.

1.21 OPERATING AND MAINTENANCE INSTRUCTION

- A. The Contractor shall prepare for the owner=s manual hereinafter specified complete sets of operating and maintenance instructions, system piping, valving, control and interlock diagrams, manuals, parts lists, etc. for each item of equipment. These are to be assembled as hereinafter specified for owner=s manual.
- B. In addition, the Contractor shall provide the service of a competent engineer or a technician acceptable to the Owner=s Representative to instruct a representative of the Owner in the complete and detailed operation of all equipment and systems. These instructions shall be provided for a period of sufficient duration to fully accomplish the desired results. Upon completion of these instructions, a letter of release will be required, acknowledged by the Owner, stating the dates of instruction and personnel to whom instructions were given.
- C. Additional diagrams, operating instructions, etc. shall be provided as specified hereinafter in the other sections of these specifications.

1.22 MATERIAL AND EQUIPMENT SCHEDULES

- A. Contractor shall refer to both drawings and specification for schedules. Where reference is made to items Ascheduled on drawings@ or Ascheduled in specifications,@ same shall include schedules contained in both the drawings and the specifications. The Contractor=s attention is directed to the various specification sections and drawings for schedules.

1.23 APPLICABLE CODES AND STANDARDS

- A. The installation shall meet the minimum standards prescribed in the latest editions of the following listed codes and standards, which are made a part of these specifications, except as may be hereinafter specifically modified in these specifications and associated drawings.
 - 1. National Fire Protection Association Standards (NFPA):
 - NFPA 10 - Portable Fire Extinguishers
 - NFPA 54 - National Fuel and Gas Code
 - NFPA 70 - National Electrical Code
 - NFPA 90A - Air Conditioning Systems
 - NFPA 101 - Life Safety Code
 - NFPA 255 - Method of Test of Surface Burning Characteristics of Building Materials
 - 2. American National Standards Institute (ANSI):
 - 15-78 - Safety Code for Mechanical Refrigeration
 - C.2 - 1984 National Electrical Safety Code
 - A117.1 - Handicapped Code
 - 3. American Society of Mechanical Engineers (ASME): Section IV, V, CSD-1
 - 4. Air Conditioning and Refrigeration Institute Standards (ARI): All standards related to refrigeration and air conditioning equipment and piping furnished under these specifications.
 - 5. American Water Works Association (AWWA): All applicable manuals and standards.
 - 6. Sheet Metal and Air Conditioning Contractors National Associate, Inc, (SMACNA): All applicable manuals and standards.
 - 7. Air Moving and Conditioning Association (AMCA): All applicable manuals and standards.
 - 8. American Society of Testing Materials (ASTM): All applicable manuals and standards.
 - 9. National Electrical Manufacturers= Association (NEMA): All applicable manuals and standards.
 - 10. Occupational Safety and Health ACT (OSHA):
 - National Sanitation Foundation - Standard No. 2
 - 11. American Society of Heating, Refrigeration, and Air conditioning Engineers (ASHRAE):
 - ASHRAE 90.1
 - 12. Americans with Disabilities Act, 1990
 - 13. American Gas Association (AGA)

- 14. Underwriters Laboratories, Inc. (UL)
 - 15. Manufacturer=s Standardization Society of the Valve and Fitting Industry (MSS)
 - 16. Applicable Local and State Building Codes (International Building Codes, as amended):
 - 17. Applicable Local and State Mechanical Code (International Mechanical Code, as amended).
 - 18. Applicable Local and State Plumbing Code (International Plumbing Code, as amended).
 - 19. Applicable Local and State Energy Code (International Energy Conservation Code, as amended).
 - 20. Applicable State Gas Code (International Fuel and Gas Code, as amended).
- B. All materials and workmanship shall comply with all applicable city, state, and national codes, specifications, and industry standards. All materials shall be listed by the Underwriters Laboratories, Inc. as conforming to its standards and so labeled in every case where such a standard has been established for the particular type of material in question.
- C. The contract documents are intended to comply with the aforementioned rules and regulations; however, some discrepancies may occur. Where such discrepancies occur, the Contractor shall immediately notify the Owner=s Representative in writing of said discrepancies and apply for an interpretation. Should the discovery and notification occur after the execution of a contract, any additional work required for compliance with said regulations shall be paid for as covered by Division 1 of these contract documents, providing no work or fabrication of materials has been accomplished in a manner of noncompliance. Should the Contractor fabricate and/or install materials and/or workmanship in such a manner that does not comply with the applicable codes, rules, and regulations, the Contractor who performed such work shall bear all costs arising in correcting these deficiencies to comply with said rules and regulations.

1.24 DEFINITIONS

- A. Refer to the condition of the contract for Division 1 for additional requirements regarding definitions.
- B. Where Aas required@ or Aas necessary@ is used in these specifications or on the drawings, it shall mean Athat situations exist that are not necessarily described in detail or indicated that may cause the Contractor certain coordination requirements in performing the work described or indicated. These coordination requirements entail the normal coordination activities expected of the Contractor where multiple trades are involved and new or existing construction causes deviations to otherwise simplistic approaches to the work to be performed. The term shall not be interpreted to permit an option on the part of the Contractor to achieve the end result.@
- C. Where Aand/or@ is used in these specifications or on the drawings, it shall mean Athat situations exist where either one or both conditions occur or are required and shall not be interpreted to permit an option on the part of the Contractor.

1.25 FINAL INSPECTION

- A. Refer to Division 1 for additional requirements for final inspection.
- B. It shall be the responsibility of the Contractor to personally conduct a careful inspection, assuring himself that the work on the project is ready for final acceptance and developing his own Apunchlists,@ before calling upon the Owner=s Representative to make a final inspection. Failure of the Contractor to conduct such inspections and provide the Owner=s Representative with a copy of his Apunchlists@ prior to the final inspection shall be adequate cause for the Owner=s Representative to cancel any Contractor-requested final inspection.

- C. In order not to delay final acceptance of the work, the Contractor shall conduct his own Afinal inspections@ prior to requesting the Owner=s Representative to Afinal@ the project; will have all necessary bonds, guarantees, receipts, affidavits, etc. called for in the various articles of this specification prepared and signed in advance; and together with a letter of transmittal listing each paper included, shall deliver the same to the Owner=s Representative at or before the time of said final inspection. The Contractor is cautioned to check over each bond, receipt, etc. before preparing same for submission to see that the terms check with the requirements of the specifications.

- D. The final inspection will be made jointly by the Owner=s Representative and the Owner.

1.26 REQUIREMENTS FOR FINAL ACCEPTANCE

- A. Requirements for final acceptance shall include but not be limited to the Contractor accomplishing the following:
1. Construction: Complete all construction.
 2. Deficiency Lists: Correct all deficiencies listed at time of Substantial Completion.
 3. Owner=s Manual: Submit at least 30 days prior to final acceptance on (1) copy of the owner=s manual for the Owner=s Representative=s review and comments. Following acceptance, prepare three (3) copies of bound and indexed owner=s manual, to be delivered at the time of final acceptance, which shall include but not be limited to the following:
 - a. System operating instructions.
 - b. System control drawings.
 - c. System interlock drawings.
 - d. System maintenance instructions.
 - e. Manufacturers=, suppliers=, and subcontractors= names, addresses, and telephone numbers, both local representatives and manufacturers= service headquarters.
 - f. Equipment operating and maintenance instructions and parts lists.
 - g. Manufacturer's certifications (see Checking and Testing Materials and/or Equipment, this section).
 - h. Contractor=s warranty.
 - i. Acceptance certificates of authorities having jurisdiction.
 - j. Log of all tests made during course of work.
 - k. Owner=s acknowledgment of receipt of instruction, enumerating items in owner=s manual.
 - l. List of manufacturers= guarantees executed by the Contractor.
 - m. Certified performance curves.
 - n. Balance and performance test reports.
 - o. Owner=s acknowledgment of items of equipment or accessories indicated or specified to be turned over to Owner.
 4. Instructions:
 - a. Verbal, as herein specified.
 - b. Posted, framed under glass or plastic laminated:
 - 1) System operating instructions.
 - 2) System control drawings.
 - 3) System interlock drawings.
 5. Record Drawings: Deliver the specified record drawings to the Owner=s Representative.

1.27 RECORD DRAWINGS

- A. The Contractor shall maintain a set of contract drawings (black-line prints) at the jobsite on which he shall indicate the installed (as-built) locations of the following:
1. Equipment

2. Main lines of piping and ductwork.
 3. Dimensional locations (including depth) of all underground piping, valves and conduits.
- B. Drawings shall be used for construction reference and shall not leave the field office of the jobsite.
- C. Drawings shall include all addenda, ASI=s, Change Orders, and existing conditions and equipment that are not reflected in the original contract drawings.
- D. Upon completion of work, the Contractor shall obtain CAD files of the contract drawings from the Owner=s Representative and transfer the above as-built information into these files. The as-built files shall be permanently marked ARECORD DRAWINGS@ and printed on full-size Mylar sheets. Upon completion, the CAD files shall be transferred to CD in AutoCAD 2007 format. Both the CAD files CD and Mylar drawings shall be submitted to the Owner=s Representative as part of the Close-out Submittals.
- E. Refer to Division 1 paragraph entitled ARecord Documents@ for additional requirements.

1.28 ALLOWANCES

- A. Refer to Division 1 for allowances.

1.29 ALTERNATE PROPOSALS

- A. Alternate proposals are summarized in Division 1 and on the bid proposal form. Refer to all sections of the specifications and the drawings to determine the exact extent and scope of the various alternate proposals as each pertains to the work of the various trades.

1.30 WARRANTY

- A. General: All work performed (including equipment and materials furnished) under the various sections of these specifications shall be 100% warranted, for a period of one (1) year from the date of final acceptance thereof, against defective materials, design, and unauthorized substitution. Upon receipt of note of failure of any part of the guaranteed equipment and/or facilities during the guaranty period, the affected part(s) or facilities shall be replaced promptly with new parts, etc. by and at the expense of the Contractor. Further, the Contractor shall properly obtain, execute, and forward any and all manufacturer=s warranties on equipment furnished under the Contract. Refer to Division 1 for additional requirements.
- B. Extended Period: The Contractor shall provide all extended time warranties available from the manufacturer of the equipment provided as standard at no additional cost. This includes all extended warranties where specified with certain equipment as directed in other sections of this Specification.

PART 2 - PRODUCTS

2.1 MATERIALS AND WORKMANSHIP

- A. All materials, unless otherwise specified, shall be current United States manufacture, new, free from all defects, and of the best quality. Foreign goods specifically approved for use by the Owner=s Representative prior to bidding may be furnished.
- B. Materials and equipment shall be installed in accordance with the manufacturer's recommendations and the best standard practice for the type of work involved. All work shall be

executed by mechanics skilled in their respective trades, and the installations shall present a neat, precise appearance.

- C. The responsibility for the furnishing and installation of the proper mechanical equipment and/or material as intended rests entirely upon the Contractor. The Contractor shall request advice and supervisory assistance from the representative of specific manufacturers during the installation.

2.2 FLAME SPREAD AND SMOKE DEVELOPED PROPERTIES OF MATERIALS

- A. Duct coverings, duct linings, vapor barrier facings, tapes, adhesives, core materials, insulation, jackets, piping (of any sort), and other materials in concealed locations, including any above-ceiling area, shall have a flame spread rating not over 25 without evidence of continued progressive combustion and a smoke developed rating no higher than 50. Flame spread and smoke developed ratings shall be in accordance with NFPA Standard No. 255.

2.3 BEARINGS

- A. All ball bearings shall be of radial and/or thrust type and enclosed in a dust and moisture-proof housing.

2.4 MOTORS

- A. The Contractor shall provide all motors required for equipment supplied under each portion of the work. Motors shall be premium efficiency and be built in accordance with the latest ANSI, IEE, and NEMA standards, shall be fully coordinated with the equipment served, shall be of sizes and electrical characteristics scheduled.

2.5 STARTING EQUIPMENT

- A. Each motor shall be provided with proper starting equipment. This equipment, unless hereinafter specified or scheduled to the contrary, shall be provided by the trade furnishing the motor. All motor starting equipment provided by any one trade shall be of the same manufacture unless such starting equipment is an integral part of the equipment on which the motor is mounted.

2.6 LOW VOLTAGE (CONTROLS/THERMOSTAT) WIRING

- A. All low voltage wiring installed by the Mechanical Contractor, Electrical Contractor or Controls Vendor shall be run in a neat and workmen like manner, parallel and perpendicular to building lines on J-Hooks (above ceiling grid only). Plenum rated cable shall be installed above ceilings. All other locations (exposed, Mechanical Rooms, outdoors or above hard lid ceiling) should be installed in conduit.

2.7 SLEEVES, INSERTS, AND FASTENINGS

- A. General: Proper openings through floors, walls, roofs, etc. for the passage of piping, ductwork, conduits, etc. shall be provided. All piping and conduit through floors and piping through walls must pass through sleeves except soil pipe installed under concrete slabs-on-fill, and pipe and conduit that is cast-in-place. Sleeves shall be set in new construction before concrete is poured, as cutting holes through any part of the concrete will not be permitted unless acceptable to the Owner=s Representative.
- B. Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve 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. Install cast-iron "wall pipes" for sleeves 6 inches in diameter and larger.
 3. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.
- C. Underground, Exterior-Wall, Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.
- D. Sleeves: The minimum clearance between horizontal pipe, including insulation where applicable, and sleeve shall be 1/4 inch, except that the minimum clearance shall be 2 inches where piping contacts the ground. Sleeves through floors shall extend 3/4 inch above the floor; sleeves through walls and partitions shall be installed flush with exposed surfaces.
- E. Materials: Install sleeves large enough to provide 1/4" annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
1. Steel Pipe Sleeves: For pipes smaller than 6-inch NPS.
 2. Steel, Sheet-Metal Sleeves: For pipes 6-inch NPS and larger, penetrating gypsum-board partitions.
 3. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
 - a) Seal space outside of sleeve fittings with non-shrink, nonmetallic grout.
- F. Inserts: Suitable concrete inserts for pipe, conduit, and equipment hangers shall be set and properly located for all piping, conduit, and equipment to be suspended from concrete construction.
- G. Fasteners: Fastening of pipes, conduits, etc. in the building shall be as follows:
1. To wood members: by wood screws.
 2. To masonry and concrete: by threaded metal inserts, metal expansion screws, or toggle bolts, whichever is appropriate for the particular type of masonry or concrete.
 3. To steel: machine screws or welding (when specifically permitted or directed), or bolts.
- NOTE: Under no circumstances will the use of plastic anchors or plastic expansion shields be permitted for any purpose whatsoever.**
- H. Ratproofing: The open space around all piping, ductwork, etc. passing through the ground floor and/or exterior walls shall be ratproofed in a manner acceptable to the Owner=s Representative.
- I. Weatherproofing: The annular space between a pipe and its sleeve in exterior walls or through floor to below grade shall be filled with polyurethane foam rods 50% greater in diameter than the space as backing and fill material and made watertight with a permanent elastic polysulfide compound. Seal both surfaces of wall or floor with a fire-resistant sealant.
- J. Air Plenums: The space around piping, ductwork, etc. passing through an air plenum shall be made airtight in a manner acceptable to the Owner=s Representative. The sealant used must be fire resistant.

2.8 FIRE AND SMOKE PARTITION, WALL, AND/OR FLOOR PENETRATIONS

- A. Pipe, ductwork, conduit, etc. shall pass through fire- or smoke-rated floors, partitions, walls, or other barriers within a UL-listed assembly which shall maintain the rating of the applicable wall, floor, partition, or barrier.

- B. The Contractor shall review the architectural and structural drawings and determine the location of the fire-rated building elements. Where these elements are penetrated, UL-listed fire-rated penetration assemblies approved by the local authority shall be provided in accordance with the manufacturer=s instructions to obtain the required rating.

2.9 METAL BUILDING SYSTEMS/MECHANICAL-ELECTRICAL SUPPORTS

- A. Metal building systems are required to be designed by the manufacturer to accommodate and support the mechanical systems indicated on the mechanical drawings and specified in Mechanical specifications.
- B. The metal building systems manufacturer is required to provide the following:
1. Framed openings through the roofs with supports, roof curbs, and flashings for roof-mounted equipment, fans, vents, and air intakes.
 2. Structural support for piping, conduits, and suspended equipment consisting of beam, joists, purlins, and/or blocking above and perpendicular to pipe routes and equipment hangers at intervals not to exceed 8 feet.
 3. Structural support for suspended ceilings, diffusers, grilles, light fixtures including associated raceways and ductwork.
- C. The mechanical trade shall:
1. Provide all routes, weights, installation heights, opening locations, etc. for all equipment, piping, vents, etc. to the metal building system manufacturer and coordinate requirements for structural supports, hangers, attachments, etc. with the metal building systems manufacturer.
 2. Provide all supporting devices (hangers, attachments, brackets, cross beams, etc.) to attach to the metal building structural system.

2.10 FOUNDATIONS / HOUSEKEEPING PADS

- A. General: All special foundations and supports required for the proper installation of equipment and pipe shall be provided as hereinafter specified and under the section of the specifications covering the equipment, unless otherwise indicated on the drawings.
- B. All mechanical equipment shall receive concrete housekeeping pads unless otherwise noted. Equipment to receive pads are to include (but not limited to): air handlers, fan-coils, condensing units, boilers, water heaters, water softeners, expansion / compression tanks, filter feeders, water treatment equipment, air compressors, fans, pumps (in addition to inertia bases where required), chillers, surge tanks, deareators, etc.
- C. Concrete foundations for the support of equipment such as floor-mounted pumps, fans, etc. shall be not less than 52 inches high and not less than 4 inches larger (in both directions) than supported unit, unless otherwise noted and shall be poured in forms built of new dressed lumber. All corners of the foundations shall be neatly chamfered by means of sheet metal or triangular wood strips nailed to the form. Pads shall not be laid out directly against walls or structures. 2 inches shall be left available for pad form work. Foundation bolts shall be placed in the forms when the concrete is poured, the bolts being correctly located by means of templates. Allow 1 inch below the equipment bases for alignment and grouting (where applicable). Foundations for equipment located on the exterior of the building shall be provided as indicated. Foundations shall be constructed in accordance with approved shop drawings and shall be reinforced with #4 bars at 12 inches on center both ways (minimum).
- D. Pipe and Conduit Support: All pipes and conduits throughout the building, both horizontal and vertical, shall be adequately supported from the construction to line of grade, with proper provision for expansion, contraction, vibration elimination, and anchorage. Vertical pipes and conduits shall be supported from floor lines with riser clamps sized to fit the lines and to

adequately support their weight. At the bases of lines, where required for proper support, provide anchor base fittings or other approved supports.

2.11 ACCESS DOORS

- A. General: Provide access doors for all serviceable mechanical appurtenances (valves, trap primers, shock arresters, volume dampers, fire/smoke dampers, actuators, sensors, etcetera) in inaccessible locations. Such locations include gypsum, brick and CMU ceilings and walls.
- B. Location of panels shall be carefully coordinated with other Exposed Devices as described in earlier paragraphs.
- C. Manufacturers shall be Inland-Milcor, Bilco, Miami Carey, or approved equal. Unless indicated otherwise, use panels equal to Milcor Style M for masonry and drywall construction, equal to Milcor Style K for plastered masonry walls and ceilings. Stainless steel panels shall be used in ceramic tile or glazed structural tile.
- D. Minimum construction features include 14-gage frame and door, continuous hinges, cam-style latch and 10x10" unobstructed opening size.
- E. UL labeled when in fire-rated construction, one and one-half hour rating.
- F. Access doors located outside, in restrooms or in a moisture-laden environment (dressing area, shower area, lockers, etc.) shall be stainless steel construction.
- G. Equipment access doors shall be of sufficient size to remove/replace equipment and provide routine maintenance as necessary, unless otherwise noted. Doors shall be set flush with adjacent finish surfaces. Exterior doors shall be provided with cylinder locks.
- H. Access doors into ductwork shall be 14-gauge insulated galvanized steel with 16-gauge galvanized gasketed steel frame and cam-type locks. Ductwork access door shall be a minimum of 12" H 12" in size.

2.12 FLOOR AND CEILING PLATES

- A. Except as otherwise noted, provide one-piece chrome-plated brass floor and ceiling plates (or escutcheons) around all pipes, conduits, etc. passing through walls, floors, or ceilings in any spaces, except underfloor and attic spaces. Plates shall be sized to fit snugly against the outside of the pipe or against the outside of insulation on lines which are insulated, and positively secured to such pipe or insulation. Plates will not be required for piping where pipe sleeves extend : of an inch above finish floor and are concealed. Plates shall be one piece.

PART 3 - EXECUTION

3.1 SPACE AND EQUIPMENT ARRANGEMENT

- A. The size of mechanical equipment indicated on the drawings is based on the dimensions of a particular manufacturer. While other manufacturers will be acceptable, it is the responsibility of the Contractor to determine whether the equipment he proposes to furnish will fit in the space. Shop drawings shall be prepared when required by the Owner=s Representative to indicate a suitable arrangement.
- B. All equipment shall be installed in a manner to permit access to all surfaces. All valves, motors, drives, filters, and other accessory items shall be installed in a position to allow removal for service without disassembly of another part.

3.2 LARGE APPARATUS

- A. Any large piece of apparatus which is to be installed in any space in the building, and which is too large to permit access through stairways, doorways, or shafts shall be brought to the job and placed in the space before the enclosing structure is completed. Following placement in the space, such apparatus shall be thoroughly, completely protected from damage as hereinafter specified.

3.3 PROTECTION

- A. The Contractor shall take such precautions as may be necessary to properly protect all materials and equipment from damage from the time of delivery until the completion of work. This shall include the erection of all required temporary shelters and supports to adequately protect any items stored in the open on the site from the weather, the ground and surrounding work; the cribbing of any items above the floor of the construction; and the covering of items in the uncompleted building with tarpaulins or other protective covering. Failure on the part of the Contractor to comply with the above will be sufficient cause for the rejection of the items in question.
- B. The Contractor shall protect existing facilities, the work of others, and the premises from any and all damages that may be made possible by the execution of work.
- C. Equipment and materials shall be protected from rust both before and after installation. Any equipment or materials found in a rusty condition at the time of final inspection must be cleaned of rust and repainted as specified elsewhere in these specifications.

3.4 COOPERATION BETWEEN TRADES AND WITH OTHER CONTRACTORS

- A. Each trade, subcontractor, and/or Contractor must work in harmony with the various trades, subcontractors, and/or Contractors on the job as may be required to facilitate the progress to the best advantage of the job as a whole. Each trade, subcontractor, and/or Contractor must pursue its work promptly and carefully so as not to delay the general progress of the job. This Contractor shall work in harmony with Contractors working under other contracts on the premises.
- B. It shall be the responsibility of each trade to cooperate fully with the other trades on the job to help keep the jobsite in a clean and safe condition. At the end of each day's work, each trade shall properly store all of its tools, equipment, and materials and shall clean its debris from the job. Upon the completion of the job, each trade shall immediately remove all of its tools, equipment, any surplus materials, and all debris caused by its portion of the work.

3.5 PRECEDENCE OF MATERIALS AND COORDINATION OF WORK

- A. These specifications and the accompanying drawings are intended to cover systems which will not interfere with the structural design of the building, which will fit into the several available spaces, and which will ensure complete and satisfactory systems. Each subcontractor and/or trade shall be responsible for the proper fitting of his material and apparatus into the building.
- B. The work of the various trades shall be performed in the most direct and workmanlike manner without hindering or handicapping the work of other trades. Piping interferences shall be handled by giving precedence to pipe lines which require a stated grade for proper operation. Where space requirements conflict, the following order or precedence shall, in general, be observed:
 1. Building lines.
 2. Structural members.
 3. Light fixtures.

- 4. Soil and drain piping.
 - 5. Condensate drains.
 - 6. Vent piping.
 - 7. Supply, return, and outside air ductwork.
 - 8. Exhaust ductwork.
 - 9. HVAC water and steam piping.
 - 10. Steam condensate piping.
 - 11. Fire protection piping.
 - 12. Natural gas piping.
 - 13. Domestic water (cold and hot).
 - 14. Refrigerant piping.
 - 15. Electrical conduit.
- C. The light fixture grid layout as indicated on the drawings must be maintained. This Contractor shall refer to all light fixture plans and details indicated on the drawings and shall coordinate the location of dampers, supply grilles, return air grilles, sprinkler heads, etc. with the location of the light fixtures to assure proper access to all items in a manner acceptable to the Owner's Representative.
- D. The electrical trades shall locate all junction boxes, pull boxes, conduits, etc. to avoid interference with the diffusers, dampers, grilles, etc. hereinbefore mentioned. The mechanical trades shall furnish to all other trades copies of approved ductwork shop drawings to assist in the coordination of the rough-in and installation of all items of work.

3.6 CONNECTIONS FOR OTHERS

- A. This Contractor shall rough-in for and make all water, sewer, electrical, etc. connections to all fixtures, equipment, machinery, etc. provided by others in accordance with detailed roughing-in drawings provided by the equipment suppliers, by actual measurements of the equipment connections, or as detailed.
- B. After the equipment is set in place, this Contractor shall make all final connections and shall provide all required pipe, fittings, valves, traps, connectors, etc.
- C. Provide all air gap fittings required, using materials hereinbefore specified. In each water line serving an item of equipment or piece of machinery, provide a shutoff valve. On each drain without integral trap provide a suitable trap.
- D. All pipe fittings, valves, traps, etc. exposed in finished areas and connected to chrome-plated lines provided by others shall be chrome-plated to match.
- E. Provide all sheet metal ducts, transition pieces, etc. required for a complete installation of equipment provided by others.

