CONTRACT DOCUMENTS
AND
SPECIFICATIONS

FOR

Western 2.5 Million Gallon
Elevated Water Storage Tank

BID # 48-11-B

Prepared by:

Kimley-Horn
and Associates, Inc.

Edith Marvin, P.E., TOWN ENGINEER

2/15/11
Cover Page
TOWN OF FLOWER MOUND

Western 2.5 Million Gallon Elevated Water Storage Tank

BID # 48-11-B

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NOTICE TO BIDDERS

1. Sealed Bids will be received in a sealed envelope addressed to the Town of Flower Mound, Purchasing Office, 2121 Cross Timbers Road, Flower Mound, TX 75028, until 2:00 o’clock p.m., on March 11, 2011 (“Closing Time”) for:

WESTERN 2.5 MILLION GALLON ELEVATED WATER STORAGE TANK

BID # 48-11-B

At the above time and place the bids will be publicly opened and read aloud and retained by the Purchasing Office for tabulation, verification and evaluation.

March 4, 2011 at 5:00pm will be the last day for bidder questions. After that day and time, no questions will be answered by the Engineer or Town.

2. The work is to include furnishing all labor, materials, and equipment, and performing all work necessary for the construction of a 2.5 million gallon elevated water storage tank and approximately 1,400 linear feet of water line, appurtenances and other improvements detailed in the construction plans and specifications.

3. Bids shall be submitted in sealed envelopes addressed to the Purchasing Manager upon the blank form of the bid form furnished, and shall be marked on the outside of the envelope with the following information: (a) the submitting firm’s name and (b) “BID # 48-11-B – Western 2.5 Million Gallon Elevated Water Storage Tank – DO NOT OPEN UNTIL 2:00 P.M. March 11, 2011.”

4. A Bid Bond in the form of a cashier’s check, a certified check, or an acceptable bidder’s bond made payable without conditions to the “Town of Flower Mound, Texas” in an amount of not less than five percent (5%) of the total amount of the bid submitted, must accompany each bid as a guarantee that if awarded the contract, the bidder will promptly enter into a contract and execute such bonds as are required and provide evidence of all required insurance coverage. All bidders’ security will be retained until a contract has been awarded and executed.

5. Plans and Specifications and Contract Documents may be examined without charge at the Engineering Services Office at 1001 Cross Timbers, Suite 2330, or the Town of Flower Mound at 2121 Cross Timbers Road.

6. Hard copies of the Plans and Specifications and Contract Documents may be purchased from the Town of Flower Mound at 2121 Cross Timbers Road Flower Mound, Texas 75028 in the amount of $100.00 for each set. THE PURCHASE PRICE IS NON-REFUNDABLE.

7. The Town reserves the right to accept the bid which, in its judgment is the lowest responsible bid; to reject any or all bids; and to waive irregularities or informalities in any bid received, deemed to be in the best interest of the Town. Conditional or qualified bids will not be accepted. In case of ambiguity or lack of clearness in stating prices in the bid, the Town reserves the right to accept the most advantageous construction thereof to the Town or to reject the bid. No officer or employee of the Town of Flower Mound shall have a financial interest, direct or indirect, in any contract with the Town of Flower
Mound. No bid may be withdrawn within one-hundred twenty (120) days after the Closing Time without prior written approval of the Purchasing Manager.

8. The date/time stamp located in the Town of Flower Mound Purchasing Division serves as the official time clock. The Town of Flower Mound cannot guarantee that any bids sent priority mail will be picked up from the post office by Town employees and delivered to the Purchasing Department by the Closing time. It is recommended that bid deliveries be made either in person or via an alternate delivery method ensuring delivery to the physical address. **Bidder bears full responsibility for ensuring the bid is delivered to the specified location by the Closing Time. The mere fact that a bid was dispatched will not be considered. Submissions received in the Purchasing Office after the Closing Time shall be returned unopened.**

9. A non-mandatory pre-bid meeting will be held at 2:00 P.M. on March 2, 2011. The meeting will be held at the Town of Flower Mound at 2121 Cross Timbers Road Flower Mound, Texas 75028.

TOWN OF FLOWER MOUND

By **January Cook, CPPO, CPPB**

Purchasing Manager

972-874-6009

Advertising Dates: **Denton Record Chronicle: February 20, 2011 & February 27, 2011**
INSTRUCTIONS TO BIDDERS

1. Each bid shall be legibly written or printed in ink, on the bid form provided in this bound copy of proposed Contract Documents. No alterations in bid, or in the printed forms thereof, by erasures, interpolations, or otherwise will be acceptable unless each such alteration is signed or initialed by the bidder, and the Town approves such alterations after the bid opening date; if initialed, the Town may require the bidder to identify any alterations so initialed. Any alterations made by a bidder, whether signed or initialed, may in the Town’s sole determination be deemed nonconforming and disqualify the bid from consideration. No alteration in any bid, or in the bid form on which it is submitted, shall be made by the person after the bid has been submitted to the Town by the bidder. Any and all addenda to the Contract Documents on which a bid is based, properly signed by the bidder, shall accompany the bid when submitted. The bidder may withdraw his bid any time prior to the bid opening date and time stipulated in the Notice to Bidders.

Each bid shall be submitted in a sealed envelope upon the blank form of the bid form furnished. Sealed envelopes shall be marked on the outside of the envelope with the following information: (a) the submitting firm’s name and (b) “BID # 48-11-B – Western 2.5 Million Gallon Elevated Water Storage Tank– DO NOT OPEN UNTIL 2:00 P.M. March 11, 2011.” The bid must be addressed to the Town of Flower Mound, 2121 Cross Timbers, Flower Mound, Texas 75028. Bids shall be delivered to:

Purchasing Office
Town of Flower Mound
2121 Cross Timbers
Flower Mound, Texas 75028

Bids shall be submitted to the Town on or before 2:00 pm, March 11, 2011, at which time bids will be publicly opened and read aloud.

All conforming bids will be tabulated for the Town Council by the Purchasing Office. In the event variations exist between unit prices and extensions or totals shown in the bid form, the unit prices shall govern. The Town Council will determine the lowest responsible bid, after considering the recommendations of the Town Engineer, and award the contract or reject any or all bids. The Flower Mound Town Council will authorize the Mayor to enter into a contract with said Contractor, provided the contract is awarded.

2. Each bid shall be accompanied by either a cashier’s check, a certified check, or an acceptable bid bond in an amount of not less than five percent (5%) of the total amount of the bid, made payable without conditions to “Town of Flower Mound, Texas”, and the amount of the said Bid Bond may be retained by and forfeited to the Town as liquidated damages if the bid covered thereby is accepted and a contract based thereon is awarded and the bidder should fail to enter into a contract in the form prescribed, with legally responsible sureties and required insurance coverage acceptable to the Town Attorney, within fifteen (15) days after such award is made by the Town.
The Bid Bond of the unsuccessful bidders will be returned if and when their bids are rejected. The Bid Bond of the bidder to whom a contract is awarded will be returned provided the bidder executes a contract and files the required bonds and insurance. The Bid Bond of the second and third lowest responsible bidders may be retained for a period of time not to exceed one hundred twenty (120) days after the contract is awarded pending the execution of the contract and bonds by the successful bidder.

3. No pre-qualification of Bidders is required. However, to demonstrate qualifications to perform the work, each bidder shall furnish an experience list of similar work along with such other information as will tend to show the bidder’s ability to prosecute the required work. This information should be submitted on the forms provided in this document. The Town may make such investigations, as it deems necessary to determine the ability of the Bidder to perform the work. At a minimum tank contractor must have constructed five (5) two (2) million gallon composite elevated storage tanks within the last five years.

4. Each bidder shall carefully examine the Plans, Specifications, and other Contract Documents, shall visit the site and fully inform himself of all conditions affecting the work or the cost thereof, and shall be presumed to have done so and his bid shall be based upon his own conclusions from such examination. Each bidder shall inform himself concerning all Federal, State, and local laws, ordinances or regulations which may in any manner affect his proposed construction operations, or those engaged or employed on the work or the material or equipment. Should a bidder find discrepancies in, or omissions from, the Plans, Specifications or other Contract Documents, he should at once notify the Purchasing Agent and obtain clarification or interpretation prior to submitting any bid.

Any clarification regarding the interpretation and/or application of the proposed Contract Documents will be made only by addendum duly issued by the Purchasing Agent with a copy of such addendum being mailed or delivered to each plan holder from the Purchasing Office. The Town will not be responsible for any other explanations or interpretations of the proposed Contract Documents. No information given by the Town or any official thereof, other than that shown on the Plans and contained in the Specifications, bid form, addendum and other Contract Documents shall be binding on the Town.

Any bidder, by submitting his bid, represents and warrants; that he has prepared his bid in accordance with the Contract Documents, with full knowledge and understanding of the terms and provisions thereof; that he has reviewed, studied and examined the bid proposal prior to the signing and submission of same; and that he is cognizant of the terms of his bid, verified his calculations and found them to be correct and agrees to be bound thereby.

5. The quantities of work and materials set forth in the bid form or on the plans approximately represent the work to be performed and materials to be furnished, and are for the purpose of comparing bids on a uniform basis. Payment shall be made to the
Contractor only for the actual quantities of Work performed and materials furnished in accordance with the Plans and Specifications; and it is specifically understood and agreed that the quantities may be increased or decreased as hereinafter provided, without in any way invalidating the bid prices.

6. The Town may disqualify bidders and their bid for any of the following specific reasons:

(a) Reasonable grounds for believing collusion exists among the bidders.

(b) Reasonable grounds for believing that any bidder or subcontractor is interested in more than one bid for the work contemplated.

(c) The bidder having a history of filing questionable claims against the Town, or against other contractors on a project of the Town.

(d) The bidder or his surety having defaulted on a previous contract, or the bidder having performed poorly on a previous contract.

(e) Lack of competency, skill, judgment, financial capability, integrity, reputation, reliability, or responsibility to perform the Work as revealed by the bid form, bid questionnaires, financial statement, performance history or other relevant information obtained by the Town.

(f) Uncompleted work which, in the judgment of the Town, may prevent or hinder the prompt completion of additional work if awarded.

(g) Failure of the bidder to use the Town’s form of bid bond in submitting his bid.

(h) Unbalanced value of any bid items.

(i) The bidder or his surety being currently involved in any litigation against Town, or where such litigation is contemplated or imminent, in the sole opinion of the Town.

7. The bidder to whom a contract for the Work is awarded will be required to furnish surety as follows:

**Performance Bond:** A good and sufficient performance bond in an amount not less than one hundred percent (100%) of the total amount of the contract shall be filed with the Town in accordance with the General Conditions and Supplementary Conditions in the Contract Documents.

**Payment Bond:** A good and sufficient payment bond in an amount not less than one hundred percent (100%) of the total amount of the contract, shall be filed with the Town in accordance with the General Conditions and Supplementary Conditions in the Contract Documents.
Maintenance Bond: A good and sufficient maintenance bond in an amount not less than one hundred percent (100%) of the total amount of the contract for a period not less than two (2) years following the date of final acceptance, shall be filed with the Town in accordance with the General Conditions and Supplementary Conditions in the Contract Documents.

Certificates of Insurance: Satisfactory certificates of insurance shall be filed with the Town in accordance with the General Conditions and Supplementary Conditions in the Contract Documents.

8. The Bidder’s attention is directed to Texas Tax Code Section 151.311 regarding the tax-exempt nature of personal property purchased for and services provided to make improvements to realty for an entity exempted from taxes by Sections 151.309 or 151.310 of the Texas Tax Code.

9. No bidder may submit more than one bid. Two bids under different names will not be received from one (1) firm or association.

10. A bidder may modify or withdraw his bid at any time prior to the expiration of the period during which bids may be submitted, by written request of the same person or persons who signed the bid.

11. None of the Notice to Bidders, Instructions to Bidders, Bid Form, Performance Bond, Payment Bond, Contract Agreement, General Conditions, Special Conditions or Specifications shall be removed from the bound copy of the Contract Documents prior to filing the bid contained therein.

12. Each bidder shall sign his bid, using signature and giving his full business address. Bids by partnerships shall be signed with the partnership name, followed by the signature of one of the members of the partnership, or by an authorized representative with the official designation of the person signing. Bids by corporations shall be signed with the name of the corporation, followed by the signature and designation of the president, secretary, or other person authorized to bind the corporate entity in the matter. The names of all persons signing should also be printed below their respective signature. A bid by a person who affixes to his signature the word “President”, “Secretary”, “Agent”, or other designation, without disclosing his principal, may be held to be the individual signing. When requested by the Town, satisfactory evidence of the authority of the officer signing on behalf of a corporation or other business entity shall be furnished.

13. The Notice of Award shall be accompanied by the necessary Contract Agreement and Bond Forms. The Bidder to whom the Contract is awarded will be required to execute the Contract Agreement in such number of originals as may be required by the Town and obtain the required Bonds and Certificates of Insurance within fifteen (15) calendar days from the date when Notice of Award is delivered to the bidder. In the case of failure of the bidder to execute the Contract Agreement, the Town may at its option consider the
bidder in default; in which case, the Bid Bond accompanying the Bid will be forfeited to the Town.

14. The Town, within fifteen (15) calendar days of receipt of acceptable Performance Bond, Payment Bond, Certificates of Insurance and Contract Agreement signed by the bidder to whom the contract was awarded, shall sign the Contract Agreement and return to the bidder two (2) executed copies of the Contract Agreement. The Bidder may withdraw his signed Contract Agreements should the Town fail to execute the Contract Agreement within the stated time period, and prior to the Bidder’s withdrawal of such documents.

15. The Notice to Proceed shall be issued by the Town within one hundred twenty (120) calendar days of the execution of the Contract Agreement by the Town. The time may be extended by mutual agreement between the Town and Contractor. If the Notice to Proceed has not been issued within the specified time or mutually agreed upon extension, the Contractor may terminate the Contract Agreement without further liability on the part of either party.

16. Not less than the federally determined prevailing wage rate, as issued by the U.S. Department of Labor, must be paid on this project or the prevailing wages for Denton County, as published by The Associated General Contractors of Texas, whichever rate is higher. Notwithstanding the foregoing prevailing wage rates, Bidders shall base their bids on the wage rates they expect to pay, if in excess of those rates listed. The Town will not consider claims for extra payment on account of payment of wages higher than those required.

17. The Town intends to award the Contract to a bidder that will be doing a substantial portion of the work rather than through subcontractors. The bidder must complete the item in the Bid Form regarding the amount of work to be done by the Prime Contractor. The Town reserves the right to consider this breakdown in awarding the Contract.

18. Each Bidder shall list all subcontractors they propose to use on this project for which the amount of the subcontractor’s work exceeds $10,000. The list shall include the name and address of the subcontractor, the work they will be performing and the total amount of the subcontract(s). The Bidder shall also complete a Statement of Qualifications and Experience for each subcontractor listed. The Town reserves the right to disapprove any subcontractor. The Contractor shall not change subcontractors or enter into contracts with subcontractors not listed without prior approval by the Town. The Town reserves the right to refuse any or all requests for changes.

19. Bid documents for this project include:

   1. Construction Agreement
   2. Properly executed Change Orders and Field Orders in writing and executed by the Town, the last in time being first in precedence
   3. Any listed and numbered addenda;
   4. Special Provisions;
5. Supplementary Conditions;
6. Construction Drawings or Plans;
7. Technical Specifications;
8. Town's Standard Construction Details;
12. The General Conditions;
14. Notice to Bidders,
15. Instructions to Bidders
16. The Town's written notice to proceed to Contractor;
17. The Contractor’s Bid Form;
18. The Performance Bond, Payment Bond and Maintenance Bond; and
19. Bid materials distributed by the Town that relate to the Project.
TOWN OF FLOWER MOUND

Western 2.5 Million Gallon Elevated Water Storage Tank

Bid # 48-11-B

PROPOSAL

THIS BID IS SUBMITTED TO:

Town of Flower Mound
2121 Cross Timbers Road
Flower Mound, Texas 75028

The Undersigned Bidder proposes to complete the work as shown on the Plans and described in the specifications:

Unit Prices: Bidder hereby guarantees the following unit prices to apply throughout the project for changing work upon written instruction of the Owner.

NOTE: Unit and lump sum prices must be shown in words and figures for each item listed in this bid, and in the event of discrepancy, the words shall prevail. In case of ambiguity or lack of clearness in stating prices in the bid, the Owner reserves the right to accept the most advantageous construction thereof to the Owner or to reject the bid.

BASE BID ITEMS:

BASE BID ITEM 1 – 2.5 MILLION GALLON ELEVATED STORAGE TANK AND YARD PIPING

For the complete construction of the 2.5 million gallon elevated storage tank, Yard Piping, Valves, Electrical, HVAC, Site Work, and all equipment, materials and services required in accordance with the contract documents, plans and specifications for the project except for Base Bid Items 2, 3, and 4, for the sum of:

$____________________________

BASE BID ITEM 2 – TRENCH SAFETY

All trench safety related to the construction of the Western 2.5 Million Gallon Elevated Water Storage Tank project and all related appurtenances in accordance with General Conditions and plans and specifications:

$____________________________
BASE BID ITEM 3 – RELOCATION OF EXISTING 20-INCH WATER LINE

Lump sum for relocation of the existing 20-inch water line as shown on the plans. This item shall include all work associated with excavation, pipe installation, embedment, backfilling, connections to existing 20-inch water line, 20-inch gate valves all other work and equipment necessary for relocation:

_________________________________________________________ Dollars ($______________)

BASE BID ITEM 4 – DECORATIVE SCREEN WALL

Lump sum for the installation of a decorative screen wall as manufactured by Hawk Construction Company. No substitutions will be allowed for the decorative screen wall. This item shall include the installation of the wall, the foundation including drilled shafts, the decorative entrance walls and decorative columns to be installed along the west property line. Also included in this bid item is the column required for the keypad station as shown on the plans. Steel tube fence to be installed along the west property line shall not be included in this bid item, nor shall the Town of Flower Mound signs shown to be installed on the decorative entrance walls be included in this item. Price below is a direct quote from Hawk Construction as shall be not be exceeded:

One hundred thirteen thousand five hundred and no cents

_________________________________________________________ Dollars (____________$113,500)

TOTAL BASE BID (Word and Figures) (Items 1, 2, 3 and 4):

_________________________________________________________ Dollars ($______________)

2/16/11
ADDITIVE BID ITEMS

For changing quantities of work items from those indicated on the plans and necessitated by actual field conditions upon written instructions from the Engineer, the following unit prices shall prevail:

1. Excavation and foundation for the elevated storage tank per vertical foot for depths different than elevation 644, as determined by the geotechnical engineer.

Extra

Dollars ($ )

Credit

Dollars ($ )

TIME FOR SUBSTANTIAL COMPLETION 480 CALENDAR DAYS

TIME FOR FINAL COMPLETION 540 CALENDAR DAYS

1. The Bidder hereby agrees to commence work within ten (10) days after the date written Notice to Proceed shall have been given to him, and to Substantially Complete the Work within the above number of calendar days after the Effective Start Date as shown in the Notice to Proceed and accepts the One Thousand Dollars ($1,000.00) per day liquidated damages provision of the Supplementary Conditions, in the event of failure to timely obtain Substantial Completion within the specified time period as fair and just compensation to Owner for the damages it suffers as a result of any such delays. Substantial Completion is defined in the General Conditions in this document.

2. The Bidder agrees that the Work will reach Final Completion within the above number of calendar days after Effective Start Date as shown in the Notice to Proceed and accepts the One Thousand Dollars ($1,000.00) per day liquidated damages provision of the Supplementary Conditions in the event of failure to reach Final Completion of the work within the specified time period as fair and just compensation to Owner for the damages it suffers as a result of any such delays.

3. The Bidder proposes and agrees, if this Bid is accepted, to enter into a Contract Agreement with the Town in the form included in the Contract Documents to complete all Work as specified or indicated in the Contract Documents for the Contract Price and within the Contract Time indicated in this Bid and in accordance with the Contract Documents.

4. Bidder accepts all of the terms and conditions of the Notice to Bidders and the Instructions to Bidders, including without limitation those dealing with the disposition of Proposal Guarantee. This Bid will remain open for one hundred twenty (120) days after
the date of bid opening. The successful bidder will sign the Contract Agreement and submit the Contract Bonds, Certificate of Insurance and other documents required by the Contract Documents within fifteen (15) days after the date of Town’s Notice of Award.

5. In submitting this Bid, Bidder represents, as more fully set forth in the Contract Agreement, that:

(a) Bidder has examined, and hereby acknowledges receipt of, copies of all the Contract Documents and the following addenda:

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<th>ADDENDUM NO:</th>
<th>DATE</th>
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(b) Bidder has examined the site and locality where the Work is to be performed, the legal requirements (Federal, State and local laws, ordinances, rules and regulations) and the conditions affecting cost, progress or performance of the Work and has made such independent investigations, as Bidder deems necessary.

(c) Bidder has obtained and carefully studied (or assumes responsibility for obtaining and carefully studying) all such examinations, investigations, explorations, tests and studies that pertain to the subsurface or physical conditions at the site or which otherwise may affect the cost, progress, performance or furnishing of the Work as Bidder considers necessary for the performance or furnishing of the Work at the Contract Price, within the Contract Time and in accordance with the other terms and conditions of the Contract Documents, and no additional examinations, investigations, explorations, tests, reports or similar information or data are or will be required by Bidder for such purposes.

(d) Bidder has reviewed and checked all information and data shown or indicated on the Contract Documents with respect to existing Underground Facilities at or contiguous to the site and assumes responsibility for the accurate location of said Underground Facilities. No additional examinations, investigations, explorations, tests, reports or similar information or data in respect of said Underground Facilities are or will be required by the Bidder in order to perform and furnish the Work at the Contract Price, within the Contract Time and in accordance with the other terms and conditions of the Contract Documents.

(e) Bidder has correlated the results of all such observations, examinations, investigations, explorations, tests, reports and studies with the terms and conditions of the Contract Documents.
(f) Bidder has given Engineer written notice of all conflicts, errors or discrepancies that it has discovered, if any, in the Contract Documents and the written resolution thereof by Engineer is acceptable to Bidder.

(g) This bid is genuine and not made in the interest of or on behalf of any undisclosed person, firm or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham bid; Bidder has not solicited or induced any person, firm or corporation to refrain from submitting a bid; and Bidder has not sought by collusion to obtain for itself any advantage over any other Bidder or over Owner.

(h) Bidder intends to perform a substantial portion of the work himself in accordance with the following approximate breakdown based on percentage of Base Bid.

<table>
<thead>
<tr>
<th>Portion of Work by Bidder</th>
<th>%</th>
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<tr>
<td>Portion of Work by Sub-Contractor(s)</td>
<td>%</td>
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**Subcontractor Information**

<table>
<thead>
<tr>
<th>Name</th>
<th>Type of Work</th>
<th>% of Work</th>
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Total % of Work Subcontracted ______

If additional space is necessary to provide a complete listing, please attach such additional pages as may be required.

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

   (a) Required Proposal Guarantee (cashier’s check, certified check, or bid bond).
   (b) Statement of Bidder’s Qualifications and Experience.
   (c) Statement of Subcontractors’ Qualifications and Experience.

7. The terms used in this Bid, which are defined in the General Conditions of the Contract Agreement included as part of the Contract Documents, have the meaning assigned to then in the General Conditions.
8. Bidder agrees that the implementation of the Owner’s right to delete any portion of the improvements shall not be considered as waiving or invalidating any conditions or provisions of the contract or bonds. Bidder shall perform the Work as altered and no allowances shall be made for anticipated profits.

9. The right is reserved, as the interest of the Owner may require, to reject any and all bids and to waive any informality in the bids received.

10. Since the Work on this Project is being performed for a governmental body and function, the Owner will issue to the Contractor a certificate of exemption for payment for the State Sales TAX on materials incorporated into this Project.

Submitted on _________________, 20__.

Circle one of the following:
Individual
Partnership
Limited Partnership
Corporation

_____________________________________________________ Firm Name

By:_________________________________________ Typed or Printed

SIGNATURE_________________________________

TITLE_______________________________________

ADDRESS____________________________________

____________________________________

____________________________________

____________________________________

TELEPHONE_________________________________
CONTRACTOR STATUS INFORMATION

Instructions: Please fill in the appropriate section below for the type of business entity through which Contractor operates, completing all blanks within the section. This information is necessary to ensure that the contract and bonds are in the correct form.

SECTION 1: If the contractor is a SOLE PROPRIETOR, fill in this section only:

Name: .................................................................
First       Middle       Last
Name under which you are engaged in business (if operating under an assumed name):

Residence:
Street                City                      County         State     ZIP

Business:
Street                City                      County         State     ZIP

Principal place of business: ________________________________
City                      County         State     ZIP

Contact Person: ________________________________
Name               Phone

SECTION 2: If the contractor is a PARTNERSHIP, fill in this section only:

Name of Partner: .................................................................
First       Middle       Last

Residence:
Street                City                      County         State
ZIP

Name of Partner: .................................................................
First       Middle       Last

Residence:
Street                City                      County         State     ZIP
Name under which contractor conducts business (if operating under an assumed name):


Business Address:
Street  City  County  State  ZIP

Principal place of business:
City  County  State  Zip

Contact Person:
Name  Phone

SECTION 3: If the contractor is a CORPORATION, fill in this section only:

Registered name of corporation:

Doing business as:

Date charter expires:

State of corporation:

Date of corporation filing:  (If non-Texas corporation, date of Certificate of Authority Issuance).

Registered Agent:
First  Middle  Last

Address:
Street  City  County  State  ZIP

Location of Corporation principal office:


Street  City  County  State  ZIP

Person executing contract on behalf of corporation: (Please print)

Name:
First  Middle  Last

Title:
Address: ____________________________________________
        Street          City          County          State          ZIP

Telephone Number: ________________________________

SECTION 4: If the contractor is a LIMITED PARTNERSHIP, fill in this section only:

Registered name of limited partnership: ________________________________

Doing business as: ________________________________

Date charter, if any, expires: ________________

State of creation: ________________________________

Date of registration or filing, if any: _______ (If non-Texas corporation, date of Certificate of Authority Issuance).

Registered Agent: ______________________________________
        First          Middle          Last

Address: ____________________________________________
        Street          City          County          State          ZIP

Location of limited partnership principal office:

_________________________________________________
        Street          City          County          State          ZIP

Registered name of limited partnership’s general partner: ________________

Doing business as: ________________________________

Date charter, if any, expires: ________________

State of corporation or creation: ________________

Date of corporation filing, if any: _______ (If non-Texas corporation, date of Certificate of Authority Issuance).
Registered Agent: ________________________________________________________________

First       Middle       Last

Address: ________________________________________________________________

Street     City     County     State     ZIP

Location of general partner’s principal office:

_______________________________

Street     City     County     State     ZIP

Person executing contract on behalf of general partner for limited partnership: 
(Please print)

Name: ________________________________________________________________

First       Middle       Last

Title: ________________________________

Address: ________________________________

Street     City     County     State     ZIP

Telephone Number: ______
STATEMENT OF BIDDING CONTRACTOR’S QUALIFICATIONS
AND EXPERIENCE

CONTRACTOR _______________________________________________________

Note: Demonstrate a minimum of three years experience. The information provided to the City
on this form will be used, in part at least, to determine whether the perceived low bidder is
the responsible low bidder for purposes of this Project.

PLEASE RESPOND TO THE FOLLOWING QUESTIONS:

1. Number of years in business as a General Contractor performing the type(s) of work
required for this Project. ______________________________.

2. Types of work performed:
   - □ Asphalt Paving □ Concrete Structures □ Miscellaneous Concrete
   - □ Auxiliary Lanes □ Demolition □ Storm Sewer
   - □ Bridge Work □ Earth Work □ Subgrade Preparation
   - □ Channel Lining □ Fencing □ Other ____________
   - □ Concrete Paving □ Landscaping □ ________________

3. Greatest number of contracts in excess of $500,000.00 under construction at one time in
company’s history. ________________________________.

4. Greatest number of contracts in excess of $1,000,000.00 under construction at one time in
company’s history. ________________________________.

5. Approximate average of dollar value of incomplete work outstanding under contracts at
any one time. ________________________________.

6. List completed projects of the type of work of this Project or similar work plus the
following information on each such project (use attachments for additional work if
necessary).

NAME OF PROJECT: ___________________________________________________

OWNER: ________________________________________________________________

POINT OF CONTACT: __________________________ PHONE: _____________
TOTAL CONTRACT COST: ____________ COMPLETION DATE: ____________

DESCRIPTION: _______________________________________________________

Number Work Days Allowed: _________ Number Work Days Required: __________

Extra Days Granted: __________ Amount Liquidated Damages: _________________

NAME OF PROJECT: ___________________________________________________

OWNER: __________________________________________________________________

POINT OF CONTACT: ____________________________ PHONE: ________________

TOTAL CONTRACT COST: ____________ COMPLETION DATE: ____________

DESCRIPTION: _______________________________________________________

Number Work Days Allowed: _________ Number Work Days Required: __________

Extra Days Granted: __________ Amount Liquidated Damages: _________________

NAME OF PROJECT: ___________________________________________________

OWNER: __________________________________________________________________

POINT OF CONTACT: ____________________________ PHONE: ________________

TOTAL CONTRACT COST: ____________ COMPLETION DATE: ____________

DESCRIPTION: _______________________________________________________

Number Work Days Allowed: _________ Number Work Days Required: __________

Extra Days Granted: __________ Amount Liquidated Damages: _________________

NAME OF PROJECT: ___________________________________________________

OWNER: __________________________________________________________________

POINT OF CONTACT: ____________________________ PHONE: ________________

TOTAL CONTRACT COST: ____________ COMPLETION DATE: ____________
DESCRIPTION: ____________________________________________________________

Number Work Days Allowed: _________  Number Work Days Required: _________

Extra Days Granted: _________  Amount Liquidated Damages: _________________

NAME OF PROJECT: ______________________________________________________

OWNER: ________________________________________________________________

POINT OF CONTACT: ____________________________ PHONE: ________________

TOTAL CONTRACT COST: ____________ COMPLETION DATE: ________________

DESCRIPTION: _________________________________________________________

Number Work Days Allowed: _________  Number Work Days used to date: ______

Extra Days Granted: _________  Anticipated Late Days, if any: _______________

7. List incomplete projects, plus the following information on each such project (use attachments for additional work if necessary).

NAME OF PROJECT: ______________________________________________________

OWNER: ________________________________________________________________

POINT OF CONTACT: ____________________________ PHONE: ________________

CONTACT COST: _________  PROJECTED COMPLETION DATE: _____________

DESCRIPTION: _________________________________________________________

Number Work Days Allowed: _________  Number Work Days used to date: ______

Extra Days Granted: _________  Anticipated Late Days, if any: _______________
NAME OF PROJECT: ___________________________________________________

OWNER: ______________________________________________________________

POINT OF CONTACT: ____________________________ PHONE: ________________

CONTRACT COST: _________ PROJECTED COMPLETION DATE: __________

DESCRIPTION: _________________________________________________________

Number Work Days Allowed: _________ Number Work Days used to date: _______

Extra Days Granted: __________ Anticipated Late Days, if any: ________________

NAME OF PROJECT: ___________________________________________________

OWNER: ______________________________________________________________

POINT OF CONTACT: ____________________________ PHONE: ________________

CONTRACT COST: _________ PROJECTED COMPLETION DATE: __________

DESCRIPTION: _________________________________________________________

Number Work Days Allowed: _________ Number Work Days used to date: _______

Extra Days Granted: __________ Anticipated Late Days, if any: ________________

NAME OF PROJECT: ___________________________________________________

OWNER: ______________________________________________________________

POINT OF CONTACT: ____________________________ PHONE: ________________

CONTRACT COST: _________ PROJECTED COMPLETION DATE: __________

DESCRIPTION: _________________________________________________________

Number Work Days Allowed: _________ Number Work Days used to date: _______

Extra Days Granted: __________ Anticipated Late Days, if any: ________________
NAME OF PROJECT: ___________________________________________________

OWNER: ______________________________________________________________

POINT OF CONTACT: ____________________________ PHONE: ________________

CONTRACT COST: _________ PROJECTED COMPLETION DATE: __________

DESCRIPTION: _________________________________________________________

Number Work Days Allowed: _________ Number Work Days used to date: ______

Extra Days Granted: __________ Anticipated Late Days, if any: ________________

8. Have you or any present partner(s) or officer(s) failed to complete a contract? _____ If yes, please list the projects for which contracts were not completed, plus the following information on each such project (use attachments for additional work if necessary).

NAME OF PROJECT: ___________________________________________________

COMPANY NAME, if different: ____________________________________________

NAME OF PARTNER / OFFICER: __________________________________________

OWNER: ______________________________________________________________

POINT OF CONTACT: ____________________________ PHONE: ________________

CONTRACT COST: _________ DEFAULT / TERMINATION DATE: __________

DESCRIPTION: _________________________________________________________

SURETY: ______________________________________________________________

POINT OF CONTACT: ____________________________ PHONE: ________________

PERFORMANCE / PAYMENT BOND NUMBERS: ________________________________
NAME OF PROJECT: ___________________________________________________

COMPANY NAME, if different: ____________________________________________

NAME OF PARTNER / OFFICER: __________________________________________

OWNER: __________________________________________________________________

POINT OF CONTACT: ____________________________ PHONE: ________________

CONTRACT COST: _______ DEFAULT / TERMINATION DATE: __________

DESCRIPTION: _________________________________________________________

SURETY: __________________________________________________________________

POINT OF CONTACT: ____________________________ PHONE: ________________

PERFORMANCE / PAYMENT BOND NUMBERS: ____________________________

NAME OF PROJECT: ___________________________________________________

COMPANY NAME, if different: ____________________________________________

NAME OF PARTNER / OFFICER: __________________________________________

OWNER: __________________________________________________________________

POINT OF CONTACT: ____________________________ PHONE: ________________

CONTRACT COST: _______ DEFAULT / TERMINATION DATE: __________

DESCRIPTION: _________________________________________________________

SURETY: __________________________________________________________________

POINT OF CONTACT: ____________________________ PHONE: ________________

PERFORMANCE / PAYMENT BOND NUMBERS: ____________________________

NAME OF PROJECT: ___________________________________________________

COMPANY NAME, if different: ____________________________________________
NAME OF PARTNER / OFFICER: __________________________________________

OWNER: ______________________________________________________________

POINT OF CONTACT: ____________________________ PHONE: ________________

CONTRACT COST: _________ DEFAULT / TERMINATION DATE: __________

DESCRIPTION: _________________________________________________________

SURETY: ______________________________________________________________

POINT OF CONTACT: ____________________________ PHONE: _______________

PERFORMANCE / PAYMENT BOND NUMBERS: ____________________________

NAME OF PROJECT: ___________________________________________________

COMPANY NAME, if different: ____________________________________________

NAME OF PARTNER / OFFICER: __________________________________________

OWNER: ______________________________________________________________

POINT OF CONTACT: ____________________________ PHONE: ________________

CONTRACT COST: _________ DEFAULT / TERMINATION DATE: __________

DESCRIPTION: _________________________________________________________

SURETY: ______________________________________________________________

POINT OF CONTACT: ____________________________ PHONE: _______________

PERFORMANCE / PAYMENT BOND NUMBERS: ____________________________

9. Are there any unsatisfied demands upon you regarding your accounts payable? If yes, give names, amounts and explanations (use attachments for additional unsatisfied demands if necessary).

________________________________________________________________________
________________________________________________________________________
10. Have you or any present partner(s) or officer(s) **been convicted of a felony or a crime involving moral turpitude (i.e., theft, bribery, fraud, perjury and so forth) within the past ten (10) years?** _____ If yes, please list the date of each such conviction, the identity of the person(s) so convicted, the crime for which each such person was convicted, the sentence(s) issued for each such conviction, the current status of the sentence(s) and whether the conviction was related to any project(s) for which contracts were awarded by a governmental entity (use attachments for additional convictions if necessary). 

________________________________________________________________________

________________________________________________________________________

11. Have you or any present partner(s) or officer(s) **been debarred, or otherwise disqualified, from receiving or participating in federal contracts or federally approved subcontracts or from any type of federal financial or nonfinancial assistance or benefits?** _____ If yes, please explain the facts surrounding such debarment in detail by identifying the project giving rise to debarment, the action date and termination date of debarment, and the cause(s) for debarment (use attachments for additional debarments if necessary). 

________________________________________________________________________

________________________________________________________________________

12. **Bank Reference.**

**NAME OF BANK:** __________________________________________________________

**BANK OFFICER:** ___________________________ **PHONE:** ________________

**MAILING ADDRESS:** _________________________________________________________

______________________________________ **FAX:** ___________________

**NAME OF BANK:** __________________________________________________________

**BANK OFFICER:** ___________________________ **PHONE:** ________________

**MAILING ADDRESS:** _________________________________________________________

______________________________________ **FAX:** ___________________

13. **Municipality References**

**NAME OF CITY:** __________________________________________________________

________________________________________________________________________
CONTACT PERSON: ________________________________  TITLE: __________________
PHONE: _________________  FAX: ___________________
MAILING ADDRESS: __________________________________________________________
____________________________________________________________________________

NAME OF CITY: __________________________________________________________

CONTACT PERSON: ________________________________  TITLE: __________________
PHONE: _________________  FAX: ___________________
MAILING ADDRESS: __________________________________________________________
____________________________________________________________________________

NAME OF CITY: __________________________________________________________

CONTACT PERSON: ________________________________  TITLE: __________________
PHONE: _________________  FAX: ___________________
MAILING ADDRESS: __________________________________________________________
____________________________________________________________________________

14. Other credit references

NAME OF REFERENCE: ______________________________________________________

CONTACT PERSON: ________________________________  TITLE: __________________
PHONE: _________________  FAX: ___________________
MAILING ADDRESS: __________________________________________________________
NAME OF REFERENCE: ______________________________________________________
CONTACT PERSON: ________________________________ TITLE: ______________________
PHONE: ________________________________ FAX: ________________________________
MAILING ADDRESS: ____________________________________________________________________
____________________________________________________________________________

NAME OF REFERENCE: ______________________________________________________
CONTACT PERSON: ________________________________ TITLE: ______________________
PHONE: ________________________________ FAX: ________________________________
MAILING ADDRESS: ____________________________________________________________________
____________________________________________________________________________
ACKNOWLEDGEMENT
(Use this form if the Contractor is a sole proprietorship)

THE STATE OF TEXAS §
COUNTY OF _____________ §

I certify that my responses and the information provided are true and correct to the best of my personal knowledge and belief and that I have made no willful misrepresentations in this Statement of Qualifications and Experience (“Statement”), nor have I withheld any relevant information in my statements and answers to questions. I am aware that any information given by me in this Statement may be investigated and I hereby give my full permission for any such investigation and I fully acknowledge that any misrepresentations or omissions in my responses and information may cause my bid to be rejected.

____________________________
____________________________,
a ____________ Sole Proprietorship,

By: ______________________________
Name: ______________________________
Date Signed: ______________________

THE STATE OF TEXAS §
COUNTY OF _____________ §

This instrument was acknowledged before me on the ______ day of ________________, 20_____, by _______________________, in his capacity as owner of _________________, a ____________ sole proprietorship, known to me to be the person whose name is subscribed to the foregoing instrument, and acknowledged to me that he executed the same for the purposes therein expressed.

GIVEN UNDER MY HAND AND SEAL OF OFFICE, THIS THE ________________________
DAY OF ________________, 20_____.

Notary Public _________________ County, Texas
My commission expires _____
ACKNOWLEDGEMENT
(Use this form if the Contractor is an ordinary partnership.)

THE STATE OF TEXAS §
COUNTY OF _____________ §

I certify that my responses and the information provided are true and correct to the best of my personal knowledge and belief and that I have made no willful misrepresentations in this Statement of Qualifications and Experience (“Statement”), nor have I withheld any relevant information in my statements and answers to questions. I am aware that any information given by me in this Statement may be investigated and I hereby give my full permission for any such investigation and I fully acknowledge that any misrepresentations or omissions in my responses and information may cause my bid to be rejected.

______________________________,

a ____________ Partnership,

By and through its Partner

______________________________

By: ______________________________
Name: ________________________
Date Signed: ____________________

THE STATE OF TEXAS §
COUNTY OF _____________ §

This instrument was acknowledged before me on the _____ day of ________________, 20____, by ____________________, in his capacity as a partner of _________________, a ____________ partnership, known to me to be the person whose name is subscribed to the foregoing instrument, and acknowledged to me that he executed the same on behalf of and as the act of the partnership.

GIVEN UNDER MY HAND AND SEAL OF OFFICE, THIS THE ______________________
DAY OF ________________, 20____.

______________________________
Notary Public ________________ County, Texas
My commission expires ____
ACKNOWLEDGEMENT

(Use this form if the Contractor is a corporation)

THE STATE OF TEXAS §
COUNTY OF _____________ §

I certify that my responses and the information provided are true and correct to the best of my personal knowledge and belief and that I have made no willful misrepresentations in this Statement of Qualifications and Experience (“Statement”), nor have I withheld any relevant information in my statements and answers to questions. I am aware that any information given by me in this Statement may be investigated and I hereby give my full permission for any such investigation and I fully acknowledge that any misrepresentations or omissions in my responses and information may cause my bid to be rejected.

______________________________

a ____________ Corporation,

By: ______________________________
Name: ________________________
Title: _________________________
Date Signed: ________________

THE STATE OF TEXAS §
COUNTY OF _____________ §

This instrument was acknowledged before me on the _____ day of ____________, 20____, by ____________________, in his capacity as _____________ of ____________________, a ____________ Corporation, known to me to be the person whose name is subscribed to the foregoing instrument, and acknowledged to me that he executed the same on behalf of and as the act of the corporation.

GIVEN UNDER MY HAND AND SEAL OF OFFICE, THIS THE ________________________
DAY OF _____________, 20____.

______________________________
Notary Public _________________ County, Texas
My commission expires _____
ACKNOWLEDGEMENT
(Use this form if the Contractor is a limited partnership.)

THE STATE OF TEXAS §
COUNTY OF _____________ §

I certify that my responses and the information provided are true and correct to the best of my personal knowledge and belief and that I have made no willful misrepresentations in this Statement of Qualifications and Experience (“Statement”), nor have I withheld any relevant information in my statements and answers to questions. I am aware that any information given by me in this Statement may be investigated and I hereby give my full permission for any such investigation and I fully acknowledge that any misrepresentations or omissions in my responses and information may cause my bid to be rejected.

________________________________________

a __________________ Limited Partnership,

By and through its General Partner

________________________________________

By: ______________________________
Name: ___________________________
Title: ___________________________
Date Signed: ______________________

THE STATE OF TEXAS §
COUNTY OF _____________ §

This instrument was acknowledged before me on the ____ day of _____________, 20____, by __________________, in his capacity as __________________, a __________________, known to me to be the person whose name is subscribed to the foregoing instrument, and acknowledged to me that __________________, is the general partner of ______________________, a __________________ Limited Partnership, and that he executed the same on behalf of and as the act of the limited partnership.

GIVEN UNDER MY HAND AND SEAL OF OFFICE, THIS THE __________________
DAY OF _____________, 20____.

________________________________________

Notary Public __________________ County, Texas
My commission expires _____
STATEMENT OF SUBCONTRACTOR’S QUALIFICATIONS AND EXPERIENCE

SUBCONTRACTOR ________________________________________________________________

Note: Demonstrate a minimum of three years experience for each subcontractor the Bidding Contractor intends to use on the Project (use attachments for additional subcontractors if necessary).

NAME OF PROJECT: ________________________________________________________________

OWNER: _______________________________________________________________________

POINT OF CONTACT: ___________________________ PHONE: _________________________

GENERAL CONTRACTOR: _______________________________________________________________________

POINT OF CONTACT: ___________________________ PHONE: _________________________

TOTAL CONTRACT COST: ________________ COMPLETION DATE: ________________

DESCRIPTION: ________________________________________________________________

Number Work Days Allowed: _____________ Number Work Days Required: _____________

Extra Days Granted: __________ Amount Liquidated Damages Assessed, if any: __________

NAME OF PROJECT: ________________________________________________________________

OWNER: _______________________________________________________________________

POINT OF CONTACT: ___________________________ PHONE: _________________________

GENERAL CONTRACTOR: _______________________________________________________________________

POINT OF CONTACT: ___________________________ PHONE: _________________________

TOTAL CONTRACT COST: ________________ COMPLETION DATE: ________________

DESCRIPTION: ________________________________________________________________

Number Work Days Allowed: _____________ Number Work Days Required: _____________

Extra Days Granted: __________ Amount Liquidated Damages Assessed, if any: __________
NAME OF PROJECT: _________________________________________________________

OWNER: ________________________________________________________________

POINT OF CONTACT: ___________________________ PHONE: __________________

GENERAL CONTRACTOR: ___________________________________________________

POINT OF CONTACT: ___________________________ PHONE: __________________

TOTAL CONTRACT COST: ________________ COMPLETION DATE: ______________

DESCRIPTION: ____________________________________________________________

Number Work Days Allowed: _____________ Number Work Days Required: __________

Extra Days Granted: __________ Amount Liquidated Damages Assessed, if any: _________
STATE OF TEXAS )
) COUNTY OF DENTON )

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned, _______________________, whose address is _______________________, hereinafter called Principal, and ______________________________, a corporation organized and existing under the laws of the State of ______________________________, and fully licensed to transact business in the State of Texas, as Surety, are held and firmly bound unto the Town of Flower Mound, a home-rule municipal corporation organized and existing under the laws of the State of Texas, hereinafter referred to as “Owner,” in the penal sum of $__________________ as the proper measure of liquidated damages arising out of or connected with the submission of a Proposal for the construction of a public work project, in lawful money of the United States, to be paid in Denton County, Texas, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors jointly and severally, firmly by these presents. The condition of the above obligation is such that whereas the Principal has submitted to Owner a certain Proposal, attached hereto and hereby made a part hereof, to enter into a contract in writing, for the construction of “BID # 48-11-B – Western 2.5 Million Gallon Elevated Water Storage Tank”. The work is to include furnishing all labor, materials, and equipment, and performing all work necessary for the construction of a 2.5 million gallon elevated water storage tank and approximately 1,400 linear feet of water line, appurtenances and other improvements detailed in the construction plans and specifications.