3.7 INSTALLATION METHODS

- A. Where to Conceal: All pipes and conduits shall be concealed in pipe chases, walls, furred spaces, below suspended floors, or above the ceilings of the building unless otherwise indicated.
- B. Where to Expose: In mechanical rooms, janitor's closets tight against pan soffits in exposed Tee structures, or storage spaces, but only where necessary, piping and conduit may be run exposed. All exposed piping and conduit shall be run in the neatest, most inconspicuous manner, and parallel or perpendicular to the building lines.
- C. Support: All piping and conduit shall be adequately and properly supported from the building structure by means of hanger rods or clamps to walls as herein specified.

- D. Maintaining Clearance: Where limited space is available above the ceilings and below concrete beams or other deep projections, pipe and conduit shall be sleeved through the projection where it crosses, rather than hung below them, in a manner to provide maximum above-floor clearance. Sleeves shall be as herein specified. Approval shall be obtained from the Owner=s Representative for each penetration.
- E. All pipe, conduits, etc. shall be cut accurately to measurements established at the building and shall be worked into place without springing or forcing. All ducts, pipes, and conduits run exposed in machinery and equipment rooms shall be installed parallel to the building lines, except that they shall be sloped to obtain the proper pitch. Piping and ducts run in furred ceilings, etc. shall be similarly installed, except as otherwise shown. Conduits in furred ceilings and in other concealed spaces may be run at angles to the construction but shall be neatly grouped and racked indicating good workmanship. All conduit and pipe openings shall be kept closed until the systems are closed with final connections.
- F. Special Requirements:
 - 1. There shall be no pipe joints nearer than 12 inches to a wall, ceiling, or floor penetration unless pipe joint is a welded or mechanically-coupled-type joint.
 - 2. The Contractor shall study all construction documents and carefully lay out all work in advance of fabrication and erection in order to meet the requirements of the extremely limited spaces. Where conflicts occur, the Contractor shall meet with all involved trades and the Owner=s Representative and resolve the conflict prior to erection of any work in the area involved.
 - 3. All piping not directly buried in the ground shall be considered as Ainterior piping.@
 - 4. Prior to the installation of any ceiling material, gypsum, plaster, or acoustical board, the Contractor shall notify the Owner=s Representative so that arrangements can be made for an inspection of the above-ceiling area about to be Asealed off.@ The Contractor shall give as much advance notice as possible up to ten (10) working days, but in no case less than five (5) working days.
 - 5. The purpose of this inspection is to verify the completeness and quality of the installation of the air conditioning systems, the plumbing systems, and any other special above-ceiling systems such as pneumatic tube. The ceiling supports (tee bar or lath) should be in place so that access panel and light fixture locations are identifiable and so that clearances and access provisions may be evaluated.
 - 6. No ceiling material shall be installed until the deficiencies listed from this inspection have been corrected to the satisfaction of the Owner=s Representative.

3.8 CUTTING AND PATCHING

- A. General: Cut and patch walls, floors, etc. resulting from work in existing construction or where made necessary by failure to provide proper openings or recesses in new construction.
- B. Methods of Cutting: Openings cut through concrete and masonry shall be made with masonry saws and/or core drills and at such locations acceptable to the Owner=s Representative. Impact-type equipment will not be used except where specifically acceptable to the Owner=s Representative. Openings in concrete for pipes, conduits, outlet boxes, etc. shall be core drilled to exact size. **Determine location of embedded conduit and reinforcing bars prior to cutting.**
- C. Restoration: All openings shall be restored to Aas-new@ condition under the appropriate specification section for the materials involved, and shall match remaining surrounding materials and/or finishes.
- D. Masonry: Where openings are cut through masonry walls, provide and install lintels or other structural supports to protect the remaining masonry. Adequate supports shall be provided during the cutting operation to prevent any damage to the masonry occasioned by the operation.

All structural members, supports, etc. shall be of the proper size and shape, and shall be installed in a manner acceptable to the Owner=s Representative.

- E. Plaster: All mechanical work in area containing plaster shall be completed prior to the application of the finish plaster coat. Cutting of finish plaster coat will not be permitted.
- F. Weakening: No cutting, boring, or excavating which will weaken the structure shall be undertaken.

3.9 ROOF PENETRATIONS AND FLASHING

- A. Pipe and conduit ducts, pitch pockets, curb bases, and flashing compatible with the roofing installation shall be provided for roof penetrations. Provide framing or other support around all openings through roof as required to preserve the structural integrity of the roof system and make the penetration weathertight.
- B. Provide 30-inch round or square flashing acceptable to the roofing trades at all roof and deck drain and sleeve flashing locations.
- C. Roof curbs for all roofs except standing seam metal roofs shall be provided by the equipment supplier supplying the roof-mounted equipment, etc., and such curbs shall be installed by the roofing trades. Contractor shall coordinate all roof curb requirements with all trades and the roofing trades at the earliest possible stage of the project.
- D. Roof curbs for standing seam metal roofs shall be provided by the roofing trades. Curb base size, height, and type shall be coordinated with the roofing trades at the earliest possible stage of the project.
- E. Flashing for pipe and conduit penetrations of standing seam metal roofs shall be provided and installed by the roofing trades.

3.10 EXCAVATING AND BACKFILLING

- A. Perform trenching, excavating, backfilling for mechanical work as set forth below.
- B. Depth of excavation to provide a minimum of 3 feet above top of pipe. Excavation to be carried to a depth of at least 6 inches below bottom of pipe elevation. Fill below pipe (6 inches), around pipe, and a minimum of 12 inches above pipe with sand of Class AB@ crushed stone tamped firm and even. Separate topsoil during excavation. Final layer of dirt (12 inches minimum) to be topsoil. Trenches to be at least 18 inches wider than pipe with batter boards placed every 25 feet. Backfilling shall be done to exclude use of rock or stone above sand or Class AB@ crushed stone.

3.11 TESTS AND INSPECTIONS

- A. General: The Contractor shall make all tests deemed necessary by the inspection departments of the authority having jurisdiction, Board of Underwriters, etc. He shall provide all equipment, materials, and labor for making such tests. Fuel and electrical energy for system operational tests following beneficial occupancy by the Owner will be paid for by the Owner.
- B. Other: Additional tests specified hereinafter under the various specification sections shall be made.
- C. Notification: The Owner=s Representative shall be notified at his office 36 hours prior to each test and other specifications requirements requiring action on the part of the Owner, Architect, Engineer, and/or Owner=s Representative.

- D. Test Logs: All tests which the Contractor conducts shall have pertinent data logged by the Contractor at the time of testing. Data shall include date, time, personnel, description and extent of system tested, test conditions, test results, specified results, and any other pertinent data. Data shall be delivered to the Owner=s Representative as specified under ARequirements for Final Acceptance.
- E. Inspections: In general, an inspection by the Owner=s Representative shall be required prior to closing up any work and prior to beneficial occupancy or final project completion. The closing up of work includes, but is not limited to, pipe and conduit installations prior to backfilling; mechanical, electrical, and fire protection work prior to placement of concrete; or closing up walls and overhead mechanical, electrical, and fire protection work prior to installation of the ceiling.

3.12 CLEANING AND PAINTING

- A. Thoroughly clean and touch up the finish on all parts of the materials and equipment. Exposed parts in equipment rooms, and all other spaces except sealed chases and attics shall be thoroughly cleaned of cement, plaster, and other materials, and all oil and grease spots shall be removed. Such surfaces shall be carefully wiped and all cracks and corners scraped out.
- B. Exposed metal work which is not galvanized shall be carefully brushed down with steel brushes to remove rust and other spots and left smooth and clean and then painted with a suitable rust resistant primer. Exposed metal work includes work exterior to the building; exposed in mechanical or electrical equipment rooms and storage rooms; and other areas where occupants could see the work, whether normally occupied or not.
- C. All other painting shall be accomplished under the Painting Section of Division 9 of the specifications.

3.13 DISCHARGE OF WASTES FROM CONSTRUCTION SITE

- A. The Contractor shall comply with all applicable provisions of local, state, and federal laws regarding the discharge of wastes into sewer and waterways. Special caution shall be exercised to prevent the discharge of wastes which contain oil, tar, asphalt, roofing compound, kerosene, gasoline, paint, mud, cement, lime, or other materials which would degrade the water quality of the receiving water course. The Contractor shall construct and maintain oil interceptors, settling basins, acid neutralization tanks, and/or other effective pollution countermeasures, as required by the Texas Water Quality Board.

END OF SECTION 230100

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SECTION 230513

BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following basic mechanical materials and methods to complement other Mechanical Sections.
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Concrete base construction requirements.
 - 3. Escutcheons.
 - 4. Dielectric fittings.
 - 5. Dielectric isolation tape
 - 6. Flexible connectors.
 - 7. Mechanical sleeve seals.
 - 8. Nonshrink grout for equipment installations.
 - 9. Field-fabricated metal and wood equipment supports.
 - 10. Installation requirements common to equipment specification sections.
 - 11. Mechanical demolition.
 - 12. Cutting and patching.
 - 13. Touchup painting and finishing.
 - 14. Access Doors
- B. Pipe and pipe fitting materials are specified in mechanical piping system Sections, if applicable.

1.2 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, 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 in duct shafts.
- 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.
- F. The following are industry abbreviations for plastic materials:
 - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
 - 2. CPVC: Chlorinated polyvinyl chloride plastic.
 - 3. NP: Nylon plastic.
 - 4. PE: Polyethylene plastic.
 - 5. PVC: Polyvinyl chloride plastic.
- G. The following are industry abbreviations for rubber materials:

1. CR: Chlorosulfonated polyethylene synthetic rubber.
2. EPDM: Ethylene propylene diene terpolymer rubber.

1.3 SUBMITTALS

- A. Product Data: For dielectric fittings, flexible connectors, access doors, solder/brazing material and mechanical sleeve seals.
- B. Shop Drawings: Detail fabrication and installation for metal and wood supports and anchorage for mechanical materials and equipment.
- C. Coordination Drawings: Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work. Include the following:
 1. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
 2. Equipment and accessory service connections and support details.
 3. Fire-rated wall and floor penetrations.
 4. Scheduling, sequencing, movement, and positioning of large equipment into building during construction.
 5. Access panel and door locations

1.4 QUALITY ASSURANCE

- A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.
- B. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.
- B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.
- C. Protect flanges, fittings, and piping specialties from moisture and dirt.
- D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.6 SEQUENCING AND SCHEDULING

- A. Coordinate Mechanical equipment installation with other building components.
- B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

- C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.
- D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.
- E. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
- F. Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces.
- G. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Dielectric Tape:
 - a. Holdrite (#272-4).
 - 2. Metal, Flexible Connectors:
 - a. Flexicraft Industries.
 - b. Flex-Hose, Co., Inc.
 - c. Grinnell Corp.; Grinnell Supply Sales Co.
 - d. Mercer Rubber Co.
 - e. Metraflex Co.
 - f. Uniflex, Inc.
 - 3. Rubber, Flexible Connectors:
 - a. General Rubber Corp.
 - b. Mercer Rubber Co.
 - c. Metraflex Co.
 - d. Red Valve Co., Inc.
 - e. Uniflex, Inc.
 - 4. Mechanical Sleeve Seals:
 - a. Calpico, Inc.
 - b. Metraflex Co.
 - c. Thunderline/Link-Seal.

2.2 PIPE AND PIPE FITTINGS

- A. Refer to individual Specification piping Sections for pipe and fitting materials and joining methods, if applicable.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Specification piping Sections for special joining materials not listed below, if applicable.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32.
 - 1. ASTM B 32, 95/5 lead-free alloys. Include water –flushable and soluble flux according to ASTM B 813.
- F. Brazing Filler Metals: AWS A5.8.
 - 1. BCuP Series: Copper-phosphorus alloys.
 - 2. BAg1: Silver alloy.
- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- H. Solvent Cements: Manufacturer's standard solvent cements for the following:
 - 1. CPVC Piping: ASTM F 493.
 - 2. PVC Piping: ASTM D 2564, medium bodied (bond). Include purple primer according to ASTM F 656.
- I. Plastic Pipe Seals: ASTM F 477, elastomeric gasket.
- J. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon-steel bolts and nuts.
- K. Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.
 - 1. Sleeve: ASTM A 126, Class B, gray iron.
 - 2. Followers: ASTM A 47 malleable iron or ASTM A 536 ductile iron.
 - 3. Gaskets: Rubber.
 - 4. Bolts and Nuts: AWWA C111.
 - 5. Finish: Enamel paint.

2.4 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature, to prevent galvanic action and stop corrosion. Unions in first paragraph below are available in at least NPS 1/2 to NPS 2.
- B. Dielectric Unions:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Company.
 - b. Central Plastics Company.

- c. EPCO Sales, Inc.
 - d. Hart Industries International, Inc.
 - e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - f. Zurn Mechanical Products Group; Wilkins Water Control Products.
 - 2. Description:
 - a. Pressure Rating: 250 psig at 180 deg F.
 - b. End Connections: Solder-joint copper alloy and threaded ferrous.
 - c. Flanges in first paragraph below are available in at least NPS 1-1/2 to NPS 4.
- C. Dielectric Flanges:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Company.
 - b. Central Plastics Company.
 - c. EPCO Sales, Inc.
 - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Description:
 - a. Factory-fabricated, bolted, companion-flange assembly.
 - b. Pressure Rating: 175 psig minimum.
 - c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Kits:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Calico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Description:
 - a. Nonconducting materials for field assembly of companion flanges.
 - b. Pressure Rating: 150 psig.
 - c. Gasket: Neoprene or phenolic.
 - d. Bolt Sleeves: Phenolic or polyethylene.
 - e. Washers: Phenolic with steel backing washers.
- E. Dielectric Couplings:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Calpico, Inc.
 - b. Lochinvar Corporation.
 - 2. Description:
 - a. Galvanized-steel coupling.
 - b. Pressure Rating: 300 psig at 225 deg F.
 - c. End Connections: Female threaded.
 - d. Lining: Inert and noncorrosive, thermoplastic.
- F. Dielectric Nipples:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Perfection Corporation; a subsidiary of American Meter Company.
 - b. Precision Mechanical Products, Inc.
 - c. Victaulic Company.
 - 2. Description:
 - a. Electroplated steel nipple complying with ASTM F 1545.
 - b. Pressure Rating: 300 psig at 225 deg F.

- c. End Connections: Male threaded or grooved.
- d. Lining: Inert and noncorrosive, propylene.

2.5 DIELECTRIC ISOLATION TAPE

- A. Tape to eliminate dissimilar metal contact: (equal to Holdrite #272-4)
 - 1. White Polyester Felt. Pressure sensitive adhesive rubber base (one side only).
 - 2. 4" width.

2.6 FLEXIBLE CONNECTORS

- A. General: Fabricated from materials suitable for system fluid and that will provide flexible pipe connections. Include 125-psig minimum working-pressure rating, unless higher working pressure is indicated, and ends according to the following:
 - 1. 2-Inch NPS and Smaller: Threaded.
 - 2. 2-1/2-Inch NPS and Larger: Flanged.
 - 3. Option for 2-1/2-Inch NPS and Larger: Grooved for use with keyed couplings.
- B. Bronze-Hose, Flexible Connectors: Corrugated, bronze, inner tubing covered with bronze wire braid. Include copper-tube ends or bronze flanged ends, braze welded to hose.
- C. Rubber, Flexible Connectors: CR or EPDM elastomer rubber construction, with multiple plies of NP fabric, molded and cured in hydraulic presses. Include 125-psig minimum working-pressure rating at 220 deg F. Units may be straight or elbow type, unless otherwise indicated.

2.7 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, used to fill annular space between pipe and sleeve.
 - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe materials and size of pipe.
 - 2. Pressure Plates: Stainless steel.
 - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.8 PIPING SPECIALTIES

- A. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:
 - 1. Steel Sheet Metal: 0.0239-inch minimum thickness, galvanized, round tube closed with welded longitudinal joint.
 - 2. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
 - 3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
 - 4. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - a. Underdeck Clamp: Clamping ring with set screws.
 - 5. Sleeve Fasteners: Manufactured, steel clips for securement during pour. Equal to B-line, BD40, BE-5-8 or BE-9-12.
- B. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.
 - 1. ID: Closely fit around pipe, tube, and insulation of insulated piping.
 - 2. OD: Completely cover opening.
 - 3. Cast Brass: One piece, with set screw. (split face acceptable for existing piping)

- a. Finish: Polished chrome-plate.

2.9 GROUT

- A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.
 - 1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psig, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

2.10 ACCESS DOORS

- A. General: Provide access doors for all serviceable mechanical appurtenances (valves, trap primers, shock arresters, actuators, sensors, etcetera) in inaccessible locations. Such locations include gypsum, brick and CMU ceilings and walls.
- B. Location of panels shall be carefully coordinated with other Exposed Devices as described in earlier paragraphs.
- C. Manufacturers shall be Milcor, Mifab, or approved equal. Unless indicated otherwise, use panels equal to Milcor Style M for masonry and drywall construction, equal to Milcor Style K for plastered masonry walls and ceilings. Stainless steel panels shall be used in ceramic tile or glazed structural tile.
- D. Minimum construction features include 16-gage frame and door, continuous hinges, cam-style latch and 10x10" unobstructed opening size.
- E. UL labeled when in fire-rated construction, one and one-half hour rating.
- F. Access doors located outside, in restrooms or in a moisture-laden environment (dressing area, shower area, lockers, etcetera) shall be stainless steel construction.
- G. Equipment access doors shall be of sufficient size to remove/replace equipment and provide routine maintenance as necessary, unless otherwise noted. Doors shall be set flush with adjacent finish surfaces. All access doors shall be provided with cylinder locks. All access doors (MEP) shall have one (1) common key.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS AND APPLICATIONS

- A. General: Install piping as described below, unless piping Sections specify otherwise. Individual piping Sections specify unique piping installation requirements.
- B. General Locations and Arrangements: 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. All piping to be installed in compliance with current NEC required clearances.
- D. Install manufactured isolation clamps at all dissimilar metal pipe supports. Install dielectric isolation tape (engineer approved) only when a manufactured isolation clamp is not available.

- E. Install piping at indicated slope.
- F. Install components with pressure rating equal to or greater than system operating pressure.
- G. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.
- H. Install piping free of sags and bends.
- I. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.
- J. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.
- K. Install piping to allow application of insulation plus 1-inch clearance around insulation.
- L. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
- M. Install fittings for changes in direction and branch connections.
- N. Install couplings according to manufacturer's written instructions.
- O. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Section "Penetration Firestopping" for firestop materials and installations.
 - 1. Fire-stop all sleeves at floor penetrations of multistory buildings including underfloor penetrations.
- P. Verify final equipment locations for roughing-in.
- Q. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.
- R. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:
 - 1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 - 2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 - 3. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."
 - 4. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
 - 5. 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:
 - a. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
 - b. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
 - c. Align threads at point of assembly.
 - d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
 - e. 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.

6. Welded Joints: Construct joints according to AWS D10.12, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe," using qualified processes and welding operators according to "Quality Assurance" Article.
7. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.
8. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join pipe and fittings according to the following:
 - a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - b. CPVC Piping: ASTM D 2846 and ASTM F 493.
 - c. PVC Pressure Piping: ASTM D 2672.
 - d. PVC Nonpressure Piping: ASTM D 2855.
9. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657 procedures and manufacturer's written instructions.
 - a. Plain-End Pipe and Fittings: Use butt fusion.
 - b. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.2 ESCUTCHEON REQUIREMENTS

- A. Install escutcheons at pipe penetrations of walls, ceilings, and floors in finished areas.
 1. Escutcheons for New Piping:
 - a. Piping exposed through floors and walls in finished areas: One piece, cast brass with polished chrome-plated finish with set screw. Deep escutcheons to be provided where standard depth will not fit.
 - b. Escutcheons shall cover entire hole penetration.
 - c. Escutcheon to be appropriately sized for pipe.
 2. Escutcheons for Existing piping:
 - a. Piping exposed through floors and walls in finished areas: Split plate, cast brass with polished chrome-plated finish with set screw. Deep escutcheons to be provided where standard depth will not fit.
 - b. Escutcheons shall cover entire hole penetration.
 - c. Escutcheon to be appropriately sized for pipe.
 3. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.3 PIPE SLEEVE INSTALLATION REQUIREMENTS

- A. Pipe sleeves are required at all through wall and floor penetrations.
 1. Sleeves are to be of the following material:
 - a. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc-coated, with plain ends.
 2. Sleeves are required for all through floor and wall penetrations. Sleeves to be set and poured in place (in slab applications), secure all sleeves with fasteners.
 3. Sleeves to extend 2 inches past face of floor or wall. Pipe sleeve in finished areas to be flush with wall or floor for installation of escutcheon.
 4. Install sleeves in new partitions, slabs, and walls as they are built.
 5. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Section "Joint Sealants" for joint sealants.

6. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Section "Joint Sealants" for joint sealants.
 7. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals specified in this Section.
 8. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated. Seal annular space with water tight sealant. (equal to NP-1). All sleeves and penetrations to maintain rating of wall / floor. Seal pipe penetrations with fire-stopping materials.
 9. Install sleeve materials according to the following applications:
 - a. Sleeves for Piping Passing through Concrete Floor Slabs: galvanized steel pipe.
 - b. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Galvanized-steel pipe sleeves.
 - 1) Extend sleeves 2 inches above finished floor level.
 - 2) For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Comply with requirements in Section "Sheet Metal Flashing and Trim" for flashing.
 10. Sleeves for Piping Passing through Gypsum-Board Partitions:
 - a. Galvanized-steel pipe sleeves.
 - b. Exception: Sleeves are not required for water supply tubes and waste pipes for individual mechanical fixtures if escutcheons will cover openings.
 11. Sleeves for Piping Passing through Concrete Roof Slabs: Reference details.
 12. Sleeves for Piping Passing through Exterior Concrete Walls:
 - a. Galvanized-steel pipe sleeves.
 - b. Install sleeves that are large enough to provide 1-inch annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.
 13. Sleeves for Piping Passing through Interior Concrete Walls:
 - a. Galvanized-steel pipe sleeves.
 14. Mechanical sleeve seals
 - a. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building. Sleeves must be poured in place. Installation of sleeves after wall is constructed is not acceptable.
 - b. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- B. Piping Connections: Make connections according to the following, unless otherwise indicated:
1. Install unions, in piping 2-inch NPS and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS or smaller threaded pipe connection.
 2. Install flanges, in piping 2-1/2-inch NPS and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 DIELECTRIC FITTING INSTALLATION

- A. Install unions, in piping 2-inch NPS and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS or smaller threaded pipe connection.
- B. Install flanges, in piping 2-1/2-inch NPS and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.

3.5 EQUIPMENT INSTALLATION – COMMON REQUIREMENTS

- A. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.
- B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect.
- C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- D. Install mechanical 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.
- E. Install equipment giving right of way to piping installed at required slope.

3.6 PAINTING AND FINISHING

- A. Apply paint to exposed piping according to the following, unless otherwise indicated:
 - 1. Interior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
 - 2. Interior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
 - 3. Interior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
 - 4. Exterior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.
 - 5. Exterior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
 - 6. Exterior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.
- B. Do not paint piping specialties with factory-applied finish.
- C. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGE

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- B. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

3.8 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment (not to be used at pipe supports).

- 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.

3.9 DEMOLITION

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.
- B. Repair cut surfaces to match adjacent surfaces.

3.10 CUTTING AND PATCHING

- A. Disconnect, demolish, and remove Work specified in Mechanical Sections.
- B. If pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.
- C. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.
- D. Work Abandoned in Place: Cut and remove underground pipe a minimum of 2 inches beyond face of adjacent construction. Cap and patch surface to match existing finish.
- E. Removal: Remove indicated equipment from Project site.
- F. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

3.11 GROUTING

- A. Install nonmetallic, nonshrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placing of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases to provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout according to manufacturer's written instructions.

END OF SECTION 230513

SECTION 230529

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following hangers and supports for mechanical system piping and equipment:
 1. Steel pipe hangers and supports.
 2. Trapeze pipe hangers.
 3. Metal framing systems.
 4. Thermal-hanger shield inserts.
 5. Fastener systems.
 6. Equipment supports.
- B. Related Sections include the following:
 1. Specification Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
 2. Specification Section "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 SUBMITTALS

- A. Product Data: For the following:
 1. Steel pipe hangers and supports.
 2. Thermal-hanger shield inserts.
 3. Powder-actuated fastener systems.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
 1. Trapeze pipe hangers. Include Product Data for components.
 2. Metal framing systems. Include Product Data for components.

3. Equipment supports.
- C. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."
- B. Welding: Qualify procedures and personnel according to the following:
 1. AWS D1.1, "Structural Welding Code--Steel."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 METAL COATING REQUIREMENTS:

- A. All metal products shall have the following coatings:
 1. Wet/damp areas: hot dipped galvanized.
 2. Dry or conditioned areas: pre-galvanized.

2.3 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Manufacturers:
 1. AAA Technology & Specialties Co., Inc.
 2. Bergen-Power Pipe Supports.
 3. B-Line Systems, Inc.; a division of Cooper Industries.
 4. Carpenter & Paterson, Inc.
 5. Empire Industries, Inc.
 6. ERICO/Michigan Hanger Co.
 7. Globe Pipe Hanger Products, Inc.
 8. Grinnell Corp.
 9. GS Metals Corp.
 10. National Pipe Hanger Corporation.
 11. PHD Manufacturing, Inc.
 12. PHS Industries, Inc.
 13. Piping Technology & Products, Inc.
 14. Tolco Inc.
- C. Galvanized, Metallic Coatings: Pre-galvanized (minimum thickness of 0.5 mils) or hot dipped (1.4 to 3.9 mil thickness).
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

- E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.4 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.5 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Manufacturers:
1. B-Line Systems, Inc.; a division of Cooper Industries.
 2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
 3. GS Metals Corp.
 4. Power-Strut Div.; Tyco International, Ltd.
 5. Thomas & Betts Corporation.
 6. Tolco Inc.
 7. Unistrut Corp.; Tyco International, Ltd.
- C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.6 THERMAL-HANGER SHIELD INSERTS

- A. Description: 100-psig minimum, compressive-strength insulation insert with a sheet metal shield.
- B. Manufacturers:
1. Carpenter & Paterson, Inc.
 2. ERICO/Michigan Hanger Co.
 3. PHS Industries, Inc.
 4. Pipe Shields, Inc.
 5. Rilco Manufacturing Company, Inc.
 6. Buckaroos
- C. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with vapor barrier. **Wood inserts are not acceptable.**
- D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.
- E. Insulation-Insert Material for Hot Piping only, up to 3" diameter: Molded fiberglass block, 20 lbs/ft³ density, thermal conductivity of 0.30.
- F. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- G. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- H. Insert Length: Extend 4 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.7 FASTENER SYSTEMS

- A. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Manufacturers:
 - a. B-Line Systems, Inc.; a division of Cooper Industries.
 - b. Empire Industries, Inc.
 - c. Hilti, Inc.
 - d. ITW Ramset/Red Head.
 - e. MKT Fastening, LLC.
 - f. Powers Fasteners.

2.8 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.9 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars.
 - 1. Exterior: Galvanized steel.
 - 2. Interior: Black steel.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.
- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated stationary pipes, NPS 1/2 to NPS 30.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.

4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
 5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8.
 8. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8.
 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 2.
 10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
 11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
 12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
 16. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
 17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
 18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
 19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.
- H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Thermal-Hanger Shield Inserts: For supporting insulated cold pipe. **Wood inserts are not acceptable.**
- K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.

- 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
- 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
- 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments in concrete construction only in locations approved by the structural engineer.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure; **attaching to metal roof decks is not permissible**.
- B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Install suspended units on supports fabricated from welded-structural-steel shapes or from strut channels as applicable for the unit weight. Vertical

- support members must be appropriately sized threaded rods. Metal straps or cables are not allowed. Isolate units to prevent vibration or noise as specified in other sections.
- H. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
 - I. Install lateral bracing with pipe hangers and supports to prevent swaying.
 - J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads for NPS 2-1/2 and larger, including valves, flanges, and strainers, and at changes in direction of piping (24" maximum distance from elbow). Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
 - K. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
 - L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.
 - M. Insulated Piping: Comply with the following:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install thermal-hanger shield inserts on insulated piping with vapor barrier. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - 5. Insert Material: Length at least as long as protective shield.
 - 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.
 - N. Insulated Ducts (Mineral Fiber Blanket). Comply with the following:
 - 1. At all unistrut supports provide mineral fiber board insert in between ductwork and unistrut. Insert to extend 12" on both sides of unistrut, full length of strut. Extend blanket between structural insert.

3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for floor-mounted equipment to make a smooth bearing surface.
- C. Provide lateral bracing to prevent swaying for suspended equipment supports.

3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and 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. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger support rods to 1-1/2 inches.

3.6 PAINTING

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean welds, bolted connections, field cuts, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 230529

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SECTION 230553
MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following mechanical identification materials and their installation:
 1. Equipment nameplates.
 2. Equipment markers.
 3. Equipment signs.
 4. Access panel and door markers.
 5. Stencils.
 6. Warning tags.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Valve Schedules: For each piping system. Furnish extra copies (in addition to mounted copies) to include in maintenance manuals. Reproduce on 8½ H 11 bond. Tabulate valve number, piping system, system abbreviation as shown on tag, room or space location of valve, and variations for identification. Mark valves intended for emergency shutoff and similar special uses. Indicate normal operating positions (open, closed, modulating, or balance).

1.4 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.5 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with location of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Products specified are for applications referenced in other Mechanical sections. In addition to a factory installed equivalent nameplate, all equipment shall have an engraved equipment sign that matches the schedule tag name.

2.2 EQUIPMENT IDENTIFICATION DEVICES

- A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.
1. Data:
 - a. Manufacturer, product name, model number, and serial number.
 - b. Capacity, operating and power characteristics, and essential data.
 - c. Labels of tested compliances.
 2. Location: Accessible and visible.
 3. Fasteners: As required to mount on equipment.
 4. Material: Brass.
- B. Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
1. Data: Instructions for operation of equipment and for safety procedures.
 2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.
 3. Thickness: 1/8 inch, unless otherwise indicated.
 4. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.3 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.
1. Size: 3 by 5-1/4 inches **minimum**.
 2. Fasteners: Brass grommet and wire.
 3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
 4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 APPLICATIONS, GENERAL

- A. Products specified are for applications referenced in other Mechanical Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.2 EQUIPMENT IDENTIFICATION

- A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:
1. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
 2. Pumps, compressors, chillers, condensers, and similar motor-driven units.
 3. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.

4. Fans, blowers, primary balancing dampers, and mixing boxes.
 5. Packaged HVAC central-station and zone-type units.
- B. Install equipment markers with permanent fasteners on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.
 1. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
 3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:
 - a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
 - b. Fire department hose valves and hose stations.
 - c. Meters, gages, thermometers, and similar units.
 - d. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
 - e. Pumps, compressors, chillers, condensers, and similar motor-driven units.
 - f. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
 - g. Fans, blowers, primary balancing dampers, and mixing boxes.
 - h. Packaged HVAC central-station and zone-type units.
 - i. Tanks and pressure vessels.
 - j. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.
- C. Install equipment signs with screws or permanent adhesive on or near each major item of mechanical equipment. Locate signs where accessible and visible.
 1. Identify mechanical equipment with equipment markers in the following color codes:
 - a. Green: For cooling equipment and components.
 - b. Yellow: For heating equipment and components.
 - c. Green and Yellow, Orange: For combination cooling and heating equipment and components.
 - d. Brown: For energy-reclamation equipment and components.
 2. Letter Size: Minimum 1/2 inch for name of units if viewing distance is less than 24 inches, 3/4 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 3. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
 4. Include signs for the following general categories of equipment:
 - a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
 - b. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
 - c. Pumps, compressors, chillers, condensers, and similar motor-driven units.
 - d. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
 - e. Fans, blowers, primary balancing dampers, and mixing boxes.
 - f. Packaged HVAC central-station and zone-type units.
 - g. Tanks and pressure vessels.
 - h. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.

- D. Install access panel markers with screws on equipment access panels.

3.3 EQUIPMENT SIGNS AND MARKERS

- A. Install engraved plastic-laminate signs or equipment markers on or near each major item of mechanical equipment. Include signs for the following general categories of equipment:
1. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
 2. Meters, gages, thermometers, and similar units.
 3. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
 4. Pumps, compressors, chillers, condensers, and similar motor-driven units.
 5. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
 6. Fans, blowers, primary balancing dampers, and mixing boxes.
 7. Packaged HVAC central-station and zone-type units.
 8. Tanks and pressure vessels.
 9. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.
 10. Any concealed appurtenances requiring access for maintenance shall be clearly identified by sign (to include but not be limited to unions, strainers, valves, etc.).
- B. Duct Systems: Identify air supply, return, exhaust, intake, and relief ducts with duct markers; or provide stenciled signs and arrows showing service and direction of flow.
1. Location: Locate signs near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.4 ADJUSTING AND CLEANING

- A. Relocate mechanical identification materials and devices that have become visually blocked by work of this or other Divisions.
- B. Clean faces of identification devices and glass frames of valve charts.

END OF SECTION 230553

SECTION 230593
TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The work included in this section consists of the furnishing of all labor, instruments, tools, and services required in connection with the testing, adjusting and balancing (TAB) of the heating, ventilating, and air conditioning systems as described in the mechanical specifications and/or shown on the mechanical plans, or reasonable implied therefrom.
- B. TAB of the HVAC systems will be performed by an impartial technical firm that is a member of NEBB and whose operations are limited to the field of professional testing and balancing.
- C. Mechanical Contractor to obtain TAB services from an independent TAB contractor.
- D. Qualified TAB firms shall submit cost, scope of work, qualifications, time line, and references.
- E. The TAB firm is responsible to and shall submit five (5) copies of all reports directly to the Architect/Engineer and one copy to the Owner.
- F. TAB services shall result in the optimum temperature, airflow, and noise levels in the conditioned space of the project.
- G. The following basic components of the HVAC systems shall be tested, adjusted, and balanced:
 - 1. Air distribution systems.
 - 2. Air moving equipment.
 - 3. HVAC pumps (chilled water, hot water, condenser water, etc.).
 - 4. Heating systems (HVAC).
 - 5. Control systems verification.

1.02 SUMMARY

- A. This Section includes testing, adjusting, and balancing HVAC systems to produce design objectives, including the following:
 - 1. Balancing airflow and water flow within distribution systems, including submains, branches, and terminals, to indicated quantities according to specified tolerances.
 - 2. Adjusting total HVAC systems to provide indicated quantities.
 - 3. Measuring electrical performance of HVAC equipment.
 - 4. Setting quantitative performance of HVAC equipment.
 - 5. Verifying that automatic control devices are functioning properly.
 - 6. Measuring sound and vibration.
 - 7. Reporting results of the activities and procedures specified in this Section.
- B. Related sections include the following:
 - 1. Testing and adjusting requirements unique to particular systems and equipment are included in the Sections that specify those systems and equipment. See all related HVAC mechanical sections.
 - 2. Field quality-control testing to verify that workmanship quality for system and equipment installation is specified in system and equipment Sections.

1.03 DEFINITIONS

- A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.
- B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to design quantities.
- C. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.
- D. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- E. Report Forms: Test data sheets for recording test data in logical order.
- F. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.
- G. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.
- H. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- I. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.
- J. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
- K. Test: A procedure to determine quantitative performance of a system or equipment.
- L. Testing, Adjusting, and Balancing Agent: The entity responsible for performing and reporting the testing, adjusting, and balancing procedures.
- M. NEBB: National Environmental Balancing Bureau.
- N. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

1.04 SUBMITTALS

- A. Quality-Assurance Submittals: Within 30 days from the Contractor's Notice to Proceed, submit 2 copies of evidence that the testing, adjusting, and balancing Agent and this Project's testing, adjusting, and balancing team members meet the qualifications specified in the "Quality Assurance" Article below.
- B. Contract Documents Examination Report: Within 45 days from the Contractor's Notice to Proceed, submit 2 copies of the Contract Documents review report as specified in Part 3 of this Section.
- C. Strategies and Procedures Plan: Within 60 days from the Contractor's Notice to Proceed, submit 2 copies of the testing, adjusting and balancing strategies and step-by-step procedures as specified in Part 3 "Preparation" Article below. Include a complete set of report forms intended for use on this Project.
- D. Certified Testing, Adjusting and Balancing Reports: Submit 2 copies of reports prepared, as specified in this Section, on approved forms certified by the testing, adjusting and balancing Agent.

- E. Sample Report Forms: Submit 2 sets of sample testing, adjusting and balancing report forms.
- F. Warranty: Submit 2 copies of special warranty specified in the "Guarantee" Article below.

1.05 QUALITY ASSURANCE

- A. Agent Qualifications: Engage a testing, adjusting, and balancing agent certified by NEBB.
- B. Testing, Adjusting, and Balancing Conference: Meet with the Owner's and the Architect's representatives on approval of the testing, adjusting, and balancing strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of testing, adjusting, and balancing team members, equipment manufacturers' authorized service representatives, HVAC controls Installer, and other support personnel. Provide 7 days' advance notice of scheduled meeting time and location.
 - 1. Agenda Items: Include at least the following:
 - a. Submittal distribution requirements.
 - b. Contract Documents examination report.
 - c. Testing, adjusting, and balancing plan.
 - d. Work schedule and Project site access requirements.
 - e. Coordination and cooperation of trades and subcontractors.
 - f. Coordination of documentation and communication flow.
- C. Certification of Testing, Adjusting, and Balancing Reports: Certify the testing, adjusting, and balancing field data reports. This certification includes the following:
 - 1. Review field data reports to validate accuracy of data and to prepare certified testing, adjusting, and balancing reports.
 - 2. Certify that the testing, adjusting, and balancing team complied with the approved testing, adjusting, and balancing plan and the procedures specified and referenced in this Specification.
- D. Testing, Adjusting, and Balancing Reports: Use standard forms from NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."
- E. Instrumentation Type, Quantity, and Accuracy: As described in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."
- F. Instrumentation Calibration: Calibrate instruments at least every 12 months or more frequently if required by the instrument manufacturer.

1.06 PROJECT CONDITIONS

- A. Partial Owner Occupancy: The Owner may occupy completed areas of the building before Substantial Completion. Cooperate with the Owner during testing, adjusting, and balancing operations to minimize conflicts with the Owner's operations.

1.07 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 testing, adjusting, and balancing activities.
- B. Notice: Provide 7 days' advance notice for each test. Include scheduled test dates and times.
- C. Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.08 GUARANTEE

- A. General: The national project performance guarantee specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

PART 2- PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper testing, adjusting, and balancing of systems and equipment.
 1. Contract Documents are defined in the General and Supplementary Conditions of the Contract.
 2. 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 Architect's and Engineer's 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.
- D. Examine equipment performance data, including fan and pump curves. Relate performance data to project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce the performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.
- E. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.
- F. Examine system and equipment test reports.
- G. 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 their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- H. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- I. Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

- J. Examine terminal units, such as variable-air-volume boxes and mixing boxes, to verify that they are accessible and their controls are connected and functioning.
- K. Examine plenum ceilings, utilized for supply air, to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.
- L. Examine strainers for clean screens and proper perforations.
- M. Examine 3-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- N. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- O. Examine open-piping-system pumps to ensure absence of entrained air in the suction piping.
- P. Examine equipment for installation and for properly operating safety interlocks and controls.
- Q. Examine automatic temperature system components to verify the following:
 - 1. Dampers, valves, and other controlled devices operate by the intended controller.
 - 2. Dampers and valves are in the position indicated by the controller.
 - 3. The Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
 - 4. Automatic modulating and shutoff valves, including 2-way valves and 3-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 design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
 - 9. Interlocked systems are operating.
 - 10. Changeover from heating to cooling mode occurs according to design values.
- R. Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.

3.02 PREPARATION

- A. Prepare a testing, adjusting, and balancing 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. Hydronic systems are filled, clean, and free of air.
 - 3. Automatic temperature-control systems are operational.
 - 4. Equipment and duct access doors are securely closed.
 - 5. Balance, smoke, and fire dampers are open.
 - 6. Isolating and balancing valves are open and control valves are operational.
 - 7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
 - 8. Windows and doors can be closed so design conditions for system operations can be met.
 - 9. Motors are wired properly with appropriate overloads and correct rotation.

3.03 GENERAL TESTING AND BALANCING PROCEDURES

- A. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental 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 the insulation Specifications for this Project.
- C. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

3.04 FUNDAMENTAL AIR SYSTEMS' BALANCING PROCEDURES

- 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 systems' "as-built" 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 the 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.

3.05 VARIABLE-AIR-VOLUME SYSTEMS' ADDITIONAL PROCEDURES

- A. Pressure-Dependent, Variable-Air-Volume Systems without Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
 1. Balance systems similar to constant-volume air systems.
 2. Set terminal units and supply fan at full-airflow condition.
 3. Adjust inlet dampers of each terminal unit to design airflow and verify operation of the static-pressure controller. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
 4. Readjust fan airflow for final maximum readings.
 5. Measure operating static pressure at the sensor that controls the supply fan, if one is installed, and verify operation of the static-pressure controller.
 6. Set supply fan at minimum airflow if minimum airflow is indicated. Measure static pressure to verify that it is being maintained by the controller.
 7. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.

- a. If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.
- 8. Measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.

3.06 FUNDAMENTAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Correct variations that exceed plus or minus 5 percent.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.
- C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
 - 1. Open all manual valves for maximum flow.
 - 2. Check expansion tank liquid level.
 - 3. Check makeup-water-station pressure gage for adequate pressure for highest vent.
 - 4. Check flow-control valves for specified sequence of operation and set at design flow.
 - 5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type, unless several terminal valves are kept open.
 - 6. Set system controls so automatic valves are wide open to heat exchangers.
 - 7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
 - 8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.07 HYDRONIC SYSTEMS' BALANCING PROCEDURES

- A. Determine water flow at pumps. Use the following procedures, except for positive-displacement pumps:
 - 1. Verify impeller size by operating the pump with the discharge valve closed. Verify with the pump manufacturer that this will not damage pump. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on the manufacturer's pump curve at zero flow and confirm that the pump has the intended impeller size.
 - 2. Check system resistance. With all valves open, read pressure differential across the pump and mark the pump manufacturer's head-capacity curve. Adjust pump discharge valve until design water flow is achieved.
 - 3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on the pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
 - 4. Report flow rates that are not within plus or minus 5 percent of design.
- B. Set calibrated balancing valves, if installed, at calculated presettings.
- C. Measure flow at all stations and adjust, where necessary, to obtain first balance.
 - 1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
- D. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than design flow.
- E. Adjust balancing stations to within specified tolerances of design flow rate as follows:

1. Determine the balancing station with the highest percentage over design flow.
 2. Adjust each station in turn, beginning with the station with the highest percentage over design flow and proceeding to the station with the lowest percentage over design flow.
 3. Record settings and mark balancing devices.
- F. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures, including outdoor-air temperature.
- G. Measure the differential-pressure control valve settings existing at the conclusions of balancing.

3.08 VARIABLE-FLOW HYDRONIC SYSTEMS' ADDITIONAL PROCEDURES

- A. Balance systems with automatic 2- and 3-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

3.09 PRIMARY-SECONDARY-FLOW HYDRONIC SYSTEMS' ADDITIONAL PROCEDURES

- A. Balance the primary system crossover flow first, then balance the secondary system.

3.010 MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
1. Manufacturer, model, and serial numbers.
 2. Motor horsepower rating.
 3. Motor rpm.
 4. Efficiency rating if high-efficiency motor.
 5. Nameplate and measured voltage, each phase.
 6. Nameplate and measured amperage, each phase.
 7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.011 BOILERS

- A. Measure entering- and leaving-water temperatures and water flow.

3.012 HEAT-TRANSFER COILS

- A. Water Coils: Measure the following data for each coil:
1. Entering- and leaving-water temperatures.
 2. Water flow rate.
 3. Water pressure drop.
 4. Dry-bulb temperatures of entering and leaving air.
 5. Wet-bulb temperatures of entering and leaving air.
 6. Airflow.
 7. Air pressure drop.
- B. Electric-Heating Coils: Measure the following data for each coil:
1. Nameplate data.
 2. Airflow.
 3. Entering- and leaving-air temperatures at full load.

4. Voltage and amperage input of each phase at full load and at each incremental stage.
5. Calculated kW at full load.
6. Fuse or circuit-breaker rating for overload protection.

3.013 TEMPERATURE TESTING

- A. During testing, adjusting, and balancing, report 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 2 successive 8-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.

3.014 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. Verify operation of limiting controllers (i.e., high- and low-temperature controllers).
- E. Verify free travel and proper operation of control devices such as damper and valve operators.
- F. Verify 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. Confirm interaction of electrically operated switch transducers.
- H. Confirm interaction of interlock and lockout systems.
- I. Record voltages of power supply and controller output. Determine if the system operates on a grounded or nongrounded power supply.
- J. Note operation of electric actuators using spring return for proper fail-safe operations.

3.015 TOLERANCES

- A. Set HVAC system airflow and water flow rates within the following tolerances:
 1. Supply, Return, and Exhaust Fans: -5 to plus 10 percent.
 2. Air Outlets and Inlets: \pm 10 percent.
 3. Heating-Water Flow Rate: \pm 10 percent.
 4. Cooling-Water Flow Rate: \pm 5 percent.

3.016 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article above, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to

- HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.
- C. Preliminary Report: Submit preliminary TAB reports to the design engineer for each floor, the central plant, and the chilled and hot water hydronic system.

3.017 FINAL REPORT

- A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in 3-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 the instruments used for procedures, along with proof of calibration.
- C. Final Report Final Report Contents: In addition to the certified field report data, include the following:
 - 1. Pump Curves.
 - 2. Fan curves.
 - 3. Manufacturers' test data.
 - 4. Field test reports prepared by system and equipment installers.
 - 5. Other information relative to equipment performance, but not include approved Shop Drawings and Product Data.
- D. General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:
 - 1. Title page.
 - 2. Name and address of testing, adjusting and balancing Agent.
 - 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 testing, adjusting and balancing Agent who certifies the report.
 - 10. Summary of contents, including the following:
 - a. Design versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 - 11. Nomenclature sheets for each item of equipment.
 - 12. Data for terminal units, including manufacturer, type size and fittings.
 - 13. Notes to explain why certain final data in the body of reports vary from design values.
 - 14. Test conditions for fans and pump 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. Face and bypass damper settings at coils.
 - e. Fan drive settings, including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume, systems.
 - g. Settings for supply-air, static-pressure, controller.
 - h. Other system operating conditions that affect performance.

E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present with single-line diagrams 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. Locations of duct traverse(s) of duct layout.

F. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data: Include the following:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in inches and bore.
 - i. Sheave dimension, center-to-center and amount of adjustments in inches (mm).
 - j. Number of belts, make and size.
 - k. Number of filters, type and size.
2. Motor Data: Include the following:
 - a. Make and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches and bore.
 - f. Sheave dimensions, center-to-center and amount of adjustments in inches.
3. Test Data: Include design and actual values for the following:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.

G. Apparatus-Coil Test Reports: For apparatus coils, include the following:

1. Coil Data: Include the following:
 - a. System Identification.
 - b. Location.
 - c. Coil type.
 - d. Number of rows.
 - e. Fin spacing in fins per inch.
 - f. Make and model number.
 - g. Face area in sq.ft.
 - h. Tube size in NPS.
 - i. Tube and fin materials.
 - j. Circuiting arrangement.
2. Test Data: Include design and actual values for the following:
 - a. Airflow rate in cfm.
 - b. Average face velocity in fpm.
 - c. Air pressure drop in inches wg.
 - d. Outside-air, wet and dry-bulb temperatures in deg F.
 - e. Return-air, wet and dry-bulb temperatures in deg F.
 - f. Entering-air, wet and dry-bulb temperatures in deg F.

- g. Leaving-air, wet and dry bulb temperatures in deg F.
 - h. Return-air, wet and dry-bulb temperatures in deg F.
 - i. Entering water temperature in deg F.
 - j. Leaving water temperature in deg F
 - k. Water flow rate in gpm.
 - l. Water pressure differential in feet of head or psig.
- H. Water Chiller Test Reports: For chillers (Air Cooled or Water Cooled)
 - 1. Unit Data: Include the following:
 - a. Unit Identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - 2. Motor Data:
 - a. Make and frame type and size.
 - b. Volts, phase and hertz.
 - c. Full-load amperage and service factor.
 - 3. Test Data:
 - a. Total chilled water flow rate in gpm.
 - b. Total condenser water flow rate in gpm.
 - c. WPD in ft across chilled water.
 - d. WPD in ft across condenser water.
 - e. Chilled water supply and return temperatures °F.
 - f. Condenser water supply and return temperatures in °F.
- I. Cooling Tower Test Reports: For condenser water cooling tower:
 - 1. Unit Data: Include the following:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - 2. Motor Data (Fan or Pump): Include the following:
 - a. Make and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - 3. Test Data: Include design and actual values for the following:
 - a. Total condenser under flowrate in gpm.
 - b. Total wpd in ft across condenser water.
 - c. Condenser water supply and return temperatures in °F.
 - d. Fan rpm.
- J. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:
 - 1. Unit Data: Include the following:
 - a. System identification.
 - b. Location.
 - c. Coil identification.
 - d. Capacity in Btu/h (kW).
 - e. Number of stages.
 - f. Connected volts, phase, and hertz.