NOW, THEREFORE, if the Principal’s Proposal shall be rejected or, in the alternative, if the Principal’s Proposal shall be accepted and the Principal shall execute and deliver a contract in the form of the Contract attached hereto (properly completed in accordance with said Proposal) and shall furnish performance, payment and maintenance bonds required by the Contract Documents for the Project and provide proof of all required insurance coverages for the Project and shall in all other respects perform the agreement created by the acceptance of said Proposal, then this obligation shall be void, otherwise the same shall remain in full force and affect; it being expressly understood and agreed that the liability of the Surety for any breach of condition hereunder shall be in the face amount of this bond and forfeited as a proper measure of liquidated damages.

PROVIDED FURTHER, that if any legal action were filed on this Bond, exclusive venue shall lie in Denton County, Texas.

AND PROVIDED FURTHER, the Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by an extension of the time within which the Owner may accept such Proposal; and said Surety does hereby waive notice of any such extension.
The undersigned and designated agent is hereby designated by the Surety herein as the Resident Agent for service of process in Texas to whom any requisite notices may be delivered and on whom service of process may be had in matters arising out of such suretyship, as provided by Article 7.19-1 of the Insurance Code, Vernon’s Annotated Civil Statutes of the State of Texas.

IN WITNESS WHEREOF, this instrument is executed in _____ copies, each one of which shall be deemed an original, this, the ______ day of ________________, 20____.

PRINCIPAL: ____________________________

BY: ____________________________
    Name

ATTEST:

__________________________
    TITLE: ____________________________

SURETY: ____________________________

BY: ____________________________
    Name

ATTEST:

__________________________
    TITLE: ____________________________

The Resident Agent of the Surety in Texas, for delivery of notice and service of the process is:

NAME: ____________________________
STREET ADDRESS: ____________________________
CITY, STATE, ZIP: ____________________________

NOTE: If Resident Agent is not a corporation, give a person’s name.

IMPORTANT – Surety companies executing BONDS must appear on the Treasury Department’s most current list (Circular 570 as amended) and be authorized to transact business in the State of Texas.
CONSTRUCTION AGREEMENT

THIS CONSTRUCTION AGREEMENT (the “Agreement”), made and entered into this _____ day of ____________, 20___, by and between the Town of Flower Mound, County of Denton, Texas, hereinafter referred to as the “Town”, and __________________________, a __________, hereinafter referred to as the “Contractor.” For and in consideration of the payment, agreements and conditions hereinabove mentioned, and under the conditions expressed in the bonds herein, Contractor hereby agrees to complete the construction of improvements described as follows:

Western 2.5 Million Gallon Elevated Water Storage Tank, Bid # 48-11-B

in the Town of Flower Mound, Texas, and all extra work in connection therewith, under the terms as stated in this Agreement, and under the terms of the Contract Documents; and at his, her or their own proper cost and expense to furnish all superintendence, labor, insurance, equipment, tools and other accessories and services necessary to complete the said construction in accordance with all the Contract Documents, incorporated herein as if written word for word, and in accordance with the Plans, which include all maps, plats, blueprints, and other drawings and printed or written explanatory manner therefore, and the Conditions and Specifications as prepared by the Town of Flower Mound or its consultant hereinafter called Engineer, who has been identified by the endorsement of the Contractor's written proposal, and the General Conditions, Supplemental Conditions and Special Provisions of this Agreement, and the payment, performance, and maintenance bonds hereto attached; all of which are made a part hereof and collectively evidence and constitute the entire Agreement.

ARTICLE 1. The Contract Documents shall consist of the following documents:

A. The Construction Agreement;
B. Properly executed Change Orders and Field Orders in writing and executed by the Town, the last in time being first in precedence;
C. Any listed and numbered addenda;
D. Special Provisions;
E. Supplementary Conditions;
F. Construction Drawings or Plans;  
G. Technical Specifications;  
H. Town's Standard Construction Details;  
I. The most current edition of the *Town of Flower Mound Design Criteria and Construction Standards* (by reference);  
J. *Occupational Safety and Health Standards – Excavation*, 20 CFR Part 1926 (by reference);  
K. *Texas Manual on Uniform Traffic Control Devices (TMUTCD)* (by reference);  
L. The General Conditions;  
M. *Public Works Construction Standards - North Central Texas, as amended* (by reference);  
N. Notice to Bidders;  
O. Instructions to Bidders;  
P. The Town's written notice to proceed to Contractor;  
Q. The Contractor’s Bid Proposal;  
R. The Performance Bond, Payment Bond and Maintenance Bond; and  
S. Bid materials distributed by the Town that relate to the Project.

These Contract Documents are incorporated by reference into this Agreement as if set out in their entirety. The Contract Documents are intended to be complementary; what is called for by one document shall be as binding as if called for by all Contract Documents. It is specifically provided, however, that in the event of any inconsistency in the Contract Documents, the inconsistency shall be resolved by giving precedence to the Contract Documents in the order in which they are listed herein above. If, however, there exists a conflict or inconsistency between the Technical Specifications and the Construction Drawings it shall be the Contractor’s obligation to seek clarification as to which requirements or provisions control before undertaking any work on that component of the project. Should the Contractor fail or refuse to seek a clarification of such conflicting or inconsistent requirements or provisions prior to any work on that component of the project, the Contractor shall be solely responsible for the costs and expenses - including additional time - necessary to cure, repair and/or correct that component of the project.

**ARTICLE 2.** For performance of the Work in accordance with the Contract Documents, the Town shall pay the Contractor in current funds an amount not to exceed
Dollars and cents ($_______) taking into consideration additions to or deductions from the Total Bid through properly executed change orders by reason of alterations or modifications of the original quantities or by reason of “Extra Work” authorized under this Agreement in accordance with the provisions of the Contract Documents. It is hereby mutually agreed that for and in consideration of the payments as provided for herein to the Contractor by the Town, the said Contractor shall furnish all labor, equipment, and material (except as otherwise specified above) and shall perform all work necessary to complete the improvements in a good and substantial manner, ready for use, within the specified time for completion of four hundred eighty (480) calendar days, and final completion of five hundred forty (540) calendar days ready for final payment. The work shall be in strict accordance with this Agreement, a copy of which is filed pursuant to law in the office of the legal representative of the Town.

ARTICLE 3. Before commencing work, the Contractor shall, at its own expense, procure, pay for and maintain the insurance coverage required by the Contract Documents written by companies approved by the State of Texas and acceptable to the Town of Flower Mound. The Contractor shall furnish to the Town of Flower Mound Purchasing Manager certificates of insurance executed by the insurer or its authorized agent stating the type of coverages, limits of each such coverage, expiration dates and compliance with all applicable required provisions of the Contract Documents.

ARTICLE 4. The Contractor shall procure and pay for performance and payment bonds applicable to the work in the amount of the total bid price. The Contractor shall also procure and pay for a maintenance bond applicable to the work in the amount of one hundred percent (100%) of the total bid price. The period of the Maintenance Bond shall be two years from the date of acceptance of all work done under the contract, to cover the guarantee as set forth in the Special Conditions. The performance, payment and maintenance bonds shall be issued in the form attached to this Construction Agreement as Exhibits B, C and D. Other performance, payment and maintenance bond forms shall not be accepted. Among other things, these bonds shall apply to any work performed during the two-year warranty period after acceptance as described in this Construction Agreement.

The performance, payment and maintenance bonds shall be issued by a corporate surety, acceptable to and approved by the Town, authorized to do business in the State of Texas, pursuant to Chapter 2253 of the Texas Government Code. Further, the Contractor shall supply capital and surplus information concerning the surety and reinsurance information concerning the performance, payment and maintenance bonds upon Town request. In addition to the foregoing requirements, if the amount of the bond exceeds One Hundred Thousand Dollars ($100,000) the bond must be issued by a surety that is qualified as a surety on obligations permitted or required under federal law as indicated by publication of the surety’s name in the current U.S. Treasury Department Circular 570. In the alternative, an otherwise acceptable surety company (not qualified on federal obligations) that is authorized and admitted to write surety bonds in Texas must obtain reinsurance on any amounts in excess of One Hundred Thousand Dollars ($100,000) from a reinsurer.
that is authorized and admitted as a reinsurer in Texas who also qualifies as a surety or
reinsurer on federal obligations as indicated by publication of the surety’s or reinsurer’s
name in the current U.S. Treasury Department Circular 570.

ARTICLE 5. It is hereby further agreed that in consideration of the faithful performance
of the work by the Contractor, the Town shall pay the Contractor the compensation due
him by reason of said faithful performance of the work in accordance with the provisions
of this Agreement. As it completes portions of the Work, the Contractor may request
progress payments from the Town. Progress payments shall be made by the Town based
on the Town's estimate of the value of the Work properly completed by the Contractor
since the time the last progress payment was made. The "estimate of the value of the
work properly completed" shall include the net invoice value of acceptable, non-
perishable materials actually delivered to and currently at the job site only if the
Contractor provides to the Town satisfactory evidence that material suppliers have been
paid for these materials.

No progress payment shall be due to the Contractor until the Contractor furnishes to the
Town:

1. copies of documents reasonably necessary to aid the Town in preparing an
   estimate of the value of Work properly completed;

2. full releases of liens, including releases from subcontractors providing
   materials or delivery services relating to the Work, in a form acceptable to
   the Town releasing all liens or claims relating to goods and services
   provided up to the date of the most recent previous progress payment;

3. an updated and current schedule clearly detailing the project’s critical path
   elements; and

4. any other documents required under the Contract Documents.

Progress payments shall not be made more frequently than once every thirty (30)
calendar days unless the Town determines that more frequent payments are appropriate.
Further, progress payments are to be based on estimates and these estimates are subject to
correction through the adjustment of subsequent progress payments and the final payment
to Contractor. If the Town determines after final payment that it has overpaid the
Contractor, then Contractor agrees to pay to the Town the overpayment amount specified
by the Town within thirty (30) calendar days after it receives written demand from the
Town.

The fact that the Town makes a progress payment shall not be deemed to be an admission
by the Town concerning the quantity, quality or sufficiency of the Contractor's work.
Progress payments shall not be deemed to be acceptance of the Work nor shall a progress
payment release the Contractor from any of its responsibilities under the Contract
Documents.
After determining the amount of a progress payment to be made to the Contractor, the Town shall withhold a percentage of the progress payment as retainage. The amount of retainage withheld from each progress payment shall be set depending upon the value of the Contract Work on the effective date of the Contract:

<table>
<thead>
<tr>
<th>Contract Amount</th>
<th>Retainage Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to $25,000</td>
<td>15%</td>
</tr>
<tr>
<td>$25,000 to $400,000</td>
<td>10%</td>
</tr>
<tr>
<td>Over $400,000</td>
<td>5%</td>
</tr>
</tbody>
</table>

Retainage shall be withheld and may be paid to:

a. ensure proper completion of the Work. The Town may use retained funds to pay replacement or substitute contractors to complete unfinished or defective work;

b. ensure timely completion of the Work. The Town may use retained funds to pay liquidated damages; and

c. provide an additional source of funds to pay claims for which the Town is entitled to indemnification from Contractor under the Contract Documents.

Retained funds shall be held by the Town in accounts that shall not bear interest. Retainage not otherwise withheld in accordance with the Contract Documents shall be returned to the Contractor as part of the final payment.

ARTICLE 6. The Town may withhold payment of some or all of any progress or final payment that would otherwise be due if the Town determines, in its discretion, that the Work has not been performed in accordance with the Contract Documents. The Town may use these funds to pay replacement or substitute contractors to complete unfinished or defective Work.

The Town may withhold payment of some or all of any progress or final payment that would otherwise be due if the Town determines, in its discretion, that it is necessary and proper to provide an additional source of funds to pay claims for which the Town is entitled to indemnification from Contractor under the Contract Documents.

Amounts withheld under this section shall be in addition to any retainage.

ARTICLE 7. When the erosion control measures have been completed, the Contractor shall request that the Town perform a final inspection. The Town shall inspect the Work. If the Town determines that the Work has been completed in accordance with the
Contract Documents and per TPDES General Construction Permit, it shall issue a written Notice of Acceptance of the Work. If the Town determines that the Work has not been completed in accordance with the Contract Documents or TPDES General Construction Permit, then it shall provide the Contractor with a verbal or written list of items to be completed before another final inspection shall be scheduled.

**ARTICLE 8.** When the Work is completed, the Contractor shall request that the Town perform a final inspection. The Town shall inspect the Work. If the Town determines that the Work has been completed in accordance with the Contract Documents, it shall issue a written notice of acceptance of the Work. If the Town determines that the Work has not been completed in accordance with the Contract Documents, then it shall provide the Contractor with a written list of items to be completed before another final inspection shall be scheduled.

It is specifically provided that Work shall be deemed accepted on the date specified in the Town’s written notice of acceptance of the Work. The Work shall not be deemed to be accepted based on “substantial completion” of the Work, use or occupancy of the Work, or for any reason other than the Town’s written Notice of Acceptance. Further, the issuance of a certificate of occupancy for all or any part of the Work shall not constitute a Notice of Acceptance for that Work.

In its discretion, the Town may issue a Notice of Acceptance covering only a portion of the Work. In this event, the notice shall state specifically what portion of the Work is accepted.

**ARTICLE 9.** After all Work required under the Contract Documents has been completed, inspected, and accepted, the Town shall calculate the final payment amount promptly after necessary measurements and computations are made. The final payment amount shall be calculated to:

1. include the estimate of the value of Work properly completed since the date of the most recent previous progress payment;
2. correct prior progress payments; and
3. include retainage or other amounts previously withheld that are to be returned to Contractor, if any.

Final payment to the Contractor shall not be due until the Contractor provides original full releases of liens, or other evidence satisfactory to the Town to show that all sums due for labor, services, and materials furnished for or used in connection with the Work have been paid or shall be paid with the final payment. To ensure this result, Contractor consents to the issuance of the final payment in the form of joint checks made payable to Contractor and others. The Town may, but is not obligated to issue final payment using joint checks.
Final payment to the Contractor shall not be due until the Contractor has supplied to the Town copies of all documents that the Town determines are reasonably necessary to ensure both that the final payment amount is properly calculated and that the Town has satisfied its obligation to administer the Agreement in accordance with applicable law.

Subject to the requirements of the Contract Documents, the Town shall pay the Final Payment within thirty (30) calendar days after the date specified in the Notice of Acceptance. This provision shall apply only after all Work called for by the Contract Documents has been accepted.

ARTICLE 10. CONTRACTOR SHALL DEFEND, INDEMNIFY, AND HOLD HARMLESS THE TOWN, ITS TOWN COUNCIL, OFFICERS, EMPLOYEES, AND AGENTS FROM AND AGAINST ALL CITATIONS, CLAIMS, COSTS, DAMAGES, DEMANDS, EXPENSES, FINES, JUDGMENTS, LOSSES, PENALTIES OR SUITS, WHICH IN ANY WAY ARISE OUT OF, RELATE TO, OR RESULT FROM THE PERFORMANCE OF THE WORK OR WHICH ARE CAUSED BY THE INTENTIONAL ACTS OR NEGLIGENT ACTS OR OMISSIONS OF CONTRACTOR, ITS SUBCONTRACTORS, ANY OFFICERS, AGENTS OR EMPLOYEES OF EITHER CONTRACTOR OR ITS SUBCONTRACTORS, AND ANY OTHER THIRD PARTIES FOR WHOM OR WHICH CONTRACTOR IS LEGALLY RESPONSIBLE (THE "INDEMNIFIED ITEMS").

BY WAY OF EXAMPLE, THE INDEMNIFIED ITEMS MAY INCLUDE PERSONAL INJURY AND DEATH CLAIMS AND PROPERTY DAMAGE CLAIMS, INCLUDING THOSE FOR LOSS OF USE OF PROPERTY.

INDEMNIFIED ITEMS SHALL INCLUDE ATTORNEYS' FEES AND COSTS, COURT COSTS, AND SETTLEMENT COSTS. INDEMNIFIED ITEMS SHALL ALSO INCLUDE ANY EXPENSES, INCLUDING ATTORNEYS' FEES AND EXPENSES, INCURRED BY AN INDEMNIFIED INDIVIDUAL OR ENTITY IN ATTEMPTING TO ENFORCE THIS INDEMNITY.

In its sole discretion, the Town shall have the right to approve counsel to be retained by Contractor in fulfilling its obligation to defend and indemnify the Town. Contractor shall retain approved counsel for the Town within seven (7) business days after receiving written notice from the Town that it is invoking its right to indemnification under this Agreement. If Contractor does not retain counsel for the Town within the required time, then the Town shall have the right to retain counsel and the Contractor shall pay these attorneys' fees and expenses.

The Town retains the right to provide and pay for any or all costs of defending indemnified items, but it shall not be required to do so. To the extent that Town elects to provide and pay for any such costs, Contractor shall indemnify and reimburse Town for such costs.
ARTICLE 11. The Contractor understands and agrees that time is of the essence in performing and completing the Work. The Town and Contractor acknowledge that the actual damages the Town may sustain if the Contractor fails to complete the Work on time are uncertain and will be difficult to ascertain. The Contractor agrees that the sum of One Thousand Dollars ($1,000.00) per day or portion of a day in Liquidated Damages will be deducted from the Contract price by the Town for each calendar day or portion thereof that the work is not substantially complete beyond the Substantially Complete Contract time, or within such extra time as may have been allowed by an extension approved by the Town. The Contractor also agrees that the sum of One Thousand Dollars ($1,000.00) per day or portion of a day in Liquidated Damages for each calendar day or portion thereof the work has not been finally completed by the Contractor beyond the Contract time for final completion, or within such extra time as may have been allowed by an extension approved by the Town. The Town and the Contractor agree that this amount is payable as reasonable and just compensation for failure to complete the Work on time. This amount is payable as liquidated damages and not as a penalty.

ARTICLE 12. For a two-year period after the date specified in a written notice of acceptance of Work and authorization to make final payment by the Flower Mound Town Council, Contractor shall provide and pay for all labor and materials that the Town determines are necessary to correct all defects in the Work arising because of defective materials or workmanship supplied or provided by Contractor or any subcontractor. This shall also include areas of vegetation that did meet TPDES General Construction Permit during final close out but have since become noncompliant.

Forty-five (45) to sixty (60) calendar days before the end of the two-year warranty period, the Town may make a warranty inspection of the Work. The Town shall notify the Contractor of the date and time of this inspection so that a Contractor representative may be present. After the warranty inspection, and before the end of the two-year warranty period, the Town shall mail to the Contractor a written notice that specifies the defects in the Work that are to be corrected.

The Contractor shall begin the remedial work within ten (10) calendar days after receiving the written notice from the Town. If the Contractor does not begin the remedial work timely or prosecute it diligently, then the Town may pay for necessary labor and materials to effect repairs and these expenses shall be paid by the Contractor, the performance bond surety, or both.

If the Town determines that a hazard exists because of defective materials and workmanship, then the Town may take steps to alleviate the hazard, including making repairs. These steps may be taken without prior notice either to the Contractor or its surety. Expenses incurred by the Town to alleviate the hazard shall be paid by the Contractor, the performance bond surety, or both.

Any Work performed by or for the Contractor to fulfill its warranty obligations shall be performed in accordance with the Contract Documents. By way of example only, this is
to ensure that Work performed during the warranty period is performed with required insurance and the performance and payment bonds still in effect.

Work performed during the two-year warranty period shall itself be subject to a one-year warranty. This warranty shall be the same as described in this section.

The Town may make as many warranty inspections as it deems appropriate.

**ARTICLE 13.** The Contractor shall be responsible for ensuring that it and any subcontractors performing any portion of the Work required under the Contract Documents comply with all applicable federal, state, county, and municipal laws, regulations, and rules that relate in any way to the performance and completion of the Work. This provision applies whether or not a legal requirement is described or referred to in the Contract Documents.

**Ancillary/Integral Professional Services:** In selecting an architect, engineer, land surveyor, or other professional to provide professional services, if any, that are required by the Contract Documents, Contractor shall not do so on the basis of competitive bids but shall make such selection on the basis of demonstrated competence and qualifications to perform the services in the manner provided by Section 2254.004 of the Texas Government Code and shall so certify to the Town the Contractor's agreement to comply with this provision with Contractor's bid.

**ARTICLE 14.** The Contractor shall sign the Construction Agreement, and deliver signed performance, payment and maintenance bonds and proper insurance policy endorsements (and/or other evidence of coverage) within ten (10) calendar days after the Town makes available to the Contractor copies of the Contract Documents for signature. Six (6) copies of the Contract Documents shall be signed by an authorized representative of the Contractor and returned to the Town.

The Construction Agreement "effective date" shall be the date on which the Town Council acts to approve the award of the Contract for the Work to Contractor. It is expressly provided, however, that the Town Council delegates the authority to the Town Manager or his designee to rescind the Contract award to Contractor at any time before the Town delivers to the Contractor a copy of this Construction Agreement that bears the signature of the Mayor or Town Manager and Town Secretary or their authorized designees. The purpose of this provision is to ensure:

1. that Contractor timely delivers to the Town all bonds and insurance documents; and
2. that the Town retains the discretion not to proceed if the Town Manager or his designee determines that information indicates that the Contractor was not the lowest responsible bidder or that the Contractor cannot perform all of its obligations under the Contract Documents.
THE CONTRACTOR AGREES THAT IT SHALL HAVE NO CLAIM OR CAUSE OF ACTION OF ANY KIND AGAINST TOWN, INCLUDING A CLAIM FOR BREACH OF CONTRACT, NOR SHALL THE TOWN BE REQUIRED TO PERFORM UNDER THE CONTRACT DOCUMENTS, UNTIL THE DATE THE TOWN DELIVERS TO THE CONTRACTOR A COPY OF THE CONSTRUCTION AGREEMENT BEARING THE SIGNATURES JUST SPECIFIED.

The Contract Documents shall be construed and interpreted by applying Texas law. Exclusive venue for any litigation concerning the Contract Documents shall be Denton County, Texas.

Although the Construction Agreement has been drafted by the Town, should any portion of the Construction Agreement be disputed, the Town and Contractor agree that it shall not be construed more favorably for either party.

The Contract Documents are binding upon the Town and Contractor and shall inure to their benefit and as well as that of their respective successors and assigns.

If Town Council approval is not required for the Construction Agreement under applicable law, then the Construction Agreement "effective date" shall be the date on which the Mayor or Town Manager and Town Secretary or their designees have signed the Construction Agreement. If the Mayor or Town Manager and Town Secretary sign on different dates, then the later date shall be the effective date.

IN WITNESS WHEREOF, the Town and the Contractor, respectively, have caused this Agreement to be duly executed in the day and year first herein written in six copies, all of which to all intents and purposes shall be considered as the original.

This Agreement will be effective on the ____ day of __________, 20_____.

TOWN OF FLOWER MOUND

____________________________ __________________________ (Signature)

Melissa D. Northern, MAYOR

__________________________ (Printed Name)

__________________________ (Position)

(CORPORATE SEAL) (CORPORATE SEAL)

___________________________ (Signature)

Tracy Knierim, TOWN SECRETARY

__________________________ (Position)
APPROVED AS TO FORM: ______________________________
TOWN ATTORNEY’S OFFICE
PERFORMANCE BOND

STATE OF TEXAS
COUNTY OF DENTON

KNOW ALL MEN BY THESE PRESENTS: That ________________ whose address is _____________________________________________________________________, hereinafter called Principal, and ________________________________________________, a corporation organized and existing under the laws of the State of ________________________, and fully licensed to transact business in the State of Texas, as Surety, are held and firmly bound unto the Town of Flower Mound, a home-rule municipal corporation organized and existing under the laws of the State of Texas, hereinafter called “Beneficiary”, in the penal sum of __________________ Dollars ($____________), lawful money of the United States, to be paid in Denton County, Texas, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents. The penal sum of this Bond shall automatically be increased by the amount of any Change Order or Supplemental Agreement, which increases the Contract price, but in no event shall a Change Order or Supplemental Agreement, which reduces the Contract price, decrease the penal sum of this Bond.

THE OBLIGATION TO PAY SAME is conditioned as follows: Whereas, the Principal entered into a certain Contract with the Town of Flower Mound, the Beneficiary, dated on or about the _____ day of ___________________, 20____, a copy of which is attached hereto and made a part hereof, to furnish all materials, equipment, labor, supervision, and other accessories necessary for the construction of:

Western 2.5 Million Gallon Elevated Water Storage Tank, Bid # 48-11-B

in the Town of Flower Mound, Texas, as more particularly described and designated in the above-referenced contract such contract being incorporated herein and made a part hereof as fully and to the same extent as if written herein word for word.

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform and fulfill all of the undertakings, covenants, terms, conditions and agreements of said Contract in accordance with the Plans, Specifications and Contract Documents during the original term thereof and any extension thereof which may be granted by the Beneficiary, with or without notice to the Surety, and during the life of any guaranty or warranty required under this Contract, and shall also well and truly perform and fulfill all the undertakings, covenants, terms, conditions and agreements of any and all duly authorized modifications of said Contract that may hereafter be made, notice of which modifications to the Surety being hereby waived; and, if the Principal shall repair and/or replace all defects due to faulty materials and workmanship that appear within a period of one (1) year from the date of final completion and final acceptance of the Work by Owner; and, if the Principal shall fully indemnify and save harmless the Beneficiary from and against all costs and damages which Beneficiary may suffer by reason of failure to so perform herein and shall fully
reimburse and repay Beneficiary all outlay and expense which the Beneficiary may incur in making
good any default or deficiency, then this obligation shall be void; otherwise, it shall remain in full
force and effect.

PROVIDED FURTHER, that if any legal action were filed on this Bond, exclusive venue
shall lie in Denton County, Texas.

AND PROVIDED FURTHER, that the said Surety, for value received, hereby stipulates
and agrees that no change, extension of time, alteration or addition to the terms of the Contract or
to the Work to be performed thereunder or the Plans, Specifications and Drawings, etc.,
accompanying the same shall in anywise affect its obligation on this Bond, and it does hereby
waive notice of any such change, extension of time, alteration or addition to the terms of the
Contract, or to the Work or to the Specifications.

This Bond is given pursuant to the provisions of Chapter 2253 of the Texas
Government Code, and any other applicable statutes of the State of Texas. The
undersigned and designated agent is hereby designated by the Surety herein as the
Resident Agent in Texas for service of process to whom any requisite notices may be
delivered and on whom service of process may be had in matters arising out of such
suretyship, as provided by Article 7.19-1 of the Insurance Code, Vernon’s Annotated
Civil Statutes of the State of Texas.

IN WITNESS WHEREOF, this instrument is executed in six copies, each one of which
shall be deemed an original, this, the ________ day of ________________, 20____.

ATTEST:  

By: _________________________________  By: ________________________________
    Signature

Typed/Printed Name

Title

Address

City    State    Zip  

Phone    Fax

PRINCIPAL:  

Company Name

By: ________________________________
    Signature

Typed/Printed Name

Title

Address

City    State    Zip

Phone    Fax
ATTEST:    

By: _________________________________ By: ________________________________
Signature       Signature

Printed Name

Title

Address

City   State   Zip

Phone   Fax

SURETY:

By: ________________________________
Signature

Printed Name

Title

Address

City   State   Zip

Phone   Fax

The Resident Agent of the Surety in Texas, for delivery of notice and service of the process is:

NAME: ________________________________
STREET ADDRESS: ________________________________
TOWN, STATE, ZIP: ________________________________

NOTE: Date on Page 1 of Performance Bond must be same date as Contract. Date on Page 2 of Performance Bond must be after date of Contract. If Resident Agent is not a corporation, give a person’s name.
PAYMENT BOND

STATE OF TEXAS  )
COUNTY OF DENTON  )

KNOW ALL MEN BY THESE PRESENTS: That _____________________whose address is ____________________________________________, hereinafter called Principal, and ____________________________________________, a corporation organized and existing under the laws of the State of ________________________, and fully licensed to transact business in the State of Texas, as Surety, are held and firmly bound unto the Town of Flower Mound, a home-rule municipal corporation organized and existing under the laws of the State of Texas, hereinafter called “Owner”, and unto all persons, firms, and corporations who may furnish materials for, or perform labor upon the building or improvements hereinafter referred to in the penal sum of ____________________________________________ Dollars ($_________________) in lawful money of the United States, to be paid in Denton County, Texas, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents. The penal sum of this Bond shall automatically be increased by the amount of any Change Order or Supplemental Agreement, which increases the Contract price, but in no event shall a Change Order or Supplemental Agreement, which reduces the Contract price, decrease the penal sum of this Bond.

THE OBLIGATION TO PAY SAME is conditioned as follows: Whereas, the Principal entered into a certain Contract with the Town of Flower Mound, the Owner, dated on or about the _____ day of _________, 20__, a copy of which is attached hereto and made a part hereof, to furnish all materials, equipment, labor, supervision, and other accessories necessary for the construction of:

Western 2.5 Million Gallon Elevated Water Storage Tank, Bid # 48-11-B

NOW THEREFORE, if the Principal shall well, truly and faithfully perform its duties and make prompt payment to all persons, firms, subcontractors, corporations and claimants supplying labor and/or material in the prosecution of the Work provided for in the above-referenced Contract and any and all duly authorized modifications of said Contract that may hereafter be made, notice of which modification to the Surety is hereby expressly waived, then this obligation shall be void; otherwise it shall remain in full force and effect.

PROVIDED FURTHER, that if any legal action were filed on this Bond, exclusive venue shall lie in Denton County, Texas.

AND PROVIDED FURTHER, that the said Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract, or to the Work performed thereunder, or the Plans, Specifications, Drawings, etc., accompanying the same, shall in anywise affect its obligation on this Bond, and it does hereby
waive notice of any such change, extension of time, alteration or addition to the terms of the Contract, or to the Work to be performed thereunder.

This Bond is given pursuant to the provisions of Chapter 2253 of the Texas Government Code, and any other applicable statutes of the State of Texas.

The undersigned and designated agent is hereby designated by the Surety herein as the Resident Agent in Texas for service of process to whom any requisite notices may be delivered and on whom service of process may be had in matters arising out of such suretyship, as provided by Article 7.19-1 of the Insurance Code, Vernon’s Annotated Civil Statutes of the State of Texas.

IN WITNESS WHEREOF, this instrument is executed in six copies, each one of which shall be deemed an original, this, the ______ day of ________________, 20__.  

ATTEST: 

PRINCIPAL:  

By: _________________________________ By: ________________________________

Signature  Signature

Typed/Printed Name  Typed/Printed Name

Title  Title

Address  Address

City    State    Zip  City    State    Zip

Phone    Fax  Phone    Fax  

[Signatures continued on following page]
ATTEST:

By: _________________________________
   Signature

Printed Name ______________________________________

Title ____________________________________________

Address _________________________________________

City __________ State __________ Zip __________

Phone __________ Fax __________

SURETY:

By: _________________________________
   Signature

Printed Name ______________________________________

Title ____________________________________________

Address _________________________________________

City __________ State __________ Zip __________

Phone __________ Fax __________

The Resident Agent of the Surety in Texas, for delivery of notice and service of the process is:

NAME: _________________________________

STREET ADDRESS: _________________________________

TOWN, STATE, ZIP: _________________________________

NOTE: Date on Page 1 of Payment Bond must be same date as Contract. Date on Page 2 of Payment Bond must be after date of Contract. If Resident Agent is not a corporation, give a person’s name.
MAINTENANCE BOND

STATE OF TEXAS )
COUNTY OF DENTON )

KNOW ALL BY THESE PRESENTS: That _______________________________, whose address is________________________________________________, hereinafter referred to as “Principal,” and ___________________________________, a corporate surety/sureties organized under the laws of the State of ___________ and fully licensed to transact business in the State of Texas, as Surety, hereinafter referred to as “Surety” (whether one or more), are held and firmly bound unto the Town of Flower Mound, a Texas municipal corporation, hereinafter referred to as “Owner,” in the penal sum of ___________________________________ Dollars ($_______________), in lawful money of the United States to be paid to Owner, its successors and assigns, for the payment of which sum well and truly to be made, we bind ourselves, our successors, heirs, executors, administrators and successors and assigns, jointly and severally; and firmly by these presents, the condition of this obligation is such that:

WHEREAS, Principal entered into a certain written Contract with the Town of Flower Mound, dated on or about the _____ day of ________________________, 20____, to furnish all permits, licenses, bonds, insurance, products, materials, equipment, labor, supervision, and other accessories necessary for the construction of:

Western 2.5 Million Gallon Elevated Water Storage Tank, Bid # 48-11-B

in the Town of Flower Mound, Texas, as more particularly described and designated in the above-referenced contract, such contract being incorporated herein and made a part hereof as fully and to the same extent as if written herein word for word:

WHEREAS, in said Contract, the Principal binds itself to use first class materials and workmanship and of such kind and quality that for a period of two (2) years from the completion and final acceptance of the improvements by Owner the said improvements shall require no repairs, the necessity for which shall be occasioned by defects in workmanship or materials and during the period of two (2) years following the date of final acceptance of the Work by Owner, Principal binds itself to repair or reconstruct said improvements in whole or in part at any time within said period of time from the date of such notice as the Town Engineer shall determine to be necessary for the preservation of the public health, safety or welfare. If Principal does not repair or reconstruct the improvements within the time period designated, Owner shall be entitled to have said repairs made and charge Principal and/or Surety the cost of same under the terms of this Maintenance Bond.

NOW, THEREFORE, if Principal will maintain and keep in good repair the Work herein contracted to be done and performed for a period of two (2) years from the date of final acceptance and do and perform all necessary work and repair any defective condition (it being understood that the purpose of this section is to cover all defective conditions arising by reason
of defective materials, work or labor performed by Principal) then this obligation shall be void; otherwise it shall remain in full force and effect and Owner shall have and recover from Principal and its Surety damages in the premises as provided in the Plans and Specifications and Contract.

PROVIDED, however, that Principal hereby holds harmless and indemnifies Owner from and against any claim or liability for personal injury or property damage caused by and occurring during the performance of said maintenance and repair operation.

PROVIDED, further, that if any legal action be filed on this Bond, exclusive venue shall lie in Denton County, Texas.

AND PROVIDED FURTHER, Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract or to the Work performed thereunder, or the Plans, Specifications, Drawings, etc. accompanying same shall in any way affect its obligation on this Bond; and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract or to the Work to be performed thereunder.

The undersigned and designated agent is hereby designated by Surety as the resident agent in Texas for service of process to whom all requisite notice may be delivered and on whom service of process may be had in matters arising out of this suretyship.

IN WITNESS WHEREOF, this instrument is executed in six copies, each one of which shall be deemed an original, on this the _____ day of ____________, 20___.

ATTEST:

PRINCIPAL:

By: _________________________________  By: ________________________________
Signature  Signature

Typed/Printed Name  Typed/Printed Name
Title  Title
Address  Address
City  State  Zip  City  State  Zip
Phone  Fax  Phone  Fax
ATTEST:

By: _________________________________  By: _________________________________
   Signature       Signature

Printed Name

Title

Address

City     State     Zip

Phone     Fax

SURETY:

By: _________________________________
   Signature

Printed Name

Title

Address

City     State     Zip

Phone     Fax

The Resident Agent of the Surety in Texas, for delivery of notice and service of the process is:

NAME: _________________________________
STREET ADDRESS: _________________________________
CITY, STATE, ZIP: _________________________________
GENERAL CONDITIONS

1. DEFINITIONS: Wherever used in the Contract Documents, the following terms shall have the meanings indicated which shall be applicable to both the singular and plural thereof.

1.1 **Acceptance, Final Acceptance:** The formal action by the Town in accepting the Work as being complete

1.2 **Addenda:** Written or graphic supplemental documents issued prior to the opening of bids that modify or interpret the Contract Documents, by additions, deletions, clarifications, or corrections.

1.3 **Bid:** The offer or proposal of the Bidder submitted on the prescribed form setting forth the prices for the work to be performed.

1.4 **Bidder:** Any individual, partnership, corporation, or combination thereof submitting a proposal for the Work contemplated, acting directly or through an authorized representative.

1.5 **Bonds:** Bid, performance, payment and/or maintenance bonds and other instruments or security, furnished by the Contractor and his surety in accordance with the Contract Documents.

1.6 **Change Order:** A document recommended by the Engineer which is signed by the Contractor and Town and authorizes an addition, deletion, or revision in the Work, which may include an adjustment in the Contract Price and/or the Contract Time, issued on or after the Effective Date of the Contract.

1.7 **Claim:** A demand or assertion by Town or Contractor seeking an adjustment in Contract Price or Contract Time or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a claim.

1.8 **Contractor:** The individual, partnership, corporation, or combination thereof that has entered into the Contract (or agreement) with the Town for the performance of the Work called for in the Contract Documents.

1.9 **Contract or Contract Agreement:** The written instrument between the Town and Contractor covering the work to be performed. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

1.10 **Contract Documents:** Construction Agreement; Properly executed Change Orders and Field Orders in writing and executed by the Town, the last in time being first in precedence; Any listed and numbered addenda; Special Provisions; Supplementary Conditions; Construction Drawings or Plans; Technical Specifications; Town's Standard Construction Details; The most current edition of the Town of Flower Mound Design Criteria and Construction Standards (by
reference); *Occupational Safety and Health Standards – Excavation*, 20 CFR Part 1926 (by reference); *Texas Manual on Uniform Traffic Control Devices (TMUTCD)* (by reference); The General Conditions; The most current edition of the *Public Works Construction Standards North Central Texas (by reference)*; Notice to Bidders; Instructions to Bidders; The Town's written notice to proceed to Contractor; The Contractor’s Bid Proposal; The Performance Bond, Payment Bond and Maintenance Bond; and Bid materials distributed by the Town that relate to the Project are each and all included in this Contract and the Work shall be done in accordance therewith.

1.11 **Contract Price:** The total monies payable to the Contractor under the terms and conditions of the Contract Documents.

1.12 **Contract Time:** The time set forth in the Contract for the performance and completion of the Work contracted for. The time may be expressed as calendar days, Working Days or a specific date. The term day as used in the Contract Documents shall mean calendar day unless specifically designated otherwise.

   **Calendar Day:** Any successive days of the week or month, no days being excepted.

   **Working Day:** A working day is defined as a calendar day not including Saturdays, Sundays or those legal holidays celebrated by the Town of Flower Mound, in which weather or other conditions not under control of the Contractor shall permit the performance of the principal units of work underway for a continuous period of not less than seven hours between 7 a.m. and 7 p.m.. A principal unit of work shall be that unit which controls the completion time of the Contract. Nothing shall be construed as prohibiting the Contractor from working on Saturdays if he so desires and permission of the Owner has been granted. Work on Sundays or legal holidays, as specified by the Owner, shall not be permitted except in cases of extreme emergency and then only with the written permission of the Owner. If Saturday or Sunday work is permitted, working time shall be charged on the same basis as week days. Where the working time is expressed as calendar days or a specific date, the concept of Working Days shall no longer apply.

1.13 **Effective Date of the Contract:** The date indicated in the Notice to Proceed as the date to proceed with the Work, the date from which Contract Time is measured.

1.14 **Engineer:** The individual or firm designated, appointed, or otherwise employed or delegated by the Town for the Work, or their duly authorized agents, such agents acting within the scope of the particular duties entrusted to them in each case. The Supplementary Conditions shall specify if the Consulting Engineer or the Town Project Engineer will be the Engineer for the contract.
Town Project Engineer or Project Engineer: The Town’s duly authorized representative overseeing the Town’s administration of the Contract and the Contractor’s performance thereunder. Unless specifically provided otherwise in the Contract Documents, the Project Engineer is an employee of the Town of Flower Mound and is not the Consulting Engineer.

Consulting Engineer: The person, firm or entity hired as an independent Consultant by the Town to design the Project and represent the Town in the administration of the Contract in whatever capacity the Town designates. The Town may, at its sole option, designate the Consulting Engineer to be the Project Engineer for the purposes of administration of the Contract. The Consulting Engineer shall be understood to be the Consulting Engineer of the Town, and nothing contained in the Contract Documents shall be construed to make the Consulting Engineer an employee of the Town, nor shall they be construed to create any contractual or agency relationship between the Consulting Engineer and the Contractor. The term includes the officers, associates, agents, and sub-consultants of Consulting Engineer, if any.

1.15 Field Order: A written order issued by the Engineer that orders minor changes in the Work but which does not involve a change in the Contract Price or the Contract Time.

1.16 Final Completion: For the purpose of tracking time, issuing payment of retainage or bonuses and assessing liquidated damages, Final Completion shall be defined as the date upon which all items identified during the walk-through as being incomplete or not functioning as designed (the punch list) have been completed or corrected and the Contractor has requested final acceptance of the Project.

1.17 Laws and Regulations: Any and all applicable laws, rules, regulations, statutes, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

1.18 Liens: Charges, security interests, or encumbrances upon real property, or personal property.

1.19 Maintenance Bond: The approved form of security furnished by the contractor and his sureties conditioned upon the repair and maintenance of any defect arising in any part of the construction of said improvements, and to take all steps necessary to provide the TOWN with a product and/or installation equal to that required by the Contract Documents for such construction for a period as specified in the referenced contract, but not less than two (2) years, following the date of final acceptance.

1.20 Milestone: A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.
1.21 **Notice of Award:** The written notice of the acceptance of the bid from the Town to the successful Bidder.

1.22 **Notice to Proceed:** Written communication issued by the Town to the Contractor authorizing him to proceed with the Work and establishing the date of commencement of the Work, also referred to as the Effective Date, or Effective Start Date of the Contract.

1.23 **Owner:** The Town of Flower Mound, Texas. The term Owner means the Owner or its authorized representative.

1.24 **Partial Utilization:** Use by the Town of a substantially 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.

1.25 **Payment Bond:** The approved form of security furnished by the Contractor and his sureties for the protection of all claimants supplying labor and materials in the prosecution of the Work.

1.26 **Performance Bond:** The approved form of security furnished by the Contractor and his sureties conditioned upon faithful performance of the Work in strict accordance with the plans, specifications, and contract documents.

1.27 **Plans:** The part of the Contract Documents that show the locations, characteristics, dimensions, and details of the Work to be performed and which have been prepared or approved by the Engineer.

1.28 **Proposal:** The offer or proposal of the Bidder submitted on the prescribed form bound herein, setting forth the prices for the elements of the Work to be performed.

1.29 **Resident Project Representative or Inspector:** The authorized representative of the Engineer who is assigned to the site or any part thereof.

1.30 **Samples:** Physical examples, which illustrate materials, equipment or workmanship, and establish standards by which the Work will be judged.

1.31 **Shop Drawings:** All drawings, diagrams, illustrations, schedules and other data which are specifically prepared by or for the Contractor to illustrate some portion of the Work and all illustrations, brochures, standard schedules, performance charts, instructions, diagrams and other information prepared by a Supplier and submitted by the Contractor to illustrate material or equipment for some portion of the Work.
1.32 **Site:** Land or areas indicated in the Contract Documents as being furnished by the Town upon which the Work is to be performed, including rights-of-way, and easements for access thereto, and such other lands furnished by the Town which are designated for use by the Contractor.

1.33 **Specifications:** Those portions of the Contract Documents consisting of written technical descriptions of material, equipment, construction systems, standards and workmanship as applied to the Work and certain administrative details applicable thereto, including these General Conditions and the Supplementary Conditions.

1.34 **Subcontractor:** An individual, firm or corporation having a direct contract with the Contractor or with any other Subcontractor for the performance of a part of the Work at the Site.

1.35 **Substantial Completion:** The Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer as evidenced by Engineer’s definitive certificate of Substantial Completion, it is sufficiently complete, in accordance with the Contract Documents, so that the Work (or specified part) can be utilized for the purposes for which it is intended.

1.36 **Superintendent:** The employee of the Contractor at the Site who shall have sole responsibility and authority for supervision of the Contractor’s forces and construction operations on the Project. The superintendent shall have authority to act on behalf of the Contractor. All communications given to the Superintendent shall be as binding as if given to the Contractor.

1.37 **Supplementary Conditions:** The part of the Contract Documents, which amends or supplements these General Conditions.

1.38 **Supplier:** A manufacturer, fabricator, supplier, distributor, material man or vendor.

1.39 **Town:** The Town of Flower Mound, Texas with whom the Contractor has entered into the Contract and for whom the Work is to be provided.

1.40 **Underground Facilities:** All pipes, pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels or other such facilities or attachments, and any encasement containing such facilities which have been installed underground to furnish any of the following services or materials: electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, sewage and drainage removal, traffic or other control systems or water.

1.41 **Work:** The entire completed construction of the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such Project, and furnishing, installing, and
incorporating all materials and equipment into such Project effect all as required in the Contract Documents.
2. TERMINOLOGY:

2.1 Whenever in these Contract Documents the words “as ordered”, “as directed”, “as required”, “as permitted”, “as allowed”, or words or phrases of like import are used, it shall be understood that the order, directions, requirements, permission or allowance of the Town and Engineer is intended.

2.2 Similarly the words “approved”, “reasonable”, “suitable”, “acceptable”, “properly”, “satisfactory”, or words of like effect and import, unless otherwise particularly specified herein, shall mean approved, reasonable, suitable, acceptable, proper or satisfactory in the judgment of the Town and Engineer.

2.3 Whenever any statement is made in the Contract Documents containing the expression “it is understood and agreed”, or an expression of like import, such expression means the mutual understanding and agreement of the parties executing the Contract of which these General Conditions are a part.

2.4 The word “defective” when modifying the word “Work” refers to Work that is unsatisfactory, faulty, or deficient in any manner and not conforming to the Contract Documents, or failure to meet the requirements of any inspection, reference, standard, test, or approval referred to in the Contract Documents, or has been damaged prior to Engineer’s recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion).

2.5 The word “furnish” when used in connection with services, materials or equipment shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition. The word “install” when used in connection with services, materials or equipment shall mean to put into use - or place in final position - said services, materials or equipment and ready for their intended use. The words “perform” or “provide” when used in connection with services, materials or equipment shall mean to furnish and install said services, materials, or equipment complete and ready for intended use. When “furnish”, “install”, “perform”, or “provide” is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, “provide” is implied.