- g. Rated amperage.
 - h. Airflow rate in cfm.
 - i. Face area in sq. ft.
 - j. Minimum face velocity in fpm.
 - 2. Test Data: Include design and actual values for the following:
 - a. Heat output in Btuh.
 - b. Airflow rate in cfm.
 - c. Air velocity in fpm.
 - d. Entering-air temperature in deg F.
 - e. Leaving-air temperature in deg F.
 - f. Voltage at each connection.
 - g. Amperage for each phase.
- K. Fan Test Reports: For supply, return, and exhaust fans, include the following:
1. Fan Data: Include the following:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in inches, and bore.
 - h. Sheave dimensions, center-to-center and amount of adjustments in inches (mm).
 2. Motor Data: Include the following:
 - a. Make and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Sheave dimensions, center-to-center and amount of adjustments in inches.
 - g. Number of belts, make, and size.
 3. Test Data: Include design and actual values for the following:
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Suction static pressure in inches wg.
- L. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
1. Report Data: Include the following:
 - a. System and air-handling unit number.
 - b. Location and zone.
 - c. Locate traverse location on duct work layout.
 - d. Traverse air temperature in deg F.
 - e. Duct static pressure in inches wg.
 - f. Duct size in inches.
 - g. Duct area in sq. ft.
 - h. Design airflow rate in cfm.
 - i. Design velocity in fpm.
 - j. Actual airflow rate in cfm.
 - k. Actual average velocity in fpm.
 - l. Barometric pressure in psig.
- M. Air-Terminal-Device Reports: For terminal units, include the following:
1. Unit Data: Include the following:

- a. System and air-handling unit identification.
 - b. Location and zone.
 - c. Test apparatus used.
 - d. Area served.
 - e. Air-terminal-device make.
 - f. Air-terminal-device number from system diagram.
 - g. Air-terminal-device type and model number.
 - h. Air-terminal-device size.
 - i. Air-terminal-device effective area in sq. ft.
2. Test Data: Include design and actual values for the following:
 - a. Airflow rate in cfm.
 - b. Air velocity in fpm.
 - c. Preliminary airflow rate as needed in cfm.
 - d. Preliminary velocity as needed in fpm.
 - e. Final airflow rate in cfm.
 - f. Final velocity in fpm.
 - g. Space temperature in deg F.
- N. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
1. Unit Data: Include the following:
 - a. System and air-handling unit identification.
 - b. Location and zone.
 - c. Room or riser served.
 - d. Coil make and size.
 - e. Flowmeter type.
 2. Test Data: Include design and actual values for the following:
 - a. Airflow rate in cfm.
 - b. Entering-water temperature in deg F.
 - c. Leaving-water temperature in deg F.
 - d. Water pressure drop in feet of head or psig.
 - e. Entering-air temperature in deg F.
 - f. Leaving-air temperature in deg F.
- O. Instrument Calibration Reports: For instrument calibration, include the following:
1. Report Data: Include the following:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

END OF SECTION 230593

SECTION 233423
HVAC POWER VENTILATORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 1. Ceiling-mounting ventilators.
 2. Centrifugal roof ventilators
 3. Destratification fans
 4. In-line centrifugal fans.
 5. Propeller fans.

1.03 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base fan-performance ratings on actual Project site elevations.
- B. Operating Limits: Classify according to AMCA 99.
- C. Fan Unit Schedule: The following information is described in an equipment schedule on the Drawings.
 1. Fan performance data including capacities, static pressure, sound power characteristics, motor requirements and electrical characteristics.
 2. Fan arrangement, including wheel configuration inlet and discharge configurations and required accessories.

1.04 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties and accessories for each type of product indicated and include the following:
 1. Certified fan performance curves with system operating conditions indicated.
 2. Certified fan sound-power ratings.
 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 4. Material thickness and finishes, including color charts.
 5. Dampers, including housings, linkages and operators.
 6. Roof curbs.
 7. Fan speed controllers.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components and location and size of each field connection.
 1. Wiring Diagrams: Power, signal and control wiring.
 2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails and base weights.
- C. Coordination Drawings: Show roof penetration requirements and reflected ceiling plans drawn to scale and coordinating roof penetrations and units mounted above ceiling. Show the following:
 1. Roof framing and support members relative to duct penetrations.
 2. Ceiling suspension assembly members.
 3. Size and location of initial access modules for acoustical tile.
 4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- D. Maintenance Data: For power ventilators to include in maintenance manuals specified in Division 1.

1.05 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. AMAC Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.
- C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.
- D. UL Standard: Power ventilators shall comply with UL 705.
- E. Listing and labeling: Provide electrically operated fixtures specified in this section that are listed and labeled.
 1. The terms "Listed" and "Labeled". As defined in the Nations Electrical Code, Article 100.
 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- F. UL Standard: Provide Power Ventilators that comply with UL 762, grease laden air at 300 deg. F where applicable (kitchen exhaust).
- G. Warranty: The manufacturer's standard warranty shall be for a period of 12 months from the date of Substantial Completion. Warranty is limited to manufacturer defects only. The warranty shall include parts and labor during this period.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.
- B. Disassemble and reassemble units, are required for moving to final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.

1.07 COORDINATION

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Specification Section "Cast-In-Place Concrete".
- C. Coordinate installation of roof curbs, equipment supports and roof penetrations. These items are specified in Specification Section "Roof Accessories".

1.08 EXTRA MATERIALS

- 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. Belts: One set for each belt-driven unit.

1.09 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions by field Measurements. Verify clearances.
- B. Do not operate fans until ductwork is clean, filters are in place, bearings are lubricated and fans have been commissioned.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Centrifugal Roof Ventilators:
 - a. Cook, Loren Company
 - b. Envirofan
 - c. Greenheck Fan Corp.
 - d. Leading Edge

2.02 CEILING-MOUNTING VENTILATORS

- A. Description: Centrifugal fans designed for installing in ceiling or wall or for concealed in-line applications.
- B. Housing: Steel, lined with acoustical insulation
- C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor and fan wheel shall be removable for service.
- D. Grille: Painted aluminum, louvered grille with flange on intake and thumbscrew attachment to fan housing.
- E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.
- F. Accessories:
 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.

2. Filter: Washable aluminum to fit between fan and grille.
3. Isolation: Rubber-in-shear vibration isolators.
4. Manufacturer's standard roof jack or wall cap and transition fittings.

G. Capacities and Characteristics: Refer to drawing schedules.

2.03 CENTRIFUGAL ROOF VENTILATORS – DOWNBLAST

- A. Description: Belt-driven or direct-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base and accessories.
- B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, two-piece, aluminum base with venturi inlet cone.
- C. Fan Wheels: aluminum hub and wheel with backward-inclined blades.
- D. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:
 1. Fan Shaft: turned, ground, and polished stainless steel; keyed to wheel hub.
 2. Shaft Bearings: Heavy-duty re-greasable ball type in a pillow block cast iron housing, selected for a minimum L50 life in excess of 200,000 hours.
 3. Pulleys: Cast-iron, adjustable-pitch motor pulley.
 4. Fan and motor isolated from exhaust airstream.
 5. Belts: Oil and heat resistant, nonstatic.
- E. Accessories: The following items are required as indicated:
 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 percent to less than 50 percent (required on direct drive fans only).
 2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
 3. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
 4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.

- F. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailing. Size as required to suit roof opening and fan base. Built in cant and mounting flange.
1. Configuration: Built-in cant and mounting flange.
 2. Overall Height: 18 inches
 3. Pitch Mounting: Manufacture curb for roof slope, if necessary.
 4. Metal Liner: Galvanized steel.

2.04 CENTRIFUGAL ROOF VENTILATORS – UPBLAST

- A. Description: Belt-driven or direct-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories. Grease laden fans to comply with UL 762 Grease Laden Air.
- B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, two-piece, aluminum base with venturi inlet cone.
- C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.
- D. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:
 1. Fan Shaft: Turned, ground and polished stainless steel; keyed to wheel hub.

- 2. Shaft Bearings: heavy-duty re-greasable ball type in a pillow block cast iron housing, selected for a minimum L50 life in excess of 200,000 hours.
 - 3. Pulleys: Cast-iron, adjustable-pitch motor pulley.
 - 4. Fan and motor isolated from exhaust airstream.
- E. Accessories: The following items are required as indicated:
- 1. Disconnect Switch: Non-fusible type, with thermal-overload protection mounted inside fan housing, factory wired through in internal aluminum conduit.
- F. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailing. Size as required to suit roof opening and fan base.
- 1. Configuration: Built-in cant and mounting flange.
 - 2. Overall Height: 18 inches
 - 3. Pitch Mounting: Manufacture curb for roof slope, if necessary.
 - 4. Metal Liner: Galvanized steel.
 - 5. Vented Curb Extension, with hinged curb cap.

2.05 DESTRATIFICATION FANS

- A. Ceiling Fans 60" diameter 3 blade fan, dynamically balanced with permanently lubricated ball bearing motor, U.L. listed (UL 507), with all necessary hooks and supports for a complete installation. Provide solid state speed controllers and secondary support cable.
- B. Wall Mount Circulators: 24" 3-blade oscillating fan. Wall bracket, 2-speed motor, powder coated for guards, heavy duty pull chain, 45°-90° sweep. Safety cable mounting kit.

2.06 IN-LINE CENTRIFUGAL FANS (TUBULAR)

- A. Description: In-line, direct or belt-driven (as scheduled on the drawings) centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets and accessories.
- B. Housing: Spilt, spun aluminum with aluminum straightening vanes, inlet and outlet flanges and support bracket adaptable to floor, side wall or ceiling mounting.
- C. Direct-Driven Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing; with wheel, inlet cone, and motor on swing-out service door.
- D. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.
- E. Fan Wheels: Aluminum, air foil blades welded to aluminum hub.
- F. Accessories:
 - 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
 - 2. Companion Flanges: For inlet and outlet duct connections.
 - 3. Fan Guards: 1/2 by 1 inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
 - 4. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.
- G. Capacities and Characteristics: Refer to drawing schedules.

2.07 IN-LINE CENTRIFUGAL FANS (SQUARE)

- A. Description: In-line, direct driven (as scheduled on the drawings) centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets and accessories.
- B. Housing: Insulated and galvanized with inlet and outlet flanges and support bracket adaptable to floor, side wall or ceiling mounting.
- C. Direct-Driven Units: ECM Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing; with wheel, inlet cone, and motor on swing-out service door.
- D. Fan Wheels: Aluminum, backward inclined air foil blades welded to aluminum hub.
- E. Accessories:
 - 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
 - 2. Companion Flanges: For inlet and outlet duct connections.
 - 3. Housing Insulation.
 - 4. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.
- F. Capacities and Characteristics: Refer to drawing schedules.

2.08 PROPELLER FANS

- A. Description: Direct-or belt-driven (as scheduled on the drawings) propeller fans consisting of fan blades, hub, housing, orifice ring, motor, drive assembly and accessories.
- B. Housing: Galvanized-steel sheet with flanged edges and integral orifice ring with baked-enamel finish coat applied after assembly.
- C. Steel Fan Wheels: Formed-steel blades riveted to heavy-gage steel spider bolted to cast-iron hub.
- D. Fan Wheel: Replaceable, extruded-aluminum, airfoil blades fastened to cast-aluminum hub; factor set pitch angle of blades.
- E. Belt-Drive Drive Assembly: Resiliently mounted to housing, statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
 - 1. Service Factor Based on Fan Motor Size: 1.4.
 - 2. Fan Shaft: Turned, ground and polished steel; keyed to wheel hub.
 - 3. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
 - a. Ball-Bearing Rating Life: ABMA 9, L₁₀ of 100,000 hours.
 - 4. Pulleys: Cast iron with split, tapered bushing; dynamically balanced at factory.
 - 5. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
 - 6. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
 - 7. Belt Guards: Fabricate of steel motors mounted on outside of fan cabinet.
- F. Accessories:
 - 1. Gravity Shutters: Aluminum blades in aluminum fame; interlocked blades with nylon bearings.
 - 2. Motor-Side Back Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.

3. Wall Sleeve: Galvanized steel to match fan and accessory size.
4. Weathershield Hood: Galvanized steel to match fan and accessory size.
5. Weathershield Front Guard: Galvanized steel with expanded metal screen.

G. Capacities and Characteristics: Refer to drawing schedules.

2.09 MOTORS

- A. Motor Construction: NEMA MG 1, general purpose, continuous duty, Design B.
- B. Enclosure Type: The following features are required as indicated.
 1. Open drip proof motors where satisfactorily housed or remotely located during operation.
 2. Guarded drip proof where exposed to contact by employees or building occupants.
- C. All motors shall be pre-wired to the disconnect at the factory.

2.10 SOURCE QUALITY CONTROL

- A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with AMCA-Certified Ratings Seal.
- B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Support inline fans with galvanized all thread and spring isolators with a static deflection of 1 inch.
- C. Support suspended units from structure using galvanized threaded steel rods and spring hangers.
- D. Secure roof-mounting fans to roof curbs with stainless steel hardware. Anchor fan to curb with a minimum of two (2) fasteners per side. Refer to Specification Section "Roof Accessories" for installation of roof curbs.
- E. Ceiling Units: Suspect units from structure; use steel wire or metal straps.
- F. Install units with clearances for service and maintenance.
- G. Label units according to requirements specified in Specification Section "Mechanical Identification."

3.02 CONNECTIONS

- A. Duct installation and connection requirements are specified in other Mechanical Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct

connections with flexible connectors for all fans; no exceptions. Flexible connectors are specified in Specification Section "Duct Accessories."

- B. Install duct adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment according to Specification Section "Grounding and Bonding."

3.03 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 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. Reconnect fan drive system, align and adjust belts and install belt guards.
 5. Adjust belt tension.
 6. Adjust damper linkages for proper damper operation.
 7. Verify lubrication for bearings and other moving parts.
 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork system are in fully open positions.
 9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
 10. Shut unit down and reconnect automatic temperature-control operators.
 11. Remove and replace malfunctioning units and retest as specified above.
- B. Starting Procedures:
 1. Energize motor and adjust fan to indicated rpm.
 2. Measure and record motor voltage and amperage.
- C. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
- D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Shut unit down and reconnect automatic temperature-control operators.
- F. Refer to Specification Section "Testing, Adjusting and Balancing" for testing, adjusting, and balancing procedures.
- G. Replace fan and motor pulleys as required to achieve design airflow.
- H. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

3.04 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.

- C. Refer to Specification Section "Testing, Adjusting and Balancing for HVAC" for testing, adjusting and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

3.05 CLEANING

- A. On completion of installation, internally clean fans according to manufacturer's written instructions. Remove foreign material and construction debris. Vacuum fan wheel and cabinet.
- B. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burns, dirt and construction debris and repair damaged finished.

3.06 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain power ventilators.
 - 1. Train owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting servicing, and maintaining equipment and schedules.
 - 2. Review data in maintenance manuals. Refer to Specification Section "Closeout Procedures."
 - 3. Review data in maintenance manuals. Refer to Specification Section "Operation and Maintenance Data."
 - 4. Schedule training with Owner, through Architect, with at least seven days' advance notice.

3.07 COMMISSIONING

- A. Final Checks before Startup: Perform the following operations and checks before startup:
 - 1. Verify that shipping, blocking and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections for piping, ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters and disconnects.
 - 3. Perform cleaning and adjusting specified in this Section.
 - 4. Disconnect fan drive from motor, verify proper motor rotation direction and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts and install belt guards.
 - 5. Lubricate bearings, pulleys, belts and other moving parts with factory-recommended lubricants.
 - 6. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in the fully open position.
 - 7. Disable automatic temperature-control operators.
- B. Starting Procedures for fans are as follows:
 - 1. Energize motor; verify proper operation of motor, drive system and fan wheel. Adjust fan to be indicated RPM.
 - 2. Measure and record motor voltage and amperage.
- C. Shut unit down and reconnect automatic temperature-control operators.
- D. Refer to Specification Section "Testing, Adjusting and Balancing," for procedures for air-handling-system testing, adjusting and balancing.
- E. Replace fan and motor pulleys as required to achieve design conditions.

END OF SECTION 233423

SECTION 26 00 00
GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SCOPE

- A. Requirements specified within this section apply to Division 16, Electrical. Work specified herein shall be performed as if specified in the individual sections.
- B. The Electrical Drawings and Specifications under this section shall be made a part of the contract documents. The Drawings and specifications of this contract, as well as supplements issued thereto, information to bidders and pertinent documents issued by the Owner's representative are a part of these drawings and specifications and shall be complied with in every respect. All of the above documents will be on file at the office of the Owner's representative and shall be examined by all bidders. Failure to examine all documents shall not relieve the responsibility or be used as a basis for additional compensation due to omission of details of other sections from the electrical documents.
- C. Furnish all work, labor, tools, superintendence, material, equipment, and operations necessary to provide for a complete and workable electrical system as defined by the contract documents.
- D. Be responsible for visiting the site and checking the existing conditions. Ascertain the conditions to be met for installing the work and adjust bid accordingly.
- E. It is intent of the contract document that upon completion of the electrical work, the entire system shall be in a finished, workable condition.
- F. All work that may be called for in the specifications but not shown on the drawings; or, all work that may be shown on the drawings but not called for in the specifications, shall be performed by the Contractor as if described in both. Should work be required which is not set forth in either document, but which work is nevertheless required for fulfilling of the intent thereof; then, the contractor shall perform all work as fully as if it were specifically set forth in the current documents.
- G. The definition of terms used throughout the contract documents shall be as specified by the following agencies:
 - 1. Underwriters Laboratories (UL)
 - 2. National Electrical Manufacturers Association (NEMA)
 - 3. American National Standard Institute (ANSI)
 - 4. Insulated Cable Engineers Association (ICEA)
 - 5. National Electrical Code (NEC)
 - 6. National Fire Protection Association (NFPA)
- F. Design Requirements
 - 1. Design of Golf Cart Barn charging stations and lighting. Design of work area within the barn. Proposed electrical distribution system shall be installed in an elevated platform.

1.02 PERMITS, CODES AND UTILITIES

- A. Secure all permits, licenses, and inspections as required by all authorities having jurisdiction. Give all notices and comply with all laws, ordinances, rules, regulations and contract requirements bearing on the work.
- B. The minimum requirements of the electrical system installation shall conform to the latest edition of the National Electrical Code as well as state and local codes.
- C. Codes and ordinances having jurisdiction and specified codes shall serve as minimum requirements; but, if the Contract Documents indicate requirements which are in excess of those minimum requirements then the requirements of the Contract Documents shall be followed. Should there be any conflicts between the Contract Documents and codes, or any ordinances, report these with bid.
- D. Determine the exact requirements for the utility service connections and metering facilities as set forth by the utilities that will serve the project, and pay for and perform all work as required by those utilities.
- F. Incoming aerial electrical service facilities provided by the serving utility as part of its normal obligation to customers is work provided outside this Contract. Under this Contract provide customer required service provisions and electrical work including, but not limited to, primary trench and backfill, primary duct system, transformer pad site preparation, transformer pad, metering components and associated conduit, and secondary facilities. Schedule and coordinate work of serving utility as required to provide electric service to the Work.
- G. Incoming telephone and cable television service facilities provided by the serving utilities as part of their normal obligation to customers is work provided outside this Contract. Under this Contract provide customer required service provisions and electrical work.
- H. Interior telecommunications central and station equipment (telephone instruments, telephone switches, data switches, and hubs, servers, software, etc.) is work provided outside this Contract. Under this Contract provide raceways, outlet and junction boxes, cover plates, pull wires, as indicated.

1.03 STANDARDS

- A. All materials and equipment shall conform to the requirements of the Contract Documents. They shall be new, free from defects, and they shall conform to the following standards where these organizations have set standards:
 1. Underwriters Laboratories, Inc. (UL)
 2. National Electrical Manufacturer's Association. (NEMA)
 3. American National Standards Association. (ANSI)
 4. Insulated Cable Engineers Association. (ICEA)
 5. Institute of Electrical and Electronic Engineers (IEEE)
 6. National Electrical Contractors Association (NECA): National Electrical Installation Standards

- B. All material and equipment, of the same class, shall be supplied by the same manufacturer unless specified to the contrary.
- C. All products shall bear UL labels where standards have been set for listing.

1.04 SUBMITTALS

- A. Shop drawings shall be taken mean detailed drawings with dimensions, schedules, weights, capacities, installation details and pertinent information that will be needed to describe material or equipment in detail.
- B. Provide manufacturer's data for the following
 1. Electrical service components
 2. Nameplates, signs, and labels
- C. Submittal procedures are described in other specification sections

1.05 ACCEPTANCE AND SUBSTITUTIONS

- A. All manufacturers named are a basis as a standard of quality and substitutions of any equal product will be considered for acceptance. The judgment of equality of product substitution shall be made by the Engineer.
- B. Substitutions after award of contract shall be made only within sixty (60) days after the notice to proceed. Furnish all required supporting data. The submittal of substitutions for review shall not be cause for time extensions.
- C. Where substitutions are offered, the substituted product shall meet the product performance as set forth in the specified manufacturer's current catalog literature, as well as meeting the details of the Contract Documents.
- D. The details on the drawings and the requirements of the specifications are based on the first listed item of material or equipment; if any other than the first listed materials or equipment is furnished, then assume responsibility for the correct function, operation, and accommodation of the substituted item. In the event of misfits or changes in work required, either in this Section or other Sections of the Contract, or in both; bear all costs in connection with all changes arising out of the use of other than the first listed item specified.

1.06 OPERATIONS AND MAINTENANCE MANUALS

- A. Six (6) weeks prior to the completion of the project, compile an operations and maintenance manual on each item of equipment. These manuals shall include detailed instructions and maintenance, as well spare parts lists.
- B. Submit six (6) copies for review.

1.07 QUALITY ASSURANCE

- A. Provide the Work in accordance with NFPA 70. Where required by Authority Having Jurisdiction (AHJ), material and equipment shall be labeled or listed by a nationally recognized testing

laboratory or other organization acceptable to the AHJ, in order to provide a basis for approval under the NEC.

- B. Materials and equipment manufactured within the scope of standards published by Underwriters Laboratories Inc. shall conform to those standards and shall have an applied UL listing mark or label.
- C. Provide materials and equipment acceptable to AHJ for Class, Division, and Group of hazardous area indicated.

1.08 ENVIRONMENTAL CONDITIONS

- A. The following areas are classified hazardous Class I, Division 1, Group D, due to the potential for occurrence of hazardous concentrations of combustible gases, and for exposure to corrosive environment. Use materials and methods required for such areas.
 - 1. N/A
- B. The following areas are classified hazardous, Class I, Division 2, Group D, due to the potential for accumulation of hazardous concentrations of combustible gases, and for exposure to corrosive environment. Use materials and methods required for such areas.
 - 1. N/A
- C. The following areas are classified nonhazardous, wet, and corrosive. Use materials and methods required for such areas.
 - 1. Elevated Platform
- D. The following areas are classified nonhazardous and wet. Use materials and methods required for such areas.
 - 1. N/A
- E. The following areas are classified as indoor and dry:
 - 1. Golf Cart Barn
- F. The following areas are not classified. Use dust-tight and oil-tight NEMA 12 materials and methods.
 - 1. N/A

PART 2 - PRODUCTS

2.01 MATERIALS AND WORKMANSHIP

- A. All materials, unless otherwise specified, shall be current United States manufacture, new, free from all defects, and of the best quality. Foreign goods specifically approved for use by the Owner's Representative prior to bidding may be furnished.

- B. Materials and equipment shall be installed in accordance with the manufacturers' recommendations and the best standard practice for the type of work involved. All work shall be executed by electricians skilled in their respective trades, and the installations shall present a neat, precise appearance.
- C. The responsibility for the furnishing and intended installation of the proper electrical equipment and/or material as intended rests entirely upon the Contract. The Contractor shall request advice and supervisory assistance from the representative of specific manufacturers during the installation.

2.02 MATERIAL AND EQUIPMENT REQUIREMENTS

- A. Manufacturer's Instructions: The manufacturer's published instructions shall be followed for preparing, assembling, installing, erecting, and cleaning manufacturer materials or equipment, unless otherwise indicated. The Contractor shall promptly notify the Owner's Representative in writing of any conflict between the requirements of the Contract Documents and the manufacturer's direction and shall obtain the clarification of the Owner's Representative before proceeding with the work. Should the Contractor perform any such work that does not comply with the manufacturer's directions or such clarification by the Owner's Representative, he shall bear all costs arising in connection with the correction of the deficiencies.
- B. Storage at Site: The Contractor shall not receive material or equipment at the jobsite until there is suitable space provided to properly protect equipment from rust, drip, humidity, and dust damage from surrounding work. All new or relocated equipment shall be stored inside or protected from the environment. Equipment that is not properly stored shall be replaced by the contractor at no cost to the owner.
- C. Capacities shall be not less than those indicated and shall be such that no component or system becomes inoperative or is damaged because of startup or other overload conditions.
- D. Conformance to Agency Requirements: Where materials or equipment are specified to be approved, listed, tested, or labeled by the Underwriters Laboratories, Inc., or constructed and/or tested in accordance with the standards as listed in the NEC, the Contractor shall submit proof that the items furnished under this section of the specifications conform to such requirements. The label of the Underwriters Laboratories, Inc. applied to the item will be acceptable as sufficient evidence that the items conform to such requirements.
- E. Nameplates: Each major component of equipment shall have the manufacturer's name, address, and model-identification number embossed on a plate securely attached to the item of equipment. All data on nameplates shall be legible at the time of Final Inspection. All equipment starters and disconnects shall be tagged with the equipment designated mark and circuit.
- F. Prevention of Rust: Standard factory finish will be acceptable on equipment specified by model number, otherwise surfaces of ferrous metal shall be given a rust-inhibiting coating. The treatment shall withstand 200 hours in salt-spray fog test, in accordance with Method 6061 of Federal Standard No. 141. Immediately after completion of the test, the specimen shall show no signs of wrinkling or cracking and no signs of rust creepage beyond 1/8 inch on either side of the scratch mark. Where rust inhibitor coating is specified hereinafter, any treatment that will pass the above test is acceptable unless a specific coating is specified, except that coal tar or asphalt-type coatings will not be acceptable unless so stated for a specific item. Where steel is specified

to be hot-dip galvanized, mill-galvanized sheet steel may be used provided all raw edges are painted with a zinc-pigmented paint conforming to Military Specification MIL-P-26915.