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

When references are made to the following abbreviations, they refer to the specifications, standards, or methods of the respective national association. All references to such specifications, standards, or methods shall, in each instance, be understood to refer to the latest issue in effect (including all amendments).

AASHTO American Association of State Highway and Transportation Officials  
ACI American Concrete Institute  
ADA Americans with Disabilities Act  
AI The Asphalt Institute  
AIA American Institute of Architects  
AISC American Institute of Steel Construction  
AISI American Iron and Steel Institute  
ANSI American National Standards Institute  
APWA American Public Works Association, Inc.  
AREMA The American Railway Engineering and Maintenance-of-Way Association  
ASTM ASTM International (Succeeding American Society for Testing Materials)  
AWS American Welding Society  
AWWA American Water Works Association, Inc.  
CRSI Concrete Reinforcing Steel Institute  
FED SPEC Federal Specifications  
IBC International Building Code  
NBFU National Board of Fire Underwriters  
NEC National Electric Code  
NEMA National Electrical Manufacturers Association  
NCTCOG North Central Texas Council of Governments  
NESC National Electric Safety Code  
NFPA National Fire Protection Association  
OSHA Occupational Safety and Health Act of 1970  
PCA Portland Cement Association  
SSPC The Society for Protective Coatings  
TCEQ Texas Commission on Environmental Quality  
TDLR Texas Department of Licensing and Regulation  
TWCC Texas Workers’ Compensation Commission  
UL Underwriters Laboratories, Inc.

When references are made to the following abbreviations, the intent and meaning shall be as follows:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>Ave.</td>
<td>Avenue</td>
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<td>Blvd.</td>
<td>Boulevard</td>
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<td>CI</td>
<td>Cast Iron</td>
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<tr>
<td>CL</td>
<td>Center Line</td>
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<td>CO</td>
<td>Cleanout</td>
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<td>Conc.</td>
<td>Concrete</td>
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<td>Min.</td>
<td>Minimum</td>
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<td>Percent</td>
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<td>PI</td>
<td>Plasticity Index</td>
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4. VERBAL STATEMENTS NOT BINDING: It is specifically understood and agreed that the written provisions, specifications, and quantities under this Contract shall supersede all prior and contemporaneous verbal statements of any and every official and/or other representative of the Town, and such statements shall not be effective or be construed as entering into, or forming part of, or altering in any way whatsoever, the written Contract.

5. INTENT OF CONTRACT DOCUMENTS: The intent of the Contract Documents is that the Contractor shall furnish all labor, materials, tools, equipment, and transportation necessary for the proper execution of the Work in accordance with the Contract Documents. The Contract Documents are complementary, and what is called for by one shall be as binding as if called for by all.

6. INTENT OF PLANS AND SPECIFICATIONS: Plans prepared by the Engineer on behalf of the Town and elsewhere described and named accompany and supplement these Specifications and constitute a part of the Contract Documents. Such Plans are agreed to be constructively attached to these Specifications for all purposes although convenience may prevent physical attachment.

6.1 Modifications or Additions to Plans: The Town shall have the right to modify minor details of these Plans, to provide final or checked plans in lieu of any preliminary or unchecked plans, to supplement these Plans with additional plans or with additional information as the Work proceeds, all of which shall be considered as Plans accompanying these Specifications.

6.2 Organization of Specifications: The organization of the Specifications into divisions, sections, and articles, and the arrangement of Plans shall not control the Contractor in dividing the Work among subcontractors or in establishing the extent of Work to be performed by any trade.
7. **PRECEDENCE OF CONTRACT DOCUMENTS:** In case of conflict between the Contract Documents, the following order of precedence shall govern:

1. Construction Agreement
2. Properly executed Change Orders and Field Orders in writing and executed by the Town, the last in time being first in precedence
3. Any listed and numbered addenda;
4. Special Provisions;
5. Supplementary Conditions;
6. Construction Drawings or Plans;
7. Technical Specifications;
8. Town's Standard Construction Details;
12. The General Conditions;
14. Notice to Bidders,
15. Instructions to Bidders
16. The Town's written notice to proceed to Contractor;
17. The Contractor’s Bid Proposal;
18. The Performance Bond, Payment Bond and Maintenance Bond; and
19. Bid materials distributed by the Town that relate to the Project.

Figure dimensions of Plans shall govern over scale dimensions, and detailed drawings shall govern over general drawings. In all cases, where a conflict is cited, the Engineer shall be duly informed.

8. **DISCREPANCIES, ERRORS, AND OMISSIONS:** Any discrepancies, errors, omissions, or ambiguities found in the Contract Documents shall be promptly reported to the Engineer. The Engineer shall clarify such discrepancies or omissions, in writing within a reasonable amount of time. Work done by the Contractor after his discovery of such discrepancies, inconsistencies, or ambiguities shall be at Contractor’s own risk in that subsequent corrective measures may be required.

9. **REUSE OF DOCUMENTS:** Neither the Contractor nor any Subcontractor or Supplier or other person or organization performing or furnishing any of the Work under a direct or indirect contract with the Town shall have or acquire any title to or ownership rights in any of the Plans, Specifications or other documents (or copies of any thereof) prepared by or bearing, the seal of the Engineer; and they shall not reuse any of said documents on extensions of the Project or any other project without prior written consent of the Town.
10. **PRECONSTRUCTION CONFERENCE:** Before the Contractor starts work at the Site, a conference attended by the Contractor, Superintendent, Engineer and others as appropriate will be held to discuss the procedures for handling Shop Drawings and other submittals and for processing Payment Estimates, and to establish a working understanding among the parties as to the Work.

11. **SHOP DRAWINGS:** Where called for in the Contract Documents, the Contractor shall submit to the Engineer for review, six (6) prints of each Shop Drawing. Shop Drawings shall be understood to include detailed calculations, reinforcement bar bending diagrams, fabrication, erection and installation drawings, parts lists, graphs, wiring diagrams, operation instructions, etc. Drawings shall be submitted in sufficient time to allow the Engineer not less than ten (10) working days for review of such drawings, and to accommodate the rate of construction progress required under the Contract.

The review of Shop Drawings by the Engineer will be limited to checking for general agreement with the Contract Documents, and shall in no way relieve the Contractor of responsibility for errors or omissions contained in the Shop Drawings. Fabricating dimensions, quantities of material, applicable code requirements, and other Contract requirements shall be the Contractor’s responsibility. When the Shop Drawings have been reviewed by the Engineer, four (4) sets of submittals will be returned to the Contractor appropriately stamped. If major changes or corrections are necessary, the Shop Drawings may be rejected and one (1) set will be returned to the Contractor with the required changes or corrections indicated, and the Contractor shall promptly make the required changes or corrections. The Contractor shall make a complete and acceptable second submittal to the Engineer. Revisions to the Shop Drawings shall be limited to changes necessary to meet the requirements of the Contract Documents and shall not be taken as the basis of claims for extra work. The Contractor shall have no claims for extra work. The Contractor shall have no claims for damages or extension of time due to any delay resulting from the Contractor’s having to make the required revisions.

Portions of the Work requiring a Shop Drawing or sample submission shall not begin until the Shop Drawing or sample has been reviewed and stamped approved by the Engineer.

12. **WORK DONE WITHOUT LINES OR GRADES:** Any work done without being properly located and work established by base lines, offset stakes, bench marks, or other basic reference points not properly and correctly located, established, or checked by the Engineer, may be ordered removed and replaced at the Contractor’s sole cost and expense.

13. **PRESERVATION OF MONUMENTS AND STAKES:** The Contractor shall carefully preserve all monuments, bench marks, reference points and stakes, and in case of willful or careless destruction of the same will be charged with the resulting expense of replacement, and shall be responsible for any mistake or loss of time that may be caused by their unnecessary loss or disturbance. In the event that the stakes and marks placed by the Engineer are destroyed through carelessness on the part of the Contractor,
and the destruction of those stakes and marks cause a delay in the Work, the Contractor shall have no claim for damages or extensions of time. In the case of any permanent monuments or benchmarks which must of necessity be removed or disturbed in the construction of the Work, the Contractor shall carefully protect and preserve the same until they can be properly referenced for relocation. The Contractor shall furnish at his own expense such materials and assistance as are necessary for the proper replacement of monuments or benchmarks that have been removed or destroyed.

14. UNDERGROUND FACILITIES:

14.1 **Shown or Indicated:** the information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based on the information and data furnished to the Town by the owners of such Underground Facilities or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

The Town shall not be responsible for the accuracy or completeness of any such information or data; and,

The Contractor shall have full responsibility for reviewing and checking all such information and data, for locating all Underground Facilities shown or indicated in the Contract Documents, for coordination of the Work with the owners of such Underground Facilities during construction, for the safety and protection thereof and repairing any damage thereto resulting from the Work, the cost of all of which will be considered as having been included in the Contract Price. This shall include any utilities owned by the Town.

14.2 **Not Shown or Indicated:** If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated in the Contract Documents and which the Contractor could not reasonably have been expected to be aware of, the Contractor shall, promptly after becoming aware thereof and before performing any work affected thereby (except in an emergency) identify the owner of such Underground Facility and give written notice thereof to that owner and to the Engineer. The Engineer will promptly review Contractor’s information and/or the Underground Facility to determine the extent to which the Contract Documents should be modified to reflect and document the consequences of the existence of the Underground Facility. During such time, the Contractor shall be responsible for the safety and protection of such Underground Facility.

14.3 Notwithstanding anything to the contrary set forth herein-above in this provision, the Contractor shall be responsible for contacting all private and public utilities for determining the location of existing facilities and compliance with the State of Texas’ “Call Before You Dig” program mandated by Texas Utility Code Chapter 251 prior to any digging or excavation.
15. **DIFFERING SITE CONDITIONS:** If the Contractor believes that any subsurface or physical condition at or contiguous to the Site that is uncovered or revealed is of such a nature as to establish that any “technical data” on which the Contractor is entitled to rely is materially inaccurate, or is of such nature as to require a change in the Contract Documents, or differs materially from that shown or indicated on the Plans, or is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in Work of the character provided for in the Contract Documents; then the Contractor shall promptly, after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in the case of emergency), notify the Town in writing about such condition. The Engineer will promptly review the information submitted by the Contractor regarding the subsurface or physical condition to determine the extent to which the Contract Documents should be modified to reflect and document the consequences of the existence of the subsurface or physical condition, and the Contract Documents will be amended or supplemented to the extent necessary.

16. **TOWN’S RESPONSIBILITIES:**

16.1 **Communications:** The Town shall issue all communications to the Contractor through the Engineer.

16.2 **Payments:** The Town shall make monthly payments to the Contractor within thirty (30) days of receipt of submittal of the Contractor’s invoice and Quantity Verifications (see Section 17.5, herein below), agreed to by the Contractor and the Engineer. The Town shall retain the right to withhold payments in the event that the Engineer disputes the Contractor’s invoice and/or Quantity Verifications. The Town shall make final payment to the Contractor after the Engineer determines final completion has been achieved and approval by the Town Council and signature by the Town Mayor.

16.3 **Land, Easements and Rights-of-Way:** Prior to issuance of the Notice to Proceed, the Town will obtain all land and rights-of-way necessary for carrying out and for the completion of the Work to be performed pursuant to the Contract Documents, unless otherwise mutually agreed. Nothing contained in the Plans or Specifications shall be interpreted as giving the Contractor exclusive occupancy of the land or rights-of-way provided. Land owned and easements and rights-of-way acquired by the Town are shown on the Plans and the Contractor shall comply with any and all encumbrances, restrictions, or special conditions related thereto. The Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities, stockpiling, disposal, or storage of materials and equipment. The Contractor shall furnish the Engineer with a copy of the agreement made with any property owner(s) for the temporary use of their property to include a description of the activities allowed and the condition in which the property is to be left when the property is no longer required.
16.5 **Encroachments:** The Town will secure, from the agencies having jurisdiction, the necessary permits to create obstructions, to make excavations if required under the Contract, and to otherwise encroach upon rights-of-way.

16.6 **Town’s Right to Retain Imperfect Work:** The Town shall never be obligated to accept any Work that is determined to be defective or imperfect. If, however, any part or portion of the Work done or material furnished under this Contract shall prove defective and not in accordance with the Contract Documents, and if the imperfection in the same, in the opinion of the Engineer, shall not be of sufficient magnitude or importance to make the Work dangerous or undesirable, the Town shall have the authority to retain such Work but shall make such deductions in the final payment therefore as may be just and reasonable. If the parties are unable to agree as to the amount of the deduction, the Town may order the defective part or portion of the Work removed and completed in compliance with the Contract Documents.

16.7 **Temporary Suspension of Work:** The Town may suspend the Work or any portion thereof by written notice to the Contractor for a period of not more than sixty (60) days or such further time as agreed upon by the Contractor due to financing delays, unsuitable weather and/or other unfavorable conditions for prosecution of the Work, delay in delivery of Town-furnished equipment or materials, due to government or judicial controls or orders which make performance of this Contract temporarily impossible or illegal, failure of utilities to be removed or relocated in a timely manner by the Town or others, or failure of the Contractor to carry out provisions of the Contract or to provide materials and workmanship meeting the requirements of the Specifications.

No additional compensation shall be paid to the Contractor for such suspension where same is caused by the fault of the Contractor. When such temporary suspension is not due to the fault of the Contractor, he shall be entitled to:

(a) An equitable extension of working time for completion of the Work not to exceed the delay caused by such temporary suspension, as determined by the Town; and

(b) The actual and necessary cost of properly protecting the finished and partially finished Work, unused materials and uninstalled equipment during the period of the ordered suspension, as determined by the Town, as being beyond the Contract requirements.

(c) With the permission of the Town, where the Contractor elects to move equipment from the job Site and then return it to the Site when the Work is ordered resumed, the actual and necessary costs of these moves, in the amount determined by the Town. The Contractor shall document all costs.
16.8 Termination of Contract (Contractor Not at Fault): The Town may, without cause and without prejudice to any other right or remedy, elect to abandon the Project and terminate the Contract provided that such termination is in the best interest of the Town. Any such termination shall be effected by delivery to the Contractor and his surety of a Notice of Termination specifying the extent to which termination becomes effective. Further, it shall be deemed conclusively presumed and established that such termination is made with just cause as therein stated; and no proof of just cause in any claim, demand or suit will be required of the Town regarding such discretionary action.

16.8.1 After receipt of the Notice of Termination, and except as otherwise directed by the Engineer, the Contractor shall:

(a) stop work under the Contract on the date and to the extent specified in the Notice of Termination.

(b) place no further orders or subcontracts for materials, services or facilities except as may be necessary for completion of such portion of the Work under the Contract as is not terminated.

(c) terminate all orders or subcontracts to the extent they relate to the performance of Work terminated by the Notice of Termination.

(d) transfer title to the Town and deliver in the manner, at the times, and to the extent, if any, directed by the Engineer:

(1) the fabricated or non-fabricated parts, work in progress, completed work, supplies and materials produced as a part of, or acquired in connection with the performance of, the Work terminated by the Notice of Termination; and

(2) the completed or partially completed plans, drawings, information and other property which, if the Contract had been completed, would have been required to be furnished to the Town.

(e) complete performance of such part of the Work as shall not have been terminated by the Notice of Termination, and

(f) take such action as may be necessary, or as the Engineer may direct, for the protection and preservation of the property related to its Contract, which is in the possession of the Contractor, and in which the Town has or may acquire an interest.

16.8.2 Within 60 days after the Notice of Termination, the Contractor shall submit his termination Claim to the Engineer in the form and with the certification prescribed by the Engineer. Unless one or more extensions in
writing are granted by the Engineer upon request by the Contractor, within such 60-day period or authorized extension thereof, any and all Claims arising from termination shall be conclusively deemed waived.

16.8.3 Subject to the provisions of 16.8.2, the Contractor and Town may agree upon the whole or any part of the amount or amounts to be paid to the Contractor by reason of the total or partial termination of the Work pursuant hereto, provided that such agreed amount shall never exceed the total Contract price as reduced by the amount of payments otherwise made and further reduced by the Contract price of Work not terminated. No amount shall be due for lost or anticipated profit.

16.8.4 Nothing shall limit or alter the rights, which the Town may have for the termination of this Contract, or any other right, which Town may have for default or breach of contract by the Contractor.

16.9 Termination of Contract (Contractor at Fault): The Town may, without prejudice to any other right or remedy, terminate the Contract after ten (10) days from delivery of a written notice to the Contractor and his surety in the event of breach of the Contract or of any default by the Contractor. It shall be considered a default by the Contractor whenever the Contractor shall:

(a) declare bankruptcy, become insolvent, or assign his assets for the benefit of his creditors, or if a trustee or receiver is appointed for the Contractor or for any of his property, or if he files a petition to take advantage of any debtor’s act, or to reorganize under the bankruptcy or applicable laws;

(b) repeatedly fail to provide a qualified Superintendent, sufficiently skilled workmen, suitable materials or equipment;

(c) repeatedly fail to make prompt payments to Subcontractors or for labor, materials, or equipment delivered;

(d) disregard laws, ordinances, rules, regulations, or orders of any public body having jurisdiction over the Work or if he disregards the authority of the Engineer;

(e) substantially violate any provision of the Contract Documents; or

(f) repeatedly fail to prosecute Work according to the approved progress schedule.

16.9.1 The Town may take possession of the Project and of all materials, equipment, tools, construction equipment and machinery thereon owned by the Contractor, and finish the Work by whatever method it may deem
expedient. In such case, the Contractor shall not be entitled to receive any further payment until the Work is finished.

16.9.2 If the unpaid balance of the Contract Price exceeds the direct and indirect cost of completing the Project, including compensation for additional professional services arising from Termination, such excess will be paid to the Contractor. If such costs exceed the unpaid balance of the Contract Price for the Work performed, the Contractor shall pay the difference to the Town. Such costs incurred by the Town will be determined by the Engineer and incorporated in a Change Order.

16.9.3 Where the Contractor’s services have been terminated by the Town, said termination shall not affect any right of the Town against the Contractor then existing or which may thereafter accrue. Any retention or payment of monies by the Town due the Contractor will not release the Contractor from compliance with the Contract Documents.

17. ENGINEER’S AUTHORITY: The Engineer will be the Town’s representative during the construction period. The Engineer will be designated the Town’s representative in the Supplementary Conditions.

17.1 Project Representation: The Engineer will be either the Town’s Project Engineer or Consultant Engineer. The Town, at its option, may furnish a Resident Project Representative to assist the Engineer in observing the performance of the Work. The duties, responsibilities and limitations of authority of any such Resident Project Representative will be as provided in the Supplementary Conditions.

17.2 Clarifications and Interpretations: The Engineer will issue with reasonable promptness such written clarifications or interpretations of the requirements of the Contract Documents (in the form of drawings or otherwise) as the Engineer may determine necessary, which shall be consistent with or reasonably inferable from the overall intent of the Contract Documents. If the Contractor believes that a written clarification or interpretation justifies an increase in the Contract Price or an extension of the Contract Time, and the parties are unable to agree to the amount or extent thereof, the Contractor may make a Claim on the Contract.

17.3 Authorized Variations in Work: The Engineer may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Time and are consistent with the overall intent of the Contract Documents. These minor variations may be accomplished by a Field Order and will be binding on the Town, and also on the Contractor who shall perform the Work involved promptly. If the Contractor believes that a Field Order justifies an increase in the Contract Price or an extension of the Contract Time and the parties are unable to agree as to the amount or extent thereof, the Contractor may make a Claim on the Contract.
17.4 Rejecting Defective Work: The Engineer will have authority to disapprove or reject Work which the Engineer believes to be defective, and will also have the authority to require special inspection or testing of the Work, whether or not the Work is fabricated, installed or completed.

17.5 Determinations for Payment: The Engineer, or his representative, and the Contractor will determine the actual Work performed by the Contractor. This Work shall be posted on a Town prepared form titled “Quantity Verification” and signed by both parties. The completed “Quantity Verification” form will be forwarded to the Town’s Capital Projects Manager to be used to prepare the estimate for payment to the Contractor. In case of a disagreement of the quantities of Work performed, the Engineer’s decision will be final and binding upon the Town and the Contractor unless, within ten days after the date of such decision, the Contractor delivers to the Town written notice of the intention to appeal such decision. If the Contractor files an appeal, except for the Final Pay Estimate, the Pay Estimate will be processed for payment based on the information furnished by the Engineer. The Engineer shall respond to the appeal within fifteen working days of receipt. If the Engineer agrees with all or any part of the appeal, the corrected quantities will be reflected on the next scheduled Pay Estimate. If the Contractor does not agree with the Engineer’s response, he may file a Claim on the Contract.

17.6 Means and Methods of Construction: The Engineer will not be responsible for the Contractor’s means, methods, techniques, procedures of construction, or the safety precautions and program incident thereto, and the Engineer will not be responsible for the Contractor’s failure to perform or furnish the Work in accordance with the Contract Documents. The Engineer will not be responsible for the acts or omissions of the Contractor, of any Subcontractor, or any Supplier, or of any other person or organization performing or furnishing any of the Work.

18. CONTRACTOR’S RESPONSIBILITY: By executing the Contract, the Contractor represents that he has visited the Site, familiarized himself with the local conditions under which the Work is to be performed, and correlated his observations with the requirements of the Contract Documents.

18.1 Insurance Requirements: All contracts entered into by the Town for construction purposes require the contractor to carry insurance coverage covering both himself and any subcontractors as outlined in Section 21, hereof, entitled “Bonds and Insurance.”

18.2 Supervision: The Contractor shall supervise 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, but the Contractor shall not be responsible for the negligence of others in the design or selection of a
specific means, method, technique, sequence or procedure of construction which is indicated in and required by the Contract Documents. The Contractor shall be responsible to see that the finished Work complies accurately with the Contract Documents.

18.3 Superintendence of Work: The Contractor shall provide and maintain, continually on the Site of the Work during its progress, adequate and competent superintendence of all operations for and in connection with the Work being performed under this Contract, either personally or by a duly authorized Superintendent or representative having the skill and authority of a Superintendent (“Representative”).

18.3.1 The Superintendent or other Representative of the Contractor on the Work or at the Site shall have authority to act for the Contractor and to receive orders given by the Engineer for the proper prosecution of the Work, and/or notices in connection therewith.

18.3.2 The Superintendent shall be a person having considerable experience on similar projects. The Contractor shall submit the name of the proposed Superintendent to the Town together with a list of projects on which the proposed individual has served as superintendent. Such list shall detail the size and complexity of projects and shall include references for each such engagement. The Engineer shall review the submitted qualifications. No person shall serve as Superintendent without approval of the Town. The Town’s approval shall not unreasonably be withheld.

18.4 Working Hours: Except in connection with the safety or protection of persons or the Work or property at the Site and adjacent thereto, and except as otherwise indicated in the Contract Documents, all Work at the Site shall be performed during standard daylight hours which shall be defined as the hours between 7:00 a.m. to 7:00 p.m. Monday through Friday and 9:00 a.m. to 5:00 p.m. Saturday. The Contractor must notify the Engineer not later than Thursday of the week for work on Saturday or Sunday. A request to work on Sunday must be in writing and the approval/disapproval by the Town must be in writing. No construction equipment or machinery shall be operated before or after standard daylight hours within one thousand feet (1,000’) of any residence. Work on Sundays, legal holidays, or before or after standard daylight hours, shall not be done without the written consent of the Town Engineer except for work done in connection with the care, maintenance or protection of equipment or already completed Work or to correct conditions that are unsafe to the public.

18.4.1 Concrete placement Work shall be scheduled so that all pouring and finishing shall be completed during standard daylight hours, except as approved in advance by the Town Engineer. When working under emergency conditions, or when Work must be concluded under artificial
lighting, lighting shall be erected and directed so that it shall not shine upon any residence or create a visual traffic hazard.

18.4.2 Certain traffic congestion areas will require that modified standard work hours be enforced where street blockage, traffic flow, channelization, and/or flagmen are required. These areas will be identified in the Supplementary Conditions.

18.4.3 The following holidays are to be observed and construction is not to be undertaken unless Contractor submits a written request and prior written approval is received from the Town Engineer:

- New Year’s Day
- Martin Luther King Day
- Good Friday
- Memorial Day
- Independence Day
- Labor Day
- Thanksgiving Day and the following Friday
- Christmas Eve Day and Christmas Day

18.5 Commencement of Work and Progress: The Contractor shall, within ten (10) days after the effective start date as shown in the notice to Proceed, commence the Work to be done under this Contract; and the rate of progress shall be such that the Work shall be completed in accordance with the terms of the Contract on or before the termination of the Contract Time stated in the Proposal, subject to any extension or extensions of such time made as hereinafter provided.

18.5.1 A minimum of two (2) working days prior to the Pre-Construction conference, the Contractor shall submit to the Engineer for approval an estimated progress schedule and a written program of construction outlining the proposed operations and the order of completion of the various parts in sufficient detail to demonstrate to the Engineer the adequacy of the progress to complete the Work within the time provided. No payment shall be made to the Contractor on any Payment Estimate until such progress schedule and program shall have been submitted and approved.

18.5.2 Should it become evident at any time during construction that construction operations will or may fall behind the schedule of this first program of construction the Contractor shall, upon request, promptly submit revised written schedules setting out operations, methods and equipment, added amounts of labor, or of working shifts, night work, etc., by which lost time shall be made up and shall confer with the Engineer until an approved modification of the original program and schedule have been provided by the Contractor. Execution of the Work according to the accepted program
of construction, or approved modifications thereof, shall be an obligation of the Contractor.

18.5.3 Should the Contractor fail to complete the Work within the Contract Time as stipulated in the Proposal or within such extra time as may have been allowed by extension through a properly approved and executed Change Order, the Town will deduct from any moneys due or coming due to the Contractor, the amount indicated in the Proposal for each calendar day the Work shall remain uncompleted. This sum shall be considered and treated not as a penalty but as fixed, agreed and liquidated damages due the Town from the Contractor by reason of interference with business, inconvenience to the public, added cost of engineering, administration, inspection, maintenance of detours and temporary facilities, and other items which have caused or may cause an expenditure of funds resulting from Contractor’s failure to complete the Work within the Contract Time.

18.5.4 Permitting the Contractor to continue and finish the Work or any part of it after the time fixed for its completion, or after the date to which the time for completion may have been extended, shall in no way operate as a waiver on the part of the Town of any of its rights under the Contract.

18.5.5 Neither by the act of taking over the Work nor by the annulment of the Contract nor by requiring the surety to complete the Contract shall the Town forfeit the right to recover liquidated damages from the Contractor or his surety for failure to complete the Contract within the specified Contract Time.

18.6 **Principal Material Orders:** The Contractor shall place orders for all principal materials to be needed in the Work within ten days after award of the Contract and delivery dates shall be obtained, in writing, from the suppliers of each of the materials. One copy of each order for the primary materials in the Contract together with one copy of the supplier’s reply stating the date of delivery shall be furnished to the Engineer prior to the payment of the first partial monthly payment estimate.

18.7 **Extensions of Time:** Should special conditions arise from war, strikes, fires, floods, epidemics, quarantine restrictions, freight embargos, unusually severe weather conditions or other national emergencies wherein restrictions may prevent or delay the acquisition, delivery or use of materials and be the direct cause of specific delays, extensions of time will be granted. In such event, the Contractor shall file with the Engineer, copies of documentary evidence to substantiate the causes and extent of resultant delays at the time they are occurred. This evidence together with the original orders and written delivery dates will be used by the Engineer to determine the amount of any extension of time to be made on account of such delays. In determining extensions of time, revised delivery dates for primary materials will be computed by extending the original
Contract Time by the actual number of days, which elapses during any emergency.

18.7.1 The Contractor is requested to bring to the attention of the Engineer, by letter, during the progress of the Work, the occurrence of events, which the Contractor considers, may warrant extensions of time under the conditions of the Contract. If the Contract is not completed within the Contract Time, the Contractor shall, at the conclusion of the Work, at his option, present to the Engineer a written statement presenting his view upon all matters of time extensions.

18.7.2 The amount of all extensions of time, for whatever reason granted, shall be determined by the Engineer with due consideration given to working seasons and working conditions. In general, only actual and not constructive or hypothetical days of delay will be considered. The Town shall have the authority to grant additional extensions of time as the Town may deem advisable and justifiable.

18.7.3 No extension of time shall be recognized by the Town unless it is specifically identified in and approved through a properly executed Change Order.

18.8 Substitutes or “Or-Equal” Items: Whenever materials or equipment are specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular supplier, the naming of the item is intended to establish the type, function and quality required. Unless the name is followed by words indicating that no substitution is permitted, materials or equipment of other Suppliers may be accepted by the Engineer to determine that the material or equipment proposed is equivalent or equal to that named. If the Contractor proposes using a substitute item of material or equipment, the Contractor shall make written application to the Engineer for acceptance thereof, certifying that the proposed substitute will perform adequately the functions and achieve the results called for by the general design, be similar and of equal substance to that specified and be suited to the same use as that specified. The application will state that the evaluation and acceptance of the proposed substitute will not prejudice the Contractor’s achievement of Substantial Completion on time, whether or not acceptance of the substitute for use in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with the Town for Work on the Project) to adapt the design to the proposed substitute and whether or not incorporation or use of the substitute in connection with the Work is subject to payment of any license fee or royalty. All variations of the proposed substitute from that specified will be identified in the application and available maintenance, repair and replacement service will be indicated. The application will also contain an itemized estimate of all costs that will result directly or indirectly from acceptance of such substitute, including costs of redesign and Claims of other contractors affected by the resulting change,
all of which shall be considered by the Engineer in evaluating the proposed substitute. The Engineer may require the Contractor to furnish, at the Contractor’s expense, additional data about the proposed substitute.

18.8.1 If a specific means, method, technique, sequence or procedure of construction is indicated in or required by the Contract Documents, the Contractor may furnish or utilize a substitute means, method, sequence, technique or procedure of construction acceptable to the Engineer, if the Contractor submits sufficient information to allow the Engineer to determine that the substitute proposed is equivalent to that indicated or required by the Contract Documents.

18.8.2 The Engineer will be allowed a reasonable time within which to evaluate each proposed substitute. The Engineer will be the sole judge of acceptability, and no substitute will be ordered, installed or utilized without the Engineer's prior written acceptance, which will be evidenced by a Change Order or an approved Shop Drawing. The Town may require the Contractor to furnish, at the Contractor's expense, a special performance guarantee or other surety with respect to any substitute.

18.9 Subcontractors and Suppliers: The Contractor shall not employ any Subcontractor, Supplier or other person or organization, whether initially or as a substitute, against whom the Town may have a reasonable objection. The Contractor shall not be required to employ any Subcontractor, Supplier or other person or organization to furnish or perform any of the Work against whom the Contractor has reasonable objection.

18.9.1 If the Supplementary Conditions require the identification of certain Subcontractors, Suppliers or other persons or organizations (including those who are to furnish the principal items of materials and equipment) be submitted to the Town for acceptance by the Town and if the Contractor has submitted a list thereof in accordance with the Supplementary Conditions, the Town's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the bidding documents or the Contract Documents) of any such Subcontractor, Supplier or other person or organization so identified may be revoked on the basis of reasonable objection after due investigation, in which case the Contractor shall submit an acceptable substitute. No acceptance by the Town of any such Subcontractor, Supplier or other person or organization shall constitute a waiver of any right of the Town to reject defective Work.
18.9.2 The Contractor shall be fully responsible to the Town 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 as if such acts or omissions were the Contractor's own acts and omissions. Nothing in the Contract Documents shall create any contractual relationship between the Town and any such Subcontractor, Supplier or other person or organization, nor shall it create any obligation on the part of the Town to compensate or provide any moneys due any such Subcontractor, Supplier or other person or organizations, except as may otherwise be required by other applicable laws and regulations, or by separate written agreements.

18.9.3 All Work performed for the Contractor by a Subcontractor shall be pursuant to an appropriate agreement between the Contractor and the Subcontractor, which agreement shall specifically bind the Subcontractor to the applicable terms and conditions of the Contract Documents for the benefit of the Town. The Contractor shall pay each Subcontractor a just share of any insurance moneys received by the Contractor on account of losses under policies issued. The Contractor shall provide reasonable assurances if requested by the Town that subcontractor payments have been made prior to the Town’s payment of Contractor invoices.

18.10 Patent Fees and Royalties: The Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product or device is specified in the Contract Documents for use in the performance of the Work and, if to the actual knowledge of the Town its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by the Town in the Contract Documents. The Contractor shall indemnify and hold harmless the Town and anyone directly or indirectly employed by the Town from and against any and all claims, damages, losses and expenses (including attorney's fees and court and arbitration costs) arising out of any infringement of patent rights or copyrights incident to the use of such patented or copyrighted items, designs or processes in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, produce or device not specified in the Contract Documents, and shall defend all such claims in connection with any alleged infringement of such rights.

18.11 Permits: Unless otherwise provided in the Supplementary Conditions, the Contractor shall obtain and pay for all construction permits and licenses. The
Town shall assist the Contractor, when necessary, in obtaining such permits and licenses. The Contractor shall pay all charges of utility owners for connections to the Work, and the Town shall pay all charges of such utility owners for capital costs related thereto such as plant investment fees.

18.12 **Laws and Regulations:** The Contractor shall give all notices and comply with all Laws and Regulations applicable to furnishing and performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, the Town shall not be responsible for monitoring the Contractor's compliance with any Laws or Regulations. If the Contractor observes that the Plans and Specifications are at variance with any Laws or Regulations, the Contractor shall give the Engineer prompt written notice thereof, and any necessary changes will be authorized by the Town. If the Contractor knowingly performs any Work contrary to such Laws or Regulations, and without such notice to the Engineer, the Contractor shall bear all costs arising therefrom; however, it shall not be the Contractor's primary responsibility to make certain that the Plans and Specifications are in accordance with such Laws and Regulations.

18.13 **Use of Premises:** The Contractor shall be responsible for the Project Site during the performance of the Work. The Contractor shall confine construction equipment, the storage of materials and equipment and the operations of workers to the Project Site and land and areas identified in and permitted by 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 land or areas contiguous thereto, resulting from the performance of the Work. Should any claim be made against the Town by any such owner or occupant because of the performance of the Work, the Contractor shall promptly attempt to settle with such other party by agreement or otherwise resolve the claim by arbitration or at law. **The Contractor shall, to the fullest extent permitted by Laws and Regulations, indemnify and hold the Town harmless from and against any and all claims, damages, losses and expenses (including, but not limited to, fees of engineers, architects, attorneys and other professionals and court and arbitration costs) arising directly, indirectly or consequentially out of any action, legal or equitable, brought by any party against the Town to the extent based on a claim arising out of the Contractor's performance of the Work.**

18.13.1 Where the space within the Project Site, right-of-way or easements is not available for a construction plant, the Contractor shall provide at his own expense any work area he requires, shall construct and maintain any
roadway or other facilities required for this purpose and the cost thereof shall be included in the prices bid for the various items scheduled in the Proposal.

18.13.2 During the progress of the Work, the Contractor shall keep the Site 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, and shall leave the Site clean and ready for occupancy by the Town. The Contractor shall restore to original condition all property not designated for alteration by the Contract Documents.

18.13.3 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.

18.14 Record Documents: The Contractor shall maintain in a safe place at the Site one record copy of all Plans, Specifications, Addenda, Change Orders, Field Orders, and written interpretations and clarifications, NCTCOG Specifications, Town of Flower Mound Design Criteria and Construction Standards in good order annotated to show all changes made during construction. These record documents together with all approved samples and a counterpart of all approved Shop Drawings will be available to the Engineer for reference.

18.15 Safety and Protection: The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work.

18.15.1 The Contractor shall comply with all applicable Laws and Regulations of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss; 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 these paragraphs caused, directly or indirectly, in whole or in part, by the Contractor, any Subcontractor, Supplier or any other 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, shall be remedied by the Contractor. The Contractor's duties and responsibilities for the safety and protection of the Work shall continue until such time as all the Work is completed and the Engineer has issued a notice to the Contractor that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

18.15.2 The Contractor shall designate a responsible representative at the Site whose duty shall be the prevention of accidents. This person shall be the Contractor's Superintendent unless otherwise designated in writing by the Contractor to the Town.

18.15.3 Where the Work is carried on, in or adjacent to any street, alley, sidewalk, public right-of-way or public place, the Contractor shall at his own cost and expense provide such flagmen and watchmen and furnish, erect and maintain such warning devices, barricades, lights, signs, and other precautionary measures for the protection of persons or property as are required by Laws and Regulations. The Contractor’s responsibility for providing and maintaining flagmen, watchmen, warning devices, barricades, signs, and lights and other precautionary measures shall not cease until the Work is accepted by the Town. In addition, the Contractor will be liable for all damage to the Work and other public or private property due to the failure of warning devices, barricades, lights, signs or other precautionary measures in protecting said property, and whatever evidence is found of such damage, the Engineer may order the damaged portion immediately removed and replaced by and at the cost and expense of the Contractor.

18.15.4 Minimum standards for safeguarding pedestrian and vehicular traffic are contained in the most current version of the “TEXAS MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES”, as amended, Texas Department of Transportation. Signage, barricades and other traffic control devices for detouring and maintenance of traffic on this Contract shall be as provided in the above-mentioned manual and as directed by the Engineer. Costs associated with the acquisition, installation, maintenance and removal of required traffic control devices shall be considered incidental to and included in this Work.

18.15.5 If an excavation is required in the Work, the Contractor shall install a trench safety system in accordance with the Occupational Safety and Health Administration Standards 1926.652 “Requirements for Protective Systems.” The regulation requires that a competent person make a daily inspection of the excavation prior to start of work and as needed.
throughout the shift. The Contractor will notify the Engineer, in writing, of the name of the “competent person”. The regulation also states “In order to be a ‘competent person’ for the purposes of this standard one must have had specific training in, and be knowledgeable about, soil analysis, the use of protective systems, and requirements of this standard.”

18.16 **Emergencies:** In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, the Contractor, without special instruction or authorization from the Engineer, is obligated to act to prevent threatened damage, injury or loss. The Contractor shall give the Engineer 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 the Engineer determines that a change in the Contract Documents is required because of the action taken in response to an emergency, a Change Order will be issued to document the consequences of the changes or variations.

18.17 **Losses From Natural Causes:** All loss or damage arising out of the nature of the Work, to be done, or from the action of the elements, or from floods or overflows, or from groundwater, or from any unusual obstruction or difficulty, or any other natural or existing circumstances either known or unforeseen, which may be encountered in the prosecution of the Work shall be sustained and borne by the Contractor at Contractor’s own cost and expense.

18.18 **Continuing the Work:** The Contractor shall carry on the Work and adhere to the progress schedule during all disputes or disagreements with the Town. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as the Contractor and Town may otherwise agree in writing.

18.19 **INDEMNIFICATION:** CONTRACTOR DOES HEREBY AGREE TO WAIVE ALL CLAIMS, RELEASE, INDEMNIFY, DEFEND AND HOLD HARMLESS THE TOWN AND ALL OF ITS OFFICIALS, OFFICERS, AGENTS, EMPLOYEES, IN BOTH THEIR PUBLIC AND PRIVATE CAPACITIES, FROM AND AGAINST ANY AND ALL LIABILITY, CLAIMS, LOSSES, DAMAGES, SUITS, DEMANDS OR CAUSES OF ACTION INCLUDING ALL EXPENSES OF LITIGATION AND/OR SETTLEMENT, COURT COSTS AND ATTORNEY FEES WHICH MAY ARISE BY REASON OF INJURY TO OR DEATH OF ANY PERSON OR FOR LOSS OF, DAMAGE TO, OR LOSS OF USE OF ANY PROPERTY OCCASIONED BY ERROR, OMISSION, OR NEGLIGENT ACT OF CONTRACTOR, HIS OFFICERS, AGENTS, EMPLOYEES, SUBCONTRACTORS, INVITEES OR ANY OTHER PERSONS, ARISING OUT OF OR IN CONNECTION WITH THE PERFORMANCE OF THIS CONTRACT, AND CONTRACTOR WILL AT HIS OR HER OWN COST AND EXPENSE DEFEND AND PROTECT TOWN FROM ANY AND ALL SUCH CLAIMS AND DEMANDS.
CONTRACTOR DOES HEREBY AGREE TO WAIVE ALL CLAIMS, RELEASE, INDEMNIFY, DEFEND AND HOLD HARMLESS TOWN AND ALL OF ITS OFFICIALS, OFFICERS, AGENTS, AND EMPLOYEES, FROM AND AGAINST ANY AND ALL CLAIMS, LOSSES, DAMAGES, SUITS, DEMANDS OR CAUSES OF ACTION, AND LIABILITY OF EVERY KIND INCLUDING ALL EXPENSES OF LITIGATION AND/OR SETTLEMENT, COURT COSTS AND ATTORNEYS FEES FOR INJURY OR DEATH OF ANY PERSON OR FOR LOSS OF, DAMAGES TO, OR LOSS OF USE OF ANY PROPERTY, ARISING OUT OF OR IN CONNECTION WITH THE PERFORMANCE OF THIS CONTRACT. SUCH INDEMNITY SHALL APPLY WHETHER THE CLAIMS, LOSSES, DAMAGES, SUITS, DEMANDS OR CAUSES OF ACTION ARISE IN WHOLE OR IN PART FROM THE NEGLIGENCE OF THE TOWN, ITS OFFICERS, OFFICIALS, AGENTS OR EMPLOYEES. IT IS THE EXPRESS INTENTION OF THE PARTIES HERETO THAT THE INDEMNITY PROVIDED FOR IN THIS PARAGRAPH IS INDEMNITY BY CONTRACTOR TO INDEMNIFY AND PROTECT TOWN FROM THE CONSEQUENCES OF TOWN'S OWN NEGLIGENCE, WHETHER THAT NEGLIGENCE IS A SOLE OR CONCURRING CAUSE OF THE INJURY, DEATH OR DAMAGE.

IN ANY AND ALL CLAIMS AGAINST ANY PARTY INDEMNIFIED HEREUNDER BY ANY EMPLOYEE OF THE CONTRACTOR, ANY SUB-CONTRACTOR, ANYONE DIRECTLY OR INDIRECTLY EMPLOYED BY ANY OF THEM OR ANYONE FOR WHOSE ACTS ANY OF THEM MAY BE LIABLE, THE INDEMNIFICATION OBLIGATION HEREIN PROVIDED SHALL NOT BE LIMITED IN ANY WAY BY ANY LIMITATION ON THE AMOUNT OR TYPE OF DAMAGES, COMPENSATION OR BENEFITS PAYABLE BY OR FOR THE CONTRACTOR OR ANY SUB-CONTRACTOR UNDER WORKMEN'S COMPENSATION OR OTHER EMPLOYEE BENEFIT ACTS.

19. OTHER WORK: The Town may perform other work related to the Project at the Site by the Town's own forces, have other work performed by utility owners or let other direct contracts therefore which shall contain General Conditions similar to these provisions. If the fact that such other work is to be performed was not noted in the Contract Documents, written notice thereof will be given to the Contractor prior to starting any such other work; and, if the Contractor believes that such performance will involve additional expense to the Contractor or require additional time and the parties are unable to agree as to the extent thereof, the Contractor may make a Claim therefore.

19.1 The Contractor shall afford each utility owner and other contractor who is a party to such a direct contract (or the Town, if the Town is performing the additional work with the Town'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. 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 the Engineer and the others whose work will be affected. The duties and responsibilities of the Contractor under this paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of the Contractor in said direct contracts between the Town and such utility owners and other contractors.

19.2 If any part of the Contractor's Work depends on proper execution of or relies upon the work of any such other contractor or utility owner (or the Town), the Contractor shall inspect and promptly report to the Engineer, in writing, any delays, defects or deficiencies in such work that render it unavailable or unsuitable for such proper execution and reliance. The Contractor's failure so to report will constitute an acceptance of the other work as fit and proper for integration with the Contractor's Work except for latent or non-apparent defects or deficiencies in the other work.

19.3 **Coordination:** If the Town contracts with others for the performance of other work on the Project at the Site, the person or organization who will have authority and responsibility for coordination of the activities among the various prime contractors will be identified in the Supplementary Conditions, and the specific matters to be covered by such authority and responsibility will be itemized, and the extent of such authority and responsibilities will be provided, in the Supplementary Conditions. Unless otherwise provided in the Supplementary Conditions, the Town shall not have any responsibility or liability resulting from any failure to coordinate the Work and any other work.

20. **MISCELLANEOUS PROVISIONS:**

20.1 **Legal Address:** The business address of the Contractor given in the Proposal upon which this Contract is founded is hereby designated as the place to which all notices, letters and other communications to the Contractor may be mailed or delivered. The business address of the Town appearing in the Contract is hereby designated as the place to which all notices, letters and other communications to the Town may be mailed or delivered. The delivery by one party to the other party at an address so designated, or the depositing in any mail box regularly maintained by the post office, of any notice, letter or other communication addressed to such address, postage prepaid, registered or certified mail, with return receipt requested, shall be deemed sufficient service thereof, and the date of said service shall be the date of such delivery or mailing. Either party may change the said address or addresses at any time by an instrument in writing delivered to the other party. Nothing herein contained shall be deemed to
preclude or render inoperative the service of any notice, letter or communication upon either party personally.

20.2 Independent Contractor: The right of general supervision by the Town shall not make the Contractor an agent of the Town, and the liability of the Contractor for all damages to persons, firms and corporations, arising from the Contractor's execution and performance of the Work, shall not be lessened because of such general supervision; but as to all such persons, firms and corporations and the damages, if any, to them or their property, the Contractor herein is an independent contractor in respect to the Work.

20.3 Suggestions to Contractor Adopted at his Own Risk: Any plan or method of work suggested by the Town, the Engineer, or their representatives, to the Contractor, but not specified or required, if adopted or followed by the Contractor in whole or in part, shall be used at the sole risk and responsibility of the Contractor, and the Town assumes no resulting liability therefor, if any.

20.4 Hindrances and Delays: In executing the Contract, the Contractor expressly covenants and agrees that, in undertaking to complete the Work within the time therein fixed, he has taken into consideration and made allowances for all hindrances and delays incident to such Work, whether growing out of delays in securing materials or workmen or otherwise. No charge shall be made by the Contractor for hindrances or delays from any cause during the progress of the Work, or any portion thereof, embraced in this Contract, except as provided by the Town's right to suspend the Work.

20.5 Provision for Emergencies: Whenever, in the opinion of the Engineer, the Contractor has not taken sufficient precaution for the safety of the public or the protection of the Work to be constructed under this Contract or of adjacent structures or property which may be injured by processes of construction on account of such neglect, and whenever, in the opinion of the Engineer, an emergency shall arise and immediate action shall be considered necessary in order to protect public or private personal property interests, then the Engineer, with or without notice to the Contractor, may provide (but does not have a corresponding duty to so provide) suitable protection to the said interests by causing such work to be done and material to be furnished and placed as the Engineer may consider necessary and adequate. The cost and expense of such work and material so furnished shall be borne by the Contractor, and, if the same shall not be paid on presentation of the bills therefore, such costs shall be deducted from any amounts due or to become due the Contractor. The performance of such emergency work under the direction of the Engineer shall in no way relieve the Contractor of
responsibility for damages which may occur during or after such precaution has been duly taken by the Engineer.

20.6 **Assignment or Delegation:** The Contractor shall not assign or delegate the Work, or any part thereof, without the previous written consent of the Town, nor shall he assign, by power of attorney or otherwise, any of the money payable under this Contract unless by and with the like consent of the Town to be signified in like manner. No right under this Contract, nor to any money due or to become due hereunder, shall be asserted in any manner against said Town, or persons acting for the Town, by reason of any so-called assignment or delegation of this Contract or any part thereof, unless such assignment shall have been authorized by the prior written consent of the Town. In case the Contractor assigns all, or any part of, any moneys due or to become due under this Contract, the instrument of assignment shall contain a right of the assignee in and to any moneys due or to become due under this Contract, and the Contractor and its assignee shall be subject to all prior liens of all persons, firms and corporations for services rendered or materials supplied for the performance of the Work called for in this Contract.

20.7 **Protests:** If the Contractor considers any work demanded of him to be outside the requirements of the Contract, or if he considers any order, instruction, or decision of the Engineer to be unreasonable, the Contractor shall, immediately upon receipt of such order, instruction, or decision, ask for a written confirmation of the same, whereupon he shall proceed without delay to perform the Work or to conform to the order, instruction, or decision; but if the Contractor finds such written order, instruction, or decision unsatisfactory, he shall, within ten (10) calendar days after receipt of same, file a written protest and Claim with the Town, stating clearly and in detail Contractor's objections and the reasons therefore. Except for such protests or objections to the orders, instructions, or decisions of the Engineer, Contractor hereby agrees that as to all matters not included in such protest, the orders, instructions, and decisions of the Engineer shall be considered final and binding. All orders, instructions, and decisions of the Engineer will be limited to matters properly falling within the Engineer's authority.

21. **BONDS AND INSURANCE**

21.1 **Bonds:** The Contractor shall furnish surety as follows:

21.1.1 **Performance Bond:** A good and sufficient bond in an amount not less than one hundred percent (100%) of the total amount of the Contract, as evidenced by the proposal tabulation, guaranteeing the full and faithful execution of the Work and performance of the Contract in accordance
with the Plans, Specifications and Contract Documents, including any
extensions thereof, for the protection of the Town. The bond shall provide
for the repair and/or replacement of all defects due to faulty materials and
workmanship within a period of one (1) year from the date of final
acceptance of the Project by the Town of Flower Mound Council and
signature of the Town Mayor.

21.1.2 Payment Bond: A good and sufficient bond in an amount not less than
one hundred percent (100%) of the total amount of the Contract, as
evidenced by the proposal tabulation, guaranteeing the full and proper
protection of all claimants supplying labor and materials in prosecution of
the work provided for in said Contract and for the use of each claimant.

21.1.3 Maintenance Bond: A good and sufficient bond in an amount not less than
one hundred percent (100%) of the total amount of the Contract, as
evidenced by the proposal tabulation, guaranteeing that the materials and
workmanship used in the Work are of such kind and quality that for a
period of two (2) years from the completion and final acceptance of the
improvements by Town the said improvements shall require no repairs,
the necessity for which shall be occasioned by defects in workmanship or
materials and during which two (2) year period following the date of final
acceptance of the Work by Town, the Contractor binds itself to repair or
reconstruct said improvements in whole or in part at any time within said
period of time from the date of such notice as the Engineer shall determine
to be necessary for the preservation of the public health, safety or welfare.

21.1.4 No sureties shall be accepted by the Town who are now in default or
delinquent on any bonds or who are interested in any litigation against the
Town. All bonds shall be made on forms furnished in these Contract
Documents and shall be issued by a corporate surety authorized to do
business in the State of Texas, pursuant to Chapter 2253 of the Texas
Government Code, and acceptable to and approved by the Town. Further,
the Contractor shall supply capital and surplus information concerning the
surety and reinsurance information concerning the performance, payment
and maintenance bonds upon Town request. In addition to the foregoing
requirements, if the amount of the bond exceeds One Hundred Thousand
Dollars ($100,000) the bond must be issued by a surety that is qualified as
a surety on obligations permitted or required under federal law as
indicated by publication of the surety’s name in the current U.S. Treasury
Department Circular 570. In the alternative, an otherwise acceptable
surety company (not qualified on federal obligations) that is authorized
and admitted to write surety bonds in Texas must obtain reinsurance on
any amounts in excess of One Hundred Thousand Dollars ($100,000) from a reinsurer that is authorized and admitted as a reinsurer in Texas who also qualifies as a surety or reinsurer on federal obligations as indicated by publication of the surety’s or reinsurer’s name in the current U.S. Treasury Department Circular 570. Each surety shall designate an agent resident in the Town’s jurisdictional area acceptable to the Town to whom any requisite notices may be delivered and on whom service of process may be had in matters arising out of such suretyship. The Town reserves the right to reject any and all sureties. Attorneys-in-fact who sign the bonds must file with each bond a certified and effective dated copy of their power of attorney.

21.2 Insurance: The Contractor shall maintain, at its own expense, procure and pay for and maintain throughout the period of this Project the insurance coverage described herein below written by companies approved by the State of Texas and acceptable to the Town of Flower Mound including by way of example and not limitation, commercial general liability, automobile liability, umbrella or excess liability and workers' compensation in forms and amounts satisfactory to Town before commencing the Work. Contractor shall submit to Town certificates of insurance executed by the insurer or its authorized agent stating the coverages, limits, expiration dates and compliance with all required provisions in amounts satisfactory to the Town. The Contractor may maintain reasonable deductibles, subject to the approval of the Town. Contractor shall assure that any and all subcontractors engaged or employed by Contractor carry and maintain similar insurance with reasonably prudent limits and coverage in light of the services to be rendered by such subcontractors. The maintenance in full current force and effect of such form and amount of insurance, in such amount as Town shall have accepted, shall be a condition precedent to the Contractor's exercise or enforcement of any rights under this Contract. Insurance polices required for Contractor shall include a provision requiring written notice to the Town at least thirty days prior to any cancellation, non-renewal or material modification of the policies. The Town shall be named as an additional insured on all insurance policies, except workers’ compensation and professional liability, required herein by using endorsement CG2026 or broader. A waiver of subrogation in favor of the Town and its officials, employees, and officers shall be contained in the Workers’ Compensation insurance policy.

21.2.1 Workers’ Compensation and Employer's Liability Insurance: This insurance shall protect the Contractor against any and all claims brought under the Workers’ Compensation law for the State of Texas. It shall also protect the Contractor against claims for injury to, disease or death of workmen engaged in the Work under this Contract which, for any reason,
may not fall within the provisions of the Workmen's Compensation Act. Liability limits for this insurance on this Project shall be:

Coverage A  Statutory Coverage
Coverage B  Employer’s Liability with minimum limits for bodily injury:
   (a) by accident $100,000 each accident
   (b) by disease, $100,000 per employee with a per policy aggregate of $500,000

21.2.2 **Commercial General Liability Insurance:** This insurance, to be on the comprehensive form, shall protect the Contractor against any and all claims arising from injuries to members of the public or damage to property or others arising out of any act or omission of the Contractor, his agents, employees, or subcontractors, in connection with the operation or performance of the Work for and in connection with this Contract.

In addition, this general liability insurance policy shall specifically insure the contractual liability of the Contractor assumed under the provisions for indemnifying the Town.

The Contractor shall provide Commercial General Liability Insurance as follows:

Bodily Injury/Property Damage: $1,000,000 per occurrence
   $1,000,000 aggregate

To include:  Premises/Operations
              Products/Completed Operations
              Independent Contractors
              Contractual Liability
              Personal & Advertising Injury
              Broad Form Property Damage

Coverage must be written on an occurrence form. The General Aggregate shall apply on a per project basis.

21.2.3 **Business Automobile Liability Insurance:** This insurance, to be on the comprehensive form, shall protect the Contractor against any and all claims or injuries to members of the public and damage to property of others arising from the use of automobiles and trucks in connection with the performance of the Work under this Contract, and shall cover
operation on or off the Site of the Work of all motor vehicles licensed for highway use, whether they are owned, non-owned, or hired by the Contractor. The policy shall include an "all states" endorsement. Liability limits for automobile liability insurance coverage on this Project shall be

**Minimum Combined Bodily Injury and Property Damage Limit:**

$1,000,000 per occurrence

**Uninsured Motorist:** Statutory Limits

To include: All Owned, Non-Owned and Hired Autos

21.2.4 **Umbrella or Excess Liability:** The Contractor shall effect and maintain an umbrella liability policy as follows:

$1,000,000 per occurrence

$1,000,000 aggregate

Such umbrella or excess liability shall follow the form of and apply in excess of the above indicated primary coverage in Sections 21.2.1, 21.2.2 and 21.2.3).

21.2.5 **Property Insurance:** The Contractor shall effect and maintain All-Risk coverage in an amount equal to one hundred percent (100%) of the completed value of the Work, with extended coverage for fire, vandalism and malicious mischief, hail, wind, storm, flood (if located in a flood zone), and theft, etc. naming the Town as co-insured. The policy shall be written on a Completed Value Form, including materials delivered and labor performed for the Project. The policy shall be written jointly in the names of the Town, Contractor and subcontractors as their interests may appear. The policy shall have endorsements as follows:

(a) This insurance shall be specific as to coverage and not contributing insurance with any permanent insurance maintained on the property.

(b) Loss, if any, shall be adjusted with and made payable to the Town on behalf of all insureds as their interests may appear.

21.2.6 **Certificates of Insurance:** A certificate of insurance, including waiver of subrogation, outlining the insurance coverage, policy name, policy number, coverage dates and insurance carrier shall be provided to the Town prior to any services being performed or rendered by the Contractor. The Contractor shall include the Town as an additional insured under its
liability insurance policies. All policies shall include a provision requiring the insurer to give the Town at least 30 days notice before cancellation of such policy.

21.2.7 All insurance shall be purchased from an insurance company that meets a financial rating of B+VI or better as assigned by the A.M. BEST Company or equivalent.

21.2.8 With respect to Workers’ Compensation insurance, the Contractor agrees to comply with all applicable provisions of 28 Tex. Admin Code § 110.110, “Reporting Requirements for Building or Construction Projects for Governmental Entities,” as such provision may be amended, and as set forth in Section 21.2.9 following.

21.2.9 **Workers' Compensation Insurance Coverage**

1. **Definitions:**

   Certificate of coverage ("certificate")- A copy of a certificate of insurance, a certificate of authority to self-insure issued by the commission, or a coverage agreement (TWCC-81, TWCC-82, TWCC-83, or TWCC-84), showing statutory workers' compensation insurance coverage for the person's or entity's employees providing services on a project, for the duration of the project.

   Duration of the project - includes the time from the beginning of the work on the project until the Contractor's/person's work on the project has been completed and accepted by the governmental entity.

   Persons providing services on the project ("subcontractor" in §406.096) - includes all persons or entities performing all or part of the services the Contractor has undertaken to perform on the project, regardless of whether that person contracted directly with the Contractor and regardless of whether that person has employees. This includes, without limitation, independent contractors, subcontractors, leasing companies, motor carriers, owner-operators, employees of any such entity, or employees of any entity which furnishes persons to provide services on the project. "Services" include, without limitation, providing, hauling, or delivering equipment or materials, or providing labor, transportation, or other service related to a project. "Services" does not include activities unrelated to the project, such as
food/beverage vendors, office supply deliveries, and delivery of portable toilets.

2. The Contractor shall provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code, Section 401.011(44) for all employees of the Contractor providing services on the project, for the duration of the project.

3. The Contractor must provide a certificate of coverage to the governmental entity prior to being awarded the contract.

4. If the coverage period shown on the Contractor's current certificate of coverage ends during the duration of the project, the Contractor must, prior to the end of the coverage period, file a new certificate of coverage with the governmental entity showing that coverage has been extended.

5. The Contractor shall obtain from each person providing services on a project, and provide to the governmental entity:

(a) a certificate of coverage, prior to that person beginning work on the project, so the governmental entity will have on file certificates of coverage showing coverage for all persons providing services on the project; and

(b) no later than seven days after receipt by the Contractor, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the project.

6. The Contractor shall retain all required certificates of coverage for the duration of the project and for one year thereafter.

7. The Contractor shall notify the governmental entity in writing by certified mail or personal delivery, within 10 days after the Contractor knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project.

8. The Contractor shall post on each project site a notice, in the text, form and manner prescribed by the Texas Workers' Compensation Commission, informing all persons providing services on the
project that they are required to be covered, and stating how a person may verify coverage and report lack of coverage.

9. The Contractor shall contractually require each person with whom it contracts to provide services on a project, to:

(a) provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code, Section 401.011(44) for all of its employees providing services on the project, for the duration of the project;

(b) provide to the Contractor, prior to that person beginning work on the project, a certificate of coverage showing that coverage is being provided for all employees of the person providing services on the project, for the duration of the project;

(c) provide the Contractor, prior to the end of the coverage period, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the project;

(d) obtain from each other person with whom it contracts, and provide to the Contractor:

(1) a certificate of coverage, prior to the other person beginning work on the project; and

(2) a new certificate of coverage showing extension of coverage, prior to the end of the coverage period, if the coverage period shown on the current certificate of coverage ends during the duration of the project;

(e) retain all required certificates of coverage on file for the duration of the project and for one year thereafter;

(f) notify the governmental entity in writing by certified mail or personal delivery, within 10 days after the person knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project; and
(g) contractually require each person with whom it contracts, to perform as required by paragraphs (a) – (g), with the certificates of coverage to be provided to the person for whom they are providing services.

10. By signing this contract or providing or causing to be provided a certificate of coverage, the Contractor is representing to the governmental entity that all employees of the Contractor who will provide services on the project will be covered by workers' compensation coverage for the duration of the project, that the coverage will be based on proper reporting of classification codes and payroll amounts, and that all coverage agreements will be filed with the appropriate insurance carrier or, in the case of a self-insured, with the commission's Division of Self-Insurance Regulation. Providing false or misleading information may subject the Contractor to administrative penalties, criminal penalties, civil penalties, or other civil actions.

11. The Contractor's failure to comply with any of these provisions is a breach of contract by the Contractor which entitles the governmental entity to declare the contract void if the Contractor does not remedy the breach within ten days after receipt of notice of breach from the governmental entity.

21.2.10 Builder’s Risk Insurance: Builder’s risk insurance shall be required. It shall provide All-Risk coverage including, but not limited to, Fire, Earthquake, Extended Coverage, Vandalism and Malicious Mischief, Flood (if located in a flood zone) and Theft in an amount equal to one hundred percent (100%) of the completed value of the project in question. The policy shall be written on a Completed Value Form, including materials delivered and labor performed for the project. The policy shall be written jointly in the names of the Owner, contractor and subcontractors as their interests may appear. The policy shall have endorsements as follows:

(a) This insurance shall be specific as to coverage and not contributing insurance with any permanent insurance maintained on the property.
(b) Loss, if any, shall be adjusted with and made payable to the Owner on behalf of all insureds as their interests may appear.

22. TESTS AND INSPECTIONS; DEFECTIVE WORK:

22.1 Warranty and Guarantee: The Contractor warrants, guarantees, and represents to the Town that all Work will be in strict compliance with the Contract Documents
and will not be defective. All defective Work, whether or not in place, may be rejected, corrected or accepted as provided in this Article.

22.2 Access to Work: The Engineer or other representatives of the Town, testing agencies and governmental agencies with jurisdictional interests will have access to the Work at reasonable times for their observation, inspecting and testing. The Contractor shall provide proper and safe conditions for such access.

22.3 Tests and Inspections: Unless otherwise stipulated in the Supplementary Conditions, initial testing of all materials, construction items or products incorporated in the Work shall be performed at the direction and expense of the Town. The Contractor is responsible for the cost of all tests, which fail to satisfy the minimum requirements of the Contract Documents.

In the event materials, construction items or products incorporated in the Work fail to satisfy the minimum requirements of the initial test, appropriate prove-out tests shall be made as directed by the Engineer to determine the extent of the failure and to verify that the corrective measures have brought the item up to specification requirements. The cost of all testing necessary to determine the extent of the failure and the adequacy of the corrective measures shall be the responsibility of the Contractor.

The failure of the Town to make any tests of materials shall in no way relieve the Contractor of his responsibility of furnishing materials conforming to the Contract Documents or waive any rights the Town has to enforce strict compliance with the Plans, Specifications, and Contract Documents.

Tests, unless otherwise specified, shall be made in accordance with the latest methods of the American Society for Testing and Materials. The Contractor shall provide such facilities as the Engineer may require for collecting and forwarding samples and shall not use the materials represented by the samples until tests have been made. The Contractor shall furnish adequate samples without charge.

22.3.1 All inspections, tests or approvals other than those required by Laws or Regulations of any public body having jurisdiction shall be performed by organizations acceptable to the Town.

22.3.2 If any Work (including the work of others) that is to be inspected, tested or approved is covered without written concurrence of the Engineer, it must, if requested by the Engineer, be uncovered for observation. Such uncovering shall be at the Contractor's expense unless the Contractor has given the Engineer timely notice of the Contractor's intention to cover the same, and the Engineer has not acted with reasonable promptness in response to such notice.
22.3.3 Neither observations by the Engineer nor inspections, tests or approvals by others shall relieve the Contractor from the Contractor's obligations to perform the Work in accordance with the Contract Documents.

22.4 Uncovering Work: If any portion of the Work is covered contrary to the written request of the Engineer, it must, if requested by the Engineer, be uncovered for the Engineer's observation and replaced at the Contractor's expense. If the Engineer considers it necessary or advisable that covered Work not contrary to Engineer's request or previously approved must be observed by the Engineer or inspected or tested by others, the Contractor, at the Engineer's request, shall uncover, expose or otherwise make available for observation, inspection or testing as the Engineer may require, that portion of the Work in question, furnishing all necessary labor, material and equipment. If it is found that such Work is defective, the Contractor shall bear all direct, indirect and consequential costs of such uncovering, exposure, observation, inspection and testing and of satisfactory reconstruction, (including, but not limited to, fees and charges of engineers, architects, attorneys and other professionals), and the Town shall be entitled to an appropriate decrease in the Contract Price, and, if the parties are unable to agree as to the amount thereof, they may make a Claim therefore. If, however, such Work is not found to be defective, the Contractor shall be allowed an increase in the Contract price or an extension of the Contract Time, or both, directly attributable to such uncovering, exposure, observation, inspection, testing and reconstruction; and, if the parties are unable to agree as to the amount or extent thereof, the Contractor may make a Claim therefore.

22.5 Two Year Correction Period: If within two years after the date of acceptance of the Work and authorization to make final payment by the Town Council or such longer time as may be prescribed by Law or Regulations or by the term of any applicable special guarantee required by the Contract Documents or by any specific provision of the Contract Documents, any Work is found to be defective, the Contractor shall promptly, without cost to the Town and in accordance with the Town’s written instructions, either correct such defective Work, or, if it has been rejected by the Town, remove it from the Site and replace it with non-defective Work. If the Contractor does not promptly comply with the terms of such instructions, or in any emergency where delay could cause serious risk of loss or damage, the Town may have the defective Work corrected by others and the Contractor shall reimburse the Town its actual costs for such corrections (such costs to include but not limited to fees and charges of engineers, architects, attorneys and other professionals).
22.6 **Town May Correct Defective Work:** If the Contractor fails within a reasonable time, after written notice of the Engineer, to correct defective Work or to remove and replace rejected Work as required by the Engineer, 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 provisions of the Contract Documents, the Town may, after seven (7) days written notice to the Contractor, correct and remedy any such deficiency. In exercising the rights and remedies under this paragraph, the Town shall proceed expeditiously. To the extent necessary to complete corrective and remedial action, the Town 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, take possession of the Contractor's tools, appliances, construction equipment and machinery at the Site and incorporate in the Work all materials and equipment stored at the Site or for which the Town has paid the Contractor but which are stored elsewhere. The Contractor shall allow the Town, the Town's representatives, agents and employees such access to the Site as may be necessary to enable the Town to exercise the rights and remedies under this paragraph. All direct, indirect and consequential cost to the Town in exercising such rights and remedies will be charged against the Contractor in an amount determined by the Engineer, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and the Town shall be entitled to an appropriate decrease in the Contract Price, and, if the parties are unable to agree as to the amount thereof, the Town may make a Claim therefore. Such direct, indirect and consequential costs will include but not be limited to fees and charges of engineers, architects, attorneys and other professionals, all court and arbitration costs and all costs of repair and replacement of Work 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 Time because of any delay in performance of the Work attributable to the exercise by the Town of the Town's rights and remedies hereunder.

23. **CHANGES IN THE WORK:**

23.1 ** Modifications and Alterations:** The Contractor agrees that the Town shall have the right to make modifications, changes and alterations in the arrangement or extent of the Work, without affecting the validity of the Contract and the Bonds thereunder.

23.1.1 If the modification or alteration increases the amount of Work to be done, and the added Work or any part thereof is of a type and character which can be properly and fairly classified under one or more unit price items of the Proposal, then such added Work or part thereof shall be paid for according to the amount actually done and at the applicable unit price or
23.1.2 If the modification or alteration decreases the amount of Work to be done, such decrease shall not constitute the basis for a Claim for damages or anticipated profits on Work affected by such decrease. Where the value of omitted Work is not covered by applicable unit prices, the Engineer shall determine, on an equitable basis, the amount of:

(a) credit due the Town for Contract Work not done as a result of an authorized change,

(b) allowance to the Contractor for any actual loss incurred in connection with the purchase, delivery and subsequent disposal of materials or equipment required for use on the Work as planned and which could not be used in any part of the Work as actually built; and

(c) any other adjustment of the contract Price where the method to be used in making such adjustment is not clearly defined in the Contract Documents.

23.1.3 Except for minor changes or adjustments which involve no adjustment in the Contract Price or other monetary consideration, and with the exception of adjustments of estimated quantities for unit price work or materials to conform to actual pay quantities therefore as hereinafter provided under "Estimated Quantities," all changes and alterations in the terms or scope of the Contract shall be made under the authority of duly executed Change Orders issued and signed by the Town and accepted and signed by the Contractor.

23.1.4 It is specifically understood and agreed that the Contractor by submission of a Bid Proposal and the execution of the Contract is deemed to consent to the Town’s right to reduce the total original Contract amount by up to 25 percent. However, when the quantity of work to be done or of materials to be furnished under any major item of the Contract is less than 75 percent of the quantity stated in the Contract and the reduction in the major item of the Contract results in the total original Contract amount being reduced by more than 25 percent, then either party to the Contract, upon demand, may negotiate for revised consideration on the work performed for such major item of the Contract. Any increase in compensation related to a greater than 25 percent decrease in the performance of any major item of the Contract shall be limited to the
lesser of (a) the original bid for the major item of the Contract or (b) that amount necessary to restore the value of the Contract to an amount equal to 75 percent of the total original Contract amount. In no event shall the CONTRACTOR be entitled to such compensation for decreased work or materials if the CONTRACTOR is then in default or the Contract has been terminated.

When a major item of the Contract is reduced to less than 75% of the original quantity and an adjusted unit price cannot be agreed upon the revised unit price for such major item of work shall be determined by multiplying the Contract unit price by one of the following factors depending on the percentage of reduction in that item:

<table>
<thead>
<tr>
<th>Multiplier</th>
<th>Percentage of Original Quantity</th>
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<tbody>
<tr>
<td>1.05</td>
<td>≥50% and &lt;75%;</td>
</tr>
<tr>
<td>1.15</td>
<td>≥25% and &lt;50%;</td>
</tr>
<tr>
<td>1.25</td>
<td>≤25%.</td>
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</tbody>
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23.2 Extra Work: The term "Extra Work", as used in this Contract, shall be understood to mean and include all Work that may be required by the Town to be done by the Contractor to accomplish any change or alteration in or addition to the Work shown by the Plans or reasonably implied by the Specifications and not covered by items, and which is not otherwise provided under "Modifications and Alterations". This is Work done under Change Order as approved by the Town Council.

23.2.1 It is agreed that the Contractor shall perform all extra Work under the direction of the Engineer when and as so ordered in writing by the Town. It is further agreed that the compensation to be paid the Contractor for performing extra Work shall be determined by one or more of the following methods:

Method A: By agreed unit prices, or

Method B: By agreed lump sum, or

Method C: If neither Method A nor Method B can be agreed upon before the extra Work is started, the Contractor shall be paid his actual field cost of the Work plus fifteen percent (15%) for the Work which he performs with his own forces and/or the Contractor shall be paid the subcontractor's actual field cost of the Work plus twenty percent (20%) for Work which is performed by his subcontractor or subcontractors.
23.2.2 Where extra Work is performed under Method C, the actual field cost of such extra Work is hereby defined to be and shall include:

(a) the payroll cost for all workmen, such as foremen, mechanics, craftsmen, laborers;

(b) the cost of all materials and supplies not furnished by the Town;

(c) rental for all power-driven equipment at agreed-upon rates for the time actually employed or used in the performance of extra Work;

(d) transportation charges necessarily incurred in connection with any equipment authorized by the Engineer for use on said extra Work and which is not already on the job;

(e) all power, fuel, lubricants, water, and similar operating expenses;

(f) all incidental expenses incurred as a direct result of such extra Work, including sales or use taxes on materials, payroll taxes, and the additional premiums for construction bonds, workmen's compensation, public liability and property damages, and other insurance required by the Contract where the premiums therefore are based on payroll and materials costs.

23.2.3 The Engineer may direct the form in which the actual field cost shall be kept, and may also specify in writing before the extra Work commences, the method of doing the Work and the type and kind of machinery and equipment, if required, which shall be used in the performance of extra Work under Method C. If machinery or heavy construction equipment is required for extra Work, the authorization and basis for the use thereof shall be stipulated in the written extra Work Change Order. The applicable "plus" percentage (15% or 20%) of the actual field cost to be allowed and paid to the Contractor shall constitute full compensation for profit, overhead, superintendence, field office expense, and all other elements of cost not embraced within the actual field cost as herein defined.

23.2.4 No claim for extra Work of any kind will be allowed unless ordered in writing by the Town through a properly authorized and executed Change Order prior to commencement of said extra Work. In case any orders or instructions, either oral or written, appear to the Contractor to involve extra Work for which he should receive compensation, he shall make a
written request to the Town for a Change Order authorizing such extra Work. Should a difference of opinion arise as to what does or does not constitute extra Work, or concerning the payment thereof, and the Engineer insists on its performance, the Contractor shall proceed with the Work after making a written request for a written extra Work Change Order and shall keep an accurate account of the actual field cost thereof as provided for Method C in the foregoing paragraph.

23.3 Extra Work a Part of Contract: If extra Work is performed in accordance with the provisions of this Contract, such extra Work shall be considered a part hereof and subject to each and all terms and conditions of said Contract.

24. PAYMENTS TO CONTRACTOR AND COMPLETION:

24.1 Estimated Quantities: Any and all estimated quantities stipulated in the Proposal under unit price items are approximate and are to be used only:

(a) as a basis for estimating the probable cost of the Work, and

(b) for the purpose of comparing the Proposals submitted for the Work, it is understood and agreed that the actual amounts of Work done and materials furnished under unit price items may differ from such estimated quantities and that the basis of payment for such Work and materials shall be the actual amount of Work done and materials furnished in each case. The Contractor agrees that he will make no Claim for damages, anticipated profits, or otherwise on account of any difference between the amounts of Work actually performed and materials actually furnished and the amounts estimated therefore in the Proposal or other Contract Documents.

24.2 Monthly Estimates and Payments: The Contract Documents will specify the manner in which payment is to be made. If the Contract Documents state payment shall be by unit bid price, the measurement for payment shall be made based on the units outlined in the Proposal. If an item is not listed, but is required to complete the Work, the cost of furnishing, installing or constructing the Work shall be subsidiary to the various bid items and will not be eligible for payment as a separate or new item. If the Contract Documents state payment shall be lump sum, the Contractor shall submit a Schedule of Values for the cost of the major items of Work for approval by the Engineer. For purposes of this Section 24.2 Schedule of Values shall refer to the itemizations of costs or payment. The Engineer will review the itemized breakdown and if he agrees with the breakdown, partial payments will be made accordingly. If the Engineer does not agree with the breakdown for any reason whatsoever and the Contractor refuses to make changes to the breakdown, no partial payment shall be made for such lump
sum items. Payments shall be made based on the approved schedule of values. The total of all Work shown on the schedule of values must exactly equal the total Lump Sum bid in the Proposal.

24.3 Monthly, on or about the day specified in the Special Provisions, a representative of the Contractor and the Town’s Resident Project Representative (hereinafter referred to collectively as “Resident Project Representative”) will meet on the job site and list the items of work completed during the estimate period. This information shall be posted on two identical Town prepared Quantity Verification worksheets. The Quantity Verification worksheets will show all the individual unit bid items or schedule of values items as applicable and the quantity measured and paid on all previous estimates. Partial payment shall in general include only completed units. The representative of the Contractor and the Resident Project Representative will sign both Quantity Verification worksheet forms. The representative of the Contractor will retain one copy of the form. The Resident Project Representative shall submit the other copy of the form to the Engineer for review. If the Engineer has any comments or corrections, the form will be returned to the representative of the Contractor and the Resident Project Representative for correction. In a case where the representative of the Contractor and the Resident Project Representative do not agree on the quantities to be reported, a note to this effect shall be shown on the form. The Engineer shall determine the quantity or quantities to be used for preparation of the estimate. A copy of his determination shall be furnished to the representative of the Contractor and the Resident Project Representative. If the Contractor does not agree with the determination of the Engineer, he may submit a written appeal to the Town. The Town will respond to the appeal within fifteen working days. If the Town agrees with all or part of the appeal, an adjustment shall be made on the following estimate. If the Contractor does not agree with the Town’s response to his appeal, he may file a Claim. Final payment will not be made to the Contractor until the Claim is resolved; however, the Town may make payment to the Contractor for all items completed and accepted by the Engineer, except the retainage. The Town may reduce the retainage if the Town determines it is in its best interest.

During the same time period when the Quantity Verification worksheets are prepared, a representative of the Contractor and the Resident Project Representative will inventory non-perishable material on the site or in a bonded warehouse approved by the Engineer, which will be incorporated in the Work that is eligible for payment. The Contractor shall bear all costs of storage, handling, security, transportation and other expenses related to materials stored on or off Site. It shall be understood that payments made by the Town for materials stored on the Site shall be based only upon the actual cost of materials to the Contractor, and shall not include any overhead or profit to the Contractor. The Contractor
must furnish the Resident Project Representative invoices reflecting the cost of the materials. If an invoice was previously submitted reflecting the unit price for a particular item, another invoice is not required unless the unit price has changed. All material on hand must be counted regardless of whether it was listed on a previous estimate or not. The inventory of materials shall be posted on two identical Town prepared Material on Hand worksheets. The representative of the Contractor will retain one copy of the form. The Resident Project Representative shall submit the other copy of the form to the Engineer for review. If the Engineer has any comments or corrections, the form will be returned to the representative of the Contractor and the Resident Project Representative for correction. In a case where the representative of the Contractor and the Resident Project Representative do not agree on the quantities to be reported, a note to this effect shall be shown on the form. The Engineer shall determine the quantity or quantities to be used for preparation of the estimate. A copy of his determination shall be furnished to the representative of the Contractor and the Resident Project Representative. Also, the Contractor must furnish proof of payment for Material on Hand listed on the previous estimate payment. If this proof is not furnished, that specific item cannot be listed again on the estimate for payment. The Contractor is totally responsible for protection and safeguarding of material stored on the Site. Payment for Material on Hand in no way whatsoever is acceptance of the materials by the Town. The materials will only be accepted for payment when they are incorporated in the Work. The Town accepts no responsibility whatsoever for any stored material damaged, stolen, missing, or in any way altered or moved so as to make it not useable for incorporation into the Work.

The monthly and final estimates will be prepared by the Town based on information shown on the Quantity Verification worksheet and the Material on Hand form approved by the Engineer. Payment will be made by the Town to the Contractor within thirty days of the Engineer’s approval of the Quantity Verification worksheet and the Material on Hand forms. The Town will forward a copy of the prepared estimate to the Contractor for signature prior to processing the estimate for payment.

24.4 **Placing Work in Service:** If desired by the Town, portions of the Work may be placed in service when completed and the Contractor shall give proper access to the Work for this purpose; but such use and operation shall not constitute an acceptance of the Work, and the Contractor shall be liable for defects due to faulty construction until the entire Work under this Contract is finally accepted and for two years thereafter as stipulated under the Paragraphs hereinbefore which address defective work.

24.5 **Completion and Acceptance of Work:** On completion of the Work, the Engineer shall:
(a) satisfy himself, by examination and tests, that the Work has been fully and finally completed in accordance with the Plans, Specifications and Contract Documents, and

(b) report such completion to the Town Council.

Before Final Acceptance by the Town of the Work, the Contractor shall submit to the Town a notarized affidavit, in duplicate, stating under oath that all subcontractors, vendors and other persons or firms who have furnished or performed labor or furnished materials for the Work have been fully paid or satisfactorily secured. Such affidavit shall bear or be accompanied by a statement, signed by the surety company who provided the Performance and Payment bonds for the Work, to the effect that said surety company consents to final payment to the Contractor being made by the Town.

24.6 No Waiver of Rights: Neither the inspection by any of the Town's officials, employees, or agents, nor any order by the Town for payment of money, or any payment for, or acceptance of, the whole or any part of the Work by the Town, nor any extension of time, nor any possession taken by the Town or its employees, shall operate as a waiver of any provisions of this Contract, or of any power herein reserved to the Town or any right to damages herein provided, nor shall any waiver of any breach in this Contract be held to be a waiver of any other or subsequent breach.

24.7 Final Estimate and Payment: After official approval and acceptance of the Work by the Town the Town shall prepare a final estimate of the Work done under this Contract and the value thereof. The Town shall prepare a Final Change Order adjusting all quantities from the original bid quantity to the quantities actually incorporated in the Project. The Contractor shall sign the Change Order indicating agreement with the final payment. In the event the Contractor does not agree with the final quantities, the Contractor shall state, in writing to the Engineer, the reason and provide documentation for the change to the final quantity. If the Engineer does not agree to adjust the quantities, the Contractor may file a Claim. Such final estimate and Final Change Order shall be submitted to the Town Council for approval. After approval as aforesaid; the Town shall pay the entire sum so found to be due hereunder, after deducting all amounts to be kept and retained under any provision of this Contract. All prior estimates and payments shall be subject to correction in the final estimate and payment; but in the absence of error or manifest mistake, it is agreed that all estimates, when approved by the Town, shall be conclusive evidence of the work done and materials furnished.
24.8 **Release of Liability:** The acceptance by the Contractor of the last or final payment shall operate as, and shall be, a release to the Town and every officer and agent thereof, from any and all Claims and liability hereunder for anything done or furnished for, or relating to the Work, or for any act or neglect of the Town or of any person relating to or affecting the Work.
SUPPLEMENTARY CONDITIONS

1. COMMENCEMENT OF CONTRACT TIME, NOTICE TO PROCEED

See Section 18.5 of the General Conditions.

2. PRECONSTRUCTION CONFERENCE

See Section 10 of the General Conditions.

3. WORKERS’ COMPENSATION

See Sections 21.2.8 and 21.2.9 of the General Conditions.

By signing the Contract Documents, the Contractor is representing to the Town that all employees of the Contractor who will provide services on the Project will be covered by Workers’ Compensation coverage for the duration of the Project.

4. WORKING HOURS

See Sections 1.12 and 18.4 of the General Conditions.

Work on Sunday will be for emergency only and if Town has given prior written permission. The hours during which such weekend work will be allowed will be specified in the written correspondence from the Town.

5. PERMITS

See Section 18.11 of the General Conditions.

If a TXDOT permit is required for this Project, it will be obtained by the Town.

6. SAFETY AND PROTECTION

See Section 18.15 of the General Conditions.

The Contractor shall indemnify and hold harmless the Town and/or the Town’s representatives for all damages suffered by the Town as a result of the Contractor’s failure to comply with the Occupational Safety and Health Act of 1970.

The Contractor shall also comply with all the pertinent provisions of the “Manual of Accident Prevention in Construction” issued by the Associated General Contractors of America, Inc.

7. SHOP DRAWINGS AND SAMPLES:

See Section 11 of the General Conditions.
8. TESTS AND INSPECTIONS

See Section 22 of the General Conditions.

The Town shall employ and pay for the services of an independent testing laboratory to perform welding inspection and coating inspection, this shall not alleviate the contractor of his responsibility to also provide testing for welding and coatings. All other required testing shall be the responsibility of the contractor. No pre-approved laboratories have been established, but the contractor shall be required to submit to the Owner the testing laboratory he intends to use prior to construction. Owner reserves the right to reject the proposed testing laboratory for any reason. All costs associated with testing required to be paid for by the Contractor shall be considered to be included with the various bid items.

9. PROGRESS PAYMENTS

See Sections 16.2, 17.5 and 24 of the General Conditions and Article 5 of the Construction Agreement.

The estimate period shall run monthly and end on the 10th or 25th of each month.

10. FIELD OFFICE

The Contractor is not required to furnish a field office on this Project.

11. SCHEDULE OF CONSTRUCTION

See Sections 18.5.1 and 18.5.2 of the General Conditions and Article 5 of the Construction Agreement.

The Contractor must submit its proposed schedule of construction for approval two (2) working days prior to the pre-construction conference as set forth in Section 18.5.1 of the General Conditions. The schedule must be in minimum increments of one week and outline the specific work to be accomplished. Construction shall be phased in accordance with Traffic Control Plans provided unless otherwise authorized in writing by the Town.

The Contractor shall be responsible for utility coordination with all franchise utility companies. Contractor shall allow sufficient time in the construction schedule for utility coordination, permitting and relocations. The Contractor shall receive neither compensation nor additional time for completion arising out of any delays or hindrances to the Work caused by utility coordination.

Contractor’s schedule shall be in accordance with the requirements set forth in the plans. Reference plan sheet G1 – Construction Sequence.
12. WATER FOR CONSTRUCTION

The Contractor shall make all necessary arrangements for securing and transporting all water required in the construction of the Project. The Contractor is responsible for obtaining a fire hydrant meter from the Town. Contractor shall be required to pay for all construction water not expressed indicated otherwise in this section, including but not limited to, water needed for landscaping, dust control, cleaning, etc. Contractor shall not be required to pay for water associated with disinfecting the elevated storage tank, filling the elevated storage tank, and pressure testing water lines. Contractor shall be provided, at no cost, water to perform the procedures listed above once and only once. In the event that any of the tests fail, or for any other reason the contractor is required to re-testing or re-fillin the elevated tank it shall be at the contractor’s expense. All costs associated with acquiring and paying for water shall be considered to be included in the Base Lump Sum bid.

13. SUBSTANTIAL COMPLETION

See Section 1.35 of the General Conditions.

When the Town can use the Project for its intended purpose and all that remains is clean up and establishing grass then the Town may declare the Project to be substantially complete.

Substantial completion shall be when the elevated storage tank is capable of being placed into service. Substantial completion shall include all components required for full functionality of the elevated storage tank. These components shall include, but not be limited to, the tank construction (including secondary interior floor), electrical and SCADA improvements, water line, water line connections, cathodic protection, valves, tank coating, etc.

Contractor shall be responsible for all utility accounts (water, electric, etc.) until Final Acceptance of the project. Owner will not take ownership of accounts, the site, the tank, or any other improvements until Final Acceptance. Any damage to any of the improvements prior to Final acceptance shall be repaired by the contractor at his expense, regardless of the cause of the damage.

All other items not associated with the functionality of the elevated storage tank shall be completed prior to Final Completion and acceptance of the project. These items shall include site grading, paving, landscaping, irrigation, fencing, etc.

14. STAKING

See Sections 12 and 13 of the General Conditions.
The Engineer shall flag for the Contractor’s use all major control points used for the Project. It shall be the Contractor’s responsibility to do all other construction staking for this Project.

15. RETAINAGE

*See* Article 5 of the Construction Agreement.

Retainage shall be 5% percent of the total dollar amount of Work done including materials on hand. Materials on hand do not include perishable items such as trees and shrubs.

When the Work is 80% complete, retainage may, at the Town’s option, be reduced to 2% of the dollar value of all Work satisfactorily completed to date (not to include material on hand), provided the Contractor is making satisfactory progress and there is no cause for greater retainage, as determined by the Engineer.

At the time of Substantial Completion, as determined by the Engineer, the retainage may be reduced to the amount the Engineer determines is required to complete the Work (e.g., if the only item remaining after substantial completion is to establish grass growth, the retainage may be reduced to an amount set in the Contract Documents that would be required to plant and establish the grass growth.)

16. FINAL PAYMENT

*See* Section 24 of the General Conditions and Article 9 of the Construction Agreement.

The Contractor must submit to the Town the following documents, in a form satisfactory to the Town Attorney, prior to processing of the final estimate:

- a) Quantity Verification Sheet;
- b) Notarized statement of the Contractor that all subcontractors and suppliers have been paid;
- c) Consent of Surety for final payment; and
- d) As-built plans (mylars will be provided by the Consulting Engineer or Town Engineer).

17. BEGINNING PERIOD OF PERFORMANCE, PAYMENT AND MAINTENANCE BONDS

*See* Sections 1.19 and 21.1 of the General Conditions and Articles 4 and 12 of the Construction Agreement.

The beginning period of the Performance and Payment Bonds shall be the date on which the Town Council acts to approve the award of the Contract for the Work to Contractor. The beginning period of the Maintenance Bond shall be the date of final acceptance of all Work done under the Contract, as approved by the Town Council.
18. WATER LINE FLUSHING

All water line testing shall be performed in compliance with AWWA Standards. Lines shall be de-chlorinated in accordance with AWWA 651 to a level that is not more than the level approved by the Project Engineer prior to release into the Town’s storm sewer system. Flushing shall not be allowed to the sanitary sewer without the prior written approval of the Town Engineer or his designee. All water used for flushing, regardless of pipe size, shall be metered.

19. MATERIALS TESTING

See Section 22 of the General Conditions.

The Town of Flower Mound will make arrangements for and pay for all tests associated with welding inspection and coatings. If a test fails, the contractor shall be responsible for the cost of any resulting additional testing.

All other required testing, except as described above, required under the Specifications shall be paid for and arranged by the contractor. Contractor shall be required to submit to the Owner for approval the testing laboratory he intends to use. Owner reserves the right to reject any testing laboratory proposed by contractor and require a different laboratory. No additional payment will be provided if the contractor is required to obtain a different testing laboratory. If a test performed by the contractor fails, the contractor shall be responsible for the cost of any resulting additional testing.

The testing laboratory personnel will secure and handle all samples and specimens.

The Contractor shall provide access to the Work at all times and at all locations where the Work is in progress. It is the Contractor’s responsibility to notify the testing firm when tests are to be made. The Contractor and Town will be furnished a copy of the test results.

The Contractor must notify the Town Inspector when tests are scheduled at least 48 hours in advance. The Town Inspector may direct additional tests be performed. The Town Inspector will have the right to determine at what locations specific tests will be performed.

The Contractor and Town will be furnished a copy of the test results.

20. ASPHALT OR CONCRETE BATCHING PLANT (TEMPORARY)

A. The batching plant site shall comply with all applicable provisions of Town, State and Federal laws.

B. The batch plant shall not be located within 600 feet of an inhabited residence.
The Contractor shall contact the Town of Flower Mound Engineering Department for additional Concrete Batching Plant application requirements prior to any Batching Plant permit application.

21. COMMENCEMENT OF WORK AND PROGRESS

A. See Article 6 of the Construction Agreement.

B. Road and lane closures will only be allowed between 9:00 a.m. and 3:00 p.m. and only with prior approval of the Town Engineer.

22. STORM WATER POLLUTION PREVENTION PLAN

A Storm Water Pollution Prevention Plan (SWPP) has been prepared and will be provided to the Contractor for his use. It is the responsibility of the Contractor to prepare and submit the Notice of Intent (“NOI”) form and Notice of Termination (“NOT”) form to the Texas Commission on Environmental Quality (“TCEQ”) with signed copies provided to the Town. The NOI shall be submitted to the TCEQ and Town at least 48 hours prior to commencement of construction or earthmoving activities.

23. JOBSITE VIDEO

The Contractor shall make a video of the entire Project prior to construction and furnish a copy to the Town on VHS or DVD format. The video should include vegetation, trees, gates and fences on either side of the proposed edge of pavement as well as other pertinent items that may be affected by performance of the Work. The Contractor shall not be permitted to begin any construction on the site until this information is furnished.

24. CITIZEN MEETINGS

The Contractor must furnish a representative, level of superintendent or Project Engineer or higher, to all citizen meetings called by the Town in conjunction with the Project.

25. ENGINEER

The Town’s Project Engineer will be the Engineer for the contract.

26. TEXAS HISTORIC COMMISSION (“THC”) ANTIQUITIES

The Contractor must cease all construction operations immediately if a suspected archeological object/artifact is uncovered during construction. The Contractor must immediately contact THC and the Town. Project Work will not commence until all proper permits are in place and provided to the Town.

27. MIGRATORY BIRD TREATY ACT

The Contractor must comply with the Migratory Bird Treaty Act.
28. THREATENED OR ENDANGERED SPECIES

The Contractor must cease all Work and construction operations immediately if a suspected federally-listed threatened or endangered species is encountered during construction operations. The Contractor must immediately contact the United States Parks and Wildlife Services (USPWS) and the Town of Flower Mound in such event. Project work will not re-commence or continue until all proper permits are in place and provided to the Town.