- G. Protection of Connections: Switches, breaker handles, keys setscrews, handles and other parts not listed for normal occupied operation (light switches, etc.) shall be located accessible to but out of paths to prevent their accidental shutoff.
- H. Verifications of Dimensions: The Contractor shall be responsible for the coordination and proper relation of his work to the Equipment and to the work of all trades. The Contractor shall visit the premises and thoroughly familiarize himself with all details of the work and working conditions, to verify all dimensions in the field, and to advise the Owner's Representative of any discrepancy before performing any work. Adjustments to the work required in order to facilitate a coordinated installation shall be made at no additional cost to the Owner, or Engineer.
- I. Standard Products: Materials and equipment to be provided shall be the standard catalog products of manufacturers regularly engaged in the manufacture of products conforming to these specifications, and shall essentially duplicate materials and equipment that have been in satisfactory use at least two years.
- J. Where two or more units of the same class of material or equipment are required, provide products of a single manufacturer. Component parts of materials or equipment need not be products of the same manufacturer.
- K. Material and equipment installed in heated and ventilated areas shall be capable of continuous operation at their specified ratings within an ambient temperature range of 40 degrees F to 104 degrees F.
- L. Equip panels installed outdoors in direct sun with sun shields.
- M. Manufacturer's standard finish color, except where specific color is indicated. If manufacturer has no standard color, finish equipment in accordance with light gray color finish as approved by Owner.

2.03 NAMEPLATES

- A. Material: Laminated plastic.
- B. Attachment Screws: Stainless steel.
- C. Color: White, engraved to a black core.
- D. Letter Height:
 - 1. Pushbuttons/Selector Switches: 1/8 inch.
 - 2. Other electrical equipment 1/4 inch.

2.4 SIGNS AND LABELS

- A. Sign size, lettering, and color shall be in accordance with NEMA Z535.4.

PART 3 - EXECUTION

3.01 GENERAL

- A. Electrical Drawings show general locations of equipment, devices, and raceway, unless specifically dimensioned. Contractor shall be responsible for actual location of equipment and devices and for proper routing and support of raceways, subject to approval of Engineer.
- B. Check approximate locations of light fixtures, switches, and electrical outlets, equipment, and other electrical system components shown on Drawings for conflicts with openings, structural members, and components of other systems and equipment having fixed locations. In the event of conflicts, notify Engineer in writing.
- C. Install work in accordance with NECA Standard of Installation, unless otherwise specified.
- D. Keep openings in boxes and equipment closed during construction.
- E. Lay out work carefully in advance. Do not cut or notch any structural member or building surface without specific approval of Engineer. Carefully perform cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, paving, or other surfaces required for the installation, support, or anchorage of conduit, raceways, or other electrical materials and equipment. Following such work, restore surfaces to original condition.

3.02 COMBINING CIRCUITS INTO COMMON RACEWAY

- A. Drawings show each homerun circuit to be provided. Do not combine power or control circuits into common raceways without authorization of Engineer.
- B. Homerun circuits shown on Drawings indicate functional wiring requirements for power and control circuits. Circuits may be combined into common raceways in accordance with the following requirements:
 - 1. Analog control circuits from devices in same general area to same destination.
 - a. No power or AC discrete control circuits shall be combined same conduit with analog circuits.
 - b. No Class 2 or Class 3 circuits including, but not limited to, HVAC control circuits, fire alarm circuits, paging system circuits shall be combined with power or Class 1 circuits.
 - c. Analog circuits shall be continuous from source to destination. Do not add TJB, splice, or combine into multi-pair cable without authorization of Engineer.'
 - d. Raceways shall be sized per Conduit and Cable Schedule and do not exceed 40 percent fill.
 - e. Changes shall be documented on record drawings.
 - 2. Discrete control circuits from devices in the same general area to the same destination.
 - a. No power or AC discrete control circuits shall be combined same conduit with discrete circuits.
 - b. No Class 2 or Class 3 circuits including, but not limited to, HVAC control circuits, fire alarm circuits, paging system circuits shall be combined with power or Class 1 circuits.
 - c. Raceways shall be sized per Conduit and Cable Schedule and do not exceed 40 percent fill.
 - d. Changes shall be documented on record drawings.

3. Power circuits from loads in same general area to same source location (such as panelboard, switchboard, low voltage motor control center).
 - a. Lighting Circuits: Combine no more than three circuits to a single raceway. Contractor shall be responsible for increasing conduit and conductor size if derating is required by NEC.
 - b. Receptacle Circuits, 120-Volt Only: Combine no more than three circuits to a single raceway. Provide a separate neutral conductor for each circuit. Contractor shall be responsible for increasing conduit and conductors size if derating is required by NEC.
 - c. All Other Power Circuits: Do not combine power circuits without authorization of Engineer.

3.03 NAMEPLATES, SIGNS, AND LABELS

- A. Arch Flash Protection Warnings Signs:
 1. Field mark switchboards, motor control centers, panelboards to warn qualified persons of potential arc-flash hazards. Locate marking so to be clearly visible to persons before working on energized equipment.
 2. Use arc flash hazard boundary, energy level, PPE level and description, shock hazard, bolted fault current, and equipment name from Engineer as basis for warning signs.
- B. Arch Flash Protection Warnings Sign: Install permanent plaque or directory at each service disconnect location denoting other services, feeders, and branch circuits supplying the building, and the area served by each.
- C. Equipment Nameplates:
 1. Provide a nameplate to label electrical equipment including switchgear, switchboards, motor control centers, panelboards, motor starters, transformers, terminal junction boxes, disconnect switches, switches and control stations.
 2. Switchgear, motor control center, transformer, and terminal junction box nameplates shall include equipment designation.
 3. Disconnect switch, starter, and control station nameplates shall include name and number of equipment powered or controlled by that device.
 4. Switchboard and panelboard nameplates shall include equipment designation, service voltage, and phases.

3.04 LOAD BALANCE

- A. Drawings and Specifications indicate circuiting to electrical loads and distribution equipment.
- B. Balance electrical load between phases as nearly as possible on switchboards, panelboards, motor control centers, and other equipment where balancing is required.
- C. When loads must be reconnected to different circuits to balance phase loads, maintain accurate record of changes made, and provide circuit directory that lists final circuit arrangement.

3.05 EXCAVATION AND BACKFILLING

- A. Do all excavating and backfilling necessary for the installation of the work. This shall include shoring and pumping in ditches to keep them dry until the work in question has been installed. All shoring required to protect the excavation and safeguard employees shall be properly performed.
- B. All excavations shall be made to the proper depth, with allowances made for floors, forms, beams, piping, finished grades, etc. Ground under conduits shall be well compacted before conduits are installed.
- C. All backfilling shall be made with selected soil; free of rock and debris and shall be pneumatically tamped in six (6") inch layers to secure a field density ratio of 90%.
- D. All excavated material not suitable and not used in the backfill shall be removed offsite at the Contractors expense.
- E. Field check and verify the locations of all underground utilities prior to any excavating. Avoid disturbing these as far as possible. In the event existing utilities are broken into or damaged, they shall be repaired so as to make their operation equal to that before the trenching was started.
- F. Where the excavation requires the opening of existing walks, drives, or other existing pavement, these facilities shall be cut as required to install new lines and to make connections to existing lines. The sizes of the cut shall be held to a minimum consistent with the work to be installed. After installation of new work is completed and the excavation has been backfilled in accordance with above, repair existing walks, drives or other existing pavement to match existing installation.

3.06 CUTTING AND PATCHING

- A. Cutting and patching required under this section shall be done in a neat workmanlike manner. Cutting lines shall be uniform and smooth.
- B. Use concrete saws for large cuts in concrete and core drills for small round cuts in concrete.
- C. Where openings are cut through masonry walls, provide lintel or other structural supports to protect the remaining masonry. Adequate support shall be provided during the cutting operation to prevent damage to masonry.
- D. Where large openings are cut through metal surfaces, attach metal angles around the opening.
- E. Patch concrete openings that are to be filled with non-shrinking cementing compound. Finish concrete patching shall be troweled smooth and shall be uniform with surrounding surfaces.

3.4 WATERPROOFING

- A. Provide waterproof flashing for each penetration of exterior walls and roofs.
- B. Flashing for conduit penetrations through built-up roofs shall be made with pitch pans filled with pitch. Conduit penetrations through poured concrete roofs shall be made with sleeves and annulus caulked.
- C. Penetrations through walls at below ground elevations shall be waterproofed by conduit sealing fittings or other methods as indicated.

- D. Interiors of raceways that are likely to have water ingress such as runs from hand holes into below-grade installations shall have water stops installed to prevent water from entering into installations.

3.07 METAL BUILDING SYSTEMS / ELECTRICAL SUPPORTS

- A. Metal building systems are required to be designed by the manufacturer to accommodate and support the electrical systems indicated on the electrical drawings and specified in Division 16.
- B. The metal building systems manufacturer is required to provide the following:
1. Framed openings through the roofs with supports, roof curbs, and flashings for roof-mounted equipment, fans, vents, and air intakes.
 2. Structural support for piping, conduits, and suspended equipment consisting of beam, joists, purlins, and/or blocking above and perpendicular to conduit routes and equipment hangers at intervals not to exceed 8 feet.
 3. Structural support for suspended ceilings and light fixtures, including associated raceways.
- C. The electrical trade shall:
1. Provide all routes, weights, installation heights, opening locations, etc. for all equipment, conduits, sleeves, etc. to the metal building system manufacturer and coordinate requirements for structural supports, hangers, attachments, etc. with the metal building systems manufacturer.
 2. Provide all supporting devices (hangers, attachments, brackets, cross beams, etc.) to attach to the metal building structural system.

3.08 CONDUIT SUPPORT

- A. Conduit Support: All conduits throughout the building, both horizontal and vertical, shall be adequately supported from the construction to line of grade, with proper provision for expansion, contraction, vibration elimination, and anchorage. Vertical conduits shall be supported from floor lines with riser clamps sized to fit the lines and to adequately support their weight. At the bases of lines, where required for proper support, provide anchor base fittings or other approved supports.

3.09 HANGERS

- A. General: Each hanger shall be properly sized to fit the supported pipe or to fit the outside of the insulation on lines where specified.
- B. Attachment:
1. The load on each hanger and/or insert shall not exceed the safe allowable load for any component of the support system, including the concrete which holds the inserts. Reinforcement at inserts shall be provided as required to develop the strength required.
 2. Where pipes are supported under steel beams, approved-type beam clamps shall be used.
 3. Where conduit is supported under wood joists, hanger rods shall be attached to joists with side beam brackets or angle clips.

- C. Spacing: All hangers shall be so located as to properly support horizontal lines without appreciable sagging of these lines. All PVC shall be supported at intervals recommended by the manufacturer, or as otherwise specified or indicated.
- D. Trapezes: Where multiple lines are run horizontally at the same elevation and grade, they may be supported on trapezes of Kindorf, Elcen, or approved equal, channel-suspended on rods or pipes. Trapeze members including suspension rods shall each be properly sized for the number, size, and loaded weight of the lines they are to support.
- E. Ceiling-Mounted Devices: All lighting and devices or assemblies mounted in lay-in-type ceilings and which are supported by the ceiling grid, directly or indirectly, and which weigh in excess of 2 lbs., shall be provided with at least two 12-gauge minimum wire supports connected securely between the device or assembly and the structure, to serve as a safety support in the event of the collapse of or a disturbance in the support of the ceiling system that might cause the device or assembly to fall through the ceiling. This includes, but is not limited to, light fixtures, J-boxes, and heavy speakers. Provide additional support as required where the weight of the device or assembly will exceed the safe limits of the wire supports.
- F. Miscellaneous: Provide any other special foundations, hangers, and supports indicated on the drawings, specified elsewhere herein, or required by conditions at the site. Hangers and supporting structures for suspended equipment shall be provided as required to support the load from the building structure in a manner acceptable to the Owner's Representative.

3.10 EQUIPMENT PROTECTION

- A. Provide suitable protection for all equipment, work and property against damage during construction.
- B. Assume full responsibility for material and equipment stored at the site.
- C. Conduit openings shall be closed with caps or plugs during installation. All outlet boxes and cabinets shall be kept free of concrete, plaster, dirt, and debris.
- D. Equipment shall be and tightly sealed against entrance of dust, dirt, and moisture.

3.11 CLEAN-UP

- A. Cleaning: Throughout the Work, clean interior and exterior of devices and equipment by removing debris and vacuuming.
- B. Remove all temporary labels, dirt, paint, grease and stains from all exposed equipment. Upon completion of work, clean equipment and the entire installation so as to present a first-class job suitable for occupancy. No loose parts or scraps or equipment shall be left on the premises.
- C. Equipment paint scars shall be repaired with paint kits supplied by the equipment manufacturer, or with an approved paint.

- D. If extensive damage is done to equipment paint surfaces, refinish entire equipment in a manner that provides a finish equal to or better than factory finish, that meets the requirements of Specification, and is acceptable to Engineer.
- E. At completion of work all equipment interiors shall be free from dust, dirt, and debris.

3.12 TESTS AND INSPECTIONS

- A. All equipment shall put through a trial run-in test to ascertain the performance complies with the intent of the specifications. All-in tests shall be made in the presence of the Owner's Representative. All cables shall have an insulation test performed.
- E. Cables installed with an unacceptable insulation reading shall be removed and new cable installed and retested at no additional cost to the owner. The Contractor shall make all tests deemed necessary by the inspection departments of the authority having jurisdiction, Board of Underwriters, etc. He shall provide all equipment, materials, and labor for making such tests. Fuel, test equipment materials for system operational tests shall be paid for by the contractor.
- F. Other: Additional tests specified hereinafter under the various specifications sections shall be made.
- G. Notification: The Owner's Representative shall be notified at his office 36 hours prior to each test and other specifications requirements requiring action on the part of the Owner, Engineer, and/or Owner's Representative.
- H. Test Logs: All tests which the Contractor conducts shall have pertinent data logged by the Contractor at the time of testing. Data shall include date, time, personnel, description and extent of system tested, test conditions, test results, specified results, and any other pertinent data. Data shall be delivered to the Owner's representative as specified under "Requirements for Final Acceptance".

3.13 CONDITIONS OF EQUIPMENT AT FINAL ACCEPTANCE

- A. At the time of acceptance, the Contractor shall have inspected all installed systems to assure the following has been completed:
 1. Fixtures are operating, and lenses and reflectors are free of dust, debris, and fingerprints.
 2. Panelboards have all conductors neatly formed, bundled, and made-up tight. Cans shall be vacuum cleaned and surfaces cleaned of stray paint, dust, grease, and fingerprints. All circuit directories to be neatly typed and in place.
 3. Wall plates and exposed switch and receptacle parts to be clean, free of paint, plaster, etc.
 4. Safety and disconnect switches and motor control centers, Control Panels, etc. to be vacuum cleaned of debris and dust, and all surfaces free of stray paint, grease, and fingerprints.
 5. Switchgear, transformers, and system devices shall be cleaned internally and externally and have all surfaces restored to original surface conditions.
 6. Touch-up all scratched surfaces using paint matching the existing equipment paint. Where paint cannot be matched, the entire surface shall be repainted in a color and manner approved by the Engineer.

END OF SECTION

SECTION 26 05 04
BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

1. Raceways.
2. Wire and connectors.
3. Supporting devices for electrical components.
4. Concrete equipment bases.
5. Electrical demolition.
6. Cutting and patching for electrical construction.
7. Touchup painting.

1.3 SUBMITTALS

- A. Supporting Devices

1.4 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 NFPA 70.

1.5 COORDINATION

- A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in structure during progress of construction to facilitate the electrical installations that follow.
 1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.
- B. Coordinate electrical service connections to components furnished by utility companies.

1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.
 2. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.
- C. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

PART 2 - PRODUCTS

2.1 RACEWAYS

- A. See Section 16130, Raceways and Boxes.

2.2 CONDUCTORS

- A. See Section 16120, Conductors and Cables.

2.3 SUPPORTING DEVICES

- A. Mounting hardware, nuts, bolts, lock washers, and washers, shall be grade 316 stainless steel.
- B. Unless otherwise indicated, slotted channel framing and supporting devices shall be manufactured of ASTM 6063, T-6 grade aluminum; 1-5/8" wide x 3-1/4" deep (double opening type). Clamp nuts for use with slotted channels shall be grade 304 stainless steel.
- C. Conduit straps for use with slotted channels shall be aluminum with stainless steel hardware.
- D. After-set concrete inserts shall consist of stainless-steel expansion bolts, 1/4": minimum diameter, 500 lbs. minimum pull-out resistance. Furnish Phillips, Wej-it, or equal.
- E. Hanger rod shall be 3/8": minimum diameter galvanized steel all-thread.
- F. Nest-back or clamp-back conduit supports shall be two-piece hot-dip galvanized malleable iron devices. Furnish Crouse-Hinds "MW + CB", Gedney 140 series, or equal.
- G. One-hole conduit clamps shall be hot-dipped galvanized malleable iron type, Crouse-Hinds type "MW", T&B 1270/1280 series, or equal.
- H. Conduit "U" bolts shall be hot-dip galvanized steel with galvanized hex-head bolts.
- I. Plastic saddles for supporting buried conduits shall be interlocking type that provides separation between conduits vertically and laterally and between bottom of conduits and trench floor.
- J. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.
- K. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits.

Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.

2.4 EQUIPMENT FOR UTILITY COMPANY'S ELECTRICITY METERING

- A. Current-Transforming Cabinets: Comply with requirements of electrical power utility company.
- B. Meter Sockets: Comply with requirements of electrical power utility company.
- C. Provide power utility company communication conduit to meter.

2.5 CONCRETE BASES

- A. Concrete: 3000-psi, 28-day compressive strength. Provide minimum 4 inches beyond equipment.
- B. Bollards: Provide bollards around transformer. Protect equipment on road or driveway sides.

2.6 TOUCHUP PAINT

- A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.
- B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.1 ELECTRICAL EQUIPMENT INSTALLATION

- A. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- B. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

3.2 ELECTRICAL SUPPORTING DEVICE APPLICATION

- A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.
- B. Dry Locations: Steel materials.
- C. Support Clamps for PVC Raceways: Click-type clamp system.
- D. Selection of Supports: Comply with manufacturer's written instructions.

- E. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb design load.

3.3 SUPPORT INSTALLATION

- A. Install support devices to securely and permanently fasten and support electrical components.
- B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.
- C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
- D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.
- E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- F. Install 1/4-inch-diameter or larger threaded steel hanger rods, unless otherwise indicated.
- G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.
- H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- I. Simultaneously install vertical conductor supports with conductors.
- J. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches from the box.
- K. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.
- L. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.
- M. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:
 1. Wood: Fasten with wood screws or screw-type nails.

2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
3. New Concrete: Concrete inserts with machine screws and bolts.
4. Existing Concrete: Expansion bolts.
5. Steel: Welded threaded studs or spring-tension clamps on steel.
 - a. Field Welding: Comply with AWS D1.1.
6. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
7. Light Steel: Sheet-metal screws.
8. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.4 FIRESTOPPING

- A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly.

3.5 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated, but not less than 6 inches larger, in both directions, than supported unit and bollards. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated. Use 3000-psi, 28-day compressive-strength concrete and reinforcement.

3.6 DEMOLITION

- A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.
- B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.
- C. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.
- D. Remove demolished material from Project site.
- E. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

3.7 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

- B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.8 FIELD QUALITY CONTROL

- A. Inspect installed components for damage and faulty work, including the following:
1. Raceways.
 2. Building wire and connectors.
 3. Supporting devices for electrical components.
 4. Electrical identification.
 5. Electricity-metering components.
 6. Concrete bases.
 7. Electrical demolition.
 8. Cutting and patching for electrical construction.
 9. Touchup painting.

3.9 REFINISHING AND TOUCHUP PAINTING

- A. Refinish and touch up paint.
1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
 2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
 3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.10 CLEANING AND PROTECTION

- A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.
- B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 26 05 10
CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Qualification Data: For testing agency.
- C. Field Quality-Control Test Reports: Megohm Meter Test Report

1.4 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 NFPA 70.

PART 2 - PRODUCTS

2.1 WIRE AND CABLE

- A. All conductors shall be soft-drawn, stranded annealed copper that meets ANSI 44, ASTM B3-74/38-72.
- B. Insulation for all power and controls conductors not used in cable trays shall be type THHN-THWN and complying with NEMA WC 5 or 7, UL-83 and UL-1063.
- C. Conductors shall be color coded for voltage and phase as per NEC and any local amendments.
- D. Large conductors shall have taped color coding.
- E. Jacket shall be polyamide outer nylon covering per UL-83 and UL-1063.

- F. Multiconductor shielded cables shall be polyethylene insulated tinned copper conductors within an aluminium-polyester shield tinned copper drain wire and a chrome PVC jacket. Shield shall provide 100% coverage. Cables shall be UL style 2092 and shall be Belden Beldfoil #8760 or equal, with number of conductors shown.
- G. Multiconductor signal cables shall consist of twisted pairs of insulated copper conductors, size and number of pairs as indicated, with a petroleum-polyethylene compound which fills all cable interstices, a non-hydroscopic core tape, .005" copper shield and a polyethylene jacket. Cable shall be manufactured to REA Specification PE-39 for REA Designation BJCF cables and shall be Okonite type KTC-F or equal.
- H. Multiconductor cords shall consist of rubber insulated high-strained copper conductors contained within a neoprene jacket. Furnish type SJO/300V class for 120/240V class applications.
- I. Multiconductor cables for installation in cable trays shall consist of stranded tinned copper conductors, 30 mil FR-EPR flame-retardant ethylene-propylene-rubber insulation, color coded, two-conductors flat, three or more conductors twisted with CPE jacket overall. Furnish Belden tray cable, or equal.
- J. Variable Frequency Drive (VFD) power cables shall consist of stranded, tinned-copper power conductors contained within a cross-linked polyolefin, 2kV insulation meeting the requirements for Type P of IEEE 1580 and Type X110 of UL 1309/CSA 245. Each conductor shall have printed phase I.D. Cable shall include 3 ground conductors consisting of stranded, tinned-copper insulated with insulation equivalent to the power conductor insulation. The shield shall be constructed of tinned-copper braid with an aluminum/polyester tape providing 100% coverage. The jacket shall meet UL 1309/CSA 245 as well as IEEE1580.

2.2 CONNECTORS

- A. Power connectors shall be insulated tap connectors. Furnish NSI Polaris connectors with no equals.
- B. Insulated spring-wire connectors, "wire-nuts", for small building wire taps and splices shall be plated spring steel with thermoplastic jacket. Connector shall be rated at 150 degrees Celsius continuous. Furnished 3M "Hyflex", T&B "PT" or equal.
- C. Insulated set-screw connectors shall consist of copper body with flame-retardant plastic insulated shield. Furnished Ideal, T&B, or equal.
- D. Connectors for control conductor connections to screw terminals shall be crimp-type with vinyl insulated barrel and tin-plated copper ring-tongue style connector. Furnish T&B, "Sta-kon", 3M "Scothlok". Or equal.

2.3 INSULATING PRODUCTS

- A. Tape products shall be furnished as herein after specified and shall be Plymouth, Okonite, F.E.,

3M, or equal.

- B. General purpose electrical tape shall be 7 mil thick stretchable vinyl plastic, pressure adhesive type, "slipknot Grey", 3M Scotch 33+, or equal.
- C. Insulating void-filling tape and high voltage bedding tape shall be stretchable thylene propylene rubber with high-tack and fast fusing surfaces. Tape shall be rated for 90 degrees Celsius continuous, 130 degrees Celsius overload, and shall be moisture proof void filling tape shall be "plysafe", 3M Schotch 23, or equal.
- D. High temperature protective tape shall be rated 180 degrees Celsius continuous indoor/outdoor, stretchable, self-bonding silicone rubber. High temperature tape shall be "plysil #3445", 3M Scotch 70, or equal.

PART 3- EXECUTION

3.1 WIRING

- A. Conductors shall be sized as shown and where no size is indicated, the conductor size shall be size #12 AWG.
- B. All control wiring, 120/240V wiring and insulated equipment grounding conductors shall be type XHHW insulated stranded copper conductors.
- C. All 480V wiring in sizes #4/0 and larger shall be made with type RHH, RH, USE, VW-1 wire with stranded copper conductors that has EPR insulation and flame retardant jacket.
- D. All 480V wiring in sizes smaller than #4/0 shall be installed with type RHH, RHW, USE insulated stranded copper conductors.
- E. Branch circuits may be spliced for receptacle, lighting and small appliances load inside appropriate junction boxes. All control and power cables shall be run continuous without splices except where approved by the engineer.
- F. Except as otherwise specified, taps and splices with #10 AWG and smaller shall be made with insulated spring wire connectors. Such connectors in damp or wet locations shall be further insulated with an envelope of stretched piece of EPR tape around each wire to fill the interstices between the wires. Then, apply one-half lapped layer of electrical tape over all.
- G. Motor connections made with #10 AWG and smaller wire shall be made up with set-screwed copper lugs with threaded-on insulating jacket. After make-up of each connector, install two (2) layers half-lapped, high temperature tape over connector barrel and down over wires into connector on (1") inch.
- H. Motor connections made with #8 AWG and larger wire shall be made up with cast copper alloy splice connector. Apply over each connector and down 1.5 inches over each wire entry, wrapping in high temperature tape. Apply at least three (3) layers, half-lapper each layer of such tape with maximum built-up over the connector. Then apply final wrapping of at least three (3) layers, half-lapped each layer of electrical tape.