29. BACKFILL

The backfill of all ditches for the installation wastewater, water, or storm sewer pipe shall be placed in layers not more than 8 inches in depth (loose measurement) beginning at a point 6 inches above the pipe embedment zone and shall be compacted to at least 95 percent of maximum density. The pipe embedment zone shall be compacted to a minimum of 90 percent of the maximum dry density at not less than optimum moisture of samples of the material as determined by the “Maximum Density Optimum Moisture Test,” ASTM Designation D 698. Backfill densities shall be 95 percent of the maximum dry density at not less than optimum moisture of samples of the material as determined by the “Maximum Density Optimum Moisture Test,” ASTM Designation D 698.

30. TRACER TAPE FOR PIPE

Blue tracer tape shall be installed for water pipe. Green tracer tape shall be installed for storm and sewer pipe. The tracer tape shall be installed in the backfill material no more than 12 inches above the top of the pipe in accordance with the manufacture’s recommendations. This item is at no cost to the Town and is included in the various bid items.

31. DETECTOR PADS

Detector pads embedded in sand shall be installed beside all valves and above all service connections. The detector pad shall be ScotchMark-Electronic Marker System, blue, 15” diameter X 0.65” thick or approved equal. This item is at no cost to the Town and is included in the various bid items.

32. SAW CUT ASPHALT AND CONCRETE

The Contractor shall saw cut all existing or new concrete and asphalt paving and sidewalks at the locations shown, at all connections to existing, or as specified in the Town of Flower Mound Engineering Services Design Criteria and Construction Standards. This item is at no cost to the Town and is included in the various bid items.

33. DISPOSAL OF MATERIAL
Excess material and debris shall not be stockpiled outside the actual construction area. The excess material and debris removed shall become the property of the Contractor and shall be removed from the right-of-way in a manner suitable to the Owner.

34. UTILITY COORDINATION

Prior to full mobilization the contractor shall visually verify the location and elevation of all existing utilities.

The contractor shall be responsible for all utility coordination with all franchise utility companies. The contractor shall allow sufficient time in construction schedule for utility coordination, permitting and relocations. The contractor shall receive neither compensation nor additional time toward completion for any delays or hindrances to the work caused by utility coordination or conflicts.

35. DRAWINGS

The term “Drawings” is included in these specifications and shall be used interchangeably with the term “Plans” as defined in Section 1.27 of the General Conditions.

36. DESCRIPTION OF PAY ITEMS IDENTIFIED IN THE PROPOSAL

The following descriptions are intended to clarify the nature of the work required for this project. The provisions of the standard technical specifications shall apply, except as otherwise noted herein:

Each pay item includes all labor, materials, equipment and incidentals necessary to construct that item.

Bid Items:

Item 1 – 2.5 Million Gallon Elevated Storage Tank

This item shall consist of the work, labor, and materials required for the construction of a 2.5 million gallon composite-style elevated storage tank, including mobilization, excavation, backfill, all site work, yard piping, valves, splash pad, ladders, stairs, internal piping, additional structural floor, doors, windows, manways, hatches, lighting, controls and instrumentation, SCADA, 30-inch offsite water main and paving to Cross Timbers Road, and all other items not covered elsewhere. Measurement for payment shall be on a lump sum basis.

Item 2 – Trench Safety

This bid item shall include all necessary activities required to provide a trench safety system in accordance with Section 01665. Measurement and payment shall be on a lump
sum basis. Payment made at the lump sum price bid shall be full compensation for all trench safety.

**Item 3 – Existing 20-Inch Water Main Relocation**

This item shall consist of the work, labor, and materials required for the relocation of an existing 20-inch water main on Cross Timbers Road (F.M. 1171). This item shall included 20-inch gate valves, fittings and labor required for connection to existing 20-inch water line. Measurement for payment shall be on a lump sum basis.

**Item 4 – Decorative Screen Wall**

This item shall consist of the work, labor, and materials required for the installation of a decorative screen wall as manufactured by Hawk Construction Company. No substitutions will be allowed for the decorative screen wall. This item shall include the installation of the wall, the foundation including drilled shafts, the decorative entrance walls and decorative columns to be installed along with the steel tube fence. This item shall also include the decorative column required for gate keypad as shown on the plans. This item does not include the decorative signs shown on the site entrance walls. Measurement for payment shall be on a lump sum basis. This item shall not include any mow strips required beneath fence. Any work associated with the installation of mow strips shall be paid for under Item 1. Any other work not specifically identified under this item shall be paid for under Item 1.
PART 1 - GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS:

A. The work is to include furnishing all labor, materials, and equipment, and performing all work necessary for the construction of a 2.5 million gallon elevated water storage tank and approximately 1,400 linear feet of 24-inch water line, appurtenances and other improvements detailed in the construction plans and specifications.

1.02 EXAMINATION OF THE SITE:

A. Contractor is required to visit the site, compare drawings and specifications with any work in place, and inform themselves of all conditions, including other work, if any, are being performed. Failure to visit the site shall not relieve the Contractor from the necessity of furnishing materials or performing work required to complete work in accordance with the Contract Documents without additional cost to the Owner.

1.03 CONTRACTS:

A. The General Contractor shall perform the Work under a single contract as designated in the Owner-Contractor Agreement.

1.04 CONTRACTOR'S USE OF PREMISES:

A. Coordinate use of premises under direction of the Owner, or the Owner's authorized representative.

B. Assume full responsibility for protection and safekeeping of products under this Contract, stored on site.

1.05 PARTIAL OWNER OCCUPANCY:

A. The Owner reserves the right to take possession and use any completed or partially completed portion of the Project regardless of the time of completion of the Project, providing it does not interfere with the Contractor's work. Such possession or use of the Project shall not be construed as final acceptance of the project or any portion thereof.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Special Conditions and other Technical Specification sections, apply to work of this section.

1.02 DESCRIPTION OF REQUIREMENTS:

A. General: This section specifies procedural and administrative requirements for compliance with governing regulations and codes and standards imposed upon the Work. These requirements include obtaining permits, licenses, inspections, releases and similar documentation, as well as payments, statements and similar requirements associated with regulations, codes and standards.

1. The term "Regulations" is defined to include laws, statutes, ordinances and lawful orders issued by governing authorities, as well as those rules, conventions and agreements within the construction industry which effectively control the performance of the work regardless of whether they are lawfully imposed by governing authority or not.

B. Governing Regulations: Refer to General and Special Conditions for requirements related to compliance with governing regulations.

1.03 DEFINITIONS:

A. General Explanation: Certain terms used in the contract documents are defined in this article. Definitions and explanations contained in this section are not necessarily complete but are general for the Work to the extent that they are not stated more explicitly in another element of the contract documents.

B. General Requirements: Provisions and requirements of other Division-1 sections apply to the entire work of the Contract and, where so indicated, to other elements which are included in the project.

C. Indicated: The term "indicated" is a cross-reference to graphic representations notes or schedules on the drawings, to other paragraphs or schedules in the specifications, and to similar means of recording requirements in contract documents. Where terms such as "shown", "noted", "scheduled", and "specified" are used in lieu of "indicated", it is for the purpose of helping the reader locate the cross-reference, and no limitation of location is intended except as specifically noted.

D. Directed, Requested, etc.: Terms such as "directed", "requested", "authorized", "selected", "approved", "required", "accepted", and "permitted" mean "directed by the Engineer", "requested by the Engineer", and similar phrases. However, no such implied meaning will be interpreted to extend the Engineer's responsibility into the Contractor's area of construction supervision.

E. Approve: Where used in conjunction with the Engineer's response to submittals, requests, applications, inquiries, reports and claims by the Contractor, the term "approved" will be held to
limitations of the Engineer's responsibilities and duties as specified in General and Special Conditions. In no case will the Engineer's approval be interpreted as a release of the Contractor from responsibilities to fulfill requirements of contract documents or acceptance of the Work, unless otherwise provided by requirements of the contract documents.

F. Project Site: The term "project site" means the space available to the Contractor for performance of the Work, either exclusively or in conjunction with others performing other construction as part of the project. The extent of the project site is shown on the drawings, and may or may not be identical with the description of the land upon which the project is to be built.

G. Furnish: The term "furnish" is used to mean "supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, and similar operations".

H. Install: The term "install" is used to describe operations at project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar operations".

I. Provide: The term "provide" means "to furnish and install, complete and ready for the intended use".

J. Installer: The "installer" is "the entity" (person or firm) engaged by the Contractor, its subcontractor or sub-subcontractor for performance of a particular element of construction at the project site, including installation, erection, application and similar required operations. It is a requirement that installers are experienced in the operations they are engaged to perform.

K. Testing Laboratories: A "testing laboratory" is an independent entity engaged to perform specific inspections or tests of the Work, either at the project site or elsewhere, and to report, and (if required) interpret results of those inspections or tests.

1.04 DRAWING SYMBOLS:

A. General: Except as otherwise indicated, graphic symbols used on the drawings are those symbols recognized in the construction industry for purposes indicated. Where not otherwise noted, symbols are defined by "Architectural Graphic Standards", published by John Wiley & Sons, Inc., seventh edition.

B. Mechanical/Electrical Drawings: Graphic symbols used on mechanical and electrical drawings are generally aligned with symbols recommended by ASHRAE. Where appropriate, these symbols are supplemented by more specific symbols as recommended by other technical associations including ASME, ASPE, IEEE and similar organizations. Refer instances of uncertainty to the Engineer for clarification before proceeding.

1.05 INDUSTRY STANDARDS:

A. Applicability of Standards: Except where more explicit or stringent requirements are written into the contract documents, applicable construction industry standards have the same force and effect as if bound into or copied directly into the contract documents. Such industry standards are made
a part of the contract documents by reference. Individual specification sections indicate which codes and standards the Contractor must keep available at the project site for reference.

1. Referenced standards (standards referenced directly in the contract documents) take precedence over standards that are not referenced but generally recognized in the industry for applicability to the Work.

2. Unreferenced standards are not directly applicable to the Work, except as a general requirement of whether the Work complies with recognized construction industry standards.

B. Publication Dates: Except as otherwise indicated, where compliance with an industry standard is required, comply with standard in effect as of date of contract documents.

C. Conflicting Requirements: Where compliance with two or more standards is specified, and where these standards establish different or conflicting requirements for minimum quantities or quality levels, the most stringent requirement will be enforced, unless the contract documents specifically indicate otherwise. Refer requirements that are different, but apparently equal, and uncertainties as to which quality level is more stringent to the Engineer for a decision before proceeding.

D. Copies of Standards: The contract documents require that each entity performing work be experienced in that part of the Work being performed. Each entity is also required to be familiar with industry standards applicable to that part of the Work. Copies of applicable standards are not bound with the contract documents.

Where copies of standards are needed for proper performance of the Work, the Contractor is required to obtain such copies directly from the publication source.

Although copies of standards needed for enforcement of requirements may be required submittals, the Engineer reserves the right to require the Contractor to submit additional copies as necessary for enforcement of requirements.

E. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where acronyms or abbreviations are used in the specifications or other contract documents they are defined to mean the recognized name of the trade association, standards generating organization, governing authority or other entity applicable to the context of the text provision. Refer to the "Encyclopedia of Associations", published by Gale Research Co., available in most libraries.

1.06 SUBMITTALS:

Permits, Licenses, and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence and records established in conjunction with compliance with standards and regulations bearing upon performance of the Work.

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: To help clarify construction contract administration procedures, the Engineer will conduct a Preconstruction Conference prior to start of the Work.

B. Related Work: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.02 QUALITY ASSURANCE

A. For those persons designated by the CONTRACTOR, his subcontractors, and suppliers to attend the Preconstruction Conference, provide required authority to commit the entities they represent to solutions agreed upon in the Conference.

1.03 SUBMITTALS

A. To the maximum extent practicable, advise the OWNER and the ENGINEER at least 24 hours in advance of the Conference as to items to be added to the agenda.

B. The ENGINEER will compile notes of the Conference, and will furnish a copy of the notes to the CONTRACTOR and required copies to the OWNER. The CONTRACTOR may make and distribute such copies as he wishes.

1.04 PRECONSTRUCTION CONFERENCE

A. The Conference will be scheduled to be held prior to the OWNER issuing the Notice to Proceed.

B. Attendance:

1. Provide attendance by authorized representatives of the CONTRACTOR and major subcontractors.

2. The ENGINEER will advise other interested parties and request their attendance.

C. Minimum agenda: Data will be distributed and discussed on:

1. Organizational arrangement of CONTRACTOR's forces and personnel, and those of subcontractors, materials suppliers, and the ENGINEER.

2. Channels and procedures for communication.

3. Construction schedule, including sequence of critical work.

4. Contract Documents, including distribution of required copies of Drawings and revisions.

5. Processing of Shop Drawings and other data submitted to the ENGINEER for review.
6. Processing of field decisions and Change Orders.


10. Inspections and Testing.

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: To enable orderly review during progress of the Work, and to provide for systematic discussion of problems, the ENGINEER will conduct project meetings throughout the construction period.

B. Related Work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

2. The CONTRACTOR's relations with his subcontractors and material suppliers, and discussions relative thereto, are the CONTRACTOR's responsibility and normally are not part of project meetings content.

1.02 QUALITY ASSURANCE

A. For those persons designated by the ENGINEER to attend and participate in project meetings, provide required authority that does not require Town Council approval to commit the CONTRACTOR to solutions agreed upon in the project meetings.

PART 2 - PRODUCTS

(No products are required in this Section)

PART 3 - EXECUTION

3.01 MEETING SCHEDULE

A. Except as noted below for Preconstruction Meeting, project meetings will be held as determined by the ENGINEER.

B. The ENGINEER shall coordinate as necessary to establish mutually acceptable schedule for meetings.

3.02 MEETING LOCATION

A. The OWNER will establish meeting location. To the maximum extent practicable, meetings will be held at the job site.
3.03 PROJECT MEETINGS

A. Attendance:

1. To the maximum extent practicable, assign the same person or persons to represent the CONTRACTOR at project meetings throughout progress of the Work.

2. OWNER, if determined to be required by the engineer.

3. ENGINEER.

4. Subcontractors, materials suppliers, and others may be invited to attend those project meetings in which their aspect of the Work is involved.

5. Others as appropriate to agenda.

B. Minimum Agenda:

1. Review progress of the Work since last meeting, including status of submittals for approval.

2. Review schedule and identify problems which impede planned progress.

3. Develop corrective measures and procedures to regain planned schedule.


3.04 PRE-INSTALLATION CONFERENCES

A. Where required in individual specification Section, convene a pre-installation conference at project site or other designed location.

B. Require attendance of parties directly affecting or affected by work of the specific Section.

C. Notify all parties to attend at least 4 days in advance of meeting.

D. Review conditions of installation, preparation and installation procedures, and coordination with related work.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification sections, apply to work of this section.

1.02 COORDINATION

Coordinate both the listing and timing of reports and other activities required by provisions of this section and other sections, as to provide consistency and logical coordination between the reports. Maintain coordination and correlation between separate reports by updating at monthly or shorter time intervals. Make appropriate distribution of each report and updated report to all parties involved in the work including the ENGINEER and OWNER. In particular, provide close coordination of the progress schedule, schedule of values, listing of subcontracts, schedule of submittals, progress reports, and payment requests.

1.03 PRELIMINARY PROGRESS SCHEDULE

A. Gantt-Chart Schedule: Submit a Gantt-chart type progress schedule prior to commencement of the work. On the schedule, indicate a time bar for each major category or unit of work to be performed at the site, properly sequenced and coordinated with other elements of work. Show completion of the work sufficiently in advance of the date established for substantial completion of the work. **Schedule shall be in accordance with Construction Sequence shown on the plans.**

1. Submittal Tabulation: With the Gantt-chart submittal, submit a tabulation, by date, of the submittals required during the first 90 days of Construction Time. This tabulation shall include both those submittals required during the initial 90 days of construction to maintain the orderly progression of the work, and those submittals required early because of long lead time for manufacturer or fabrication. At the CONTRACTOR's option, submittal dates may be shown on the bar-chart schedule, in lieu of being tabulated.

1.04 SUBMITTAL SCHEDULE

A. General: Immediately after the development and acceptance of the progress schedule, prepare a complete schedule of work-related submittals. Submit this schedule within 10 days of the date required for establishment of progress schedule. Correlate this submittal schedule with a listing of principal subcontractors, and with the "listing of products" or the "procurement schedule" as specified in "Products and Substitutions" sections and elsewhere in the contract documents.

B. Form: Prepare the schedule in chronological order of submittals. Show category of the submittal, name of subcontractor, a generic description of the work covered, related section numbers, the activity or event number on the progress schedule, the scheduled date for the first submittal, resubmittal, and the final release or approved by the ENGINEER. Provide with the listing of the subcontractors the corresponding mailing address, business address, telephone number, fax number (if applicable) and contact person.
1.05 SCHEDULE OF VALUES

A. General: The contractor shall prepare a schedule of values in conjunction with the preparation of the progress schedule. The Contractor shall coordinate preparation of schedule of values and progress schedule. The Contractor shall correlate line items with other administrative schedules and the forms required for the work, including the progress schedule, payment request form, listing of subcontractors, schedule of allowances, schedule of alternatives, listing of products and principal suppliers and fabricators, and the schedule of submittals. The Contractor shall provide breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of payment requests and progress reports. Break down principal subcontract amounts into several line items. Round off to the nearest whole dollar, but with the total equal the Contract Sum.

B. Time Coordination: In coordination of initial submittals and other administrative “start-up” activities, the Contractor shall submit a complete schedule of values to the Engineer for approval at the earliest feasible date, but in no case later than 7 days before initial payment request is to be submitted. Pay requests will not be reviewed by the Engineer before a complete schedule of values is approved.

1.06 PAYMENT REQUESTS

A. Refer to the Supplementary Conditions.

B. Application at Time of Final Walk Through: Following issuance of ENGINEER's final punch list, and also in part as applicable to prior certificates on portions of completed work as designated, a "special" payment application may be prepared and submitted by CONTRACTOR. The principal administrative actions and submittals which must precede or coincide with such special applications can be summarized as follows, but not necessarily by way of limitation:

1. Occupancy permits and similar approvals or certifications by governing authorities and franchised services, assuring OWNER's full access and use of completed work.

2. Warranties (guarantees), maintenance agreements and similar provisions of contract documents.

3. Test/adjust/balance records, maintenance instructions, meter readings, start-up performance reports, and similar change-over information germane to OWNER's occupancy, use, operation and maintenance of completed work.

4. Final cleaning of the work.

5. Listing of Contractor's incomplete work, recognized as exceptions to ENGINEER's certificate of substantial completion.

C. Final Payment Application: The administrative actions and submittals which must precede or coincide preparation of final estimate by Engineer can be summarized as follows, but not necessarily by way of limitation:

1. Completion of project closeout requirements.
2. Completion of items specified for completion beyond time of substantial completion (regardless of whether special payment application was previously made).

3. Assurance, satisfactory to OWNER, that unsettled claims will be settled and that work not actually completed and accepted will be completed without undue delay.

4. Transmittal of required project construction records to OWNER.

5. Proof, satisfactory to OWNER, that taxes, fees and similar obligations of CONTRACTOR have been paid.

6. Removal of temporary facilities, services, surplus materials, rubbish and similar elements.

7. Affidavit that all subcontractors and suppliers have been paid in full.

8. Consent of surety for final payment.

D. Application Transmittal: Submit to the ENGINEER waivers of lien and similar attachments. Transmit a form listing those attachments and recording information related to the Final Payment.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Special Conditions and other Division-1 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF REQUIREMENTS

A. General: This section specifies procedural requirements for non-administrative submittals including shop drawings, product data, samples and other miscellaneous work-related submittals. Shop drawings, product data, samples and other work-related submittals are required to amplify, expand and coordinate the information contained in the Contract Documents.

1. Required administrative, non-work-related submittals. Include, but are not limited to the following items:

   A. Permits.
   B. Performance and Payment Bonds.
   C. Insurance Certificates.
   D. Inspection and Test Reports.
   E. Excavation Safety Plan.
   F. Trench Safety Plan.
   G. Listing of Subcontractors.
   H. Traffic Control Plan.
   I. Stockpile Plan.

B. Shop Drawings: Shop drawings prepared for this project by the CONTRACTOR including but not limited to the following items:

   1. Fabrication and installation drawings.
   2. Setting diagrams.
   4. Templates.
   5. Patterns.
   6. Coordination drawings (for use on-site).
   7. Schedules.
   8. Design mix formulas.
   9. Contractor's engineering calculations.

Standard information prepared without specific reference to a project is not considered to be shop drawings.
Address for Submittals shall be addressed to the Owner’s representative:

Anthony Samarripas, P.E.
Kimley-Horn and Associates, Inc.
12700 Park Central Drive
Suite 1800
Dallas, TX 75251-1516
(972) 770-1300

C. Product data includes standard printed information on manufactured products that has not been specially-prepared for this project by the CONTRACTOR, including but not limited to the following items:

1. Manufacturer's product specifications and installation instructions.
2. Standard color charts.
3. Catalog cuts.
4. Roughing-in diagram and templates.
5. Standard wiring diagrams.
7. Operational range diagrams.
8. Mill reports.

D. Miscellaneous submittals are work-related, non-administrative submittals that do not fit in the three previous categories, including, but not limited to the following:

1. Specially-prepared and standard printed warranties.
3. Workmanship bonds.
4. Survey data and reports.
5. Project photographs.
6. Testing and certification reports.
7. Record drawings.
8. Field measurement data.
9. Operating and maintenance manuals.
11. Maintenance tools and spare parts.

1.03 SUBMITTAL PROCEDURES

A. Submit six (6) copies (eight (8) copies for Division 15 and 16) of shop drawings, layouts, manufacturer's data, and material schedules as may be required by the ENGINEER for his review. Submittals may be checked by and stamped with the approval of the CONTRACTOR and identified as the ENGINEER may require. Such review by the ENGINEER shall include checking for general conformance with the design concept of the project and general compliance with information given in the General Contract Documents. Indicated actions by the ENGINEER
which may result from his review, shall not constitute concurrence with any deviation from the plans and specifications unless such deviations are specifically identified by the method described below, and further shall not relieve the CONTRACTOR of responsibility for errors or omissions in the submitted data. Processed shop drawing submittals are not change orders. The purpose of submittals by the CONTRACTOR is to demonstrate that the CONTRACTOR understands the design concept, and that he demonstrates his understanding by indicating which equipment and materials he intends to furnish and install, and by detailing the fabrication and installation methods he intends to use. If deviations, discrepancies or conflicts between submittals and the design drawings and/or specifications are discovered, either prior to or after submittals are processed, the design drawings and specifications shall govern.

B. The CONTRACTOR shall be responsible for dimensions which are to be confirmed and correlated at the job site, fabrication processes and techniques of construction, coordination of his work with that of other trades and satisfactory performance of his work. The CONTRACTOR shall check and verify all measurements and review submittals prior to being submitted, and sign or initial a statement included with the submittal, which signifies compliance with plans and specifications and dimensions suitable for the application. Any deviation from the specified criteria shall be expressly stated in writing in the submittal. Two (2) copies of the approved submittals shall be retained by the CONTRACTOR until completion of the project.

C. Coordination: Coordinate the preparation and processing of submittals with the performance of the work. Coordinate each separate submittal with other submittals and related activities such as testing, purchasing, fabrication, delivery and similar activities that require sequential activity.

1. Coordinate the submittal of different units of interrelated work so that one submittal will not be delayed by the ENGINEER’s need to review a related submittal. The ENGINEER reserves the right to hold action on any submittal requiring coordination with other submittals until related submittals are forthcoming.

D. Coordination of Submittal Times: Prepare and transmit each submittal to the ENGINEER sufficiently in advance of the scheduled performance of related work and other applicable activities. Transmit different kinds of submittals for the same unit of work so that processing will not be delayed by the ENGINEER’s need to review submittals concurrently for coordination.

E. Review Time: Allow sufficient time so that the installation will not be delayed as a result of the time required to properly process submittals, including time for resubmittal, if necessary. Advise the ENGINEER on each submittal, as to whether processing time is critical to the progress of the work and if the work would be expedited if processing time could be shortened.

F. Submittal Preparation: Mark each submittal with a permanent label for identification. Provide the following information on the label for proper processing and recording of action taken.

1. Project name.
2. Date.
3. Name and address of Engineer.
4. Name and address of Contractor.
5. Name and address of subcontractor.
6. Name and address of supplier.
7. Name of manufacturer.
8. Number and title of appropriate specification section.
9. Drawing number and detail references, as appropriate.
10. Similar definitive information as necessary.
11. Provide a space on the label for the CONTRACTOR's review and approval markings, and a space for the ENGINEER's "Action" marking.

G. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from the CONTRACTOR to the ENGINEER, and to other destinations as indicated, by use of a transmittal form. Submittals received from sources other than the CONTRACTOR will not be returned to the sender and no action will be taken by the ENGINEER.

1. Transmittal Form: Prepare a draft of a transmittal form and submit to the ENGINEER for acceptance. Provide on the form places for the following information:
   a. Project name.
   b. Date.
   c. To:
   d. From:
   e. Names of subcontractor, manufacturer and supplier.
   f. References.
   g. Category and type of submittal.
   h. Submittal purpose and description.
   i. Submittal and transmittal distribution record.
   j. Signature of transmitter.
   k. Contractor's certification stating that the information submitted complies with the requirements of the Contract Documents, with a place for the Contractor's signature.

Record relevant information and requests for data on the transmittal form. On the transmittal form, or on a separate sheet attached to the form, record deviations from the requirements of the Contract Documents, if any, including minor variations and limitations.

1.04 SPECIFIC SUBMITTAL REQUIREMENTS

A. General: Specific submittal requirements for individual units of work are specified in the applicable specification section. Except as otherwise indicated in the individual specification sections, comply with the requirements specified herein for each type of submittal.

Where it is necessary to provide intermediate submittals between the initial and final submittals, provide and process intermediate submittals in the same manner as for initial submittals.
B. Shop Drawings: Information required on shop drawings includes dimensions, identification of specific products and materials which are included in the work compliance with specified standards and notations of coordination requirements with other work. Provide special notation of dimensions that have been established by field measurement. Highlight, encircle or otherwise indicate deviations from the contract documents on the shop drawings.

1. Coordination Drawings: Provide coordination drawings where required for the integration of the work, including work first shown in detail on shop drawings or product data. Show sequencing and relationship of separate units of work, which must interface in a restricted manner to fit in the space provided, or function as indicated. Coordination drawings are considered shop drawings and must be definitive in nature.

2. Do not permit shop drawing copies without an appropriate final "Action" marking by the Engineer to be used in connection with the work.

C. Product Data: General information required specifically as product data includes manufacturer's standard printed recommendations for application and use, compliance with recognized standards of trade associations and testing agencies, and the application of their labels and seals (if any), special notation of dimensions which have been verified by way of field measurement, and special coordination requirements for interfacing the material, product or system with other work.

1. Preparation: Collect required product data into a single submittal for each unit of work or system. Mark each copy to show which choices and options are applicable to the project. Where product data has been printed to include information on several similar products, some of which are not required for use on the project, or are not included in this submittal, mark the copies to show clearly that such information is not applicable.

   a. Where product data must be specially prepared for required products, materials or systems, because standard printed data is not suitable for use, submit data as "shop drawings" and not as "product data".

2. Submittals: Product data submittal is required for information and record and to determine that the products, materials and systems comply with the provisions of the contract documents. Therefore, the initial submittal is also the final submittal, except where the Engineer observes that there is non-compliance with the provisions of the contract documents and returns the submittal promptly to the CONTRACTOR marked with the appropriate "Action".

   Provide a preliminary single-copy submittal where required, for selection of options by the Engineer.

   a. Submittal: Except as otherwise indicated in individual sections of these specifications, submit 3 copies of each required product data submittal, plus 2 additional copies where required for maintenance manuals.

   The ENGINEER will retain one copy, and will return the other marked with "Action" and corrections or modifications as required.
b. Do not submit product data or allow its use on the project, until compliance with the requirements of the contract documents has been confirmed by the CONTRACTOR.

3. Installation Copy: Do not proceed with installation of materials, products and systems until a copy of product data applicable to the installation is in the possession of the installer. Do not permit the use of unmarked copies of product data in connection with the performance of the work.

D. Miscellaneous Submittals:

1. Inspection and Test Reports: Classify each inspection and test report as being either "shop drawing" or "product data" depending on whether the report is specially prepared for the project, or a standard publication of workmanship control testing at the point of production. Process inspection and test reports accordingly.

2. Warranties: Refer to section "Substitutions and Product Options" for specific general requirements on warranties, product bonds, workmanship bonds and maintenance agreements. In addition to copies desired for the CONTRACTOR's use, furnish 2 executed copies of such warranties, bonds or agreements. Provide 2 additional copies where required for maintenance manuals.

3. Standards: Where submittal of a copy of standards is indicated, and except where copies of standards are specified as an integral part of a "Product Data" submittal, submit a single copy of standards for the ENGINEER's use. Where workmanship, whether at the project site or elsewhere is governed by a standard, furnish additional copies of the standard to fabricators, installers and others involved in the performance of the work.

4. Closeout Submittals: Refer to section "Contract Close-out" and to individual sections of these specifications for specific submittal requirements of project closeout information, materials, tools, and similar items.

5. General Distribution: Provide additional distribution of submittals to governing authorities, and others as necessary for the proper performance of the work. Include such additional copies of submittals in the transmittal to the ENGINEER where the submittals are required to receive "Action" marking before final distribution. Record distributions on transmittal forms.

6. Stockpile Plan: The CONTRACTOR shall submit a "Stockpile Plan" that designates locations for temporary storage of excavated pavement and soil. This plan is subject to approval by the Owner.

7. Traffic Control Plan: The CONTRACTOR shall submit a Traffic Control Plan that outlines how ingress and egress requirements will be adhered to in conjunction with the sequence of the work.

9. Telephone Numbers: The CONTRACTOR shall submit telephone numbers of the Project Manager, Superintendent, Foreman and individual(s) authorized to verify the monthly pay estimate.

10. Storm Water Pollution Plan: The CONTRACTOR shall submit a Storm Water Pollution Plan (if required).

11. Competent person as defined by OSHA.

12. Name of Safety Representative.

1.05 ENGINEER'S ACTION

A. General: Except for submittals for the record and similar purposes, where action and return on submittals is required or requested, the ENGINEER will review each submittal, mark with appropriate "Action", and return. Where the submittal must be held for coordination, the ENGINEER will so advise the CONTRACTOR.

1. Action Stamp: The ENGINEER will stamp each submittal to be returned with a uniform, self-explanatory action stamp, appropriately marked and executed to indicate whether the submittal returned is for unrestricted use, final-but-restricted use (as marked), must be revised and resubmitted (use not permitted) or without action (as explained on the transmittal form).

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION:
   A. Work Included: Provide testing and inspecting, complete, as described in this Section and elsewhere in the Contract Documents.

   B. Related Work:
      1. Requirements for testing may be described in various Sections of these Specifications, including this Section.

1.02 QUALITY ASSURANCE:
   A. Provide the services of a soils engineer and a testing laboratory to be approved by the Engineer and Town.

   B. Upon completion of each test and/or inspection, promptly distribute copies of test or inspection reports to the Engineer, to governmental agencies requiring submission of such reports, and to such other persons as directed by the Engineer.

   C. Employment of Testing Laboratory shall in no way relieve Contractor of his obligations to perform work in accordance with contract documents.

   D. Qualifications of laboratory:
      1. Meet ACIL requirements referenced.
      2. Meet basic requirements of ASTM E 329.
      3. Authorized to operate in State in which project is located.
      4. Meet minimum requirements specified in other sections of the Contract Documents.

   E. Approved testing laboratories:

      Contractor shall be required to submit for approval the testing laboratory he intends to use. Owner reserves the right to reject any testing laboratory proposed by the contractor for any reason. In the event the contractor is required to obtain a different testing laboratory than submitted it shall be at the contractor’s expense, no additional payment will be made to the contractor for rejections in the proposed testing laboratory.

PART 2 - PRODUCTS

2.01 PAYMENT FOR TESTING:
   A. Contractor shall be responsible for all testing associated with the project. Cost associated with testing shall be included in the contractor’s bid and shall be considered subsidiary to the various pay items shown in the Bid Proposal.
B. When initial tests indicate non-compliance with the Contract Documents, the contractor will be required to perform additional tests until the test indicate the work is in compliance with the Contract Documents. All additional tests associated with failing tests shall be at the expense of the contractor, no additional payment will be made.

C. Owner will, at their own expense, hire an independent testing laboratory to perform weld tests as well as coating tests associated with the elevated storage tank. This does not alleviate the contractor of his responsibility to test these items. Contractor shall be required to coordinate work schedule with the Owner so that the Owner has sufficient time to schedule their testing. In the event of any conflicting testing data between the Owner’s laboratory and the Contractor’s laboratory, the Owner shall have the sole authority to determine which results will be utilized. Any additional testing associated with conflicting data between testing laboratories shall be at the contractor’s expense, no additional payment will be made.

2.02 SPECIFIC TESTS AND INSPECTIONS:

A. Provide all tests and inspections required by governmental agencies having jurisdiction, required by provisions of the Contract Documents, and such other tests and inspections as are directed by the Engineer.

B. Tests include, but are not necessarily limited to, those described in detail in Part 3 of this Section.

2.03 CONTRACTOR'S RESPONSIBILITIES:

A. Cooperate with Laboratory personnel, provide access to Work, and to manufacturer's operations.

B. When materials require testing prior to being incorporated into Work, secure and deliver to Laboratory adequate quantities of representative samples of materials proposed to be used.

C. Furnish copies of product test reports as required.

D. Furnish incidental labor and facilities:
   1. To provide access to work to be tested.
   2. To obtain and handle samples at site or at source of product to be tested.
   3. To facilitate inspections and tests.
   4. For safe storage and cutting of test samples.

E. Notify Laboratory sufficiently in advance of operations to allow for Laboratory assignment of personnel and scheduling of tests.

F. Make arrangements with Laboratory and pay for additional samples and tests required for Contractor's convenience.
PART 3 - EXECUTION

3.01 TAKING SPECIMENS:

A. Except as may be specifically otherwise approved by the Engineer, have the laboratory secure and handle all samples and specimens for testing.

3.02 COOPERATION WITH TESTING LABORATORY:

A. Provide access to the Work at all times and at all locations where the Work is in progress. Provide facilities for such access to enable the laboratory to perform its functions properly.

3.03 CONCRETE INSPECTING AND TESTING: The following applies to structural concrete, pavement and flat works, see Section 13201 for testing requirements associated with elevated storage tank

A. Portland Cement:

1. Secure from the cement manufacturer Certificates of Compliance delivered directly to the concrete producer for further delivery directly to the testing laboratory.

2. Require the Certificates of Compliance to positively identify the cement as to production lot, bin or silo number, dating and routing of shipment, and compliance with the specified standards.

3. If so required by the Engineer, promptly provide such other specific physical and chemical data as required.

B. Aggregate:

1. Provide one test unless character of material changes, material is substituted, or additional test is requested by the Engineer.

2. Sample from conveyor belts or batching gates at the ready-mix plant:
   a. Sieve analysis to determine compliance with specified standards and grading;
   b. Specific gravity test for compliance with specified standards.

C. Laboratory Design Mix:

1. After approval of aggregate, and whenever character or source of materials is changed, provide mix design in accordance with ACI 613.

2. Provide designs for all mixes prepared by a licensed civil engineer.

D. Molded Concrete Cylinders:

1. Provide four test cylinders for each 50 cu.yds. or fraction thereof, of each class of concrete of each day's placement.
2. Test one cylinder at (7) seven days, two at (28) twenty eight days, and one when so directed.

3. Report the mix, slump, location of concrete in the structure, and test results prior to the addition of any plasticizers.

4. Take specimens and make tests in accordance with the applicable ASTM standard specifications.

E. Core Tests:

1. Provide only when specifically so directed by the Engineer because of low cylinder test results.

2. Cut from locations directed by the Engineer, securing in accordance with ASTM C42, and prepare and test in accordance with ASTM C39.

F. Placement Inspections:

1. On concrete over 2,000 psi, provide continuous or other inspection as required by governmental agencies having jurisdiction.

2. Throughout progress of concrete placement, make slump tests to verify conformance with specified slump.

3. Using all required personnel and equipment, throughout progress of concrete placement verify that finished concrete surfaces will have the level or slope that is required by the Contract Documents.

3.04 MASONRY:

1. Provide mortar testing per ASTM C-270.

3.05 STEEL:

A. Inspection of Structural Steel:

1. Inspect structural steel during fabrication and during and after erection for conformance with Contract Documents and Shop Drawings.

2. Inspect shop and field welds including certification of welders.

3. Visually inspect check welds for size and appearance.

4. No burning or other field corrections of steel members are permitted without express permission of the Engineer. Immediately report violations.

B. Inspecting Bolting:
1. Visually examine joints to determine that bolts and washers are properly installed and have been tensioned.

2. Check tightness of bolts by using a calibrated torque wrench.

3. Torque wrench test two bolts in each connection, but not less than 10% of bolts.

C. Inspection of Open Web Steel Joists: Inspect erection of open web steel joists for conformance with Contract Documents or Shop Drawings.

D. Inspection of Metal Deck: Inspect all metal deck for proper installation. Include correct welds and lapping of deck.

3.06 EARTH EXCAVATION, BACKFILL AND GRADING: Shall be in accordance with Section 02200.

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION:

A. Work Included: Provide temporary facilities and controls needed for the Work including, but not necessarily limited to:

1. Temporary utilities such as water, electricity, and telephone;
2. Field office shall not be required;
3. Sanitary facilities;
4. Enclosures such as tarpaulins, barricades, and canopies;
5. Temporary fencing of the construction site;
6. Security;
7. Water, erosion, sediment, and dust control;
8. Removal.

B. Related Work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Special Requirements, and Sections in Division 1 of these Supplementary Detailed Specifications.
2. Except that equipment furnished by subcontractors shall comply with requirements of pertinent safety regulations, such equipment normally furnished by the individual trades in execution of their own portions of the Work are not part of this Section.
3. Permanent installation and hookup of the various utility lines are described in other Sections.

1.02 PRODUCT HANDLING:

A. Maintain temporary facilities and controls in proper and safe condition throughout progress of the Work.

PART 2 - PRODUCTS

2.01 UTILITIES:

A. Water:

1. Provide necessary temporary piping and water supply and, upon completion of the Work, remove such temporary facilities.

2. The Contractor will be responsible for providing necessary potable water for personnel during construction, except as noted in Section 13201.
B. Electricity:

1. Provide necessary temporary wiring and, upon completion of the Work, remove such temporary facility.

2. Install all wiring in accordance with applicable electrical codes and safety requirements.

3. Furnish, install, operate, and maintain temporary lights as are required by law or ordinance, or by good safety practices, and as are necessary for the proper protection of the public and workmen, Owner’s employees, Owner’s guests and invitees, or as necessary for proper performance and inspection of the Work.

4. Provide and pay for electricity used in construction.

C. Telephone:

1. Provide telephone, radio, and communication equipment for the Contractor’s, Owner’s, Project Representative’s, and Engineer’s use during construction.

2.02 TEMPORARY SANITARY FACILITIES

A. Provide and maintain sanitary facilities for Contractor’s employees, including those of all subcontractors, in the quantity required to meet site requirements and in accordance with local laws and codes. Provide a minimum of one (1) toilet per twenty (20) employees.

B. Transport sanitary sludge off-site for disposal in accordance with applicable local, state, and federal requirements.

2.03 FIELD OFFICES AND SHEDS:

A. Any Field Office furnished shall be in accordance with this Section.

B. Locate temporary offices and sheds a minimum distance of thirty feet (30’) from any new or existing structure(s) and in area(s) designated by the Engineer.

C. Obtain approval by the Engineer prior to erecting all temporary buildings.

D. Maintain office in good repair and appearance.

2.04 DEWATERING:

A. For the entire duration of the Contract, the Contractor, at his expense, shall keep all parts of the project site, including excavations, free from any accumulation of water, regardless of the source or cause of such water, by adequate trenching and pumping as required.
B. Pumping shall include adequate pumps, hose strainers, and other appurtenances, fuel, power, trenching, erosion control facilities, and pumping as required.

C. Water shall be disposed of in such a manner as will not endanger public health or cause damage or expense to public or private property, and in accordance with the requirements of any public agencies having jurisdiction. If sewers and streets are used for drainage or the disposal of water during construction, they shall be maintained and left satisfactorily clean upon the completion of the work.

2.05 ENCLOSURES:

A. Provide and maintain for the duration of construction all scaffolds, tarpaulins, canopies, warning signs, steps, platforms, bridges, and other temporary construction necessary for proper completion of the Work in compliance with pertinent safety and other regulations.

2.06 TEMPORARY PROTECTION:

A. The Contractor or subcontractors shall also be responsible for protecting his work from damage due to the weather.

2.07 TEMPORARY FENCING:

A. Provide and maintain for the duration of construction a temporary fence of design and type needed to prevent entry onto the Work by the public. A temporary fence will be required. Temporary fencing shall consist of an 8-foot tall chain link fence that is secured and locked when the Contractor is not on-site.

PART 3 - EXECUTION

3.01 MAINTENANCE AND REMOVAL:

A. Maintain temporary facilities and controls as long as needed for safe and proper completion of the Work.

B. Remove such temporary facilities and controls as rapidly as progress of the Work will permit, or as directed by the Engineer.

3.02 PROTECTION:

A. Provide spare safety helmets for use by Owner, Engineer, their representatives and authorized visitors to the site.

END OF SECTION
PART 1 - GENERAL

1.01 CONTRACTOR’S OPTIONS

A. For products specified only by reference standards, select any product meeting standards.

B. For products specified by naming several products or manufacturers, select any names.

C. For products specified by naming one or more products, followed by "or equal", CONTRACTOR must submit request for substitution for any product not specifically named.

D. For products specified by naming only one product and manufacturer, no option and no substitution will be allowed.

1.02 SUBSTITUTIONS

A. Within 30 days after award of Contract (unless noted otherwise), the ENGINEER will consider formal requests from CONTRACTOR for substitution of products in place of those specified.

B. Submit five copies of each request for substitution, including:

1. Complete data substantiating compliance of proposed substitution with Contract Documents.

2. For products:
   a. Product identification, including name and address of manufacturer.

3. For construction methods:
   a. Detailed description of proposed method.
   b. Illustration drawings.


5. Accurate cost data in comparison with product or method specified.

C. In making request for substitution, CONTRACTOR represents that:

1. He has investigated proposed substitution and determined that it is equal or superior to that specified in all aspects.

2. He will provide same warranty as for product or method specified.

3. He will coordinate installation of accepted substitution into Work, making changes as may be required to complete work in all aspects.
4. He waives all claims for additional costs related to substitution which subsequently become apparent.

5. Cost data is complete and includes all related costs under Contract, excluding ENGINEER's redesign.

D. Substitutions will not be considered if:

1. They are indicated or implied on shop drawings or data submittals without formal request.

2. Acceptance will require substantial revision of Contract Documents.

E. CONTRACTOR alone will be responsible for substantiating acceptability of proposed substitutions. ENGINEER's decision in acceptance or non-acceptance of substitutions shall be final.
REQUEST FOR SUBSTITUTION FORM:

TO: __________________________________________

PROJECT: ___________________________ DATE: ___________________________

We hereby submit for your consideration the following product instead of the specified item for the above project:

SECTION PARAGRAPH SPECIFIED ITEM

________________________________________________________

Proposed Substitution: ________________________________________

Reason for Substitution: _________________________________________

Include complete information on changes to Drawings and/or Specifications which proposed substitution will require for its proper installation.

Fill in Blanks Below:

A. Will the undersigned contractor pay for changes to the building design, including engineering and detailing costs caused by the requested substitution?

________________________________________________________

B. What effect does substitution have on other trades?

________________________________________________________

C. Differences between proposed substitution and specified item?

________________________________________________________

D. Differences in product cost or product delivery time?

________________________________________________________

E. Manufacturer's guarantees of the proposed and specified items are:

________ Equal __________ Better (explain on attachment)

The undersigned states that the function, appearance and quality are equivalent or superior to the specified item.

Submitted By: ___________________________ For Use by Engineer

Signature ___________________________ _______ Recommended _______ Recommended as noted

Firm ___________________________ _______ Not recommended _______ Received too late

Address ___________________________ By ________________

Date ________________ Remarks ___________________________

Telephone ___________________________

For Use by Engineer:

________ Approved _______ Rejected

Project Engineer ___________________________ Date ___________________________

END OF SECTION
PART 1:  GENERAL

1.01  SCOPE OF WORK

A. Furnish all labor, materials, and equipment and perform all operations to plan, design, construct, install, maintain, monitor, modify as necessary, and remove upon completion, a Trench Safety System as specified herein.

B. The requirements of this Section apply to all trenches which equal or exceed a depth of five (5) feet, measured from the ground surface at the highest side of the trench to the trench bottom.

C. All applicable and non-conflicting portions of Section 02221 – Trenching, Backfilling and Compaction apply as appropriate.

1.02  RELATED REQUIREMENTS

A. Section 02221 – Trenching, Backfilling and Compaction.

B. Texas Statute: HB 1569, 71st Regular Legislative Session.


PART 2:  PRODUCTS

2.01  GENERAL

A. All materials and products incorporated into the Trench Safety System shall be suitable for their intended uses; shall meet all design criteria and parameters used by the Trench Safety System designer; and shall meet all applicable requirements of OSHA Standards.

PART 3:  EXECUTION

3.01  PROCEDURES

A. At least ten (10) Calendar Days prior to execution or any excavation operations, and not more than thirty (30) Calendar Days following the execution date of the construction Agreement, Contractor shall submit a site specific Trench Safety System Conformance Affidavit stating that operations will be conducted in full conformance with the OSHA Standards.

1. The Conformance Letter shall also describe the Trench Safety System techniques proposed to be used on the project.

2. Specific references to the applicable OSHA Standards sections shall be included for each technique to be used.
B. The Trench Safety System Plan shall be in writing, site specific and sufficiently detailed and clear to be understandable and usable by all personnel who will be executing, supervising and witnessing the trenching operations. A copy of the Trench Safety System Plan shall be available at the site of trenching operations at all times. A second copy shall be provided to the Engineer for the Owner’s records.

C. If borings and/or detailed geotechnical analyses are required to develop the Trench Safety System Plan, they shall be executed by the Contractor at his cost.

D. For trenches having depths greater than the various limits given in the OSHA Standards (8, 12 or 20 feet, depending on the techniques used), a site specific protective system shall be designed by a Licensed Professional Engineer experienced in soil mechanics and structural design. The design shall be signed, sealed and dated by the Professional Engineer, and it shall identify those specific locations where the design is applicable.

3.02 METHODS OF PROVIDING FOR TRENCH SAFETY

A. Protective systems referenced in this Section shall be as defined and described in 29 CFR 1962.652, “Requirements for Protective Systems.”

B. It is the duty, responsibility and prerogative of the Contractor to determine the specific applicability of a proposed Trench Safety System for each field condition encountered on the project. Contractor specifically holds the Owner, Engineer, and any of their designated representatives harmless in any actions resulting from the failure or inadequacy of the Trench Safety System used to complete the project.

C. Unless otherwise noted on the drawings or excluded below, Sloping/Benching, Trench Shielding with trench boxes, and/or Sheeting/Shoring/Bracing protective systems may be used on this project.

D. Restrictions on the use of the various protective systems for this project are as follows:

1. Sloping or Benching. No Restrictions, except as noted on plans.


3.03 INSPECTION DUTIES OF CONTRACTOR

A. Provide a Competent Person, as defined in the OSHA Standards, to make frequent inspections of the trenching operations and the Trench Safety System in full conformance with the OSHA Standards.

B. If evidence of a possible cave-in or landslide is apparent, all work in the trench shall immediately cease and not be resumed until all necessary precautions have been taken to safeguard personnel entering the trench.
C. In an emergency situation which may threaten or affect the safety or welfare of any persons or properties, the Contractor shall act at his discretion to prevent possible damage, injury or loss. Any additional compensation or time extension claimed for such actions shall be considered in view of the cause of the emergency and in accordance with the Agreement.

3.04 MEASUREMENT AND PAYMENT

A. Payment for the Trench Safety System shall be in accordance with Supplementary Conditions.
PART 1 - GENERAL

1.01 SCOPE OF WORK:

A. Provide testing for water line as described in this Section and elsewhere in the Contract Documents.

B. Once pipe has been laid and backfilled according to the Contract Documents the pipe shall be subjected to a hydrostatic pressure test by raising the pressure to the required test pressure.

C. The Contractor may install plugs and bulkheads at intermediate locations for the purposes of testing shorter lengths of pipe.

D. In the event the pipeline does not meet the requirements during the hydrostatic test the Contractor shall dewater the pipeline and re-perform the test. Contractor shall be responsible for paying for water during any re-tests.

E. Contractor shall be required to disinfect the pipeline in accordance with AWWA standard C651. Contractor shall be responsible for insuring that all criteria set forth in C651 are met.

1.02 STANDARDS:

A. Except as modified or supplemented herein, hydrostatic testing shall conform to the following:

   AWWA M9   “Concrete Pressure Pipe – Bar Wrapped Steel Cylinder Type”

   AWWA M11   “Steel Water Pipe”

   AWWA M41   “Ductile Iron Pipe”

PART 2 - PRODUCTS

2.01 DEFINITIONS

A. Makeup Water – Quantity of water to be pumped into the pipe necessary to maintain the specified test pressure after the pipe has been filled with water and any air expelled.

2.02 CHLORINATION FOR DISINFECTION

A. Calcium Hypochlorite in granular form conforming to ANSI/AWWA B300 must be used and must contain approximately 65 percent available chlorine by weight. The material should be stored in a cool, dry, and dark environment to minimize deterioration.

PART 3 - EXECUTION

3.01 GENERAL:
A. Testing shall be in accordance with manufacturer’s recommendations and AWWA M41.

3.02 TEST DURATION:

A. The duration of the pressure test shall be for 8 hours.

3.03 TEST PRESSURE

A. Refer to Section 02612 and 02615 for pressure requirements.

3.04 PROCEDURE:

A. Inspecting materials to be used to ensure their integrity.

B. Preventing contaminating materials from entering the water main during storage and construction.

C. Remove, by flushing or other means, those materials that may have entered the water main.

D. Perform a hydrostatic test.

E. Chlorinating any residual contamination that may remain, and flushing the chlorinated water from the main.

F. Protecting the existing distribution system from backflow caused by hydrostatic test and disinfection procedure.

G. Documenting that an adequate level of chlorine contacted each pipe to provide disinfection.

H. Determining the bacteriological quality by laboratory test after disinfection.

I. Final connection of the approved new water main to the active distribution system.

3.05 PREVENTATIVE AND INSPECTION MEASURES:

A. General. Heavy particulates generally contain bacteria and prevent even very high chlorine concentrations from contacting and killing these organisms.

B. Keeping pipe dry and clean.

1. Openings in the pipeline shall be closed with watertight plugs when pipe laying is stopped.

2. The lubricant used in the installation of sealing gaskets shall be suitable for use in potable water and shall not contribute odors.

3. If dirt enters the pipe during storage or installation, it shall be removed and the interior surface swabbed with a 1 to 5 percent hypochlorite disinfecting solution.
C. Connection to the existing distribution system. Water required to fill the new main for hydrostatic pressure testing, disinfection, and flushing shall be supplied through a temporary connection between the distribution system and the new main. The temporary connection shall include an appropriate cross-connection control device and shall be disconnected during the hydrostatic pressure test. As an alternate, a connection to the existing distribution system is permitted provided a new valve is placed at the connection point. Do not test against an existing valve in the existing system.

3.06 PURGING

A. Purging may be accomplished by passing an appropriate sized “poly-pig(s)” through the pipe or by flushing. A “poly-pig” must be used on all mains 12-inch and larger.

B. Flushing Method

Before the main is chlorinated, it shall be filled to eliminate air pockets and flushed to remove particulates. The flushing velocity in the main shall not be less than 2.5 ft/sec.

Required flow and openings to flush pipelines with a pressure of 40 psi

<table>
<thead>
<tr>
<th>Pipe Inch</th>
<th>Flow gpm</th>
<th>1” Tap</th>
<th>1-1/2” Tap</th>
<th>2” Tap</th>
<th>2-1/2” Hydrant Outlets</th>
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<td></td>
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</tr>
</tbody>
</table>

C. Poly-Pig Method

1. The “poly-pig” shall be inserted in the new conduit at the location where the new conduit is connected to the active distribution system.

2. Where expulsion of the “poly-pig” is required through a dead-ended conduit, the Contractor shall make every effort to prevent back flow of the purged water into the conduit after passage of the pig. Backwater re-entry into the pipe can be prevented by the temporary installation of mechanical joint bends and pipe joints to provide a riser out of the trench.

3. After passage of the “poly-pig”, flushing of all backwater from the pipe, and satisfactory test results, the Contractor shall secure the test location openings and then proceed with disinfection.

3.07 HYDROSTATIC TEST

All ductile iron and plastic pipelines shall be tested with a hydraulic test pressure of not less than 200 psi...
over a period of not less than 2 hours. The rate of leakage of all pipe tested shall not exceed 11.65-gallons-per-inch of nominal diameter of the pipe per mile. If the tests indicate a leakage in excess of the acceptable rate, the Contractor shall be required to find and repair the leak. Even if the test requirements are met, all apparent leaks shall be stopped.

The hydrostatic pump shall be connected to a system where the amount of leakage can be determined by measurement or gauge. The 200-psi pressure shall be maintained over the entire 2-hour test period. The leakage shall be determined by comparing the quantity of water in the measuring system at the beginning of the test and quantity of water at the end of the test. The difference in these quantities shall be the leakage. An alternate method is to add water to the measuring system during the test. At the end of the 2-hour test, the quantity of water added shall be the leakage.

3.08 DISINFECTION

A. The Continuous-feed method must be used unless it is stated otherwise in the Contract Specifications.

B. The Contractor shall install and remove all pump-in, blow-off and sampling points.

C. Water from the existing system or other approved source shall be made to flow at a constant rate in the new main.

D. At a point no more than 10-ft downstream of the beginning of the new conduit, water entering the new conduit shall receive a dose of chlorine such that the water shall have not less than 100-mg/L (ppm) free chlorine. Chlorine application shall not cease until the entire conduit is filled with heavily chlorinated water. 125 lbs of Calcium Hypochlorite (65% available chlorine) is required in 100,000 gal of water to produce 100 mg/L (ppm) Chlorine concentration.

E. The chlorinated water shall be retained in the conduit for at least 24 hours, during which time all valves and hydrants in the section treated shall be operated in order to disinfect the appurtenances. Every effort shall be made to prevent the flow of chlorinated water into conduits in active service. At the end of the 24-hour period, the treated water in all portions of the conduit shall have a residual of at least 10-mg/L (ppm) free chlorine.

F. The heavily chlorinated water shall then be flushed from the conduit and disposed in a manner meeting the requirements set out below.

G. The chlorine residual shall be tested prior to flushing operations.

3.09 HEAVILY CHLORINATED WATER

If the chlorine residual exceeds 4-mg/L (ppm) the water shall remain in the new water conduit until the chlorine residual is less than 4-mg/L (ppm). As an alternate, the Contractor may choose to evacuate the water into water trucks, or discharge into an existing sanitary sewer system, or an approved storage facility (such as a detention pond until the chlorine residual is 4-mg/L (ppm) or less), or treat the water with Sodium Bisulfite or another dechlorination chemical (Sulfur Dioxide, Sodium Sulphite, Sodium Thiosulfate, or Ascorbic Acid) or method appropriate for potable water and approved by the Owner until
the chlorine residual is reduced to 4-mg/L (ppm) or less. **The heavily chlorinated water shall not be disposed of into the storm sewer system.** After the specified chlorine residual is obtained, less than 4-mg/L (ppm), the water may then be discharged into the storm sewer system or utilized by the Contractor.

The requirement for discharge of heavily chlorinated water is found in the TPDES General Permit To Authorize the Discharge of Storm Water And Certain Non-Storm Water Discharges from Regulated Construction Activities Within the State of Texas.

3.10 CONTRACTOR REQUIREMENTS

The Contractor shall prepare the conduit for disinfection activities and secure same after chlorination is complete.

A. This shall consist of furnishing all equipment, material and labor to satisfactorily prepare the conduit for disinfection. The Contractor shall also be required to provide adequate provisions for sampling.

B. The Contractor shall make all necessary taps into the pipe to accomplish chlorination of a new line

C. After satisfactory completion of the disinfection operation, the Contractor shall remove surplus pipe at the chlorination and sampling points, plug the remaining pipe, backfill, and complete all appurtenant work necessary to secure the conduit.

3.11 SAMPLING

A. Unless otherwise specified, the Contractor shall inject chlorine disinfectant into the conduit and monitor the solution.

B. The Owner’s inspector shall take water samples from a suitable tap (not through a fire hydrant) for analysis by the Owner’s testing laboratory. The sample(s) shall be transported by City staff to the laboratory at 9:00 AM on Tuesdays and Thursdays. Samples may not be taken earlier than 3:00 PM on the day prior to delivery. The Owner’s inspector shall notify the Contractor of the results.

C. Microbiological sampling shall be done prior to connecting the new conduit into the existing distribution system in accordance with AWWA C651 Disinfecting Water Mains. Samples shall be tested in accordance with *Standard Methods for the Examination of Water and Wastewater*. Samples for bacteriological analysis shall be collected in sterile bottles treated with sodium thiosulfate. At least one sample shall be collected from every 1,000-linear-feet of new water conduit, plus one set from the end of the line and at least one set from each branch. If trench water has entered the new conduit during construction or, if in the opinion of the City inspector, excessive quantities of dirt or debris have entered the new conduit, samples shall be taken at intervals of approximately 200-linear-feet. Samples shall be taken of water that has stood in the new conduit for at least 16-hours.

D. Unsatisfactory test results shall require a repeat of the disinfection process and resampling as required above until a satisfactory sample is obtained.
E. In the event there are three unsatisfactory test results from the same sampling point, the Contractor must “poly-pig” the new water main and samples taken again until a satisfactory sample is obtained.

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION:

A. Work Included: Provide an orderly and efficient transfer of the completed Work to the OWNER.

B. Related Work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.02 QUALITY ASSURANCE:

A. Prior to requesting inspection by the ENGINEER, use adequate means to assure that the Work is completed in accordance with the specified requirements and is ready for the requested inspection.

1.03 PROCEDURES:

A. Final Walk Through:

1. The ENGINEER and the CONTRACTOR will prepare a list of items to be completed by the CONTRACTOR.

2. Within a reasonable time after receipt of the list, the ENGINEER will inspect to determine status of completion.

3. Should the ENGINEER determine that the Work is not substantially complete:

   a. The ENGINEER promptly will so notify the CONTRACTOR, in writing, giving the reasons therefore.
   b. Remedy the deficiencies and notify the ENGINEER when ready for reinspection.
   c. The ENGINEER will reinspect the Work.

4. When the ENGINEER concurs that the Work is substantially complete:

   a. The ENGINEER will prepare a Letter accompanied by the CONTRACTOR's list of items to be completed or corrected, as verified by the ENGINEER.
   b. The ENGINEER will submit the Letter to the OWNER and to the CONTRACTOR for their written acceptance of the responsibilities assigned to them in the Letter.
   c. CONTRACTOR shall have a maximum of four weeks to complete the assigned tasks on the final punch list.

B. Final Completion:

1. Prepare and submit notice.

2. Verify that the Work is complete.
3. Certify that:
   a. Contract Documents have been reviewed;
   b. Work has been inspected for compliance with the Contract Documents;
   c. Work has been completed in accordance with the Contract Documents;
   d. Equipment and systems have been tested as required, and are operational;
   e. Work is completed and ready for final inspection.

4. The ENGINEER will make an inspection to verify status of completion.

5. Should the ENGINEER determine that the Work is incomplete or defective:
   a. The ENGINEER promptly will so notify the CONTRACTOR, in writing, listing the incomplete or defective work.
   b. Remedy the deficiencies promptly, and notify the ENGINEER when ready for reinspection.

6. When the ENGINEER determines that the Work is acceptable under the Contract Documents, he will request the CONTRACTOR to make close-out submittals.

C. Close-out submittals include, but are not necessarily limited to:

1. Project Record Documents described in Section 01720;

2. Operation and maintenance data for items so listed in pertinent other Sections of these Specifications, and for other items when so directed by the ENGINEER;

3. Warranties and bonds;

4. Keys and keying schedule;

5. Spare parts and materials extra stock;

6. Evidence of compliance with requirements of governmental agencies having jurisdiction including, but not necessarily limited to:
   a. Certificates of Inspection;
   b. Certificates of Occupancy.

7. Certificates of Insurance for products and completed operations;

8. Evidence of payment and release of liens;

9. List of subcontractors, service organizations, and principal vendors, including names, addresses, and telephone numbers where they can be reached for emergency service at all times including nights, weekends, and holidays.
D. Final adjustment of accounts:

1. Submit a final statement of accounting to the ENGINEER, showing all adjustments to the Contract Sum.

2. If so required, the Engineer will prepare a final Change Order showing adjustments to the Contract Sum which were not made previously by Change Orders.

1.04 INSTRUCTIONS:

A. Instruct the OWNER's personnel in proper operation and maintenance of systems, equipment, and similar items which were provided as part of the Work. Contractor shall be responsible for arranging for the instructions and supervision at a time convenient to the OWNER or his representatives.

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION:

A. Work Included: Throughout the construction period, maintain the buildings and site in a standard of cleanliness as described in this Section.

B. Related Work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Special Conditions, and Sections in Division 1 of these Specifications.

2. In addition to standards described in this Section, comply with the requirements for cleaning as described in pertinent other Sections of these Specifications.

1.02 QUALITY ASSURANCE:

A. Conduct daily inspection, and more often if necessary, to verify that requirements for cleanliness are being met.

B. In addition to the standards described in this Section, comply with pertinent requirements of governmental agencies having jurisdiction.

PART 2 - PRODUCTS

2.01 CLEANING MATERIALS AND EQUIPMENT:

A. Provide required personnel, equipment, and materials needed to maintain the specified standard of cleanliness.

2.02 COMPATIBILITY:

A. Use only the cleaning materials and equipment which are compatible with the surface being cleaned, as recommended by the manufacturer of the material.

PART 3 - EXECUTION

3.01 PROGRESS CLEANING:

A. General:

1. Retain stored items in an orderly arrangement allowing maximum access, not impeding traffic or drainage, and providing required protection of materials.

2. Do not allow accumulation of scrap, debris, waste material, and other items not required for construction of this Work.

3. At least twice each month, and more often if necessary, completely remove all scrap, debris, and waste material from the job site.
4. Provide adequate storage for all items awaiting removal from the job site, observing requirements for fire protection and protection of the ecology.

B. Site:

1. Daily, and more often if necessary, inspect the site and pick up all scrap, debris, and waste material. Remove such items to the place designated for their storage.

2. Weekly, and more often if necessary, inspect all arrangements of materials stored on the site. Restack, tidy, or otherwise service arrangements to meet the requirements of subparagraph 3.01-A-1 above.

3. Maintain the site in a neat and orderly condition at all times.

C. Structures:

1. Weekly, and more often if necessary, inspect the structures and pick up all scrap, debris, and waste material. Remove such items to the place designated for their storage.

2. Weekly, and more often if necessary, sweep interior spaces clean.

   a. "Clean", for the purpose of this subparagraph, shall be interpreted as meaning free from dust and other material capable of being removed by use of reasonable effort and a handheld broom.

3. As required preparatory to installation of succeeding materials, clean the structures or pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material, using equipment and materials required to achieve the necessary cleanliness.

4. Following the installation of finish floor materials, clean the finish floor daily (and more often if necessary) at all times while work is being performed in the space in which finish materials are installed.

   a. "Clean", for the purpose of this subparagraph, shall be interpreted as meaning free from foreign material which, in the opinion of the Engineer, may be injurious to the finish floor material.

3.02 FINAL CLEANING:

A. "Clean", for the purpose of this Article, and except as may be specifically provided otherwise, shall be interpreted as meaning the level of cleanliness generally provided by skilled cleaners using commercial quality building maintenance equipment and materials.

B. Prior to completion of the Work, remove from the job site all tools, surplus materials, equipment, scrap, debris, and waste. Conduct final progress cleaning as described in Article 3.01 above.
C. Site:

1. Unless otherwise specifically directed by the Engineer, broom clean paved areas on the site and public paved areas adjacent to the site.

2. Completely remove resultant debris.

D. Structures:

1. Exterior:
   a. Visually inspect exterior surfaces and remove all traces of soil, waste materials, smudges, and the foreign matter.
   b. Remove all traces of splashed materials from adjacent surfaces.
   c. If necessary to achieve a uniform degree of cleanliness, hose down the exterior of the structure.
   d. In the event of stubborn stains not removable with water, the Engineer may require light sandblasting or other cleaning at no additional cost to the Owner.

2. Interior:
   a. Visually inspect interior surfaces and remove all traces of soil, waste materials, smudges, and other foreign matter.
   b. Remove all traces of splashed material from adjacent surfaces.
   c. Remove paint droppings, spots, stains, and dirt from finished surfaces.


4. Polished surfaces: To surfaces requiring routine application of buffed polish, apply the polish recommended by the manufacturer of the material being polished.

E. Schedule final cleaning as approved by the Engineer to enable the Owner to accept a completely clean Work.

3.03 CLEANING DURING OWNER'S OCCUPANCY:

A. Should the Owner occupy the Work or any portion thereof prior to its completion by the Contractor and acceptance by the Owner, responsibilities for interim and final cleaning shall be as determined by the Engineer in accordance with the General Conditions of the Contract.
PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. Throughout progress of the Work, maintain an accurate record of changes in the Contract Documents, as described in Paragraph 3.01 below.

2. Upon completion of the Work, transfer the recorded changes to a set of Record Documents, as described in Paragraph 3.02 below.

B. Related Work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

2. Other requirements affecting Project Record Documents may appear in pertinent other Sections of these Specifications.

1.02 QUALITY ASSURANCE

A. Delegate the responsibility for maintenance of Record Documents to one person on the CONTRACTOR's staff as approved by the ENGINEER.

B. Accuracy of records:

1. Thoroughly coordinate changes within the Record Documents, making adequate and proper entries on each page of Specifications and each sheet of Drawings and other Documents where such entry is required to show the change properly.

2. Accuracy of records shall be such that future search for items shown in the Contract Documents may rely reasonably on information obtained from the approved Project Record Documents.

C. Make entries within 24 hours after receipt of information that the change has occurred.

1.03 SUBMITTALS

A. Comply with pertinent provisions of Section 01340.

B. The ENGINEER's approval of the current status of Project Record Documents may be a prerequisite to the ENGINEER's approval of requests for progress payment and request for final payment under the Contract.

C. Prior to submitting each request for progress payment, secure the ENGINEER's approval of the current status of the Project Record Documents.
D. Prior to submitting request for final payment, submit the final Project Record Documents to the ENGINEER and secure his approval.

1.04 PRODUCT HANDLING

A. Maintain the job set of Record Documents completely protected from deterioration and from loss and damage until completion of the Work and transfer of all recorded data to the final Project Record Documents.

B. In the event of loss of recorded data, use means necessary to again secure the data to the ENGINEER's approval.

1. Such means shall include, if necessary in the opinion of the ENGINEER, removal and replacement of concealing materials.

2. In such case, provide replacements to the standards originally required by the Contract Documents.

PART 2 - PRODUCTS

2.01 RECORD DOCUMENTS

A. Job set: Promptly following receipt of the OWNER's Notice to Proceed, secure from the ENGINEER at no charge to the CONTRACTOR one complete set of all Documents comprising the Contract.

B. Final Record Documents: At a time nearing the completion of the Work, secure from the ENGINEER at no charge to the CONTRACTOR one complete set of all Drawings in the Contract.

PART 3 - EXECUTION

3.01 MAINTENANCE OF JOB SET

A. Immediately upon receipt of the job set described in Paragraph 2.01-A above, identify each of the Documents with the title, "RECORD DOCUMENTS - JOB SET".

B. Preservation:

1. Considering the Contract completion time, the probable number of occasions upon which the job set must be taken out for new entries and for examination, and the conditions under which these activities will be performed, devise a suitable method for protecting the job set to the approval of the ENGINEER.

2. Do not use the job set for any purpose except entry of new data and for review by the ENGINEER, until start of transfer of data to Final Project Record Documents.
3. Maintain the job set at the site of Work as that site is designated by the ENGINEER.

C. Making entries on Drawings:

1. Using an erasable colored pencil (not ink or indelible pencil), clearly describe the change by graphic line and note as required.

2. Date all entries.

3. Call attention to the entry by a "cloud" drawn around the area or areas affected.

4. In the event of overlapping changes, use different colors for the overlapping changes.

D. Make entries in the pertinent other Documents as approved by the ENGINEER.

E. Conversion of schematic layouts:

1. In some cases on the Drawings, arrangements of conduits, circuits, piping, ducts, and similar items, is shown schematically and is not intended to portray precise physical layout.

   a. Final physical arrangement is determined by the CONTRACTOR, subject to the ENGINEER's approval.

   b. However, design of future modifications of the facility may require accurate information as to the final physical layout of items which are shown only schematically on the Drawings.

2. Show on the job set of Record Drawings, by dimension accurate to within one inch, the centerline of each run of items such as are described in subparagraph 3.01-E-1 above.

   a. Final physical arrangement is determined by the Contractor, subject to the ENGINEER's approval.

   b. Show, by symbol or note, the vertical location of the Item ("under slab", "in ceiling plenum", "exposed", and the like).

   c. Make all identification sufficiently descriptive that it may be related reliably to the Specifications.

3. The ENGINEER may waive the requirements for conversion of schematic layouts where, in the ENGINEER's judgment, conversion serves no useful purpose. However, do not rely upon waivers being issued except as specifically issued in writing by the ENGINEER.
3.02 FINAL PROJECT RECORD DOCUMENTS

A. The purpose of the Final Project Record Documents is to provide factual information regarding all aspects of the Work, both concealed and visible, to enable future modification of the Work to proceed without lengthy and expensive site measurement, investigation, and examination.

B. Approval of recorded data prior to transfer:
   1. Following receipt of the documents described in Paragraph 2.01-B above, and prior to start of transfer of recorded data thereto, secure the ENGINEER's approval of all recorded data.
   2. Make required revisions.

C. Transfer of data to Drawings:
   1. Carefully transfer change data shown on the job set of Project Record Drawings to the corresponding documents, coordinating the changes as required.
   2. Clearly indicate at each affected detail and other Drawings a full description of changes made during construction, and the actual location of items described in Paragraph 3.01 above.
   3. Call attention to each entry by drawing a "cloud" around the area or areas affected.
   4. Make changes neatly, consistently, and with the proper media to assure longevity and clear reproduction.

D. Transfer of data to other Documents:
   1. If the Documents other than Drawings have been kept clean during progress of the Work, and if entries thereon have been orderly to the approval of the ENGINEER, the job set of those Documents other than Drawings will be accepted as Final Project Record Documents.
   2. If any such Document is not so approved by the ENGINEER, secure a new copy of that Document from the ENGINEER at the ENGINEER's usual charge for reproduction and handling, and carefully transfer the change data to the new copy to the approval of the ENGINEER.

E. Review and submittal:
   1. Submit the completed set of Project Record Documents to the ENGINEER as described in Paragraph 1.03-D above.
   2. Participate in review meetings as required.
   3. Make required changes and promptly deliver the Final Project Record Documents to the ENGINEER.
3.03 CHANGES SUBSEQUENT TO ACCEPTANCE

A. The CONTRACTOR has no responsibility for recording changes in the Work subsequent to Final Completion, except for changes resulting from work performed under Warranty.

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION:

A. Work Included:


2. Upon completion of the Work, submit Operation and Maintenance Manuals to the Engineer, as described in Article 3.01 below.

B. Related Work:

1. Documents affecting work of this Section include, but are not necessarily limited to Sections in Division 1 of these Specifications.

2. Other requirements affecting Operation and Maintenance Data may appear in pertinent other Sections of these Specifications.

1.02 SUBMITTALS:

A. Comply with pertinent provisions of Section 01340. One set of Operation and Maintenance Manuals will be required. Operation and Maintenance manuals shall also be provide in electronic format on a compact disc.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01. OPERATION AND MAINTENANCE MANUALS:

A. Organize operating and maintenance data into suitable sets of manageable size. Bind data into individual binders properly identified and indexed. Bind each set of data in a new heavy-duty 2-inch or 3-inch, 3-ring vinyl-covered binder, with typed tabs for each specification section, and with pocket folders for folded sheet information. Mark the appropriate identification on both front and spine of each binder.

1. Include the following types of information in operation and maintenance manuals:

   a. Emergency instructions.
   b. Spare parts listing.
   c. Copies of warranties.
   d. Wiring diagrams.
   e. Recommended "turn-around" cycles.
   f. Inspection procedures.
   g. Shop drawings and product data.

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION:
   A. Work Included: Clear and grub the site as shown on the Drawings and specified herein.
   B. Related work:
      1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Special Conditions, and Sections in Division 1 of these Specifications.

1.02 QUALITY ASSURANCE
   A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
   B. Remove any existing uncontrolled fill, vegetation and soft or loose soils in all areas designated for building and pavements and perform required undercutting.
   C. Provide for a soils engineer to be on site providing observation to determine if further remedial work is required. Execute the engineer's instructions.

PART 2 - PRODUCTS

2.01 MATERIALS
   A. Provide materials, not specifically described but required for proper completion of the work of this Section, as selected by the Contractor subject to the approval of the Engineer.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS
   A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 PROTECTION
   A. Protect existing utilities indicated or made known.
   B. Protect trees and shrubs, where indicated to remain, by providing a fence around the tree or shrub of sufficient distance away and of sufficient height so trees and shrubs will not be damaged in any way as part of this Work.
C. Protection of persons and property:

1. Barricade open depressions and holes occurring as part of this Work, and post warning lights on property adjacent to or with public access.

2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.

3. Protect structures, utilities, sidewalks, pavements, existing trees, in particular, trees designated as "protected" and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by operations under this Section.

D. Use means necessary to prevent dust from becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.

E. Maintain access to the site at all times.

3.03 CLEARING

A. Clean out roots 1" in diameter and larger to a depth of at least 12" below the existing ground surface or subgrade of new graded surface, whichever is lower.

B. In cut areas where fill is to be placed, the subgrade moisture content and density shall be verified unless intact undisturbed limestone is present in which case density testing is not required. If the density is less than 95 percent of the maximum dry density as determined by ASTM D 698 (Standard Proctor) or if the moisture content is below optimum, the subgrade shall be scarified to a depth of 6 inches. After scarifying moisture shall be adjusted as necessary and the soils shall be compacted to a minimum of 95 percent of the maximum of dry density as determined by ASTM D 698 (Standard Proctor) at moisture contents that are at or above the Proctor optimum value.

C. Do not allow water to collect in or near foundation areas or floor slab areas during or after construction.

3.04 DISPOSAL

A. General:

1. Remove brush, grass, roots, trash, and other material from clearing operations.

2. Dispose of away from the site in a legal manner.

3. Do not store or permit debris to accumulate on the job site. Cleared vegetation shall be removed from the site within 10 working days.

4. Burning will not be allowed as a method of disposal.
3.05 UTILITIES

A. Contact all utility companies and agencies 48 hours prior to beginning any clearing.

B. Where utility cutting, capping, or plugging is required, perform such work in accordance with requirements of the utility company or governmental agency having jurisdiction.

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION:

A. Perform the following earth excavation, backfill, fill and grading as indicated or specified:

B. Make excavations to accommodate piping, conduits, foundations and other structures.

C. Provide materials for backfilling excavations and constructing embankments and fills as indicated and specified.

D. Construct embankments of compacted materials.

E. Grade surfaces to meet finished grades indicated.

F. Immediately notify the Engineer if suspected hazardous materials are encountered and cease operations in that part of work.

G. Remove boulders and tree stumps within the excavation limits.

1.02 RELATED WORK:

A. Division 1: General Requirements

B. Special Conditions

   1. Item 201 Erosion, Sediment and Water Pollution Control
   2. Item 203.4 Unclassified Street Excavation
   3. Item 203.5 Unclassified Channel Excavation
   4. Item 203.6 Borrow
   5. Item 701.2 Structural Excavation

D. Section 02800: Landscape Work

E. Section 02952: Site Maintenance
1.03 REFERENCES:

A. American Society for Testing and Materials (ASTM) Publications:


3. D421: Practice for Dry Preparation of Soil Samples for Particle Size Analysis and Determination of Soil Constants.


5. D448: Sizes of Aggregate for Road and Bridge Construction.

6. D1140: Test Method for Amount of Material in Soils Finer than the No. 200 (75 Fm) Sieve.

7. D1556: Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.

8. D698: Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort \((56,000 \text{ ft-lb/ft}^3 (600 \text{ kN-m/m}^3))\).


B. Occupational Safety and Health Administration (OSHA) Standards and Regulations contained in Title 29: Subpart P - Excavations, Trenching and Shoring.

1.04 DEFINITIONS:

A. Percentage of compaction is defined as the ratio of the field dry density, as determined by ASTM D1556 to the maximum dry density determined by ASTM D698, multiplied by 100.

B. Proof Roll: Compaction with a minimum of 4 passes of a vibratory steel drum or rubber tire roller. Vibratory plate compactors shall be used in small areas where vibratory steel drum or rubber tire roller can not be used.

C. Acceptable Material: Material which does not contain organic silt or organic clay, peat, vegetation, wood or roots, stones or rock fragments over 6-inches [15 cm] in diameter, porous biodegradable matter, loose or soft fill, excavated pavement, construction debris, or refuse. Stones or rock fragments shall not exceed 40 percent by weight of the backfill material.

D. Unacceptable Materials: Materials, which do not comply with the requirements for acceptable material or which, cannot be compacted to the specified or indicated density.

1.05 SUBMITTALS:

A. Shop Drawings: Submit the following in accordance with Section 01340: Shop Drawings, Product Data and Samples:

1. Submit an excavation, backfilling, and filling plan at least two weeks prior to start of any earth moving activities. The review will be only for the information of the Owner and third parties for an overall understanding of the project relating to access, maintenance of existing facilities and proper utilization of the site. The Contractor shall remain responsible for the adequacy and safety of the means, methods and sequencing of construction. The plan shall include, but not be limited to the following items:

   a. Detailed sequence of work.
   
   b. General description of construction methods.
   
   c. Numbers, types, and sizes of equipment proposed to perform excavation and compaction.
   
   d. Details of dust control measures.
   
   e. Proposed locations of stockpiled excavation and/or backfill materials.
   
   f. Proposed surplus excavated material off-site disposal areas and required permits.
2. The following material submittals shall be submitted to the Engineer prior to backfilling and filling for only those materials specified on the plans:

   a. Screened Gravel

   b. Gravel and Crushed Gravel

   c. Select Borrow/Select Fill

   d. Fine and Coarse Aggregates

   e. Crushed Stone

   f. Rip-rap: As specified in Section 2.01F of this specification.

   g. Stone Fill Pad: 467 Stone as specified in ASTM D448

   h. Geotextile Fabric: As specified in Section 2.01G of this specification.

   i. Other Acceptable Materials: Laboratory testing results of gradation and moisture-density relationship. Submittal shall include specific location of the source and the date when sample was taken.

3. During Construction, submit written confirmation of fill lift thickness, in-place soil moisture content, and percentage of compaction to the Engineer before placing the next lift or constructing foundations.

1.06 QUALITY ASSURANCE AND CONTROL:

A. Excavations shall be performed in the dry, and kept free from water, snow and ice during construction with the exception of the water that is applied for dust control and to aid in the compaction efforts. Bedding and backfill material shall not be placed in water. Water shall not be allowed to rise upon or flow over the bedding and backfill material.

B. The Contractor shall be solely responsible for making all excavations in a safe manner. All excavation, trenching, and related sheeting, bracing, etc. shall comply with the requirements of OSHA excavation safety standards (29 CFR Part 1926 Subpart P) and State requirements. Where conflict between OSHA and State regulations exists, the more stringent requirements shall apply.

C. The Contractor shall not excavate, construct embankments, or fill until the Engineer has reviewed all the required submittals.

D. The Contractor shall prepare excavation, backfilling, and filling schedule and procedures to eliminate possibility of undermining or disturbing foundations of partially and completed structures, pipelines and embankments or existing structures and pipelines.
E. The Contractor shall be required to employ an independent testing laboratory to perform particle size and gradation analyses in accordance with ASTM D422, and to determine compactibility in accordance with ASTM D698 for all the proposed backfill and fill materials, and monitoring field compaction operations. Cost associated with testing shall be considered subsidiary to the various bid items shown in the Bid Proposal. The independent testing laboratory shall have the following qualifications:

1. Owner’s Approval – Contractor shall submit to the Owner for approval the testing laboratory he intends to use.

2. Be accredited by the American Associates of State Highway and Transportation Officials (AASHTO) Accreditation Program.

3. Have three (3) years experience in sampling, testing and analysis of soil and aggregates, and monitoring field compaction operations.

4. Able to provide three (3) references from previous work.

F. Field Testing and Inspections:

1. By the Owner’s independent testing laboratory.

2. Location of tests mutually acceptable to testing laboratory and the Engineer, the Owner’s Representative or as directed by the Engineer.

3. In the event compacted material does not meet specified in-place cost, recompact material and retest this area until specified results are obtained at no additional cost to the Owner.

4. Testing laboratory to perform inspection at least once daily to confirm lift thickness and compaction effort for entire fill area.

G. Methods of Field Testing:

1. In-Place Density: ASTM D1556, ASTM D2167, or ASTM D2922.

2. In-Place Moisture Content: ASTM D3017, ASTM D4944, or ASTM D4959.

H. Material Testing Frequency: The following testing frequencies are the minimum required for all structural and non-structural fill, grading and embankment.

1. Field In-Place Density and Moisture Content - Screened gravel and crushed stone

2. Shall be compacted as specified and indicated. For other backfill, embedment and fill materials, minimum test frequency shall be as follows, and no less than one test per:
a. Trenches under structures foundation preparation or roadways subbase: Every 200 lin. ft. per lift

b. Trench Embedment – Every 100 lin. ft.

c. Trenches in areas without structures or roadways: Every 300 lin. ft. per alternate lift.

d. Paved Roadways: Every 200 lin. ft. per lift.

e. Paved Areas: 2,000 sq. ft. per lift.

f. Under Structure: 100 sq. ft. per lift.

g. Around Structures: 500 sq. ft. per lift.

h. Embankment Fills: 10,000 sq. ft. per lift.

2. Moisture Density - One per source, except for screened gravel and crushed stone. Repeat the moisture density test for every 200 cubic yard of material use, and whenever visual inspection indicates a change in material gradation as determined by the Engineer.

3. Gradation Analysis - A minimum of one per source and for each moisture density test and whenever visual inspection indicates a change in material gradation.

4. Liquid Limit, Plastic Limit and Plasticity Index - Minimum of one test per 200 cubic yard of soil for use as fill material and whenever classification of material is in doubt as determined by the Engineer.

I. Construction Tolerances:

1. Construct finished surfaces to plus or minus 1 inch [2.5 cm] of the elevations indicated.

2. Grade cut and fill areas to plus or minus 0.20 foot [6.0 cm] of the grades indicated.

3. Complete embankment edges to plus or minus 6 inches [15 cm] of the slope lines indicated.

4. Structures: Conform to elevations and dimensions shown within a tolerance of plus 0.10', or minus 0.10', and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of service, other construction, and for inspection.

5. The Contractor shall provide the Engineer with adequate survey information to verify compliance with above tolerances.
J. Cut pavement with a saw or pneumatic tools to prevent damage to remaining pavement without extra compensation. Where pavement is removed in large pieces, dispose of pieces before proceeding with excavation.

K. Pipes, drains, and other utilities may exist in certain locations not indicated on drawings. No attempt has been made to show all services. Completeness or accuracy of information given is not guaranteed.

L. Dig test pits are considered as incidental to the normal excavation as indicated and specified in this Section, at no additional compensation.

M. Carefully support and protect from damage, existing pipes, poles, wires, fences, curbings, property line markers, and other structures, which the Engineer determines must be preserved in place without being temporarily or permanently relocated. Should such items be damaged, restore without compensation therefor, to at least as good condition as that in which they were found immediately before the work was begun.

N. Whenever certain existing structures, as described below, are encountered, and the Engineer so directs, change the location, remove and later restore, or replace such structures, or assist the Owner in doing so. Such work to be paid for under applicable items of work, otherwise as Extra Work.

O. In removing existing pipes or other structures, include for payment only those new materials that are necessary to replace those unavoidably damaged as determined by the Engineer.

P. The preceding two paragraphs apply to pipes, wires, and other structures which meet the following: (a) are not indicated on the drawings or otherwise provided for, (b) encroach upon or are encountered near and substantially parallel to the edge of the excavation, and (c) in the opinion of the Engineer, will impede progress to such an extent that satisfactory construction cannot proceed until they have been changed in location, removed (to be later restored), or replaced.

Q. Restore existing property or structures as promptly as practicable.

R. If material is unacceptable for foundation (in the opinion of the Engineer) is found at or below the grade to which excavation would normally be carried in accordance with the drawings and/or specifications, remove such material to the required width and depth as directed by the Engineer and replace it with screened gravel, select borrow, or concrete.

S. Do not remove excavation materials from the site of the work or dispose of except as directed or permitted by the Engineer.

T. Haul away and dispose of surplus excavated materials at NO additional cost to the Owner. Any required permits or other disposal requirements are the responsibility of the Contractor.
U. During progress of work, conduct earth-moving operations and maintain work site so as to minimize the creation and dispersion of dust. Apply water to aid in dust control as specified in NCTCOG Item 203.8 or by other methods that are acceptable to the Engineer. Furnish and spread calcium chloride if the Engineer or Owner decides that it is necessary for more effective dust control.

V. Provide suitable and safe bridges and other crossings where required for accommodation of travel, and to provide access to private property during construction, and remove said structures thereafter.

### 1.07 SITE CONDITIONS:

A. Subsurface Conditions: Refer to Special Conditions.

B. Site Information: Any data, which has or may be provided on subsurface conditions, is not intended as a representation or warranty of accuracy or continuity between soil strata. It is expressly understood that neither the Owner nor the Engineer will be responsible for interpretations or conclusions drawn therefrom by Contractor. Data is made available for convenience of Contractor.

1. Contractor may make additional test borings and other exploratory operations at no cost to Owner, provided he obtains the Owner's permission prior to performing these operations.

C. Contractor is to verify existing site grading within 30 days of contract date. Discrepancies are to be brought to the Engineer's attention in writing during that period. Any and all site grading discrepancies found after that date will be the total responsibility of the general contractor.

D. Existing Utilities: Contractor shall locate all existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations.

### PART 2 - PRODUCTS

2.01 GENERAL:

A. Use only acceptable materials from excavations or borrows.

B. Provide screened gravel, fine aggregate, select borrow, and crushed stone as specified in NCTCOG.

C. Provide Fine Aggregate conforming to ASTM C33.

D. Provide Number 467-67, or 8 stone conforming to ASTM D448.

E. Provide erosion/sedimentation control devices as indicated and in accordance with NCTCOG Item 201.
F. Provide rip-rap material meeting the following gradation:

<table>
<thead>
<tr>
<th>Sieve Designation</th>
<th>Percentage by Weight Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 in. [15.2 cm]</td>
<td>100</td>
</tr>
<tr>
<td>2 in. [5.1 cm]</td>
<td>20 - 65</td>
</tr>
<tr>
<td>No. 4</td>
<td>10 - 35</td>
</tr>
<tr>
<td>No. 200</td>
<td>0 – 5</td>
</tr>
</tbody>
</table>

G. Provide geotextile fabric as indicated, meeting the following requirements and conforming to NCTCOG:

<table>
<thead>
<tr>
<th>Physical Properties</th>
<th>Average Roll Minimum Value (Weakest Principle Direction)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grab Strength (ASTM D-4632)</td>
<td>200</td>
</tr>
<tr>
<td>Grab Elongation (ASTM D-4632) (%)</td>
<td>60</td>
</tr>
<tr>
<td>Mullen Burst Strength (ASTM D-3786) (psi)</td>
<td>320</td>
</tr>
<tr>
<td>Permeability – k (cm/sec) (ASTM D-4491)</td>
<td>100</td>
</tr>
<tr>
<td>AOS (O₉₅) mm (ASTM D-4751)</td>
<td>0.3</td>
</tr>
<tr>
<td>Trapezoid Tear Strength (ASTM D-4533) (lbs.)</td>
<td>60</td>
</tr>
<tr>
<td>Puncture Resistance (ASTM D-4833) (lbs.)</td>
<td>80</td>
</tr>
<tr>
<td>UV Resistance - % Strength Retained (ASTM D-4355)</td>
<td>70</td>
</tr>
</tbody>
</table>

The Geotextile material shall be a non-woven fabric consisting of filaments or yarns of polyester or polypropylene.

The Geotextile shall be provided in rolls with protective covering to protect the fabric from mud, dirt, dust, and debris. The fabric shall be free of defects or flaws which significantly affect its physical properties. Each roll of fabric in the shipment shall have a number of symbol identifying that production run.

A competent laboratory shall be maintained by the producer of the fabric at the point of manufacture to provide quality control in accordance with ASTM testing procedures. The laboratory shall maintain records of its quality control results and provide a manufacturer’s certificate to the owner prior to shipment. The certificate shall include the following:

1. Name of Manufacturer
2. Chemical Composition
3. Product Description
4. Statement of compliance to specification requirements

2.02 EQUIPMENT:
A. The compaction equipment shall be selected by the Contractor, and shall be capable of consistently achieving the specified compaction requirements.

PART 3 - EXECUTION

3.01 SITE MAINTENANCE:

A. Roadway and Site Leveling: Grade roadway and site as to maintain them in a level unrutted condition and to eliminate puddling of surface and subsurface water.

3.02 EXCAVATION:

A. General:

1. Execution of any earth excavation shall not commence until all the submittals are reviewed by the Engineer and all Engineer’s comments satisfactorily addressed.

2. Carry out program of excavation and excavation support systems to eliminate possibility of undermining or disturbing foundations of existing structures or of work previously completed under this contract.

3. Excavate to widths that give suitable room for building structures or laying and jointing piping.

4. Do not plow, scrape or dig by machinery near to finished subgrade in a manner that would result in disturbance of subgrade.

5. Excavate to lines and grades indicated in an orderly and continuous program.

6. Establish limits of excavation to allow adequate working space for installing forms and for safety of personnel.

7. Excavate to elevations indicated, or deeper, as directed by the Engineer, to remove unacceptable bottom material.

8. Place excavated material at the approved stockpile locations and in no case closer than 3 feet [90 cm] from edge of excavations to discourage a cave-in or bank slides.

9. Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.

10. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.
11. Regard small, less than one-half (0.5) cubic yard [0.38 cubic meter], boulders, rock fragments, and concrete encountered during excavation as a normal part of in-place soils and not included for payment as rock.

12. Unsuitable excavation and suitable excavation in excess of that needed for construction shall be known as "waste" and shall become the property of the Contractor to be disposed of by him outside the limits of the project, associated rights-of-way, etc.

13. Payment will not be allowed for excavation of any material which is used for purposes other than those designated, except as provided in the specifications.

14. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner, and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

15. Do not interrupt existing utilities serving facilities occupied and used by Owner or others, during occupied hours, except when permitted in writing by Engineer and then only after acceptable temporary utility services have been provided.

a. Provide minimum of 48-hour notice to Engineer, and receive written notice to proceed before interrupting any utility.

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

17. Use of Explosives: The use of explosive is not permitted.

18. Apply final seeding to all disturbed areas, as specified in Section 02936: Seeding of Lawns or Disturbed Areas.

B. STRUCTURAL EXCAVATION:

Perform all structural excavation in accordance with NCTCOG Item 701.2. Where discrepancies exist between the following paragraphs and Item 701.2, the more stringent requirements shall apply.