- I. Taps, splices, and connection in #8 AWG and larger wires shall be made with copper alloy bolted pressure connectors. Each such connector shall be insulated by means of applying insulation putty over sharp edges so as to present a smooth bonding surface. Next, apply at least four (4) layers, half-lapped each layer of EPR tape. Then, make final wrapping of at least three (3) layers, half-lapped each layer of electrical tape.
- J. Control wiring connections to stud type and screw type terminals shall be made with ring-tongue type crimp connectors. Label each terminal jacket with wire marking label at each connection.
- K. Each wire connection shall be made up tightly so that resistance of connection is as low as equivalent length of associated conductor resistance.
- L. Phase label black pigmented power wires with color banding tape. Color of tape applies shall be that specified below.

CONDUCTOR	120/240V SYSTEMS	480V SYSTEMS
Phase A	Black	Purple
Phase B	Red	Brown
Phase C	Blue	Yellow
Neutral	White	Gray
Equipment Ground	Green	Green

- M. Numbered labels shall be installed to identify circuit numbers from panel boards. Install labels on each wire in each panelboard, junction, and pullbox, and device connection.
- N. Label each wiring run with write-on waterproof labels inside each motor control center and in service switchboard. Install write-on label ties around wire group at conduit entrance and write-on label the wire size, and service.
- O. Install numbered marking on each control wiring termination at each terminal strip and at each device. Do this in motor control center, terminal cabinets, safety switches, remote controllers, pilot operators, and instrumentation equipment. Number selected shall correspond to number on terminal strip.
- P. All wiring inside enclosures will be neatly trained and laced with nylon tie-wraps.
- Q. All wiring shall be installed in raceways unless otherwise noted; however, no wire shall be drawn into a conduit until all work of a nature which may cause injury is completed. Do not exceed wire and cable manufacturer's recommended pulling tensions. A cable pulling compound shall be used as a lubricant and its composition shall not affect the conductor or its insulation.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections or on the drawings.

1.3 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the InterNational Electrical Testing Association and that is acceptable to authorities having jurisdiction.

- 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.

- 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.

- 1. Comply with UL 467.

- C. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

- 1. Grounding Conductors, Cables, Connectors, and Rods:
 - a. Apache Grounding/Erico Inc.
 - b. Boggs, Inc.
 - c. Chance/Hubbell.
 - d. Copperweld Corp.
 - e. Dossert Corp.
 - f. Erico Inc.; Electrical Products Group.
 - g. Framatome Connectors/Burndy Electrical.

- h. Galvan Industries, Inc.
- i. Harger Lightning Protection, Inc.
- j. Hastings Fiber Glass Products, Inc.
- k. Heary Brothers Lightning Protection Co.
- l. Ideal Industries, Inc.
- m. ILSCO.
- n. Kearney/Cooper Power Systems.
- o. Korns: C. C. Korns Co.; Division of Robroy Industries.
- p. Lightning Master Corp.
- q. Lyncole XIT Grounding.
- r. O-Z/Gedney Co.; a business of the EGS Electrical Group.
- s. Raco, Inc.; Division of Hubbell.
- t. Robbins Lightning, Inc.
- u. Salisbury: W. H. Salisbury & Co.
- v. Superior Grounding Systems, Inc.
- w. Thomas & Betts, Electrical.

2.2 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Section 16120, Conductors and Cables.
- B. Material: Copper.
- C. Equipment Grounding Conductors: Insulated with green-colored insulation.
- D. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.
- E. Grounding Electrode Conductors: Stranded cable.
- F. Underground Conductors: Bare, stranded, unless otherwise indicated.
- G. Bare Copper Conductors: Comply with the following:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Assembly of Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
- H. Copper Bonding Conductors: As follows:
 - 1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch in diameter.
 - 2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
 - 3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
 - 4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- I. Ground Conductor and Conductor Protector for Wood Poles: As follows:

1. No. 4 AWG minimum, soft-drawn copper conductor.
 2. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir, or cypress or cedar.
- J. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

2.3 CONNECTOR PRODUCTS

- A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.
- B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.
- C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

2.4 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel.
- B. Ground Rods: Sectional type; copper-clad steel.
 1. Size: 3/4 by 120 inches.
- C. Test Wells: Provide handholes for test wells.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
- B. In raceways, use insulated equipment grounding conductors.
- C. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells.
- D. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.
- E. Ground Rod Clamps at Test Wells: Use bolted pressure clamps with at least two bolts.
- F. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 1. Use insulated spacer; space 1 inch from wall and support from wall 6 inches above finished floor, unless otherwise indicated.

2. At doors, route the bus up to the top of the door frame, across the top of the doorway, and down to the specified height above the floor.
- G. Underground Grounding Conductors: Use bare stranded-copper conductor, No. 4/0 AWG minimum. Bury at least 24 inches below grade or bury 12 inches above duct bank when installed as part of the duct bank.

3.2 EQUIPMENT GROUNDING CONDUCTORS

- A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
- B. Install equipment grounding conductors in all feeders and circuits.
- C. Busway Supply Circuits: Install insulated equipment grounding conductor from the grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
- D. Computer Outlet Circuits: Install insulated equipment grounding conductor in branch-circuit runs from computer-area power panels or power-distribution units.
- E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate equipment grounding conductor. Isolate equipment grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- G. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.
- H. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate equipment grounding conductor to each electric water heater, heat-tracing, and antifrost heating cable. Bond conductor to heater units, piping, connected equipment, and components.
- I. Metal Poles Supporting Outdoor Lighting Fixtures: Provide a grounding electrode in addition to installing a separate equipment grounding conductor with supply branch-circuit conductors
- J. Common Ground Bonding with Lightning Protection System: Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

3.3 INSTALLATION

- A. **Grounding Conductors:** Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. **Bonding Straps and Jumpers:** Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

3.4 CONNECTIONS

- A. **General:** Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
 2. Make connections with clean, bare metal at points of contact.
 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. **Exothermic-Welded Connections:** Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. **Equipment Grounding Conductor Terminations:** For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- D. **Noncontact Metal Raceway Terminations:** If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.
- E. **Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values.** If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- F. **Compression-Type Connections:** Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

- G. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

END OF SECTION

SECTION 26 05 33

RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

1.3 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: Show fabrication and installation details of components for raceways, fittings, boxes, enclosures, and cabinets.

1.4 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 NFPA 70.

PART 2 - PRODUCTS

2.1 RACEWAYS

- A. Above ground conduit shall be schedule 40 aluminum and shall comply with Article 346 of NEC and U.L. standard UL-6.
- B. Below grade conduit shall be non-metallic rigid PVC Schedule 40, rated 90 degrees Celsius and conform to NEMA TC-2 and UL-651 Standards, transitions to above ground to be made with PVC coated hot dipped rigid steel conduit.
- C. Connections to motors shall be made using liquid tight flexible conduit and shall consist of galvanized flexible interlocking steel core with thermoplastic cover.

2.2 CONDUIT FITTINGS

- A. NEMA 1 lock nuts for indoor rigid metallic conduit shall be galvanized steel.

- B. Outdoor field applied hubs for sheet metal enclosures shall be galvanized steel ring, nylon throat, threaded NPT insert and shall be MYERS "SCRU-TITE", or equal.
- C. Conduit hubs for non-metallic enclosures shall be fiberglass polyester reinforced with galvanized steel core, complete with lockout and grounding bushing and shall be Square D Type NH, or equal.
- D. Rigid metallic conduit chase nipples, slip fittings, unions, reducers shall be hot dipped galvanized steel.
- E. Rigid metallic conduit grounding bushings shall be hot dipped galvanized steel with threaded hub, nylon insulated throat, and ground lug.
- F. Liquid tight flexible conduit fittings shall be hot dipped galvanized steel body with internal locking ring.

2.3 CONDUIT BODIES, BOXES, AND ENCLOSURES

- A. Conduit bodies such as "C", "LB", "T" and the like pulling fittings shall be sand-cast copper free aluminum. Covers shall be gasketed cast metal with stainless steel cover screws and clamp style attachment. Furnish Crouse-Hinds Form 7, or equal.
- B. Conduit bodies such as "GUA", "GUAT", "GUAL", and the like pulling/splicing fittings shall be copper free aluminum with cast metal covers. All such conduit bodies shall be Crouse-Hinds GU/EA series, Appleton "GR" series, equal.
- C. Cast metal outlet boxes, pullboxes, and junction boxes whose volume is smaller than 100 cubic inches, and cast metal device boxes, shall be sand-cast copper free aluminum. All boxes shall have threaded hubs. Furnish Crouse-Hinds "FD" style Condulets, Appleton "FD" style Unilets, or equal.
- D. Covers for cast metal boxes shall be gasketed cast metal covers with stainless steel screws.
- E. Enclosures shall be NEMA types as indicated. NEMA 4X types shall be 316 stainless steel with gasketed door and 316 stainless steel hardware.
- F. Conduit hubs for NEMA 4X enclosed safety switches shall be steel body type with fiberglass reinforced polyester covering and with grounding bushing inside.
- G. Conduit hubs for NEMA 3 and NEMA 4 and NEMA 4X enclosures shall be water-tight threaded hubs with grounding bushing inside.
- H. Each enclosure shall be equipped with ground lug.

2.4 MISCELLANEOUS MATERIAL

- A. Double bushing for insulating wiring through sheet metal panels shall consist of mating male and female threaded phenolic bushings. Phenolic insulation shall be high-impact "ABB", Gedney type "ABB", or equal.
- B. Cable grips shall be grip-type wire mesh with machined metal support. Furnish Kellems, Appleton, or equal products.
- C. Conduit pull-cords for use in empty raceways shall be glass-fiber reinforced tape with foot-marked along its length. Furnish Thomas, Greenlee, or equal products.
- D. Conduit thread coating compound shall be conductive, non-galling, and corrosion-inhibiting. Furnish Crouse-Hinds type "STL", Appleton type "ST", or equal.
- E. Wire pulling compound shall be non-injurious to insulation and to conduit and shall be lubricating, non-crumbling, and non-combustible. Furnish Gedney "Wire-Quick", Ideal "Yellow", or equal.
- F. Plastic compound for field-coating of ferrous material products shall be PVC in liquid form that sets-up semi-hard upon curing. Furnishing Rob Roy "rob Kote", Sedco "Patch Coat", or equal.
- G. Zinc spray for coating electrogalvanized steel products shall be Research Laboratory type "LPS", Mobil "Zinc-spray", or equal.
- H. Splicing kit shall be provided with insulating and sealing compound to provide a moisture-tight splice. Provide Scotchcast Series 82 or equal splicing kit.
- I. Conduit straps for use with slotted channels shall be aluminum with stainless steel hardware.
- J. After-set concrete inserts shall consist of stainless steel expansion bolts, 1/4: minimum diameter, 500 lbs. minimum pull-out resistance. Furnish Phillips, Wej-it, or equal.
- K. Hanger rod shall be 3/8": minimum diameter galvanized steel all-thread.
- L. Nest-back or clamp-back conduit supports shall be two-piece hot-dip galvanized malleable iron devices. Furnish Crouse-Hinds "MW + CB", Gedney 140 series, or equal.
- M. One-hole conduit clamps shall be hot-dipped galvanized malleable iron type, Crouse-Hinds type "MW", T&B 1270/1280 series, or equal.
- N. Conduit "U" bolts shall be hot-dip galvanized steel with galvanized hex-head bolts.
- O. Plastic saddles for supporting buried conduits shall be interlocking type that provides separation between conduits vertically and laterally and between bottom of conduits and trench floor.

PART 3 - EXECUTION

3.1 RACEWAYS

- A. Install the conduit system to provide the facility with the utmost degree of reliability and maintenance free operation. The conduit system shall have the appearance of having been installed by competent workmen. Kinked conduit, conduit inadequately supported or carelessly installed, do not give such reliability and maintenance free operation and will not be accepted.
- B. Raceways shall be installed for all wiring runs except as otherwise indicated.
- C. Conduit sizes, where not indicated, shall be N.E.C. code-sized to accommodate the number and diameter of wires to be pulled into the conduit. Unless otherwise indicated, 3/4" trade-size shall be minimum size conduit.
- D. Unless otherwise noted, conduit runs shall be installed exposed. Such runs shall be made parallel to the lines of the structure. Where aluminum conduit or supporting devices come in contact with concrete, the conduit and or supporting devices shall be coated with zinc chromate or other suitable coating to prevent galvanic action.
- E. Conduit runs installed below-grade in earth shall be PVC. Use manufacturer's approved cement for joining couplings and adapters. Runs shall be installed so that tops of conduits are at least twenty-four (24") inches below finished grade. Support runs on plastic spacers and backfill to three (3") inches above topmost conduits with washed sand. Wash down all sand backfill with water so as to completely fill interstices and to compact sand. Backfill to finished grade with selected soil that is free from clods, debris, rocks and the like. Pneumatically tamp backfill in six (6") inches to eight (8") inches below finished grade, install continuous run of "BURIED CABLE" marking taped.
- F. Below-grade to above-grade upturns in non-metallic runs shall be made with PVC coated rigid metallic conduit.
- G. Rigid metallic conduit runs shall have their couplings and connections made with screwed fittings and shall be made up wrench-tight. Check all threaded conduit joints prior to wire pull.
- H. All conduit runs shall be watertight over their lengths of run except where drain fittings are indicated. In which cases, install specified breather-drain fittings.
- I. Plastic jacketed flexible steel conduit shall be used to connect wiring to motors, limit switches, bearing thermostats, and other devices that may have to be removed for servicing. Unless otherwise indicated, maximum lengths of flex shall be six (6') feet.
- J. Each flex connector shall be made-up tightly so that the minimum pull-out resistance is at least 150 lbs.
- K. Empty conduits shall have pull-tape installed. Identify each terminus as to location of other end. Use blank plastic waterproof write-on label and write information on each label with waterproof ink. Cap exposed ends of empty conduit with plastic caps.
- L. Conduit runs into boxes, cabinets, and enclosures shall be set in a neat manner. Vertical runs shall be set plumb. Conduits set cocked or out of plumb will not be acceptable.

- M. Conduit entrances into equipment shall be carefully planned. Cutting away of enclosure structure, torching out sill or braces, and removal of enclosure structural members, will not be acceptable.
- N. Use approved hole cutting tools for entrances into sheet metal enclosure. Use of cutting torch or incorrect tools will not be acceptable. Holes shall be cleanly cut and they shall be free from burrs, faged edges, and torn metal.
- O. All raceways shall be swabbed clean after installation. There shall be no debris left inside. All interior surfaces shall be smooth and free from burrs and defects that would injure wire insulation. All conduits shall be sealed after cable installation with electrical insulation putty.
- P. All raceways labeled as "spare" or "future" on the construction documents and are indicated to be installed below grade and rise thru the finished floor beneath concrete construction to serve future equipment shall be capped level with the finished floor.

3.2 CONDUIT BODIES AND BOXES

- A. Conduit bodies such as "LB", "T", etc., shall be installed in exposed runs of conduit wherever indicated and where required to overcome obstructions and to provide pulling access to wiring. Covers for such fittings shall be accessible and unobstructed by the adjacent construction.
- B. Covers for conduit bodies installed shall be gasketed cast metal type.
- C. All conduit boxes installed shall be cast metal type. Covers for all such boxes shall be gasketed cast metal type.
- D. Install enclosures plumb

3.3 RACEWAY SUPPORT

- A. All raceway systems shall be adequately and safely supported. Loose, sloppy and inadequately supported raceways will not be acceptable. Supports shall be installed at intervals not greater than those set forth under Article 300 of N.E.C., unless shorter intervals are otherwise indicated, or unless conditions require shorter intervals of supports.
- B. Surface mounted runs of conduit on concrete or masonry surfaces shall be supported off the surface by means of aluminum slotted channels and conduit clamps. Attach each slotted channel support to concrete surface by means of two (2) 1/4" diameter stainless steel bolts into drilled expansion shields. Coat surface contacting concrete or masonry with zinc chromate.
- C. Conduit runs that are installed along metallic structures shall be supported by means of beam clamps or other methods as may be indicated. Coat each beam clamp with PVC prior to installation.
- D. Below-grade conduits shall be supported with plastic saddles.

3.4 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.5 CLEANING

- A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

END OF SECTION

SECTION 26 05 33

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. This Section includes electrical identification materials and devices required to comply with ANSI C2, NFPA 70, OSHA standards, and authorities having jurisdiction.

1.3 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Schedule of Nomenclature: An index of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with ANSI A13.1 and NFPA 70 for color-coding.

PART 2 - PRODUCTS

2.1 LABELS

- A. Colored banding tape shall be 5 mil stretchable vinyl with permanent solid color. Color shall be as herein after specified. Tape shall be Plymouth "Slipknot 45", 3M Scotch #35, or equal.
- B. Numbered wire marking labels shall be colored vinyl markers, T&B, Brady, or equal. With clear heat shrinking tubing placed over the marking labels.
- C. Cable identification labels shall be water resistant polyester with blank write-on space, T&B, Brady or equal. For use in handholds, manholes and boxes.
- D. Underground-Conduit Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape.
 - 1. Not less than 6 inches wide by 4 mils thick

2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend indicating type of underground line.

2.2 NAMEPLATES AND SIGNS

- A. Safety Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145.
- B. Engraved Plastic Nameplates and Signs: Engraving stock, melamine plastic laminate, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.
 1. Engraved legend with black letters on white face.
 2. Punched or drilled for mechanical fasteners.
- C. Baked-Enamel Signs for Interior Use: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for the application. 1/4-inch grommets in corners for mounting.
- D. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for the application. 1/4-inch grommets in corners for mounting.
- E. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32, stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Phase label black pigmented power wires with color banding tape. Color of tape applies shall be that specified below:

CONDUCTOR	120/240V SYSTEMS	480V SYSTEMS
Phase A	Black	Purple
Phase B	Red	Brown
Phase C	Blue	Yellow
Neutral	White	Gray
Equipment Ground	Green	Green

- B. Numbered labels shall be installed to identify circuit numbers from panel boards. Install labels on each wire in each panel board, junction, pullbox, and device.
- C. Label each wiring run with write-on waterproof labels inside each motor control center and in service switchboard. Install write-on label ties around wire group at conduit entrance and write-on label the wire size, and service.
- D. Install numbered marking on each control wiring termination at each terminal strip and at each device. Do this in motor control center, terminal cabinets, safety switches, remote controllers,

pilot operators, and instrumentation equipment. Number selected shall correspond to number on terminal strip.

- E. Phase bank each power wire and cable with colored banding tape. Do this at each termination
- F. Apply numbered wire marking labels to control wires; power wiring in Panelboards, pull and junction boxes, and at outlets to identify circuit numbers. Each control wire shall be labeled at each connection.
- G. Apply write-on identification labels to wiring sets in each hand-hole to identify function. Use waterproof labels.
- H. Apply write-on identification labels to empty conduits to identify each with information as to terminus of other end and also trade size of conduit.
- I. Install micarta nameplates with engraving to identify function and/or load served for the following:
 - 1. Starters
 - 2. Overcurrent Devices
 - 3. Safety Switches
 - 4. Instruments
 - 5. Control Panels
 - 6. Motor Control Centers
 - 7. Panel Boards
 - 8. Switchgear and Switchboards

Micarta nameplates shall be attached with stainless steel screws, use two(2) per each nameplate.

Submit for review a schedule for engraving along with size for each proposed micarta nameplate. Do not fabricate nameplate until review has been completed.

- J. Type circuit directory information on circuit directory cards on all panelboards.

END OF SECTION

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SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. This Section includes receptacles, connectors, switches, and finish plates.

1.3 DEFINITIONS

- A. GFI: Ground-fault circuit interrupter.
- B. TVSS: Transient voltage surge suppressor.

1.4 SUBMITTALS

- A. Product Data: For each product specified.
- B. Shop Drawings: Legends for receptacles and switch plates.

1.5 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.
- B. Comply with NEMA WD 1.
- C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 WIRING DEVICES

- A. All wiring devices shall be specification grade and shall meet NEMA WD1 requirements. Furnish following types unless otherwise indicated.
- B. Two-pole, 3-wire grounding, 15A/125V, NEMA 5-15R duplex receptacle shall be Arrow-Hart # 5662-S, Hubbel #5262, or equal.
- C. Two-pole 3-wire grounding, 20A/125V, NEMA 5-20R duplex receptacle shall be Arrow-Hart#5739-S, Hubbel #5362, or equal.

- D. GFI receptacle shall be duplex receptacle in a duplex body containing reset and test push-buttons. Furnish Square D "GFSR", or equal.
- E. Two-pole, 3-wire grounding, #20A/250V NEMA 6-20R single receptacle shall be Arrow-Hart # 5861, Hubbel # 5461, or equal.
- F. Single-pole, single throw 20A toggle switch shall be Arrow-Hart # 1791, Hubbel #1221, or equal.
- G. Single-pole, double throw (three-way) 20A toggle switch shall be Arrow-Hart #1994, Hubbel # 1224, or equal.
- H. Double-pole, single-throw 29A toggle switch shall be Arrow-Hart #1992, Hubbel # 1222, or equal.
- I. Double-pole, single-throw 29A toggle switch shall be Arrow-Hart# 1992, Hubbell #1222, or Equal.
- J. Single-pole, double-throw, momentary/centeroff, 20A toggle switch shall be Arrow-Hart # 1995, Hubbell #1556, or equal.
- K. Door Switch, single-throw pressure sensitive shall be Pass & Seymour #1205, or equal.

2.2 FACE PLATES

- A. Plant receptacle covers shall be zinc die cast with vertical duplex cover. Furnish Crouse-Hinds #TP7199 or approved equal.
- B. Plant switch covers shall be zinc die cast vertical opening cover. Furnish Crouse-Hinds #TP7214 or approved equal.
- C. Office areas receptacle and switch covers shall be nylon ivory colored with attachment screws painted to match cover. Furnish Leviton or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install devices and assemblies plumb and secure.
- B. Install wall plates when painting is complete.
- C. Install wall dimmers to achieve indicated rating after derating for ganging as instructed by manufacturer.
- D. Do not share neutral conductor on load side of dimmers.

- E. Arrangement of Devices: Unless otherwise indicated mount with long dimension vertical, and grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.2 CONNECTIONS

- A. Connect wiring device grounding terminal to branch-circuit equipment grounding conductor.
- B. Isolated-Ground Receptacles: Connect to isolated-ground conductor routed to designated isolated equipment ground terminal of electrical system.
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturers torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

- A. Test wiring devices for proper polarity and ground continuity. Operate each device at least six times.
- B. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.
- C. Replace damaged or defective components.

3.4 CLEANING

- A. Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION

APPENDIX

GEOTECHNICAL REPORT

Geotechnical Engineering Report

**New Golf Cart Barn Project
Starcke Park Golf Course
Seguin, Texas**

April 21, 2023

TRC Project No. 498355

Prepared For:

CITY OF SEGUIN
DEVELOPMENT SERVICES CENTER
108 E. Mountain Street
Seguin, Texas 78155

Prepared By:

TRC Engineers, Inc.
505 E. Huntland Drive, Suite 250
Austin, Texas 78752

Texas Registered Engineering Firm:

Firm # 8632





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Suite 250
Austin, TX 78752

T 512.329.6080
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April 21, 2023

Mr. Bruce Allen
City of Seguin
650 River Drive West
Seguin, Texas 78155

Re: GEOTECHNICAL ENGINEERING REPORT
New Golf Cart Barn Project
Seguin, Guadalupe County, Texas
TRC Project No. 450711

Dear Mr. Allen:

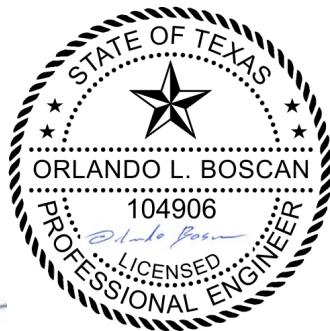
TRC Engineers, Inc. (TRC) is pleased to present this Geotechnical Engineering Report for the above-referenced improvements project. The attached report describes our exploration procedures, summarizes existing subsurface conditions, presents results of our laboratory testing, and provides our geotechnical findings and recommendations as relates to the referenced project.

TRC appreciates this opportunity to provide engineering services and looks forward to working with City of Seguin on future projects. Please contact us if you have questions regarding the contents of this report or if you require additional information.

Sincerely,

TRC Engineers, Inc.

Orlando L. Boscan, PE (TX)
Senior Geotechnical Engineer
Office Practice Leader



Shawn D. McGee, PE*
Senior Geotechnical Engineer
* (AR, IN, MI, OH, PA, TN & WV)

cc: Mr. Phillip M. Mullan, PE, TRC

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APPENDICES

- Appendix A Site/Boring Location Map
- Appendix B Boring Logs
- Appendix C Laboratory Testing Results

1.0 Introduction

1.1 Project Description

City of Seguin (hereafter referred to as Client) retained TRC to provide geotechnical services for the development of engineering recommendations for a new golf cart barn building project (herein referred to as the “Project”) in Seguin, Guadalupe County, Texas.