Excavation is unclassified, and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered. Structural excavation shall include the furnishing of all materials and equipment; the construction or installation of all facilities which may be necessary to perform the excavations and place and compact the backfill; and the subsequent removal of such facilities, except where they are required or permitted by the plans or specifications to remain in place.
1. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific approval or direction of the Engineer. Unauthorized excavation, as well as remedial work resulting from the unauthorized excavation, shall be at Contractor's expense.

   a. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation. Soil bearing shall be verified by a registered geotechnical engineer.

   b. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classifications, unless otherwise directed by the Engineer.

2. Additional Excavation:

   a. When excavation has reached required subgrade elevations, notify the Engineer so that he may observe the conditions.

   b. When unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material as directed by the Engineer.

   c. When footing concrete or masonry is to rest upon rock, the rock shall be removed to a depth sufficient to expose sound rock. The rock shall be roughly leveled off or cut to approximate horizontal and vertical steps, and shall be roughened. Seams in the rock shall be grouted under pressure or treated as the Engineer may direct and the cost thereof will be included for payment in the quantities for the unit of the structure for which the excavation is made. When footing concrete or masonry is to rest on an excavated surface other than rock, care shall be taken not to disturb the bottom of the excavation and final removal of the foundation material to grade shall not be made until just before the concrete or masonry is placed. Except when over-excavation is directed by the Engineer, excavation below grade shall be replaced at the Contractor's expense with the same class of concrete specified for the structure and at the time the concrete for the structure is being placed.

   d. For all single and multiple box culverts, pipe culverts, and pipe arch culverts, where the soil encountered at established footing grade is a quick sand, muck, or similar unstable material, the following procedure shall be used unless other methods are called for on the plans:

      (1) All unstable soil shall be removed to a depth of two (2) feet below bottom of culvert for culverts two (2) feet to four (4) feet in height, and to a depth equal to the height of culvert for culverts less than two (2) feet in height. Such excavation shall be carried at least one (1) foot beyond the horizontal limits of the structure on all sides. The Engineer will determine the necessary over excavation for culverts larger than four (4) feet in height. All unstable soil so removed shall be replaced with suitable stable material, placed in uniform layers of suitable depth for compaction as directed by the Engineer,
and each layer shall be wetted if necessary, and compacted by rolling or tamping as required to provide a stable foundation for the structure. Soil that is considered to be of sufficient stability to sustain properly the adjacent sections of the roadway embankment will be considered a suitable foundation material for the culvert.

(2) When the material encountered at footing grade of a culvert is found to be partially rock, or incompressible material, and partially a soil or material that is compressible, but otherwise satisfactory for the foundation, the incompressible material shall be removed for a depth of six (6) inches below the footing Grade and backfilled with a material similar to the compressible foundation used for the rest of the structure.

(3) When the material encountered at footing grade of a bridge bent or pier is found to be partially of rock or incompressible material, and partially of a compressible material, the foundation shall not be placed until the Engineer has authorized such changes as are found necessary.

(4) Removal of unsuitable material and its replacement as directed will be paid on basis of contract conditions relative to changes in work.

3. Excavation for Concrete Slab on Grade: Remove the existing soils to a depth of 3 feet below the proposed finished floor elevation and within five feet horizontally of the slab or as specified on the plans. Recompact backfill material as specified in Section 3.15.

C. UNCLASSIFIED CHANNEL EXCAVATION:

1. Perform all channel excavation in accordance with NCTCOG Item 203.5. Where discrepancies exist between the following paragraphs and Item 203.5, the more stringent requirements shall apply.

2. Contractor is responsible for securing all required regulatory permits should construction occur near or in existing drainage ways.

3. All excavation of channels shall be performed in accordance with the lines, grades, and sections indicated on the plans or as approved by the Engineer.

4. Where excavation to grades established in the field would terminate in unstable soil, the Engineer may require the Contractor to remove the unstable soil and backfill to the required grade with suitable material compacted in an approved manner to the required density.

5. All acceptable materials removed from the excavation shall be used, insofar as practicable for fill material or, in the formation of "Embankments", or shall be otherwise utilized or satisfactorily disposed of as indicated on the plans, or as directed, at no expense to the Owner.

6. During construction, the channel shall be kept drained, insofar as practicable, and the work shall be prosecuted in a neat workmanlike manner.
7. Prior to final grading, at minimum, the upper six (6) inches of the exposed soil should be scarified; moisture conditioned at optimum to five (5) percentage points above optimum moisture content, and compacted to at least 95% of the maximum dry density (per ASTM D698).

D. UNCLASSIFIED STREET EXCAVATION:

1. Perform all street and roadway excavation in accordance with NCTCOG Item 203.4. Where discrepancies exist between the following paragraphs and Item 203.4, the more stringent requirements shall apply.

2. All excavation shall be in accordance with the lines, grades, and typical sections as shown on the plans or as established by the Engineer. Unless otherwise shown on the plans or established by the Engineer, the street excavation will be made to the subgrade of the street or paving project and the finished grade of parkways.

   a. Where excavation to grades established in the field would terminate in unstable soil, the Engineer may require the Contractor to remove the unstable soil and backfill to the required grade with suitable material compacted in an approved manner to the required density.

   b. Where excavation to grade established in the field terminates in loose or solid rock, the Contractor may be required to extend the depth of excavation six (6) inches and backfill with select material compacted in an approved manner to the required density. Subject to the approval of the Engineer, the select material may be obtained from any point within the project limits where suitable backfill material is available.

   c. The Contractor shall conduct his operation in such a manner that adequate measurements may be taken before any backfill, as required above, is placed.

3. Provisions for Drainage: If it is necessary in the prosecution of the work to interrupt the natural drainage of the surface, or the flow of artificial drains, the Contractor shall provide temporary drainage facilities that will prevent damage to public or private interests, and shall restore the original drains as soon as the work will permit. The Contractor shall be held liable for all damages which may result from neglect to provide for either natural or artificial drainage which his work may have interrupted.

4. Excess Excavation: Unsuitable street excavation and suitable street excavation in excess of that needed for construction shall be disposed of at the Contractor’s expense as directed by the Engineer. In general, suitable excess excavation from paving projects will be used in the construction of parkways, widening of embankments, flattening of slopes, etc., but if necessary to waste any material, it shall be disposed of, at the Contractor’s expense, in such a manner as to present a neat appearance and to not obstruct proper drainage or cause injury to any street improvements or abutting property.

E. BORROW EXCAVATION:
1. Construction Methods:

   a. All suitable materials removed from the excavation shall be used, insofar as practicable, in the formation of "Embankments", or shall otherwise be utilized as indicated on the plans or as directed, and the completed work shall conform to the established alignment, grades, and cross-section. During construction, the borrow sources shall be kept drained, insofar as practicable, and the work shall be prosecuted in a neat and workmanlike manner.

   b. Payment will not be allowed for excavation for any material which is used for purposes other than those designated, except as provided in the governing specifications.

   c. The site of the borrow operations shall be left in a suitable and sightly condition, such as to provide proper drainage. Where indicated on the plans, the sides and/or ends of borrow pits shall be sloped to the dimensions indicated on the plans.

2. Selection of Materials: Where shown on the plans, selected materials will be utilized in the formation of backfill, embankment or to improve the paving sub-grades, in which case the work shall be performed in such manner and sequence that suitable material may be selected, removed separately, and deposited within the limits and at the elevations required. Acceptable borrow material when tested by standard laboratory methods shall meet the requirements indicated on the plans.

3.03 SEPARATION OF EXCAVATED MATERIALS FOR REUSE:

   A. Remove only existing pavement that is necessary for prosecution of work.

   B. Carefully remove loam and topsoil from excavated areas. Store separately for further use or furnish equivalent loam and topsoil as directed.

   C. Carefully remove acceptable material from excavated areas and store separately for further use as backfill material.

3.04 EXCAVATION NEAR EXISTING STRUCTURES:

   A. Discontinue digging by machinery when excavation approaches pipes, conduits, or other underground structures. Continue excavation by use of hand tools. Include such manual excavation in work to be done when incidental to normal excavation and under items involving normal excavation.

   B. Excavate test pits when determination of exact location of pipe or other underground structure is necessary for doing work properly.

3.05 REMOVAL OF SUBSURFACE OBSTRUCTIONS:
A. Remove indicated subsurface structures and related obstructions to extent shown.

B. Promptly notify the Engineer when any unexpected subsurface facilities are encountered during excavation such as utility lines and appurtenances, walls and foundations.

3.06 REUSE AND DISPOSAL OF SURPLUS EXCAVATED MATERIALS:

A. Reuse surplus acceptable excavated materials for backfill; deposit neatly and grade so as to make or widen fills, flatten side slopes, or fill depressions; or legally dispose off-site; all as directed or permitted and without additional compensation.

3.12 SUBGRADE PREPARATION AND PROTECTION:

A. Remove loam and topsoil, loose vegetable matter, stumps and large roots from areas upon which embankments will be built or material will be placed for grading. Shape subgrade as indicated on drawings, and prepare by forking, furrowing, or plowing so that the first layer of new material placed thereon will be well bonded to it.

B. As directed by the Engineer, overexcavate unacceptable materials below the foundation subgrade. Backfill the overexcavation with compacted screened gravel or crushed stone wrapped with nonwoven geotextile fabric. In no case shall the screened gravel be placed directly on the exposed subgrade prior to placing the geotextile fabric.

C. Proof roll the foundation subgrade prior to backfilling and filling operation, or placing foundation concrete.

3.13 PROTECTION AND CARE OF PROPERTY:

A. Cut all branches, limbs, and roots smoothly and neatly without splitting or crushing. Neatly trim, cut the injured portions and cover with an application of grafting wax or tree healing paint as directed.

B. Protect cultivated hedges, shrubs, and plants which might be injured by the Contractor's operations by suitable means or dig up and temporarily replant and maintain. After construction operations have been substantially completed, replant in original positions and care for until growth is reestablished. If cultivated hedges, shrubs, and plants are injured to such a degree as to effect their growth or diminish in their beauty or usefulness, replace by items of equal kind and quality existing at the start of the work.

C. Do not use or operate tractors, bulldozers, or other power-operated equipment on paved surfaces when their treads or wheels of which are so shaped as to cut or otherwise damage such surfaces.

D. Restore surfaces damaged by the Contractor's operations to a condition at least equal to that in which they were found immediately before work commenced. Use suitable materials and methods for such restoration.
E. Protect structures, utilities, sidewalks, pavements, and other facilities from damages caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

3.14 BACKFILLING - GENERAL:

A. Do not place frozen materials in backfill or place backfill upon frozen material. Remove previously frozen material or treat before new backfill is placed.

B. Do not place, spread, roll or compact fill material during unfavorable weather conditions. If interrupted by heavy rain or other unfavorable conditions, do not resume until ascertaining that the moisture content and density of the previously placed soil are as specified.

C. Do not use puddling, ponding or flooding as a means of compaction.

3.15 MATERIAL PLACEMENT AND COMPACTION REQUIREMENTS:

A. Select Borrow, and Fine Aggregate:
   1. Dump and spread in layers not to exceed 8-in. [20 cm] uncompacted thickness.
   2. Compact, fill and backfill under all streets, roadways and structures to not less than 95 percent (per ASTM D698).

B. Screened Gravel and Crushed Stone:
   1. Dump and spread in layers not to exceed 8-in. [20 cm] uncompacted thickness.
   2. Compact using self-propelled vibratory steel drum or rubber tire rollers with a minimum of 4 passes in directions perpendicular to one another in open areas. In small areas, use manually operated vibratory plate compactors with a minimum of 4 passes.

C. Bank-run Gravel and Acceptable materials for use as non-structural fill:
   1. Dump and spread in layers not to exceed 12-in. [30 cm] uncompacted thickness.
   2. Compact to not less than 90 percent (per ATMD D698) unless otherwise indicated.

D. Backfilling and filling operation shall be suspended in areas where tests are being made until tests are completed and the testing laboratory has advised the Engineer that adequate densities are obtained.

E. Geotextile Fabric
The geotextile shall be placed with overlaps of a minimum of 36 inches. The backfill shall be back dumped on the fabric and spread in a uniform lift maintaining the design aggregate thickness at all times. Construction vehicles will not be allowed to traffic directly on the fabric.

3.16 STRUCTURAL FILL AND BACKFILL UNDER STRUCTURES:
   A. Compact fill and backfill under structures and pavements with screened gravel, crushed stone, select borrow, or fine aggregate as specified and indicated.

3.17 NON-STRUCTURAL BACKFILL AROUND STRUCTURES:
   A. Use acceptable materials for non-structural backfill around structures and compacted as specified and indicated.
   
   B. Conduct hydraulic testing as soon as practicable after structures are constructed and other necessary work has been done. Start backfilling promptly after completion of tests.
   
   C. Deposit material evenly around structure to avoid unequal soil pressure.
   
   D. Do not place backfill against or on structures until they have attained sufficient strength to support the loads (including construction loads) to which they will be subjected, without distortion, cracking, or other damage.

3.18 MATERIAL FOR FILLING AND EMBANKMENTS:
   A. Use acceptable materials for filling and building embankments unless otherwise indicated.

3.19 PLACING AND COMPACTING EMBANKMENT MATERIAL:
   A. Compact fill material as specified and indicated.
   
   B. Perform fill operation in an orderly and systematic manner using equipment in proper sequence to meet the specified compaction requirements.
   
   C. Place fill on surfaces which are free of unacceptable materials.
   
   D. Begin filling in lowest section of work area. Grade surface of fill approximately horizontal but provide with sufficient longitudinal and transverse slope to allow for runoff of surface water from every point.
   
   E. Conduct filling so that no obstruction to drainage from other sections of fill area is created at any time.
F. Install temporary dewatering sumps in low areas during filling operation where excessive amounts of rain runoff collect.

G. Compact uniformly throughout. Keep surfaces of fill reasonably smooth and free from humps and hollows that would prevent proper and uniform compaction. Do not permit hauling equipment to follow a single track on the same layer but direct equipment to spread out to prevent overcompaction in localized areas. Take care in obtaining thorough compaction at edges of fill.

H. Slightly slope surface of fill to ensure drainage during periods of wet weather. Do not place fill while rain is falling or after a rainstorm until the Engineer considers conditions satisfactory. During such periods and upon suspension of filling operations for any period in excess of 12 hours, roll smooth the surface of fill using a smooth wheel static roller to prevent excessive absorption of rainfall and surface moisture. Prior to resuming compaction operations, remove muddy material off surface to expose firm, compacted material, as determined by the Engineer.

I. When fill is placed against an earlier fill or against in-situ material under and around structures, including around piping beneath structures or embankments, slope junction between two sections of fill, 1 vertical to 1.5 horizontal. Bench edge of existing fill 24-in. [60 cm] to form a serrated edge of compact stable material against which to place the new fill. Ensure that rolling extends over junction between fills.

J. When fill is placed directly upon another older fill, clean surface thoroughly of debris and remove any loose material. Then proof roll the entire old surface.

K. After spreading each loose lift to the required thickness and adjusting its moisture content as necessary, roll with sufficient number of passes to obtain the required compaction. One pass is defined as the required number of successive trips that by means of sufficient overlap will insure complete coverage and uniform compaction of an entire lift. Do not make additional passes until previous pass has been completed.

L. In case material of any fill sinks and weaves under roller or under hauling units and other equipment, required degree of compaction is not being obtained. Reduce the moisture content. If such sinking and weaving produces surface cracks, suspend operations on that part of the embankment until it becomes sufficiently stabilized. Ideal condition in fill is that attained when the entire fill below the surface being rolled is so firm and hard as to show only the slightest weaving and deflection as roller passes. Spread out rolling operations over the maximum practicable area to minimize condition of sinking and weaving.

M. If because of defective workmanship, compaction obtained over any area is less than that required, remedy condition at no cost to Owner. If additional rolling or other means fail to produce satisfactory results, remove material in that area down to a level of satisfactory density. Perform removal, replacement, and rerolling without additional compensation.

3.20 **COMPACATION CONTROL OF BACKFILL, FILL, AND EMBANKMENT:**
A. Compact to density specified and indicated for various types of material. Control moisture content of material being placed as specified.

1. For all expansive, low-permeability earth fill zones and for re-worked fill beneath structures and streets, compact to required density at a moisture content between optimum and four (4) percentage points wet of optimum (as determined by ASTM D698).

2. For non-expansive earth fill zones and general earth fill zones, compact to the required density at a moisture content between two (2) percentage points below to four (4) percentage points above optimum moisture content as determined by ASTM D698.

B. The soil-testing laboratory shall provide inspection during filling or backfilling operations to ensure compaction of screened gravel or crushed stone and record compaction equipment in use.

C. Moisture control may be required either at the stockpile areas, pits, or on embankment or backfill. Increase moisture content when material is too dry by sprinkling or other means of wetting uniformly. Reduce moisture content when material is too wet by using ditches, pumps, drainage wells, or other devices and by exposing the greatest possible area to sun and air in conjunction with harrowing, plowing, and spreading of material or any other effective methods.

3.21 ALLOWANCE FOR SHRINKAGE:

A. Build embankments or backfill to a height above finished grade that will, in the opinion of the Engineer, allow for the shrinkage or consolidation of material. Initially, provide at all points, an excess of at least one percent of total height of backfill measured from stripped surface to top of finished surface.

B. Supply specified materials and build up low places as directed, without additional cost if embankment or backfilling settles so as to be below the indicated level for proposed finished surface at any time before final acceptance of the work.

END OF SECTION
PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals necessary to perform all trenching for pipelines and appurtenances, including drainage, bedding, filling, backfilling, disposal of surplus material, and restoration of trench surfaces and easements.

B. Excavation shall be extended to the width and depth shown on the Drawings or as specified and shall provide suitable room for installing pipe, structures and appurtenances.

C. Furnish and place all sheeting, bracing and supports and remove from the excavation all materials which the Engineer may deem unsuitable for backfilling. The bottom of the excavation shall be firm, dry, and in all respects acceptable. If conditions warrant, the Contractor may be ordered to deposit gravel for pipe bedding, or gravel refill for excavation below grade, directly on the bottom of the trench immediately after excavation has reached the proper depth and before the bottom of the trench has become softened or disturbed by any cause whatever. The length of open trench shall be related closely to the rate of pipe laying. All excavation shall be made in open trenches.

D. All excavation, trenching, and related sheeting, bracing, etc., shall comply with the requirements of OSHA excavation safety standards (29 CFR Part 1926.650 Subpart P), and H.B. 1569 of the 71st Regular Legislative Session.

E. Wherever compaction requirements are referred to herein it shall refer to Standard Proctor Density as determined by ASTM D 698.

F. Prior to the start of work the Contractor is required to submit his/her proposed method of backfilling and compaction to the Engineer for review.

1.02 RELATED WORK

A. Sedimentation and erosion control shall be in accordance with Drawings.

B. Hydromulch seeding shall be in accordance with Drawings and Section 202.6 of NCTCOG.

C. Trench safety shall be in accordance with NCTCOG and Section 01665 of these Specifications.

1.03 SUBMITTALS

A. Submittals shall be in accordance with Section 01340.

1.04 QUALITY ASSURANCE AND CONTROL

A. Quality Assurance and Control shall be in accordance with Section 01340.
PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION

3.01 TRENCH EXCAVATION

A. Trench excavation shall include material of every description and of whatever substances encountered, regardless of the methods or equipment required to remove the material. Pavement shall be cut with a saw, wheel or pneumatic chisel along straight lines before excavating.

B. The Contractor shall strip and stockpile topsoil from grassed areas crossed by trenches. At the Contractor’s option, topsoil may be otherwise disposed of and replaced, when required, with approved topsoil of equal quality.

C. While excavating and backfilling is in progress, traffic shall be maintained, and all utilities and other property protected as provided in the Agreement.

D. Trenches shall be excavated to the depth indicated on the Drawings and in widths sufficient for laying the pipe, bracing and for pumping and drainage facilities. The bottom of the excavations shall be firm and dry and in all respects acceptable to the Engineer. Trench width shall be practical minimum, but not less than 12-inches nor more than indicated on the Drawings.

E. Excavation and dewatering shall be accomplished by methods which preserve the undisturbed state of subgrade soils. The trench may be excavated by machinery to, or just below, the designated subgrade, provided that material remaining in the bottom of the trench is no more than slightly disturbed. Subgrade soils which become soft, loose, “quick”, or otherwise unsatisfactory as a result of inadequate excavation, dewatering or other construction methods shall be removed and replaced by gravel fill as required by the Engineer at the Contractor’s expense.

F. Clay and organic silt soils are particularly susceptible to disturbance due to construction operations. When excavation is to end in such soils, the Contractor shall use smooth-edge bucket to excavate the last one foot of depth.

G. Where pipe is to be laid in gravel bedding, the trench may be excavated by machinery to the normal depth of the trench provided that the material remaining in the bottom of the trench is no more than slightly disturbed.

3.02 SHEETING AND BRACING

A. Furnish, put in place and maintain sheeting and bracing required by Federal, State or local safety requirements to support the sides of the excavation and prevent loss of ground which could endanger personnel, damage or delay the work or endanger adjacent structures. If the Engineer is of the opinion that at any point sufficient or proper supports have not been provided, he may order additional supports placed at the expense of the Contractor. Compliance with such order shall not relieve the Contractor from his responsibility for the sufficiency of such supports. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and rammed.
B. Where sheeting and bracing is required to support the sides of trenches, the Contractor shall engage a Professional Engineer, licensed in the State of Texas, to design the sheeting and bracing. The sheeting and bracing installed shall be in conformity with the design and certification of this shall be provided by the Professional Engineer.

C. When moveable trench bracing such as trench boxes, moveable sheeting, shoring or plates are used to support the sides of the trench, care shall be taken in placing and moving the boxes or supporting bracing to prevent movement of the pipe, or disturbance of the pipe bedding and the backfill.

1. When installing rigid pipe (R.C., D.I., V.C., etc), any portion of the box extending below mid-diameter shall be raised above this point prior to moving the box ahead to install the next pipe. This is to prevent the separation of installed pipe joints due to movement of the box.

2. When installing flexible pipe (Steel, PVC, etc.) trench boxes, moveable sheeting, shoring or plates shall not be allowed to extend below mid-diameter of the pipe. As trench boxes, moveable sheeting, shoring or plates are moved, backfill shall be placed to fill any voids created and the backfill shall be recompacted to provide uniform side support for the pipe.

D. The Contractor will be permitted to use steel sheeting in lieu of wood sheeting for the entire job wherever the use of sheeting is necessary. The cost for use of sheeting shall be included in the bid items for trench safety and shall include full compensation for driving, bracing and later removal of sheeting.

E. All sheeting and bracing shall be carefully removed in such manner as not to endanger the construction of other structures, utilities, or property, whether public or private. All voids left after withdrawal of sheeting shall be immediately refilled with backfill by ramming with tools especially adapted to that purpose, or otherwise as directed.

3.03 TEST PITS

A. The Contractor may be required to excavate test pits for the purpose of locating underground utilities or structures as an aid in establishing the precise location of new work.

B. Test pits shall be backfilled as soon as the desired information has been obtained. The backfilled surface shall be maintained in a satisfactory condition for travel until resurfaced as specified.

3.04 DRAINAGE AND DEWATERING

A. The Contractor shall furnish all materials and equipment and perform all incidental work required to install and maintain the drainage system he proposes for handling groundwater or surface water encountered. A Dewatering Plan shall be submitted outlining how sufficient groundwater will be removed. Dewatering Plan shall be performed by and sealed by a licensed engineer in the State of Texas. Contractor shall assume all responsibility for the adequacy of the methods, materials, and equipment employed.
B. The Contractor shall provide pumping equipment and devices to properly remove and dispose of all water entering trenches and excavations. The subgrade shall be maintained acceptably dry, to a level of 5 feet below the bottom of the trench, until the facilities to be built therein are completed. Piezometers shall be provided at appropriate locations for verification of dewatering depth. All drainage related work shall be performed without damage to the trench, pavement, pipes, electrical conduits, or other utilities and without damage to public or private property.

C. The pipe or concrete shall not be laid in water or submerged within 24 hours after being placed. Water shall not flow over new concrete within four days after placement, or as designated on the plans.

D. In no event shall water rise to cause unbalanced pressure on facilities until the concrete or mortar has set at least 24 hours. The Contractor shall prevent flotation of the pipe by promptly placing backfill.

3.05 EXCAVATION BELOW GRADE AND REFILL

A. Whatever the nature of unstable material encountered or the groundwater conditions, trench drainage shall be complete and effective.

B. If the contractor excavates below grade through error or for his own convenience, or through failure to properly dewater the trench, or disturbs the subgrade before dewatering is sufficiently complete, he may be directed by the Engineer to excavate below grade as set forth in the following paragraph, in which case the work of excavating below grade and furnishing and placing the refill shall be performed at his own expense.

C. If using gravel backfill and the material at the level of trench bottom consists of fine sand, sand and silt or soft earth which may work into the gravel backfill notwithstanding effective drainage, the subgrade material shall be removed to the extent directed and the excavation refilled with a 6-inch to 12-inch layer of crushed stone No. 467, or as approved by the Engineer, to form a filter layer preserving the voids in the gravel bed of the pipe. The composition and gradation of gravel shall be approved by the Engineer prior to placement. Gravel backfill shall then be placed in 6-inch layers thoroughly compacted up to the normal grade of the pipe.

D. Geotextile filter fabric may be installed in specified locations. Filter fabric shall be Mirafi 400 or 402, Carthage Mill Carthage 15% of 30%, SIGeoSolutions Geotechs 111F, or approved equal. Geotextile materials must be woven and possess percent open areas on the order of 10% or greater.

3.06 EMBEDMENT

A. Embedment for water lines shall be fine crushed rock grade 8, as shown on the Drawings.

B. The initial layer of embedment placed to receive the pipe shall be brought to the grade and dimensions indicated on the Drawings, and the pipe shall be placed thereon and brought to grade by tamping, or by removal of the slight excess amount of embedment under the pipe. Adjustments to grade shall be made by scraping away or filling with embedment material. Wedging or blocking up of pipe will not be permitted. Each pipe section shall have a uniform bearing on the embedment for the full length of the pipe, except immediately at the joint. All
embedment shall extend the full width of the trench bottom. Embedment shall remain dewatered, in accordance with Section 3.04, until all backfilling is complete.

C. After the pipe has been laid, jointed and inspected, embedment material shall be brought up in mechanically tamped layers not exceeding eight inches in thickness of loose fill, approximately equal on each side of the pipe, to 6 inches above the top of pipe. Compaction shall be 90% of maximum density in accordance with NCTCOG Section 504.5.2.8 Class B-4 and ASTM D 698.

3.07 BACKFILLING

A. As soon as practicable after the initial bedding has been placed and the pipe has been laid and jointed, backfilling shall begin and thereafter be prosecuted expeditiously. Bedding, as specified for the type of pipe installed, shall be placed as shown on the Drawings and as specified in Paragraph 3.06 above.

B. The remainder of the trench shall be filled with Type C Backfill in accordance with NCTCOG Section 504.5.2.9. Layers shall not exceed 8-in in loose measure compacted to 95 percent of maximum density in accordance with ASTM D698. The backfill shall be mounded 6-in above the existing grade, or as directed. Where a grass, loam or gravel surface exists prior to excavation, it shall be removed, conserved and replaced to the full original depth as part of the work under the pipe items. In some areas it may be necessary to remove excess material during the clean-up process, so that the ground may be restored to its original level and condition.

C. Where the pipes are laid in paved areas or designated future paved areas, the remainder of the trench above the embedment shall be backfilled Type C Backfill in accordance with NCTCOG Section 504.5.2.9 in layers not to exceed 8-in loose measure and compacted to 95 percent of maximum density in accordance with ASTM D698. The top 18-inches below subgrade level shall be Flowable Backfill in accordance with NCTCOG Section 504.2.3.4 compacted to 100 percent of maximum density in accordance with ASTM D698.

D. To prevent longitudinal movement of the pipe, dumping backfill material into the trench and then spreading will not be permitted until the bedding material has been placed and compacted to a level 6 inches over the pipe.

E. Backfill shall be brought up evenly on both sides of the pipe. Each layer of backfill material shall be thoroughly compacted by rolling, tamping, or vibrating with mechanical compacting equipment or hand tamping. If rolling is employed, it shall be by use of a suitable roller or tractor, being careful to fill throughout the full width of the trench.

F. Compaction shall be by use of hand or pneumatic tamping with tools weighing at least 20 lbs. The material being spread and compacted shall be placed in layers not over 8-in loose thick. If necessary, sprinkling shall be employed in conjunction with rolling or ramming.

G. Subject to the approval of the Engineer, fragments of ledge and boulders smaller than 4-in may be used in trench backfill providing that the quantity, in the opinion of the Engineer, is not excessive. Rock fragments shall not be placed until the pipe has at least 2-ft of cover. Small stones and rocks shall be placed in thin layers alternating with earth to insure that all voids are completely filled. Fill shall not be dropped into the trench in a manner to endanger the pipe. If rock
fragments are placed in the backfill material, it will be the Contractor’s responsibility to prove to the Engineer that the specified compaction is occurring. If the Engineer’s opinion is that the compaction is not achieved, then the Contractor shall remove material that contains rock fragments and replace it with suitable material.

H. Bituminous paving shall not be placed in backfill unless specifically permitted, in which case it shall be broken up as directed. Frozen material shall not be used under any circumstances.

I. Water jetting will not be accepted as a means of consolidating/compacting backfill.

J. All road surfaces shall be broomed and hose-cleaned immediately after backfilling. Dust control measures shall be employed at all times.

K. Dewatering, per Section 3.04, shall be maintained until backfill is complete.

3.08 RESTORING TRENCH SURFACE

A. Where the trench occurs adjacent to paved areas, road shoulders, sidewalks, or in cross-country areas, the Contractor shall thoroughly consolidate the backfill and shall maintain the surface as the work progresses. If settlement takes place, he shall immediately deposit additional backfill to restore the level of the ground.

B. In paved areas, the edge of the existing pavement to be removed shall be cut along straight lines, and the pavement replaced as indicated on the Drawings.

C. The surface of any driveway, or any other area, which is disturbed by the trench excavation and which is not a part of the paved road shall be restored by the Contractor to a condition at least equal to that existing before work began.

D. In sections where the pipeline passes through grassed areas, the Contractor shall, at his own expense, remove and replace the sod, or shall loam and reseed the surface to the satisfaction of the Engineer.

END OF SECTION
PART 1: GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals necessary to perform all installation, maintenance, removal and area cleanup related to sedimentation control work as shown on the Drawings and as specified herein. The work shall include, but not necessarily be limited to; installation of temporary access ways and staging areas, silt fences, sediment protection at storm drain inlets, sediment removal and disposal, device maintenance, removal or temporary devices, temporary mulching, erosion control blankets and final cleanup.

1.02 RELATED WORK

A. Seeding is included in Section 02936.

1.03 SUBMITTALS

A. Within 10 days after award of Contract, the Contractor shall submit to the Engineer for approval, technical product literature for all commercial products to be used for sedimentation and erosion control.

1.04 QUALITY ASSURANCE

A. The Contractor shall be responsible for the timely installation of all sedimentation control devices necessary to prevent the movement of sediment from the construction site to off-site areas or into the stream system via surface runoff or underground drainage systems. Measures in addition to those shown on the Drawings necessary to prevent the movement of sediment off-site shall be installed, maintained, removed, and cleaned up at the expense of the Contractor. No additional charges to the Owner will be considered.

PART 2: PRODUCTS

2.01 MATERIALS

A. Crushed stone for stabilized construction entrances shall be 3” to 5” Hard Stone.

B. Silt Fence

    Shall be as shown on the drawings.

C. Erosion control blanket shall be installed as shown on the Drawings. The erosion control blanket shall be AMXCO Curlex Blanket as manufactured by American Excelsior Company, Arlington, TX or equal.

PART 3: EXECUTION

3.01 INSTALLATION
A. Silt Fence

1. Silt fences shall be positioned as indicated on the Drawings and as necessary to prevent off site movement of sediment produced by construction activities as directed by the Engineer.

2. Dig trench approximately 6-in wide and 6-in deep along proposed fence lines.

3. Drive metal-stakes, 5 feet on center (maximum) at back edge of trenches. Stakes shall be driven 2 feet (minimum) into ground.

4. Hand 2 by 4 woven wire mesh on posts, setting bottom of wire in bottom of trench. Secure wire to posts with self-fastening tabs.

5. Hang filter fabric on wire carrying to bottom of trench with about 12-in of fabric laid across bottom of trench. Stretch fabric fairly taut along fence length and secure with tie wires 12-in O.C. both ways. The silt fence shall be a minimum of 24 inches high.

6. Backfill trench with excavated material and tamp.

7. Install pre-fabricated silt fence according to manufacturer’s instructions.

B. Erosion control blankets shall be installed as shown on the Drawings and as directed by the Engineer in accordance with the manufacturer’s instructions. The area to be covered shall be properly prepared, fertilized and seeded before the blanket is applied. When the blanket is unrolled, the netting shall be on top of the fibers in contact with the soil over the entire area. The blankets shall be applied in the direction of water flow and stapled. Side overlaps shall be 4-in minimum. The staples shall be made of wire, 0.091-inch in diameter or greater, “U” shaped with legs 10-inches in length and 12-inch crown. The staples shall be driven vertically into the ground, spaced approximately two linear feet apart on each side with one row in the center alternately spaced between each side row. Adjoining blankets shall be overlapped and shall utilize a common row of staples to attach.
3.02 MAINTENANCE AND INSPECTIONS

A. Inspections

1. Contractor shall make a visual inspection of all sedimentation control devices once per week and promptly after every rainstorm. If such inspection reveals that additional measures are needed to prevent movement of sediment to offsite areas, Contractor shall promptly install additional devices as needed. Sediment controls in need of maintenance shall be repaired promptly.

B. Device Maintenance

1. Silt Fences
   a. Remove accumulated sediment once it builds up to one-half of the height of the fabric.
   b. Replace damaged fabric, or patch with a 2-ft minimum overlap.
   c. Make other repairs as necessary to ensure that the fence is filtering all runoff directed to the fence.

3.03 REMOVAL AND FINAL CLEANUP

A. Once the site has been fully stabilized against erosion, remove sediment control devices and all accumulated silt. Dispose of silt and waste materials in proper manner. Regrade all areas disturbed during this process and stabilize against erosion with surfacing materials as specified and as shown on the Drawings.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. Furnish labor, materials, equipment and incidentals necessary to install bar-wrapped concrete cylinder pipe and fittings, and specials, including connections and appurtenances as shown on the drawings and specified herein. Contractor shall be allowed to install bar-wrapped concrete cylinder pipe for buried pipe applications only.

B. Joint bonding and electrical isolation is detailed in Section 15640.

1.02 QUALITY ASSURANCE

A. Manufacturer: Finished pipe shall be the product of one (1) manufacturer. Pipe manufacturing operations (pipe, fittings, lining, coating) shall be performed at one (1) location. Fittings may be furnished in a separate location normally performed by the manufacturer.

B. Factory Testing:

1. The OWNER reserves the option to have an independent testing laboratory, at the OWNER's expense, inspect pipe and fittings at the pipe manufacturer's plant. The OWNER's testing laboratory and ENGINEER shall have free access to the manufacturer's plant. The pipe manufacturer shall notify the OWNER, in writing, at least two (2) weeks ahead of pipe fabrication as to start of fabrication and fabricating schedule so that the OWNER can advise the manufacturer as to OWNER's decision regarding tests to be performed by an independent testing laboratory. In event the OWNER elects to retain an independent testing laboratory to make material tests and weld tests, it is the intent that the tests be limited to one (1) spot testing of each category unless the tests do not show compliance with the standard. If these tests do not show compliance, the OWNER reserves the right to have the laboratory make additional tests and observations.

2. The OWNER may require the manufacturer to furnish mill test certificates on reinforcing steel or wire, steel plate, and cement. The manufacturer shall perform the tests described in AWWA C303, for all pipe, fittings, and specials, except that the following absorption test shall supersede the requirements of the applicable portion of AWWA C303.

3. Absorption Test. A water absorption test shall be performed on samples of cured mortar coating taken from each working shift. The mortar coating samples shall have been cured in the same manner as the pipe. A test value shall consist of the average of a minimum of three samples taken from the same working shift. The test method shall be in accordance with ASTM C497, Method A. The average absorption value for any test shall not exceed 9 percent and no individual sample shall have an absorption exceeding 11 percent. Tests for each working shift shall be performed on a daily basis until conformance to the absorption requirements has been established by 10 consecutive passing test results, at which time testing may be performed on a weekly basis for each working shift. Daily testing shall be resumed for each working shift with failing absorption test results and shall be maintained
until conformance to the absorption requirements is re-established by 10 consecutive passing test results.

4. The cost of all tests specified are subsidiary to the cost of the pipe and will not be paid for separately.

C. Manufacturer's Technician for pipe installation:

1. During the construction period, the Pipe Manufacturer shall furnish the services of a factory trained, qualified, job experienced technician to advise and instruct as necessary in pipe laying and pipe jointing. The technician shall assist and advise the Contractor in his pipe laying operations and shall instruct construction personnel in proper joint assembly and joint inspection procedures. The technician is not required to be on-site full time; however, the technician shall be regularly on-site during the first two weeks of pipe laying and thereafter as requested by the Engineer, Owner, or Contractor.

1.03 SUBMITTALS

Submittals shall be in accordance with the Special Conditions and shall include the following:

A. Prior to the fabrication of the pipe, submit Record Data of fabrication and laying drawings to the OWNER for review of general conformance to contract documents. Record Data shall include a complete description of the pipe offered, including cuts, tabulated layout, design calculations, joint restraint and thrust calculations, and pertinent design data. Record Data shall reference stationing on the plan profile sheets and shall incorporate changes necessary to avoid conflicts with existing utilities and structures. Details for the design and fabrication of all fittings and specials and provisions for thrust shall be included. Submittal shall be sealed by a Licensed Professional ENGINEER in the State of Texas.

B. Prior to delivery of the pipe to the project site, the manufacturer shall furnish an affidavit certifying that all pipe, fittings, and specials, and other products and materials furnished, comply with this specification. If requested by the OWNER, the manufacturer shall submit certified reports of all testing required by AWWA C303.

1.04 STANDARDS

Except as modified or supplemented herein, pretensioned concrete cylinder pipe shall conform to the applicable requirements of the following standard specifications, latest edition.

AWWA C303 "Concrete Pressure Pipe – Bar-Wrapped Steel Cylinder Type"

AWWA M9 Manual: "Concrete Pressure Pipe"

ASTM A33 "Standard Specification for Concrete Aggregates"
ASTM A635  "Standard Specification for Steel, Sheet and Strip, Carbon, Hot Rolled, Structural Quality"

ASTM C144  "Specification for Aggregate for Masonry Mortar"

ASTM C150  "Specification for Portland Cement"

ASTM C497  "Methods of Testing Concrete Pipe"

NCTCOG Item 2.12.5(a) through (d) and (h)

1.05 DELIVERY AND STORAGE

A. Packing:

1. The pipe shall be prepared for shipment to afford maximum protection from normal hazard of transportation and allow pipe to reach project site in an undamaged condition. Pipe damaged in shipment shall not be delivered to the project site unless such damaged pipe is properly repaired.

2. After the completed pipe and fittings have been removed from the final cure at the manufacturing plant, the pipe lining shall be protected from drying by means of plastic end covers banded to the pipe ends. Covers shall be maintained over the pipe ends at all times until ready to be placed in the trench. Moisture shall be maintained inside the pipe by periodic addition of water as necessary.

3. Pipes shall be carefully supported during shipment and storage. Each length of pipe, fitting, or special shall be internally supported and braced with stulls to maintain a true circular shape. Internal supports shall consist of timber or steel stulls firmly wedged and secured so that the stulls remain in place during handling. Pipe shall be rotated so that one (1) of the stulls is vertical during storage, shipment and installation. Stulls shall not be removed from pipe until backfill operations are complete for pipe 36-inch and larger (excluding final cleanup), unless it can be demonstrated to the OWNER's satisfaction that removal of the stulls will not adversely affect the pipe installation. Pipe, fittings, and specials shall be separated so that they do not bear against each other in transit. Store pipe on padded skids, sand or dirt berms, tires, or other suitable means to protect the pipe from damage.

4. In addition, deliver, handle, and store pipe in accordance with the manufacturer's recommendations to protect coating systems.

B. Marking for Identification: Each joint of pipe and each fitting shall have plainly marked on one end the class for which it is designed, the date of manufacturer, and the identification number that matches shop drawing records. The top centerline shall be marked on all specials.

PART 2 - PRODUCTS
2.01 MATERIALS

A. Cement: Cement for use in concrete and mortar shall be Type I or II Portland Cement.

B. Aggregates: Aggregates for concrete lining and coating shall conform to ASTM C-33.

C. Sand: Sand used for inside and outside joints shall be of silica base, conforming to ASTM C-144.

D. Special Coating: Pipe to be installed in casing shall have two built-up mortar rings, each approximately 2 feet long and slightly higher than the pipe bell, to prevent the pipe from being supported by the pipe bell. Built-up mortar rings are to be applied at the quarter points of the pipe section.

E. Bushes, Couplings and Plugs: Where outlets or taps are threaded, furnish and install brass reducing bushings in larger steel half couplings for the outlet size indicated. Threaded plugs shall be brass.

2.02 MIXES; CEMENT MORTAR

Cement mortar used for pouring joints shall consist of one (1) part Portland Cement to two (2) parts clean, fine, sharp silica sand, mixed with water. No manufactured sand shall be permitted. Exterior joint mortar shall be mixed to the consistency of thick cream. Interior joint mortar shall be mixed with as little water as possible so that the mortar is very stiff, but workable. Cement shall be ASTM C150, Type I or Type II. Sand shall conform to ASTM C144. Cement mortar used for patching shall be mixed as per cement mortar for inside joints.

2.03 MANUFACTURED PRODUCTS

A. Pipe:

1. General: Pipe, bends, and special fittings shall be designed, manufactured, and tested in accordance with the applicable requirements of AWWA C303 and AWWA M9, and the special requirements of this specification. Pipe shall be certified by the National Sanitation Foundation Standard 61 for use with potable water.

2. Pipe Design Criteria: Sizes and pressure classes (working pressure) shall be as specified. For the purposes of pipe design, working pressure plus transient pressure shall be as indicated below. Fittings, specials and connections shall be of the same or greater pressure class as the associated pipe. Pipe and fittings shall be clearly marked with the pressure class and piece number to permit easy identification in the field. Pipe design shall be based on trench conditions and design pressure class specified. Pipe shall be designed according to the methods indicated in AWWA C303 and AWWA Manual M9 for trench construction, using the following parameters:

   a) Unit Weight of Fill \( (w) = 130 \text{pcf} \)
   b) Live Load = AASHTO H-20 truck for unpaved conditions
c) Trench Depth = As indicated

d) Coefficient Ku' = 0.150

e) Trench Width (Bd) as indicated

f) Bedding Conditions = As indicated

g) Pressure Class = 150 psi min. working pressure, (150 psi test pressure)

h) Surge Allowance = 100 psi minimum:
   Total Pressure (including surge) = 150 psi + 100 psi = 250 psi.

i) Deflection Lag Factor = 1.5

j) Soil Reaction Modulus, E' < 1,000

Trench depths indicated shall be verified after existing utilities are located. Vertical alignment changes required because of existing utility or other conflicts shall be accommodated by an appropriate change in pipe design depth. In no case shall pipe be installed deeper than its design allows.

3. Provisions for Thrust:

   a) All joints shall be restrained for thrust. All joints shall be welded for restraint unless otherwise approved by the Engineer.

   b) Thrust collars will only be permitted for temporary plugs. Thrust collars may not be used for any other application, unless approved in writing by the ENGINEER.

4. Inside Diameter: The inside diameter, of the cement mortar lining shall be the Nominal diameter specified.

B. Joint Wrappers: Similar and equal to those manufactured by Mar-Mac Manufacturing Company.

C. Insulated Connections: Insulated connection shall be in accordance with Section 15640. Where insulated connections are indicated, furnish dielectric insulation gaskets, sleeves, and plastic washers as indicated. Insulating flange kits are to be installed on all flanged outlets of the main line pipe and on both flanges of each main line valve.

D. Flexible Joint Couplings: Dresser Style 38, Smith-Blair Style 411, or approved equal.

E. Pipe Ends: The standard pipe end shall include steel joint ring and a continuous solid rubber ring gasket as per AWWA Manual M-9.

F. Flanges: Flanges shall conform to AWWA C207 with laying dimensions and drilling in accordance with ANSI B 16.1, Class 125. Flanges shall be Flange Class E with a minimum working pressure of 275 psi for areas designated with 225 psi test pressure. Flanges shall be Flange Class D for areas designated with 175 psi test pressure or less. In no case shall the working or test pressure of the pipe exceed the working pressure of the flange. Drilling shall match class of valves or appurtenances which are attached. Nuts and bolts shall conform to AWWA C207.
PART 3 - EXECUTION

3.01 INSTALLATION

A. General:

1. Install pipe, fittings, specials, and appurtenances as specified herein, as specified in AWWA Manual M9, and in accordance with the pipe manufacturer's recommendations.

2. Lay pipe to the lines and grades as indicated.

B. Pipe Handling:

1. Haul and distribute pipe, fittings at the project site. Handle piping with care to avoid damage. Before lowering into the trench, inspect each joint of pipe, and reject or repair any damaged pipe.

2. Keep the pipe clean during and after the laying operation and free of sticks, dirt, animals, and trash, and at the close of each operating day, effectively seal the open end of the pipe using a gasketed night cap.

C. Pipe Jointing:

1. General:

   a) Thoroughly clean the bell and spigot rings before laying each joint of pipe by brushing and wiping. If any damage to the protective coating on the metal has occurred, repair the damage before laying the pipe. Lubricate the gasket and the inside surface of the bell with an approved lubricant (flax soap) which will facilitate the telescoping of the joint. Tightly fit together sections of pipe and exercise care to secure true alignment and grade. When a joint of pipe is being laid, place the gasket on the spigot ring and enter the spigot end of the pipe into the bell of the adjoining pipe and force into position. The inside joint space between ends of the pipe sections shall have an opening within the tolerances as recommended by the pipe manufacturer. No "blocking up" of pipe or joints will be permitted, and if the pipe is not uniformly supported or the joint not made up properly, remove the joint and properly prepare the trench. After joining, check the position of the gasket with a feeler gauge. If the gasket is out of position, disassemble the joint and repeat the joint laying procedure.

   b) For interior welded joints, complete backfilling before welding. For exterior field-welded joints, provide adequate working room under and beside the pipe.