The project site is located approximately 450 feet south of the existing Starcke Park Golf Course clubhouse located at 650 River Drive West in Seguin, Texas. It is our understanding the Project consists of a new single-story, lightly loaded slab-on-grade metal building. The structure will be approximately 80 ft x 60 ft and will have no basements or other below grade portions of the building. Specific information regarding structural loads, anticipated foundation types, and/or a grading plan is not known at the time of this report. It is understood the site is flat and will require minimal grading to achieve final building floor elevation (up to one foot above existing grade). The site is currently an asphalt parking lot.

If the details of the proposed construction and/or improvements differ from that described herein, TRC should be contacted to evaluate the potential impact on the recommendations provided in this report.

1.2 Purpose and Scope

The scope of services presented in this report has been based upon the information provided by the Client. To accomplish its intended purpose, this work has been conducted in the following phases:

1. Drilling of test borings to determine the general subsurface conditions to the depths of the test borings and to obtain samples for laboratory testing;
2. Performing laboratory tests on selected samples to determine pertinent engineering properties of the subsurface materials; and,
3. Performing engineering analyses, using the field and laboratory data to develop geotechnical-related information to be used by TRC’s Design Team for the design and construction of the proposed golf cart barn structure.

Exploration for underlying geologic conditions or evaluation of potential geologic hazards, such as salt contamination, karst conditions, sinkholes, solution cavities, surface or underground mines, seismic activity, faulting, growth faulting, ground heaving/subsidence associated with hydrocarbon production, and/or ground subsidence/cracking potential due to groundwater withdrawal/injection well activities, were beyond the scope of this report.

2.0 Field Exploration and Testing

2.1 Field Exploration

The field exploration for this project was conducted at the Site on July 25, 2022. TRC retained the services of an independent local drilling contractor, Envirocore of Corpus Christi, Texas, to drill the test borings and collect samples for laboratory testing. Subsurface conditions beneath the Site were explored by advancing two test borings (labeled B-1 and B-2) each to a depth of

approximately 30 feet below existing ground surface (bgs). The test boring locations and depths were established by TRC based on the proposed site development layout. The drilling subcontractor located the test borings in the field by reference from existing site features and by using conventional hand measuring methods. The accuracy of the test boring locations should only be considered to the level implied by the method used to determine them. Ground surface elevations at the test boring locations were neither surveyed nor furnished by the Client. The approximate test boring locations are shown on the Site/Boring Location Plan included in Appendix A.

A truck-mounted rotary drilling rig, using solid flight augers, was used to advance the test borings. Soil sampling was conducted in general accordance with the American Society for Testing and Materials (ASTM) D1586, entitled "Standard Method for Penetration Test and Split-Barrel Sampling of Soils". Soil samples were obtained using the Standard Penetration Test (SPT) split-barrel sampler. Soil samples were sealed in plastic bags to minimize loss of moisture. The samples were transported to the laboratory for visual observations and assignment of laboratory testing.

Test borings were logged by a representative of the subcontract driller. The Field Boring Logs were reviewed, and the samples observed by a geotechnical engineer from TRC's geotechnical team. TRC edited the driller's logs as needed using the results of the sample observations and tests performed on selected soil samples from the test borings that represent foundation and slabs subgrade materials. The Boring Logs are included in Appendix B and represent the geotechnical engineer's interpretations of the subsurface conditions based on the driller's field observations, visual-manual observation of samples and laboratory test results. Lines designating the interface between various strata on the Boring Logs represent the approximate positions of the interface. The in-situ transition between strata may be gradual.

Groundwater conditions recorded on the Boring Logs are based on the field observations at the time the field exploration was conducted. Upon completion of the drilling operations, boreholes were generally backfilled with the auger cuttings. In borings drilled through pavement, a cold asphalt patch was placed to cap the boring backfill.

2.2 Laboratory Testing

The samples were transported to the laboratory where the Field Boring Logs were reviewed and edited by a geotechnical engineer from TRC's geotechnical team. Soil samples were then selected for geotechnical laboratory testing. Testing included grain-size distribution, Atterberg limits, and moisture content tests on a limited number of soil samples representative of the foundation soils. All geotechnical testing was conducted in general accordance with the applicable ASTM Standards. The results of the laboratory tests are provided on the appropriate Boring Logs, which are included in Appendix B. Soil descriptions recorded on the Boring Logs result from field data as well as from laboratory observations and/or test data.

Copies of the laboratory testing reports are provided in Appendix C.

Samples will be retained for 30 days from the date of this report, after which time they will be discarded unless Client requests otherwise.

3.0 Subsurface Conditions

3.1 Subsurface Conditions

Approximately 2 inches of asphalt pavement were observed at the ground surface during the field exploration. In addition, the subsurface materials encountered in the borings generally consist of native silty sand soils from below the pavement to a depth of 30 feet, the maximum depth explored. The encountered native soils are generally brown to light brown and fine grained. The results of Standard Penetration Testing (SPT) yielded “N” values ranging from 5 to 38 blows per foot (bpf), indicating loose to dense relative densities. Furthermore, the sands were observed to be loose in the upper 23 feet, and medium dense to dense below a depth of approximately 23 feet. Grain-size distribution testing yielded percentage of fines (material finer than a No. 200 Sieve) values ranging from 16 to 45 percent.

Uncontrolled fill soils were not identified in the borings drilled during our field activities. However, it is possible that loose fill, buried debris, or other deleterious materials could be encountered intermediate of the test boring locations. Based on this, it is recommended that any existing fill encountered prior to or during construction be evaluated and any soft/loose or otherwise unsuitable areas be remediated at the direction of the Geotechnical Engineer.

3.2 Groundwater Observations

During drilling operations, free water was not observed in the test borings for this study. It should be noted the presence, depth, and quantity of groundwater seepage may fluctuate based on variations in seasonal rainfall, climatic conditions, site surface runoff characteristics, permeability of on-site soils, continuity of pervious materials, irrigation practices, and other factors. As such, the observations presented herein do not constitute a long-term groundwater study nor was such an evaluation authorized as a part of the scope of this project. Any changes noted in groundwater levels during the construction process may require a review of the recommendations presented in this report.

3.3 Expansive Soil Movements

To estimate the potential vertical soil movement for this Site, we used the Texas Department of Transportation Potential Vertical Rise (PVR) method (TEX-124-E). Also, the results of the laboratory tests performed on samples obtained from the Site, engineering judgment, and experience have been considered. For a full seasonal cycle, ***the estimated soil PVR is on the order of less than 1 inch at the ground surface within the proposed project areas.***

The aforementioned estimated soil movement is based on the observed subsurface conditions, laboratory testing results and anticipated seasonal moisture fluctuations. Actual soil movements will depend on the subsurface moisture fluctuations over the life of the structure and the overlying structural loading conditions. Soil movements may be less than those estimated if moisture variations are minimized after construction or if the structural loading conditions assumed in this report are different. However, soil movements, significantly larger than estimated, could occur due to inadequate site grading, poor drainage, ponding of rainfall, leaky water or sprinkler lines, or other increases in moisture conditions.

The estimated PVR is based on the existing grades (at time of our field exploration) and conditions observed in the test borings drilled for this project. PVR calculations may differ at other locations or



times. Site grading will alter the estimated PVR movements. **Proper construction practices, such as those outlined in this report, will tend to reduce potential movements.**

4.0 Analysis and Recommendations

4.1 Seismic Considerations

Part of the International Building Code (IBC) procedure to evaluate seismic forces requires the evaluation of the Seismic Site Class, which categorizes the site based upon the characteristics of the subsurface profile within the upper 100 feet of the ground surface. To define the Seismic Site Class for this project, we have interpreted the results of our soil test borings drilled within the project site and estimated appropriate soil properties below the base of the test borings to a depth of 100 feet, as permitted by the IBC. Based upon our evaluation, it is our opinion that the subsurface conditions within the Site are generally consistent with the characteristics of Site Class D as listed in Chapter 16, Section 1613.2.2 of the 2018 edition of the IBC and as defined in Table 20.3-1, Chapter 20 of ASCE 7.

4.2 Golf Cart Barn Foundations

Based on our review of the soil samples and test boring logs and our experience with the subsoils in this geologic setting, the site is suitable for foundation support and construction of the planned building on shallow foundations. Additionally, the existing silty sands are generally suitable for re-use in compacted backfills, however, they contain significant fine-grained portions and will be moisture sensitive. The following paragraphs present our recommendation for the design and construction of shallow foundations.

Shallow Foundations – Following site preparation as recommended, the anticipated relatively light building loads may be supported on a shallow foundation system. Considering the encountered near-surface loose silty sands, we recommend the overexcavation, reworking, and compaction at least 2.5 feet of the in-situ sands beneath foundations. This soil improvement should help to prevent excessive settlements within the loose sands and to improve bearing capacity of these soils. The recommended soil improvement should extend laterally at least 5 feet beyond the perimeter of shallow foundations. The following table presents our recommended design parameters lightly loaded foundations bearing on reworked and compacted in-situ sands.

Table 1: Shallow Foundations Design Parameters

Design Parameter	Recommendation
Maximum Allowable Bearing Capacity	2,000 psf (for footing foundations bearing on at least 2.5 feet of improved native soils)
Minimum Embedment Depth	2 feet below exterior grade
Bearing Material ¹	Reworked and compacted in-situ sands
Minimum Footing Width	Columns: 30 inches Continuous: 18 inches
Coefficient of Sliding Friction	Granular Soils: 0.35
Total Estimated Settlement ²	Less than 1 inch
Differential Settlement ²	Typically, about 1/2 of total settlement

1. Foundations should not be placed on existing unimproved sandy soils.

2. Applicable to foundations with a maximum width of 8 feet.

The Geotechnical Engineer should evaluate each footing excavation prior to steel reinforcement or concrete placement. Conditions that are observed should be compared to the test boring data and design requirements. If unsuitable bearing material is encountered, it should be excavated and replaced or otherwise treated as recommended by the Geotechnical Engineer.

Final site grading plans were not provided to TRC; however, for purposes of this project we anticipate that minimal (less than 1-foot) grading will be required to achieve final grades. The general arrangement of the proposed development is shown on the Site/Boring Location Plan included in the Appendix.

TRC has developed geotechnical-related information to be used by others in the building foundations on the basis of the previously described project characteristics and subsurface conditions observed in the test borings drilled during the field exploration and as previously discussed in this report. After final design plans and specifications are available, a general review by TRC is recommended as a means to check that the evaluations made in preparation of this report are correct, and that earthwork, foundation, and subgrade preparation recommendations are properly interpreted and implemented.

Floor Slabs – A “conventional” slab-on-grade, designed for a subgrade modulus of 95 pounds per cubic inch (pci), may be utilized for the proposed building floor, provided the site subgrade is prepared as recommended. This includes excavating at least 12 inches of the existing subgrade and reworking and compacting the native sands. Alternatively, select fill may be used to replace loose soils beneath slabs.

In general, the slab-on-grade subgrade is often disturbed by weather, foundation and utility line installation, and other construction activities between completion of grading and slab construction. For this reason, the Geotechnical Engineer should evaluate the subgrade shortly prior to placing the concrete. Areas judged by the Geotechnical Engineer, or his representative, to be unstable should be re-compacted or treated as recommended by the Geotechnical Engineer.

4.2 Site Preparation

Before proceeding with construction, any old foundations, existing pavements, base materials, buried structures, construction debris, vegetation, root systems, topsoil, refuse, sediment in low-lying areas and other deleterious non-soil materials should be stripped/removed from proposed construction areas. The actual stripping depth should be based on field observations with particular attention given to old drainage areas, uneven topography, unexpected fill material areas, and excessively wet soils (if present). The stripped areas should be observed to determine if additional excavation is required to remove weak or otherwise objectionable materials that would adversely affect foundation installations or fill placement. The stripping should extend at least 5 feet beyond the limits of construction areas.

The on-site soils are moisture sensitive and will likely become unstable when saturated (wet). Generally, more undercutting and delays due to the need for extended drying times can be expected if the grading is performed in the seasonally wet period of the year.

After site stripping/removal, the exposed subgrade should be proofrolled to detect soft spots, which, if they exist should be reworked. Proofrolling should be performed using a heavy pneumatic tired roller, loaded dump truck, or similar piece of equipment weighing

approximately 25 tons. The proofrolling operations shall be observed by a geotechnical engineer or his/her representative. The subgrade shall be firm and able to support the construction equipment without displacement. Soft or yielding subgrade shall be corrected and made stable before construction proceeds. The depth and extent of the undercut operations at the site should be established by a qualified geotechnical engineer during earthwork construction activities based on the results of the proofroll.

4.3 Fill Types and Compaction

The project will include the placement and compaction of a variety of materials. Typical material requirements and compaction specifications for various materials are provided below.

- **On-site native sandy soils (below foundations and slabs).** Compact to at least 98 percent of maximum laboratory dry density at a -2 to +2 percent of the optimum moisture content as determined by Standard Proctor method (ASTM D 698).
- **On-site native sandy soils (areas subject to surface loads, but not below structure, or used as backfill)** - Compact to at least 95 percent of maximum laboratory dry density at -2 to +2 percentage points of the optimum moisture content as determined by ASTM D 698.
- **Select Fill** - Non-expansive select fill should consist of a sandy clay or clayey sand having a plasticity index between 5 and 15, a liquid limit less than 36, no particles greater than 3 inches, a maximum of 70 percent passing #200 sieve and be free of roots or any other organic debris. Organic content should be less than 2 percent. The select fill material used at this site should be compacted to at least 95 percent of maximum laboratory dry density within plus or minus 2 percentage points of optimum moisture content (-2 to +2) as determined by the Standard Proctor method (ASTM D 698). TRC recommends that any grade-raise fill placed beneath the proposed building area meet the requirements of non-expansive select fill.

The moisture content of the subgrade must be maintained until placement of the first fill lift. Fill material, whether non-expansive select fill or moisture conditioned on site soils, should be placed in horizontal loose lifts not exceeding 8 inches in uncompacted thickness. The fill material should be uniform with respect to material type and moisture content. Clods and chunks of material greater than 3 inches should be broken and the fill material mixed as necessary, so that a material of uniform moisture and density is obtained for each lift. Water required to bring the fill material to the proper moisture content should be applied evenly through each layer.

Each lift should be compacted, tested, and approved before another lift is added. As a guide, one field density test per lift for each 5,000 square feet of compacted area is recommended. For small areas or critical areas, the frequency of testing may need to be increased to one test per 2,500 square feet. A minimum of two tests per lift should be required. The purpose of the field density tests is to provide some indication that uniform and adequate compaction and moisture control are being achieved. The actual quality of the fill, as compacted, should be the responsibility of the contractor and satisfactory results from the tests should not be considered as a guarantee of the quality of the contractor's work.

Backfill placed within utility trenches that project areas should be properly compacted. Numerous parking, drive, sidewalk, and landscape areas for other projects typically experience settlement due to soft backfill within utility trenches. Backfill placed in utility trenches or other excavated areas

within the project areas should be placed in lifts, compacted, and tested in accordance with these earthwork recommendations. Trenches should be opened a sufficient width to safely allow compaction equipment access to the backfill and to safely allow for confirmation testing to occur. Backfill should be placed in horizontal lifts, and if the trench is over 5 feet deep, a trench box should be used or the side slopes benched prior to placing the backfill.

4.4 Site Excavation Characteristics

Finished grades at the Site have not been provided. We present the following general comments regarding our opinion of the excavation conditions for the designers' information with the understanding that they are opinions based on information from widely spaced test borings. More accurate information regarding the excavation conditions should be evaluated by contractors or other interested parties from test excavations using the equipment that will be used during construction.

Borings drilled as part of our field exploration were advanced using continuous augers. Drilling effort was relatively easy to moderate through the native in-situ soils. Based on this, we consider that conventional heavy-duty earthmoving equipment should be capable of excavating the in-situ soils. However, if the weathered rock is anticipated to be excavated, earthmoving equipment appropriate for hard rock excavation may be required. The contractor is responsible for evaluating the excavation characteristics of the soil. Areas of lower density, lower blow count soils, or excavations below groundwater levels will likely experience sloughing, and the use of temporary shoring will likely be required to complete excavations through the lower density or saturated soils. Planning and budgeting should consider these items and provide for a contingency.

In accordance with Texas State law, the design and maintenance of all excavations and excavation retention systems is the sole responsibility of the Contractor. Attention is drawn to OSHA Standards 29 CFR - 1926 Subpart P for guidance in the design of such systems.

Stockpiles should be located well away from the edge of excavations, and their heights should be controlled so they do not excessively surcharge sides of the excavation. Surface drainage should be carefully controlled to prevent flow of water into the excavations. Construction slopes should be closely observed for signs of mass movement, including tension cracks near the crest or bulging at the toe. If potential stability problems are observed, a geotechnical engineer should be contacted immediately. Shoring, bracing, or underpinning may be required to provide structural stability and to protect personnel working within the excavation. Shoring, bracing, or underpinning required for the project (if any) should be designed by a professional engineer registered in the State of Texas.

4.5 Temporary Excavations

The sidewalls of confined excavations deeper than 4 ft must be sloped, benched or adequately shored per OSHA 29 CFR 1926 regulations. The onsite surficial fill soils are classified as Type C soils according to OSHA 29 CFR 1926. Open excavations in the existing surficial soils should not be steeper than 1.5H:1V if dry and 2H:1V if submerged or where considerable wetness is observed. Alternately, trench boxes and/or sheeting could be used in conjunction with open cut slopes to permit access to confined excavations.

5.0 Limitations

This work has been performed in accordance with our authorized scope of work and in accordance with generally accepted practice in the fields of geotechnical and foundation engineering. This warranty is in lieu of all other warranties either expressed or implied. Our conclusions and recommendations are based on the data revealed by this exploration. We are not responsible for any conclusions or opinions drawn from the data included herein, other than those specifically stated, nor are the recommendations presented in this report intended for direct use as construction specifications. This report is intended for use with regard to the specific project discussed herein and any changes in loads, structures, or locations should be brought to our attention so that we may determine how they may affect our conclusions. An attempt has been made to provide for normal contingencies, but the possibility remains that unexpected conditions may be encountered during construction. If this should occur, or if additional or contradictory data are revealed in the future, we should be notified so that modifications to this report can be made, if necessary. If we do not review the relevant construction documents and witness the relevant construction operations, then we cannot be responsible for any problem, which may arise, from the misunderstanding or misinterpretation of this report or failure to comply with our recommendations.

Appendix A: Site/Boring Location Map



Notes:

- Not to scale.
- Boring locations are approximate.

Project No.	498355
Date:	April 21, 2023
For:	City of Seguin



BORING LOCATION PLAN

NEW GOLF CART BARN PROJECT
STARCKE PARK GOLF COURSE
SEGUIN, TEXAS

FIGURE

1

Appendix B: Boring Logs



TEST BORING LOG

PROJECT: GOLF CART BARN

LOCATION: SEGUIN, TX

BORING **B-1**

G.S. ELEV.

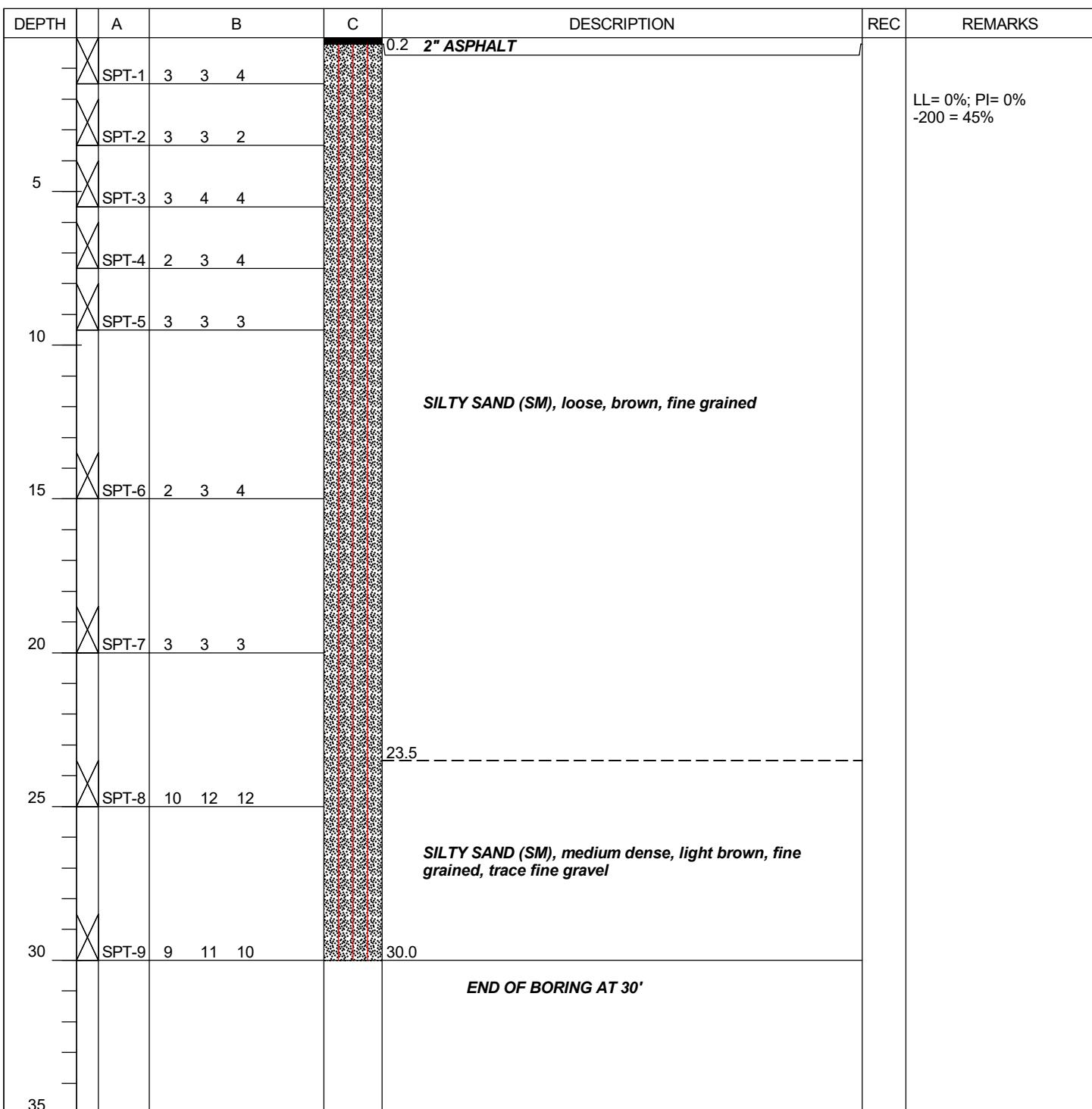
FILE 498355

SHEET 1 OF 1

GROUNDWATER DATA			
FIRST ENCOUNTERED	N/A		
DEPTH	HOUR	DATE	ELAPSED TIME

METHOD OF ADVANCING BOREHOLE			
b	FROM	0.0 '	TO

DRILLER	ENVIROCORE
HELPER	
INSPECTOR	
DATE STARTED	07/25/2022
DATE COMPLETED	07/25/2022



Groundwater was not observed during drilling.

DRN. OLB

CKD.



TEST BORING LOG

PROJECT: GOLF CART BARN

LOCATION: SEGUIN, TX

BORING **B-2**

G.S. ELEV.

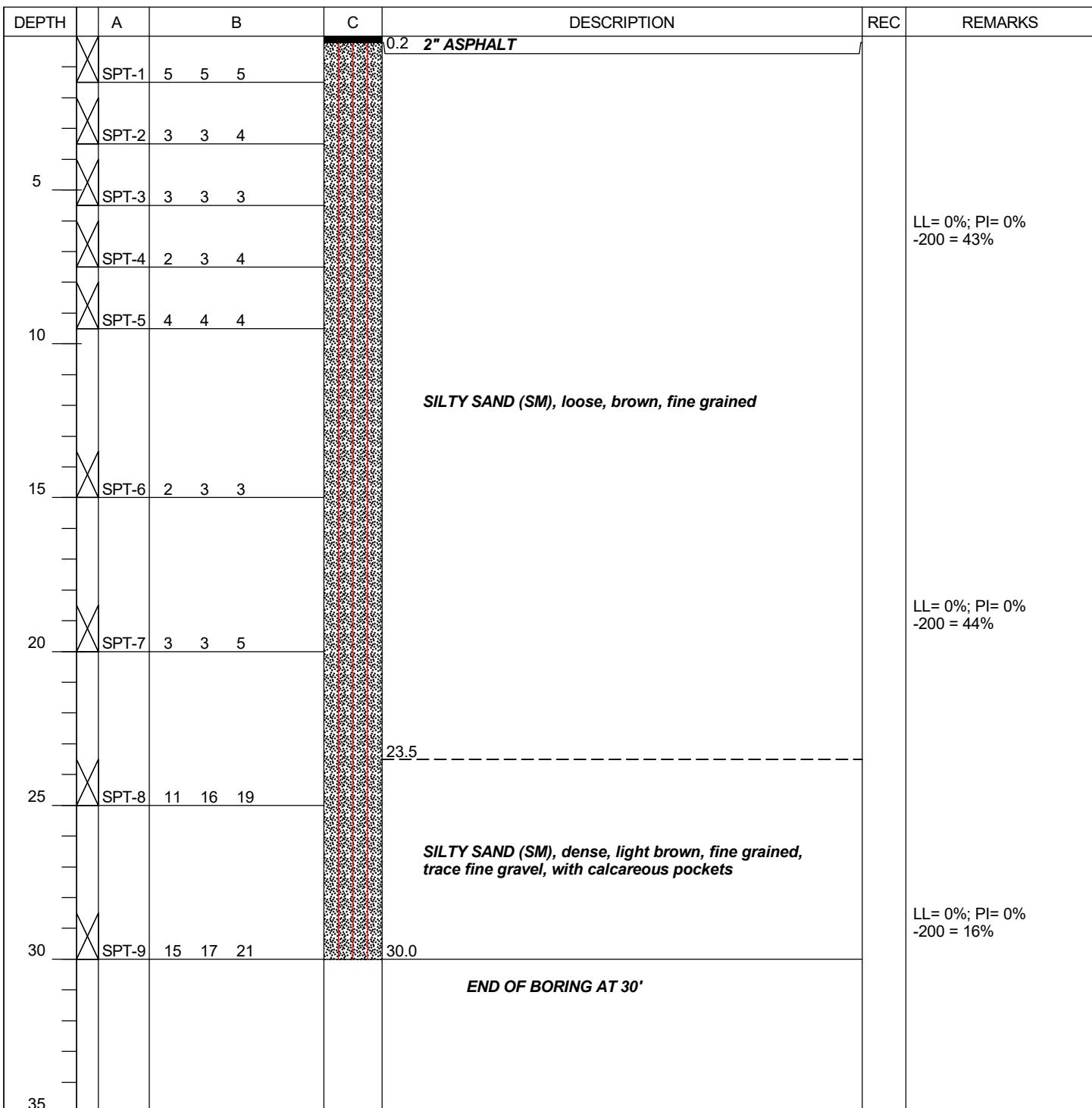
FILE 498355

SHEET 1 OF 1

GROUNDWATER DATA			
FIRST ENCOUNTERED	N/A		
DEPTH	HOUR	DATE	ELAPSED TIME

METHOD OF ADVANCING BOREHOLE			
b	FROM	0.0 '	TO
			30.0 '

DRILLER	ENVIROCORE
HELPER	
INSPECTOR	
DATE STARTED	07/25/2022
DATE COMPLETED	07/25/2022



Groundwater was not observed during drilling.

DRN. OLB

CKD.

KEY TO SYMBOLS

Symbol Description

Strata symbols



Asphalt



Poorly graded silty fine sand

Symbol Description

Misc. Symbols

Water table first encountered

Water table first reading after drilling

Water table second reading after drilling

Water table third reading after drilling

NR Not Recorded

MH Moh's Hardness

Soil Samplers



Standard Penetration Test

Lab Symbols

FINES = Fines %

LL = Liquid Limit %

PI = Plasticity Index %

U_c = Unconfined Compressive Strength

Notes:

COLUMN A) Soil sample number.

COLUMN B) FOR SOIL SAMPLE (ASTM D 1586): indicates number of blows obtained for each 6 ins. penetration of the standard split-barrel sampler. FOR ROCK CORING (ASTM D2113): indicates percent recovery (REC) per run and rock quality designation (RQD). RQD is the % of rock pieces that are 4 ins. or greater in length in a core run.

COLUMN C) Strata symbol as assigned by the geotechnical engineer.

DESCRIPTION) Description including color, texture and classification of subsurface material as applicable (see Descriptive Terms). Estimated depths to bottom of strata as interpolated from the borings are also shown.

DESCRIPTIVE TERMS: F = fine M = medium C = coarse NP = nonplastic LP = low plasticity

RELATIVE PROPORTIONS:

-Descriptive Term-	-Symbol-	-Est. Percentages-
Trace	TR	< 5
Few	-	5-10
Little	LT	15-25
Some	SM	30-45
Mostly	-	50-100

CORRELATIONS FOR RELATIVE DENSITY:

-Compactness-	-Relative Density-	-N (SPT) *-
Very Loose	< 0.15	< 4
Loose	0.15-0.35	4-10
Medium Dense	0.35-0.65	10-30
Dense	0.65-0.85	30-50
Very Dense	0.85-1.0	> 50

* Based on corrected N values.

REMARKS) Special conditions or test data as noted during investigation. Note that W.O.P. indicates water observation pipes.

* Free water level as noted may not be indicative of daily, seasonal, tidal, flood, and/or long term fluctuations.

Appendix C: Laboratory Testing Results



SUMMARY OF LABORATORY TEST DATA

Project Name: Golf Cart Barn
Seguin, TX
Client Name: City of Seguin
TRC Project #: 498355

SAMPLE IDENTIFICATION			Soil Group (USCS System)	Moisture Content (%)	GRAIN SIZE DISTRIBUTION				PLASTICITY			
Boring #	Sample #	Depth (ft)			Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)
B-1	S-2	2.0-4.0	SM	11.4	0.0	54.7	45.3	NP	NP	NP	-	
B-2	S-4	6.0-8.0	SM	9.6	0.3	56.6	43.1	NP	NP	NP	-	
B-2	S-7	18.5-20.0	SM	16.7	3.8	52.4	43.8	NP	NP	NP	-	
B-2	S-9	28.5-30.0	SM	2.7	27.3	56.6	16.1	NP	NP	NP	-	

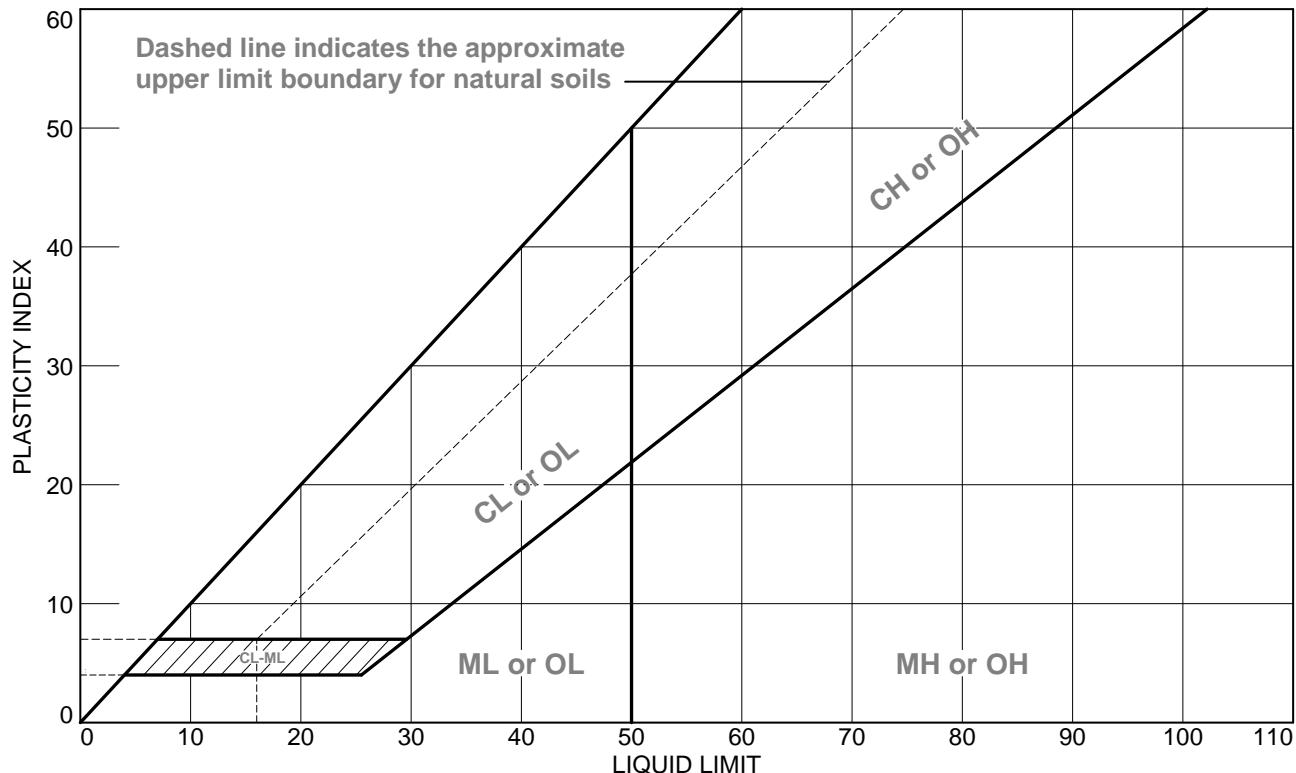
NP = NON-PLASTIC



TRC ENGINEERS, INC
NATURAL MOISTURE CONTENT

Boring #	Sample #	Depth (ft)	Natural Moisture Content			
			Wet Wt + Tare (g)	Dry Wt + Tare (g)	Tare (g)	% Moisture Content
B-1	S-1	0.0-2.0	444.35	412.84	156.85	12.3%
B-1	S-4	6.0-8.0	349.90	331.22	162.82	11.1%
B-2	S-5	8.0-10.0	363.91	341.89	151.29	11.6%

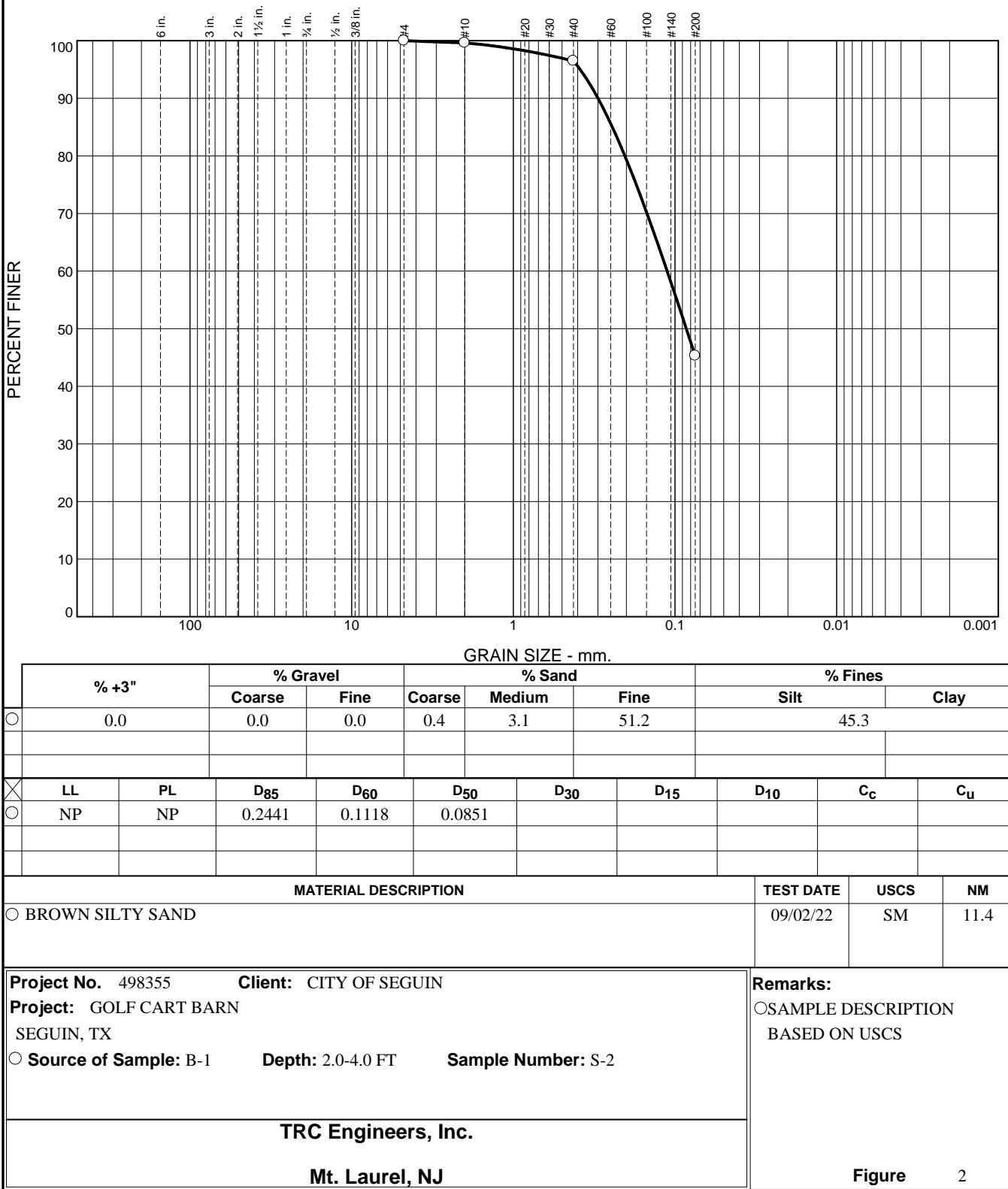
LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B-1	S-2	2.0-4.0 FT	11.4	NP	NP	NP	SM
■	B-2	S-4	6.0-8.0 FT	9.6	NP	NP	NP	SM
▲	B-2	S-7	18.5-20.0 FT	16.7	NP	NP	NP	SM
◆	B-2	S-9	28.5-30.0 FT	2.7	NP	NP	NP	SM

TRC Engineers, Inc. Mt. Laurel, NJ	Client: CITY OF SEGUIN Project: GOLF CART BARN SEGUIN, TX Project No.: 498355	Figure 1
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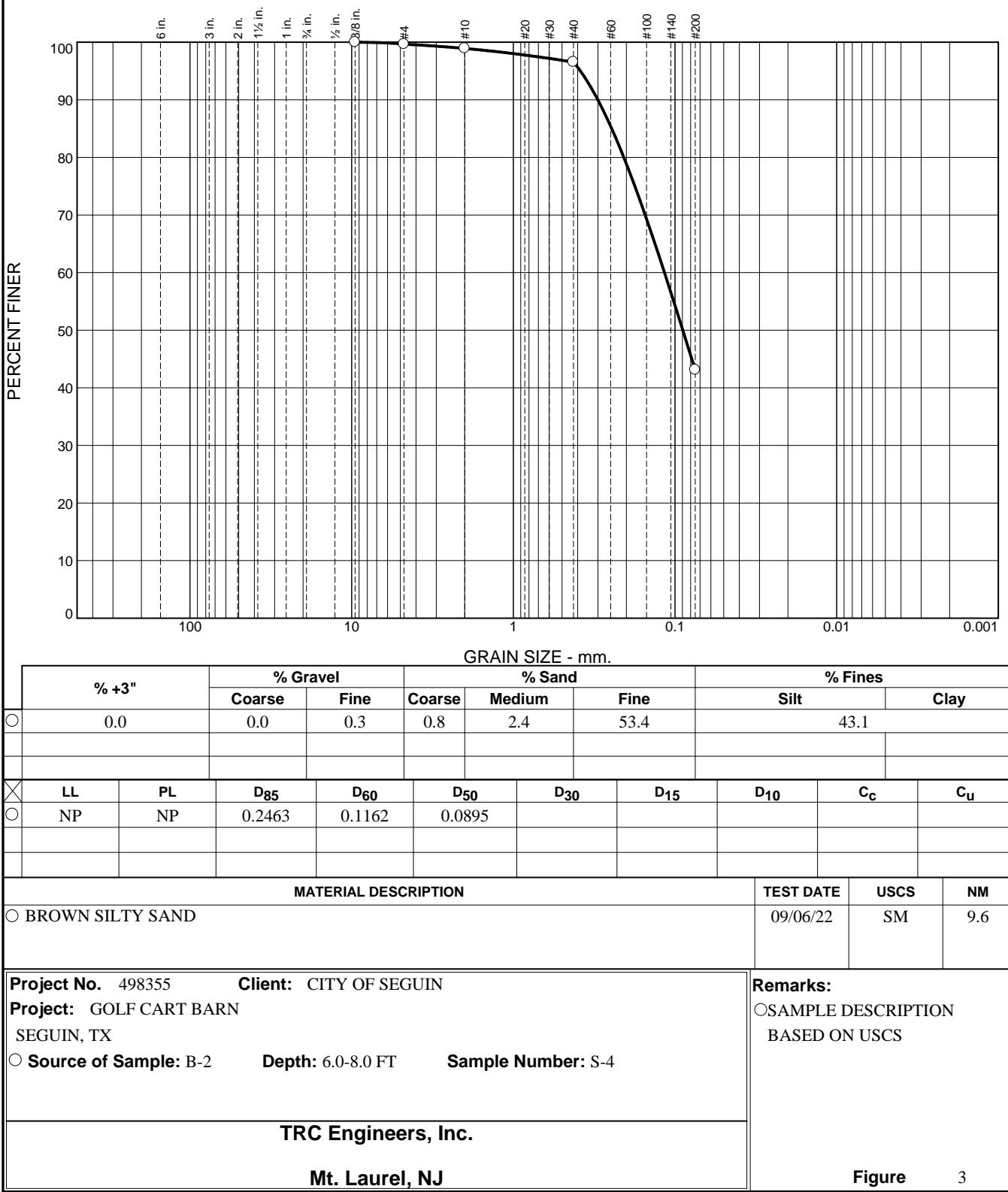
Particle Size Distribution Report



Tested By: JC 09/02/22

Checked By: OB 09/07/22

Particle Size Distribution Report



Tested By: JC 09/06/22

Checked By: OB 09/07/22

Particle Size Distribution Report

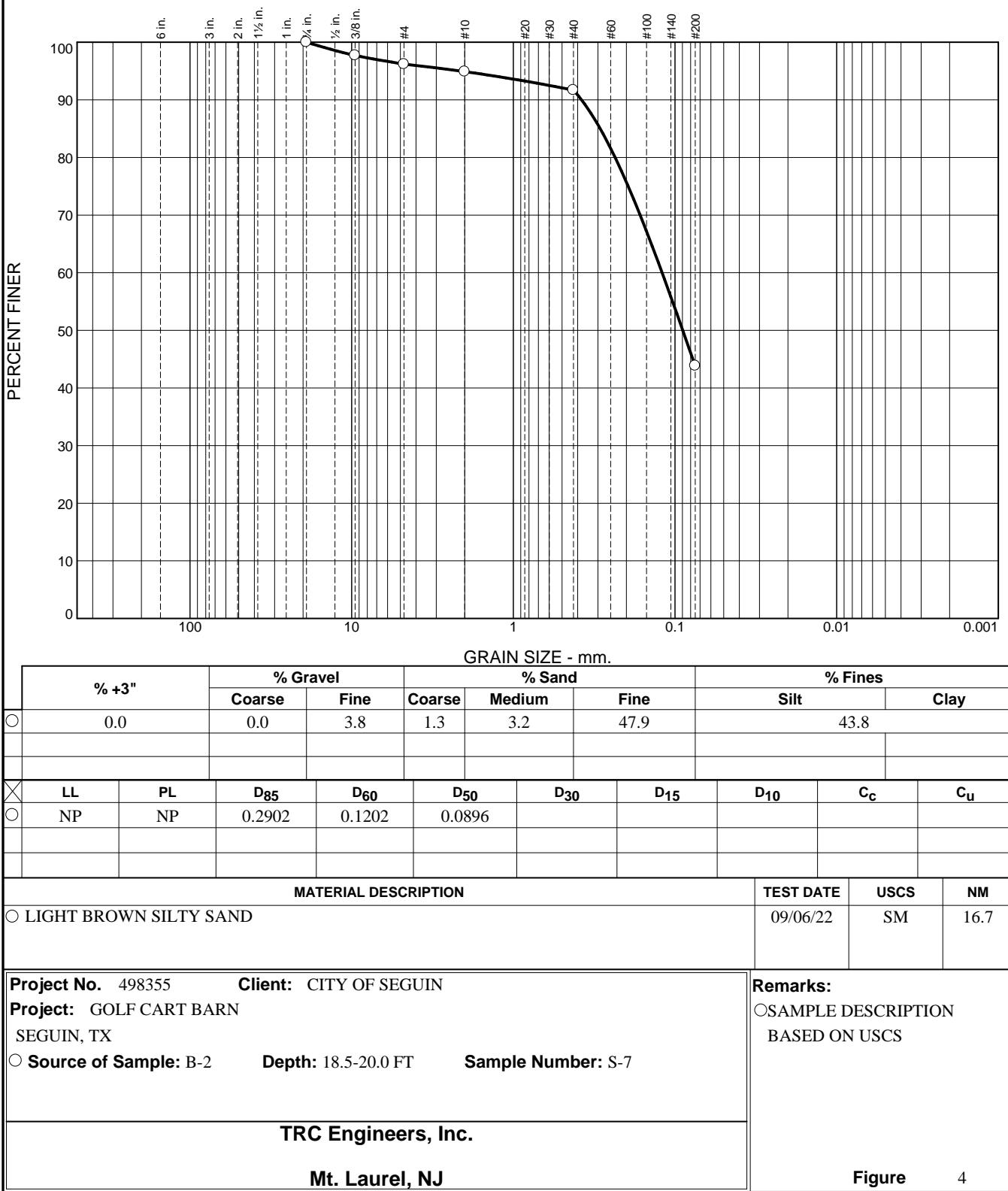


Figure 4

Tested By: JC 09/06/22 Checked By: OB 09/07/22

Particle Size Distribution Report

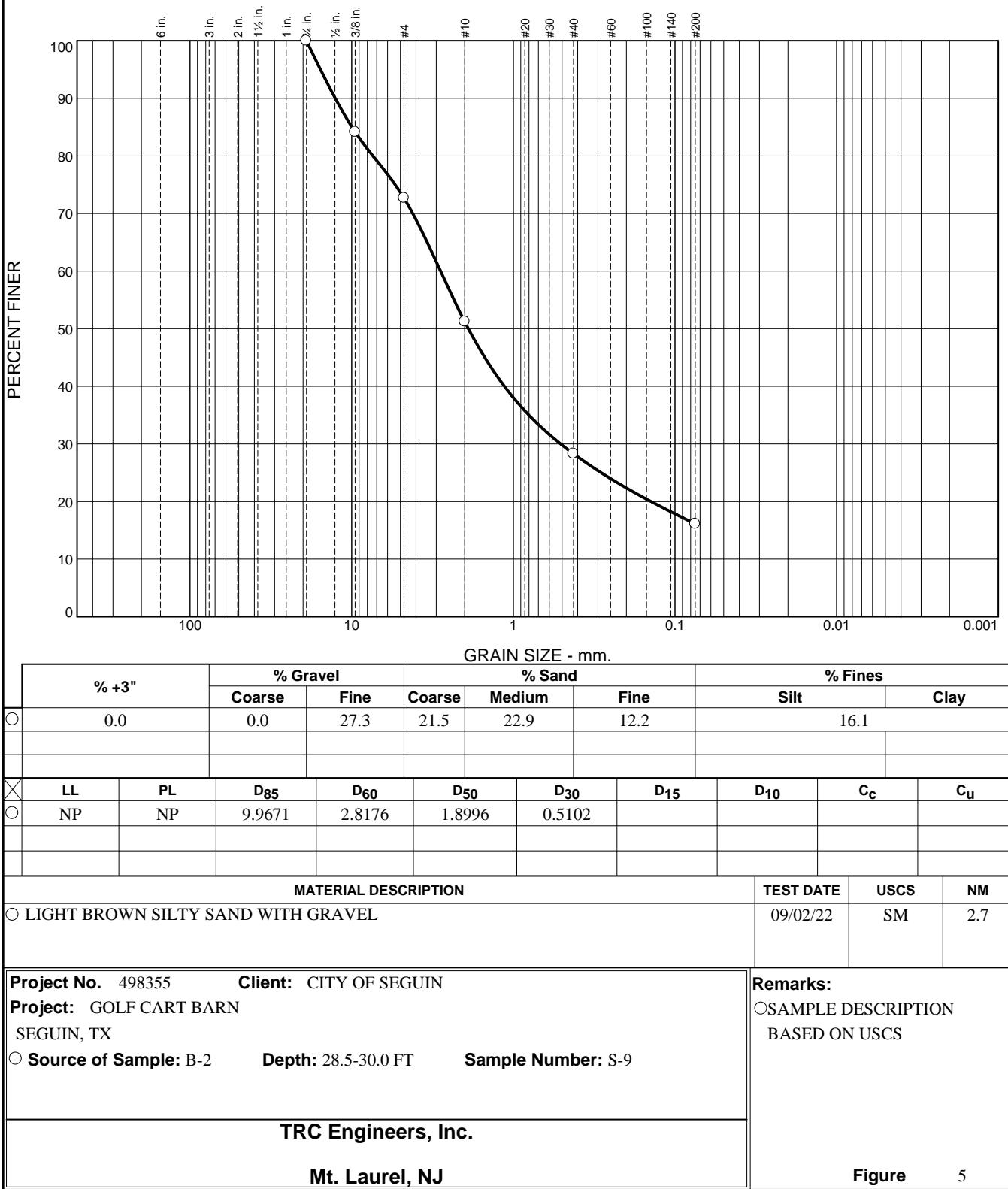


Figure 5

Tested By: TBT 09/02/22 Checked By: OB 09/07/22

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