2. Exterior Joints: Make the exterior joint by placing a joint wrapper around the pipe and secure in place with two (2) metal straps. The wrapper shall be 9" inches wide for pipe 36" and larger, and 7" wide for smaller pipe, hemmed on each side. The wrapper shall be fiberglass reinforced or burlap cloth, with lengths encircling the pipe, leaving enough opening between
ends to allow the mortar to be poured inside the wrapper into the joint. Fill the joint with mortar from one side in one (1) continuous operation until the grout has flowed entirely around the pipe. During the filling of the joint, pat or manipulate the sides of the wrapper to settle the mortar and expel any entrapped air. Leave wrappers in place undisturbed until the mortar has set-up.

A minimum of 1” thick coating of concrete or cement mortar shall be provided for corrosion protection for exposed steel. Some examples of exposed steel include flanges, blind flanges, threaded outlets, caulked joints, mechanical joint connections and closures. The cement mortar used should consist of one part Portland cement to three parts of fine sharp sand. All surfaces receiving cement mortar coating must be thoroughly cleaned and wetted with water just before placing the cement mortar coating. After placement, care should be taken to prevent the cement mortar from drying out too rapidly by covering with damp earth or burlap. Cement mortar linings or coatings must not be allowed to freeze.

3. Interior Joints: Upon completion of backfilling of the pipe trench, fill the inside joint recess with a stiff cement mortar. Prior to placing of mortar, clean out dirt or trash which has collected in the joint, and moisten the concrete surfaces of the joint space by spraying or brushing with a wet brush. Ram or pack the stiff mortar into the joint space and take extreme care to insure that no voids remain in the joint space. After the joint has been filled, level the surfaces of the joint mortar with the interior surfaces of the pipe with a steel trowel so that the surface is smooth. Interior joints of pipe smaller than 21” shall have the bottom of the bell buttered with mortar, prior to inserting the spigot, such that when the spigot is pushed into position it will extrude surplus mortar from the joint. The surplus mortar shall be struck off flush with the inside of the pipe by pulling a filled burlap bag or an inflated ball through the pipe with a rope.

4. Welded Joints:

a) Weld joints in accordance with the AWWA Manual M9. Contractor shall provide adequate ventilation for welders and for Owner's representative to observe welds. Unless otherwise specified, welds shall be full circle fillet welds.

b) Adequate provisions for reducing temperature stresses shall be the responsibility of the Contractor.

c) After the pipe have been joined and properly aligned and prior to the start of the welding procedure, the spigot and bell shall be made essentially concentric by shimming or tacking to obtain clearance tolerance around the periphery of the joint. In no case shall the clearance tolerance be permitted to accumulate.

d) Furnish labor, equipment, tools and supplies, including shielded type welding rod. Protect welding rod from any deterioration prior to its use. If any portion of a box or carton is damaged, reject the entire box or carton.
e) In all hand welding, the metal shall be deposited in successive layers. For hand welds, not more than 1/8" of metal shall be deposited in each pass. Each pass except the final one, whether in butt or fillet welds, shall be thoroughly bobbed or peened to relieve shrinkage stresses and to remove dirt, slag, or flux before the succeeding bead is applied. Each pass shall be thoroughly fused into the plates at each side of the welding groove or fillet and shall not be permitted to pile up in the center of the weld. Undercutting along the side shall not be permitted.

f) Welds shall be free from pin holes, non-metallic inclusions, air pockets, undercutting and/or any other defects.

g) If the ends of the pipe are laminated, split or damaged to the extent that satisfactory welding contact cannot be obtained, remove the pipe from the line.

h) Furnish each welder employed with a steel stencil for marking the welds, so that the work of each welder may be identified. Have each welder stencil the pipe adjacent to the weld with the stencil assigned to him. In the event any welder leaves the job, his stencil shall be voided and not duplicated if another welder is employed.

i) Use only competent, skilled and qualified workmen. Each welder employed by the Contractor shall be required to satisfactorily pass a welding test in accordance with AWWA C206 before being allowed to weld on the line.

j) After each welder has qualified in the preliminary tests referred to above, inspections shall be made of joints in the line. Any welder making defective welds shall not be allowed to continue to weld.

k) Dye penetrant tests in accordance with ASTM E165, or magnetic particle test shall be performed by the Contractor under the supervision and inspection of the Owner’s Representative or an independent testing laboratory, on all full welded joints. Welds that are defective will be replaced or repaired, whichever is deemed necessary by the Engineer, at the Contractor's expense.

l) If the Contractor disagrees with the Engineer's interpretation of welding tests, test sections may be cut from the joint for physical testing. The Contractor shall bear the expense of repairing the joint, regardless of the results of physical testing. The procedure for repairing the joint shall be approved by the Engineer before proceeding.

D. Protection of Exposed Metal:

1. Protect exposed ferrous metal by a minimum of one (1") inch coating of cement mortar as previously specified for inside joints unless otherwise specified. Exposed large flat surfaces such as flanges, bolts, caulked joints, threaded outlets, closures, etc., shall have coating reinforced with galvanized wire mesh.
2. Thoroughly clean and wet the surface receiving a cement mortar coating with water just prior to placing the cement mortar coating. After placing, take care to prevent cement mortar from drying out too rapidly by covering with damp earth or burlap. Cement mortar coating shall not be applied during freezing weather.

E. Patching:

1. Excessive field-patching of lining or coating shall not be permitted. Patching of lining or coating will be allowed where area to be repaired does not exceed 100 square inches and has no dimensions greater than 12". In general, there shall not be more than one patch on either the lining or the coating of any one joint of pipe.

2. Wherever necessary to patch the pipe, make patch with cement mortar as previously specified for interior joints. Do not install patched pipe until the patch has been properly and adequately cured and approved for laying by the OWNER. Promptly remove rejected pipe from the site.

F. Pipe Bedding and Backfill: Pipe bedding and backfill shall be as specified in Section 02221, Trenching, Backfilling and Compaction.

3.02 FIELD QUALITY CONTROL

A. Hydrostatic and Leakage Tests

1. Hydrostatic tests shall be as specified in Section 01666 Hydrostatic Testing and Disinfection.

2. Furnish all necessary equipment and labor for carrying out a pressure test on the pipelines. The procedures and method for carrying out the pressure tests shall be approved by the Engineer.

3. Make any taps and furnish all necessary caps, plugs, bulkheads, etc., as required in conjunction with testing portions of the pipe. Furnish test pumps, gauges, meters and any other equipment required in conjunction with carrying out the tests. Hydrostatic pressure and leakage tests shall conform with AWWA M9.

4. All pipelines shall be subjected to hydrostatic pressure as indicated in 2.03.A.2 at the lowest points of the section being tested and this pressure maintained for at least one hour. The amount of leakage which will be permitted shall be in accordance with AWWA C600.

5. Lines which fail to meet the requirements of the test shall be repaired and retested as necessary until test requirements are met. Defective materials, pipes, valves, and accessories shall be removed and replaced.

END OF SECTION
PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish labor, materials, equipment, and incidentals necessary to install ductile-iron pressure pipe, fittings, and specials, including connections and appurtenances as required for the proper installation and function of the system, as indicated in the NCTCOG Standard Specification Item 501.7 except as modified herein.

B. Polyethylene encasement for ductile iron pipe is detailed in this Section.

1.02 QUALITY ASSURANCE

A. Manufacturer: Finished pipe shall be the product of one (1) manufacturer. Pipe manufacturing operations (pipe, fittings, lining, coating) shall be performed at one (1) location.

B. Reference Standards:


2. ANSI/AWWA C105/A21.5 - American National Standard for Polyethylene Encasement.


10. AWWA M-41 - Ductile-Iron Pipe and Fittings.

11. NCTCOG 501.7 - Ductile Iron Pressure Pipe and Fittings.

1.03 SUBMITTALS:
Submittals shall be in accordance with the Section 01340 and shall include the following:

A. Prior to the fabrication of the pipe, submit Record Data of fabrication and laying drawings to the Owner for review of general conformance to contract documents. Record Data shall include a complete description of the pipe offered, including cuts, tabulated layout, design calculations, thrust calculations, and pertinent design data. Record Data shall incorporate any changes necessary to avoid conflicts with existing utilities and structures. Record Data shall include a pipe layout table showing pipe joints, fittings, and appurtenances, utilizing stationing, or northings and eastings matching that shown on the plans. The laying schedule shall show pipe class, class coding, station limits and transition stations for various pipe classes. Details for the design and fabrication of all fittings and specials and provisions for thrust shall be included. Submittal shall be sealed by a Licensed Professional Engineer in the State of Texas.

B. Submittal for painting exterior pipe to include recommendation for preparation, application and storage.

C. Prior to delivery of the pipe to the project site, the manufacturer shall furnish an affidavit certifying that all pipe, fittings, and specials, and other products and materials furnished, comply with this specification. If requested by the OWNER, the manufacturer shall submit certified reports of all testing.

1.04 DELIVERY AND STORAGE:

A. Delivery and Storage shall be in accordance with ANSI/AWWA C600 and AWWA M41.

PART 2 - PRODUCTS

2.01 DUCTILE IRON PIPE:

A. Pipe shall be in accordance with NCTCOG 501.7, AWWA C110, AWWA C111, AWWA C115, AWWA C150, and AWWA C151. All pipe shall meet the requirements of NSF 61.
B. Joint restraints shall be as follows:

<table>
<thead>
<tr>
<th>RESTRAINED JOINTS</th>
<th>DIP DIAMETERS 4”–12”</th>
<th>DIP DIAMETERS 16”–20”</th>
<th>DIP DIAMETERS 24”–42”</th>
<th>DIP DIAMETERS 48” &amp; LARGER</th>
</tr>
</thead>
<tbody>
<tr>
<td>VALVES</td>
<td>MECHANICAL JOINT WITH MEGALUGS</td>
<td>MECHANICAL JOINT WITH MEGALUGS</td>
<td>MJ WITH MEGALUGS OR OR RESTRAINED PUSH-ON JOINT*</td>
<td>MJ WITH MEGALUGS OR LOK–RING** JOINTS</td>
</tr>
<tr>
<td>FITTINGS</td>
<td>MECHANICAL JOINT WITH MEGALUGS</td>
<td>MECHANICAL JOINT WITH MEGALUGS</td>
<td>MJ WITH MEGALUGS OR OR RESTRAINED PUSH-ON JOINT*</td>
<td>LOK–RING** JOINTS</td>
</tr>
<tr>
<td>PIPE</td>
<td>RESTRAINED PUSH-ON JOINT*</td>
<td>RESTRAINED PUSH-ON JOINT*</td>
<td>RESTRAINED PUSH-ON JOINT*</td>
<td>RESTRAINED PUSH-ON JOINT*</td>
</tr>
</tbody>
</table>

* TR-FLEX BY US PIPE, FLEX-RING BY ACIPCO OR APPROVED EQUAL
** LOK-RING BY ACIPCO, OR APPROVED EQUAL

C. All pipe shall be cement mortar coated in accordance with ANSI/AWWA C104.

D. All buried pipe shall be polyethylene encased in accordance with AWWA C105.

E. Working pressure shall be 150 psi.

F. Test pressure shall be 150 psi:

G. As a minimum standard, the following pressure classes shall apply, except for 12-inch supply line from existing NTWMD 12-inch line to proposed supply meter vault:

<table>
<thead>
<tr>
<th>Diameter Pipe (inch)</th>
<th>Min. Pressure Class (PSI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3” through 12”</td>
<td>350 psi</td>
</tr>
<tr>
<td>14” – 20”</td>
<td>250 psi</td>
</tr>
<tr>
<td>24”</td>
<td>250 psi</td>
</tr>
<tr>
<td>30” – 64”</td>
<td>250 psi</td>
</tr>
</tbody>
</table>

H. For 12-inch water line from NTWMD line to proposed supply meter vault contractor shall use Special Thickness Class 51 pipe.

I. Ductile iron pipe shall have nominal lay lengths of 18 or 20 feet. Dimensions and tolerances of each nominal pipe size shall be in accordance with ANSI/AWWA C151/A21.

J. Pipe markings shall meet the minimum requirements of ANSI/AWWA C151/A21, latest revision. Minimum pipe markings shall be as follows:

1. “DI” or “DUCTILE” shall be cast or metal stamped on each pipe
2. Weight, pressure class, and nominal thickness of each pipe
3. Year and country pipe was cast
4. Manufacturer’s mark

J. Iron used in the manufacture of pipe for these specifications shall have:
   1. Minimum tensile strength – 60,000 psi
   2. Minimum yield strength – 42,000 psi
   3. Minimum elongation – 10%

2.02 DUCTILE IRON PIPE JOINTS:

A. Comply with ANSI/AWWA C111/A21.11, latest revision.
   1. Push-On Joints
   2. Mechanical Joints
   3. Restrained Joints

B. All rubber joint gaskets utilized on ductile-iron pipe shall be in conformance with ANSI/AWWA C111/A21.11, latest revision.

C. All buried bolts and nuts shall be 304 stainless steel. All buried T-bolts shall be 316 stainless steel. Bolts and nuts located within vaults shall be considered a buried application and shall be provided with stainless steel.

D. All non-buried bolts and nuts for mechanical joints or flanged ends shall be of a high strength corrosion resistant low-carbon steel in accordance with ANSI/AWWA C111/A21.11, ANSI/AWWA C115/A21.15, and ASTM A307, “Standard Specification for Carbon Steel Bolts and Nuts.” Bolts and nuts shall be coated with a ceramic-filled, baked on fluorocarbon resin. Coated bolts and nuts shall be prepared “near white” or “white” when coated to manufacturer’s recommended thickness by a certified applicator. Coating shall be of Xylan® as manufactured by Whitford Corporation, or approved equal. Coating shall conform to the performance requirements of ASTM B117, “Salt Spray Test” and shall include, if required, a certificate of conformance.

2.03 DUCTILE IRON PIPE COATINGS:

A. All ductile iron pipe shall have an asphaltic coating, minimum of 1 mil thick, on the pipe exterior, unless otherwise specified.

B. Pipes shall have an interior cement mortar lining applied in accordance with ANSI/AWWA C104/A21.04, or latest revision.

C. Pipe and fittings exposed to view in the finished work shall not receive the standard asphaltic coat on the outside surfaces, but shall be shop-coated with rust inhibitive primer. Primer shall have a minimum dry film thickness of 4 mils and be certified in accordance with ANSI/NSF 61.
D. All buried ductile iron pipe shall be polyethylene encased, unless otherwise specified. Encasement for buried pipe shall be 8 mil linear low density (LLD) polyethylene or 4 mil high density cross-laminated (HDCL) polyethylene encasement conforming to AWWA C105/A21.5. Polyethylene film must be marked as follows:

1. Manufacturer’s name or trademark
2. Year of manufacturer
3. ANSI/AWWA C105/A21.5
4. Minimum film thickness and material type
5. Applicable range of nominal diameter size(s).
6. Warning-Corrosion Protection-Repair Any Damage

E. For gravity sewer applications, all ductile iron pipe shall have an approved corrosion resistant coating applied to the interior. Coating shall be Protecto 401 or approved equal.

2.04 DUCTILE IRON PIPE FITTINGS:

A. Joints: Fittings shall have flanged, mechanical, restrained, push-on joints or any combination of these. Joints must be manufactured in accordance with the above referenced standards. Unless specified otherwise on the plans or in the project specifications, fittings will be provided for installation as follows:

B. Pressure Rating: Unless specified otherwise, the rated working pressures for fittings are as follows:

<table>
<thead>
<tr>
<th>Nominal Size (in)</th>
<th>Pressure Rating (PSI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3” – 24”</td>
<td>350 PSI</td>
</tr>
<tr>
<td>30” – 48”</td>
<td>250 PSI</td>
</tr>
<tr>
<td>54” – 64”</td>
<td>250 PSI</td>
</tr>
</tbody>
</table>

Ductile-Iron Full Body Fittings (AWWA C110/A21.10)

<table>
<thead>
<tr>
<th>Nominal Size (in)</th>
<th>Pressure Rating (PSI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3” – 24”</td>
<td>350 PSI</td>
</tr>
<tr>
<td>30” – 48”</td>
<td>250 PSI</td>
</tr>
</tbody>
</table>

C. Dimensions and Thickness: Fittings and joints shall conform to the thickness and dimensions shown in the various standards referenced under Section 1.02.B.

D. Flange: Unless specified otherwise, the bolt circle and the bolt-holes shall match those of ANSI B16.1 Class 125. All screwed-on flanges shall be ductile iron. Field fabrication of flanges shall be prohibited, unless approved otherwise.

E. Gland: Glands shall be manufactured of ductile iron conforming to ASTM A536. Restraining devices shall be of ductile iron. Dimensions of the gland shall be such that it can be used with the standardized joint bell and tee-head bolts conforming to ANSI/AWWA C153/A21.53.
F. Bolts and Nuts:

All buried bolts and nuts for mechanical joints or flanged ends shall be 304 stainless steel. All buried T-bolts shall be 316 stainless steel. Bolts and nuts located within vaults shall be considered a buried application and shall be provided with stainless steel.

All non-buried bolts and nuts for mechanical joints or flanged ends shall be of a high strength corrosion resistant low-alloy steel in accordance with ANSI/AWWA C111/A21.11 and ASTM A307, “Standard Specification for Carbon Steel Bolts and Nuts”. For mechanical joints, the bolts and nuts shall be coated with a ceramic-filled, baked on fluorocarbon resin. Coated bolts and nuts shall be prepared “near white” or “white” when coated to manufacturer’s recommended thickness by a certified applicator. Coating shall be Xylan®, as manufactured by Whitford Corporation, or approved equal. Coating shall conform to the performance requirements of ASTM B117, “Salt Spray Test” and shall include, if required, a certificate of conformance.

G. Accessories: Unless otherwise specified, gaskets, glands, bolts, and nuts shall be furnished with mechanical joints, and gaskets and lubricant shall be furnished with push-on joints; all in sufficient quantity for assembly of each joint.

H. Outside Coating: All ductile fittings shall have an asphaltic or fusion bonded epoxy coating. Asphaltic coatings shall be a minimum of 1 mil thickness, on the pipe exterior, unless otherwise specified. Fusion bonded exterior coatings shall comply with ANSI/AWWA C116/A21.16, shall have a minimum dry film thickness of 4 mils, and be certified in accordance with ANSI/NSF 61.

I. Interior Lining: All ductile iron fittings are to be furnished with a cement-mortar lining of standard thickness as defined in referenced ANSI/AWWA C104/A21.4 and given a seal coat of asphaltic material, unless otherwise specified. Fusion bonded interior coatings shall comply with ANSI/AWWA C116/A21.16, shall have a minimum dry film thickness of 4 mils, and be certified in accordance with ANSI/NSF 61.

J. Marking: Fitting marking shall meet the requirements of ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53 shall have distinctively cast on them the following information:

1. C-153 or C-110, depending on which type of fitting provided.
2. Pressure Rating
3. Nominal diameter of openings
4. Manufacturer’s identification
5. Country where cast
6. Number of degrees or fraction of the circle on all bends
7. Letters “DI” or “DUCTILE” cast on them.

PART 3 - EXECUTION

3.01 GENERAL:
A. Install, pipe, fittings, and appurtenances as special in accordance with AWWA M41 and AWWA C600.

B. All pipe shall be mechanically restrained at fittings and within the calculated restraint areas, as shown on plans.

C. Polyethylene encasement shall be installed in accordance with AWWA C105 and AWWA M41, Method A or B. Method C will not be allowed.

3.02 FIELD QUALITY CONTROL:

A. Purging, sterilization, and testing shall be performed in accordance with Section 01666 Hydrostatic Testing.

END OF SECTION
PART 1 - GENERAL

1.01 WORK INCLUDED:

Furnish labor, materials, equipment and incidentals necessary to install pipe casings (or carrier pipe on uncased bores) by boring, tunneling or open cut as specified. This section sets forth the requirements for utility lines crossing roadways or railroads using bore, tunneling, or open cut.

1.02 QUALITY ASSURANCE:

A. DESIGN CRITERIA:

The pipe casing (or carrier pipe on uncased bores) shall be designed for the following loading conditions and applicable combinations thereof:

a) Cooper's E-80 Railway loading or AASHTO HS20 loading as applicable
b) Earth loading with the height of fill above the casing as shown on the plans
c) Loads applied during jacking, including axial load from jacking
d) All other applicable loading conditions, including loads applied during transportation and handling.

B. INSTALLER'S QUALIFICATIONS:

Installation shall be by a competent, experienced contractor or sub-contractor. The installation contractor shall have a satisfactory experience record of at least three (3) years engaged in similar work of equal scope.

All welding shall be performed by a certified welder in the state of Texas.

C. PERFORMANCE REQUIREMENTS:

Lateral or vertical variation in the final position of the pipe casing (or carrier pipe on uncased bores) from the line and grade established by the engineer shall be permitted only to the extent of 1" in 50' feet, provided that such variation shall be regular and only in the direction that will not detrimentally affect the function of the carrier pipe.

1.03 SUBMITTALS:

Submittals shall include:

1. Shop drawings of the casing pipe (or carrier pipe for uncased bores) from the manufacturer. Shop drawings shall include calculations for the design of the casing pipe (or carrier pipe for uncased bores) by a Licensed Professional Engineer.

2. Provide Certificate of Adequacy of Design of casing and/or carrier pipe.
3. Provide record data of casing insulators including sketches of insulators with material components and dimensions and proposed locations of insulators.

4. Provide Pressure Grout material and method.

1.04 STANDARDS:

- AWWA C-206 "Field Welding of Steel Water Pipe"
- AWWA C-210 "Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines"
- ASTM A-36 "Structural Steel"
- ASTM A-135 "Electric - Resistance - Welded Steel Pipe"
- ASTM A-139 "Electric - Fusion (Arc) - Welded Steel Pipe"
- ASTM A-569 "Steel, Carbon, Hot-Rolled Sheet and Strip, Commercial Quality"
- ASTM A-570 "Hot Rolled Carbon Steel Sheet and Strip, Structural Quality"
- ASTM C-76 "Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe"

1.05 JOB CONDITIONS, PERMITS AND EASEMENT REQUIREMENTS:

A. Where the work is in the public right-of-way or railroad company right-of-way, the OWNER will secure the appropriate permits or easements. The CONTRACTOR shall observe regulations and instructions of the right-of-way Owner as to the methods of performing the work and take precautions for safety of property and the public. Negotiations and coordination with the right-of-way Owner shall be carried on by the CONTRACTOR, not less than five (5) days prior to the time of his intentions to begin work on the right-of-way.

B. Comply with the requirements of the permit and/or easement. If required by the Right-of-Way Owner, obtain Protective Liability Insurance in the amount required by the particular company or other insurance as is specified in the permit at no additional cost to the OWNER. Acquire a permit, agreement, or work order from the right-of-way Owner as is required.

C. Construction along roads and railroads shall be performed in such manner that the excavated material be kept off the roads and railroads at all times, as well as, all operating equipment. Construction shall not interfere with the operations of the roads and railroads.

D. Barricades, warning signs, and flagmen, when necessary and specified, shall be provided by the CONTRACTOR.
E. No blasting shall be allowed. Existing pipelines are to be protected. The CONTRACTOR shall
determine and verify the location and elevation of any pipelines, utility lines, fiberoptics,
telephone cable, etc. before proceeding with the construction. The CONTRACTOR shall plan his
construction so as to avoid damage to the existing pipelines, utility lines, fiberoptic telephone
cables, etc. Determining the location of existing utilities shall be the complete responsibility of
the CONTRACTOR.

1.06 OPTIONS:

A. CASING MATERIAL AND UNCASED BORES:

Casing material shall be welded steel casing only.

The material specification for casing and carrier pipe are the minimum acceptable. The
CONTRACTOR shall be fully responsible to insure the materials used are of sufficient strength
for the installation method chosen and the soil conditions encountered.

B. BORE AND TUNNEL METHODS:

Unless specified otherwise, the CONTRACTOR may use boring, jacking, or tunneling for the
installation method of casing or uncased carrier pipe. Wet bore methods are not acceptable. The
CONTRACTOR shall be fully responsible to insure the methods used are adequate for the
protection of workers, pipe, property, and the public. CONTRACTOR shall comply with the
requirements of the DOT, the railroad companies and other Owners of right-of-way. Provide a
finished product as required.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. GENERAL:

The diameter for the casing pipe is a minimum diameter.

B. STEEL PIPE:

Steel casing pipe shall be new (or used if approved by the Owner) and suitable for the purpose
intended and shall have a minimum yield strength of 35,000 psi. Casing shall meet ASTM A-36,
ASTM A-570, ASTM A-135, ASTM A-139, or approved equal. Pipe shall be coated with coal tar
epoxy (15 mils min.) in accordance with AWWA C-210. Pipe joints shall be welded in
accordance with AWWA C-206. After pipe is welded, coating shall be repaired. Unless specified
otherwise, the minimum wall thickness of steel casing pipe shall be as follows:

<table>
<thead>
<tr>
<th>Casing Diameter</th>
<th>Min. Wall Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>42&quot; OD or ID</td>
<td>0.5625&quot;</td>
</tr>
</tbody>
</table>
2.02 MIXES:

A. CEMENT MORTAR:

Cement mortar shall consist of one (1) part cement to two (2) parts clean sand with sufficient water to make a thick, workable mix.

B. PRESSURE GROUT MIX:

Grout shall be comprised of 1 cubic foot of cement and 3.5 cubic feet of clean fine sand with sufficient water added to provide a free flowing thick slurry. If desired to maintain solids in the mixture in suspension, one cubic foot of commercial grade bentonite may be added to each twelve to fifteen cubic feet of the slurry.

2.03 MANUFACTURED PRODUCTS:

A. CASING INSULATORS (CHOCKS):

Use casing insulators for any type of carrier pipe. Insulators shall be high density polyethylene. Insulators shall fit snug over the carrier pipe and position the carrier pipe approximately in the center of the casing pipe to provide adequate clearance between the carrier pipe bell and the casing pipe. Insulators shall be manufactured by "Recon" and be Racci Type or approved equal.

PART 3 - EXECUTION

3.01 GENERAL CONSTRUCTION PROCEDURES:

A. EXCAVATION AND BACKFILL OF ACCESS PITS:

1. Do not allow excavation over the limits of the bore or tunnel as specified. Trench walls of access pits adjacent to the bore or tunnel face shall be truly vertical. Shore the trench walls as necessary to protect workmen, the public, structures, roadways, and other improvements.

2. Excavations within the right-of-way and not under surfacing shall be backfilled and consolidated by mechanical methods as specified for compaction of trenches under roadways. Surplus material shall be removed from the right-of-way and the excavation finished to original grades. Backfill pits immediately after the installation of the carrier pipe is completed. If carrier pipe is not installed immediately after casing pipe installation, the right-of-way Owner may require the access pits be temporarily backfilled until installation of carrier pipe.

3. Where seeding or sodding is disturbed by excavation or backfilling operations, such areas shall be replaced by seeding or sodding as specified elsewhere.
B. INSTALLING CARRIER PIPE IN CASINGS:

1. Pipe to be installed within the casing shall meet the requirements for this type of pipe as specified. Where indicated, place, align, and anchor guide rails, wooden skids, and/or casing insulators inside the casing. If guide rails are used, place cement mortar on both sides of the rails. If mortar "brush coat" bands are used to protect pipe bell, follow pipe manufacturer's directions for installation of pipe in casing. Weld each joint and pour exterior joint wrapper full of grout before pushing pipe into casing. Stretch, form or in some other way protect the grouted joint wrappers from damage during installation of pipe in casing.

2. Push, pull or skid pipe into place inside the casing. Lubricants such as flax soap or drilling mud may be used to ease pipe installation. Do not use petroleum products, oil or grease for this purpose. If guide rails are used, install pipe and hold down jacks after installation of carrier pipe.

3. After installation of the carrier pipe, mortar inside and outside of the joints as applicable.

4. Contractor shall make positive provisions to prevent carrier pipe floatation by means of casing spacers or chocks or wooden skids strapped to the pipe as shown in the plans as applicable.

5. After carrier pipe installation is complete, seal or plug the ends of the casing.

C. FREE-AIR SYSTEM:

If required by OSHA standards, free-air systems shall be installed and maintained.

D. INSTALLATION OF PRESSURE GROUT MIX:

1. Install pressure grout mix in the void space between the outside of the casing pipe and the excavation. For bored or jacked casing pipe, install pressure grout mix immediately upon completion of setting casing pipe.

2. Unless specified otherwise, install pressure grouting through grout fittings for the casing pipe. Grout fittings shall be fabricated into casing pipe at a maximum spacing of 6'. Remove and plug grout fittings after pressure grouting.

3. Install pressure grout from the low end for all crossings where grout fittings are not used. Seal the low end and pressure grout until grout is extruded from the opposite end.

3.03 CROSSINGS INSTALLED BY BORING:

A. Perform the boring from the low or downstream end unless specified otherwise. Bore the holes mechanically using a pilot hole. By this method, an approximate 2" pilot hole shall be bored the entire length of the crossing and shall be checked for line and grade. This pilot hole shall serve as the centerline of the larger diameter hole to be bored. Place excavated material near the top of the
working pit and dispose of material as required. The use of water or other fluids in connection with the boring operation will be permitted only to the extent to lubricate cuttings. Jetting shall not be permitted.

B. In unconsolidated soil formations, a gel-forming colloidal drilling fluid consisting of at least 10% of high grade carefully processed bentonite may be used to consolidate cuttings of the bit, seal the walls of the hole, and furnish lubrication for subsequent removal of cuttings and installation of the pipe immediately thereafter.

C. In locations where the soil formation is other than consolidated rock, insert the casing pipe simultaneously with the boring operation. This requirement applies to all bored holes of 18" or greater in diameter. For smaller diameter bored holes, it is desirable that the casing be installed as the boring progresses, but because of differences in soil formations, the time for inserting the casing shall be the CONTRACTOR'S responsibility. In the event that caving sand or water bearing materials are encountered, insert the casing pipe simultaneously with the boring operation regardless of the diameter of the bored hole. In all cases, the security and integrity of the roadway is the primary concern. The CONTRACTOR shall be held fully responsible for the continued integrity of the structure of the roadway being crossed, whether or not a casing pipe is inserted simultaneously with the boring operation.

3.04 CROSSINGS INSTALLED BY TUNNELING AND JACKING:

A. Jack the pipe from the low or downstream end, unless specified otherwise. Provide heavy duty jacks suitable for forcing the pipe through the embankment. In operating jacks, apply even pressure to the jacks used. Provide a suitable jacking head and bracing between jacks so that pressure will be applied to the pipe uniformly around the ring of the pipe. Provide a suitable jacking frame or back stop. Set the pipe to be jacked on guides, properly braced together, to support the section of the pipe and to direct it in the proper line and grade. Place the whole jacking assembly so as to line up with the direction and grade of the pipe. In general, excavate embankment material just ahead of the pipe and material removed through the pipe. Force the pipe through the embankment with jacks into the space provided.

B. The excavation for the underside of the pipe, for at least one third (1/3) of the circumference of the pipe, shall conform to the contour and grade of the pipe. Provide a clearance of not more than 2" for the upper half of the pipe. This clearance is to be tapered off to zero at the point where the excavation conforms to the contour of the pipe. Extend the distance of the excavation beyond the end of the pipe depending on the character of the material, but do not exceed 2' in any case. Decrease the distance if the character of the material being excavated makes it desirable to keep the advance excavation closer to the end of the pipe.

C. If the CONTRACTOR desires, he may use a cutting edge of steel plate around the head end of the pipe extending a short distance beyond the end of the pipe with inside angles or lugs to keep the cutting edge from slipping back onto pipe.
D. When jacking of pipe has begun, carry on the operation without interruption to prevent the pipe from becoming firmly set in the embankment. Remove and replace any pipe damaged in the jacking operations. The CONTRACTOR shall absorb the entire expense.

END OF SECTION
PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required to completely install and put into operation resilient seated gate valves and actuator as specified herein and shown on the drawings.

1.02 QUALITY ASSURANCE

A. References:

1. American Water Works Association (AWWA)
   AWWA C509 Resilient seated gate valve for water supply service.
   AWWA C515 Reduced wall resilient seated gate valves for water supply service.

   ASTM A48 Gray Iron Castings
   ASTM A126 Gray Iron Castings for Valves, Flanges, and Pipe Fittings
   ASTM A436 Austenitic Gray Iron Castings
   ASTM A536 Ductile Iron Castings.

B. Unit Responsibility and Coordination:

The Contractor shall cause all equipment specified under this section to be furnished by the valve manufacturer who shall be responsible for the adequacy and compatibility of all valve components including the actuator. Any component of each complete unit not provided by the valve manufacturer shall be designed, fabricated, testing, and installed by factory-authorized representatives experienced in the design and manufacture of the valve equipment. This requirement, however, shall not be construed as relieving the Contractor of the overall responsibility for this portion of the work.

1.03 ENVIRONMENTAL CONDITIONS

The equipment to be provided under this section shall be suitable for installation and operation either inside vault structure or directly buried for a gate valve only.

1.04 SUBMITTALS

A. Submittals required after award of contract and prior to installation:

1. Technical bulletins and brochures on resilient seated gate valves.

B. Submittals required prior to final walk through:

1.05 SPARE PARTS AND TOOLS

A. Furnish one set of special tools required for the proper servicing of all equipment supplied under these Specifications, packed in a suitable steel tool chest with a lock.

1.06 SHIPPING INSTRUCTIONS

A. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.

B. All equipment and parts must be properly protected against any damage during a prolonged period at the site.

C. The finished surfaces of all exposed flanges shall be protected by wooden blank flanges, strongly built and securely bolted thereto.

D. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

E. Storage and Protection: Take special care to prevent plastic and similar brittle items from being directly exposed to the sun, or exposed to extremes in temperature, preventing any deformation.

1.07 WARRANTY

A. The equipment shall be warranted to be free from defects in workmanship, design and materials. If any part of the equipment should fail during the warranty period, it shall be replaced and the unit(s) restored to service at no expense to the Owner. Warranty shall be for a period of two years and begin on the Date of Final Acceptance.

PART 2 - PRODUCTS

2.01 RESILIENT SEATED GATE VALVES

A. Resilient seated gate valves through 36" shall meet or exceed the latest revisions of AWWA C509 or AWWA C515 and shall meet or exceed the requirements of this specification. All valve components in contact with potable water shall conform to the requirements of ANSI/NSF Standard 61. All valve materials for components in contact with potable water shall be resistant to chloramines.

B. Valve body shall be ductile iron per ASTM A536. Flanged ends shall be furnished in accordance with ANSI/AWWA C115/A21.15. Standard Flanged Drilling. Mechanical Joints shall be furnished with outlets which conform to ANSI/AWWA C111/A21.11 mechanical joint requirements.

C. The disc shall be constructed of ductile iron fully encapsulated in rubber. No iron shall be exposed on the disc.
D. Hex head bolt, and hex nut shall be Steel ASTM A307 Gr. B, Zinc Plate per ASTM B633, SC3 for non-buried service (4" through 12" valves). Hex head bolt and hex nut shall be 316 Stainless Steel for buried service (all sizes) and for valves 16-inch through 30-inch (non-buried service).

E. For non-buried service T-Bolts shall be high strength low alloy Cor-Ten or approved equal. For buried service T-Bolts shall be 316 stainless steel.

F. Resilient seated gate valves shall be American Flow Control, Mueller or equal for size 4" through 36".

G. Gate valves in buried service shall be provided with polyethylene encasement in accordance with AWWA C105.

H. Resilient seated gate valves for buried service shall be furnished with a square 2" operating nut. The valve box shall be Tyler Pipe 6850 series or Engineer approved equal.

I. In all non-buried service, handwheel operators shall be furnished, unless otherwise specified.

J. Resilient seated gate valves shall be non-rising stem type unless otherwise specified.

K. 24" and larger resilient seated gate valves shall be furnished with gear reduction, 20” gate valves shall not have gearing.

PART 3 - EXECUTION

3.01. INSTALLATION

A. All resilient seated gate valves shall be installed in accordance with the instructions of the manufacturer and as shown on the drawings.

END OF SECTION
PART 1 - GENERAL

1.01 SCOPE OF WORK:

A. Furnish all labor, materials, equipment and incidentals required to completely install and put into operation, AWWA butterfly valves for buried and plant applications as specified herein and shown on the drawings.

1.02 REFERENCES:

A. American Water Works Association (AWWA).

AWWA A-C504 Rubber Seated Butterfly Valves


ASTM A48 Gray Iron Castings.
ASTM A436 Austenitic Gray Iron Casting.
ASTM A536 Ductile Iron Casings.

1.03 SYSTEM DESCRIPTION

A. The arrangement shown on the drawings is based upon the best information available to the Engineer at the time of design and is not intended to show exact dimensions to any specific equipment unless otherwise shown or specified. Therefore, it may be anticipated that the structural supports, foundations, and connected piping shown, in part of in whole, may have to be changed in order to accommodate the equipment furnished. No additional payment will be made for such changes. All necessary calculations and drawings for any related redesign shall be submitted to the Engineer for his approval prior to beginning the work.

B. The valve shall be designed to operate with the following working conditions without damage to the valve.

<table>
<thead>
<tr>
<th>Valve Application Description</th>
<th>Min. Acceptable Valve Class</th>
<th>Max. Non-Shock Line Pressure</th>
<th>Normal Flow Range (gpm)</th>
<th>Maximum Flow (gpm)</th>
<th>Test Pressure</th>
<th>Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>24” Water Line</td>
<td>150B</td>
<td>150 psi</td>
<td>500 – 8,000</td>
<td>10,000</td>
<td>150 psi</td>
<td>Tank Pedestal</td>
</tr>
<tr>
<td>16” Water Line</td>
<td>150B</td>
<td>150 psi</td>
<td>500 – 8,000</td>
<td>10,000</td>
<td>150 psi</td>
<td>Tank Pedestal</td>
</tr>
</tbody>
</table>
C. The Butterfly valves shall operate satisfactorily over the complete operating range shown. The equipment to be provided under this section shall be suitable for installation and operation at elevations for about 650 feet above sea level inside weather-protected structures and in buried service. Outside ambient temperatures range between 10 and 110 degrees F, and reported water temperatures vary between 50 and 105 degrees F. relative humidity is expected to range between 5 and 100 percent.

1.04 QUALITY ASSURANCE

A. The valve shall be the product of a manufacturer regularly engaged in the manufacture of Butterfly valves having similar service and size. The valves covered by the specifications are intended to be standard equipment of that has proven ability. The following manufacturers and models are acceptable.

   **Manufacturer**
   DeZurik
   Pratt
   Crispin K-Flo

B. All other valves will be considered a substitution, and will be required to submit a substitution form as specified in Section 01630. The Engineer shall be the sole judge of the acceptability of any substitution requested. If the substitution request is found to be unacceptable by the Engineer then the contractor shall provide the listed equipment at no additional expense to the owner. The Contractor shall be responsible for any delays as a result of a substitution request.

C. The listing above does not imply that the valve or the manufacturer’s standard product is acceptable. The successful manufacturer will be required to conform to all specifications.

D. Unit Responsibility and Coordination:

   The Contractor shall cause all equipment specified under this section to be furnished by the valve manufacturer who shall be responsible for the adequacy and compatibility of all unit components including but not limited to the valve, actuator and extension stems.

   Any component of each complete unit not provided by the valve manufacturer shall be designed, fabricated, tested, and installed by factory-authorized representatives experienced in the design and manufacture of the equipment. This requirement, however, shall not be construed as relieving the Contractor of the overall responsibility for this portion of the work.

1.05 SUBMITTALS:

A. Submittals required after award of contract and prior to shipping.

1. Technical bulletins and brochures on butterfly valves.

2. Certification of compliance with the specifications.
B. Submittals required prior to final walk through:


1.06 SPARE PARTS AND TOOLS:

A. None Required.

1.07 SHIPPING INSTRUCTIONS:

A. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.

B. All equipment and parts must be properly protected against any damage during a prolonged period at the site.

C. The finished surfaces of all exposed flanges shall be protected by wooden blank flanges, strongly built and securely bolted thereto.

D. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

E. Storage and Protection: Take special care to prevent plastic and similar brittle items from being directly exposed to the sun, or exposed to extremes in temperature, preventing any deformation.

1.08 WARRANTY:

A. The equipment shall be warranted to be free from defects in workmanship, design and materials. If any part of the equipment should fail during the warranty period, it shall be replaced and the unit(s) restored to service at no expense to the Owner. Warranty shall be for a period of two years and begin on the Date of Final Acceptance.

PART 2 - PRODUCTS

2.01 16” – 36” BUTTERFLY VALVES:

A. Butterfly valves shall be in general conformance the latest revision of AWWA Standard C504 butterfly valves and shall meet or exceed the requirements of this specification. All valve components in contact with potable water shall conform to the requirements of ANSI/NSF Standard 61.
B. Valve bodies shall be of ductile iron per ASTM A536 Grade 65-45-12 or fabricated steel ASTM A36. Flange end valves shall be of the short body design with Class 125 Standard flanged ends faced and drilled per ANSI B16.1 standard for cast iron flanges. Flanges shall be designed for the test pressure of the valve. Mechanical joint end valves shall meet the requirements of AWWA C111/ANSI 21.11. Flanged ends shall be provided for plant service or when joined to steel pipe or concrete pressure pipe bar wrapped steel cylinder type. Buried service with ductile iron pipe shall be mechanical joint.

C. Discs shall be ductile iron. The disc seating edge shall be solid 316 stainless steel. The disc shall be securely attached to the valve shaft.

D. Valve shaft shall be type 304 stainless steel. Valve shaft seals shall be self-compensating V-type packing with a minimum of 4 sealing rings.

E. The seat shall be a Buna-N for water and shall be molded in and bonded to the valve body for 16”-24” valves. The seat shall either be bonded or bolted to the valve body. Seats on the disc are not acceptable. The seat shall contain an integral shaft seal protecting the valve bearings and packing from any line debris.

F. Valve shaft bearings shall be non-metallic and permanently lubricated.

G. Unless otherwise specified, exterior and interior metallic surfaces of each valve shall be shop painted per the latest revision of AWWA C504.

H. Painting and Coatings: All surfaces of the valve shall be clean, dry and free from grease before applying paint or coating. The valve interior and exterior surfaces, except for the seating surfaces, shall be provided with the manufacturer’s standard coating or as specified by contract. All internal exposed surfaces that are susceptible to corrosion shall be coated with a Polyamide cured, rust inhibiting epoxy. Surfaces to be coated shall be prepared and sand-blasted per Steel Structures Painting Council Specification SSPC-SP-10-638 No. 10. Final coating thickness shall be 16 mils minimum. All surfaces shall be inspected for proper dry film thickness using a magnetic dry film thickness gauge. Tests for invisible holidays shall be conducted using a low voltage, wet sponge holiday or leak detector.

2.02 MANUAL ACTUATORS:

A. Valves shall be provided with manual actuators unless otherwise specified or indicated on the plans.

B. Manual actuators shall be fully greased, packed and have stops in the open and closed position. The actuator shall have a mechanical stop which will withstand an input torque of 450 ft. lbs. against the stop. The actuator shall have a built in packing leak bypass to eliminate possible packing leakage into the actuator housing.

C. Butterfly valves for buried service shall be furnished with a 2” operating nut. The actuator shall be placed in a vault as indicated on the plans and have extension to the top of the vault.
D. Butterfly valves for plant service shall be provided with a 16” minimum diameter handwheel operator. A position indicator shall be provided. Handwheels shall be painted red.

E. Buried butterfly valves shall be contained within a vault as shown on the plans.

F. Butterfly valves within vaults shall be provided with extension bonnets such that the body is not within the vault wall.

G. A position indicator shall be provided.

H. Actuator shall be worm-gear type, as follows:

1) Worm gear manual operator shall comply fully with AWWA C-504, latest edition.

2) Worm gear drive sleeve and worm shaft shall be of solid, one-piece design; bolted segments or pinned worms will not be acceptable. Drive sleeve shall include an integral spline to accept a removable bottom-entry spline bushing for valve shaft connection.

3) If required for torque purposes, spur gear reducers may be provided for increased torque outputs and to reduce handwheel diameter.

4) Worm gear operator shall include handwheel with maximum 80# rim pull.

5) Materials of Construction:

   Housing: Ductile Iron
   Drive sleeve: Bronze
   Worm: Alloy steel with splined input drive connection
   Bearings: Heavy duty tapered roller bearings
   Finish: Thermostatically Applied Polyester Powdercoat
   Fasteners: Stainless steel

6) Manual gears shall be capable of being field retrofit with an electric motor operator in the future without major modifications. With spur gear removed, splined worm gear input shaft and motor adapter flange shall be easily added to accept a multi-turn “torque-only” electric valve actuator. Supplier shall include the Number of Turns required to complete on Open-to-Close stroke in the Equipment Submittal.

7) Worm gear operators shall be EIM Type WO for non-buried applications or Type WB for direct-buried applications or Engineer pre-Approved Equal.
PART 3 - EXECUTION

3.01. INSTALLATION

A. All butterfly valves shall be installed in accordance with the instructions of the manufacturer and as shown on the drawings.

B. Installation and adjustment shall be checked and approved by a manufacturer’s factory representative. After acceptance, the representative shall address a letter to the Engineer outlining all installation and start up procedures. The letter shall include statement that the valves are installed per the manufacturer’s recommendations. The manufacturer or his qualified representative shall conduct training session for the Owner’s personnel in the operation and maintenance of the valve.

END OF SECTION
PART 1 - GENERAL

1.01 SCOPE OF WORK:

A. Furnish all labor, materials, equipment and incidentals required to completely install and put into service expansion joints, couplings, and tapping sleeves as specified herein and shown on the drawings.

1.02 QUALITY ASSURANCE:

A. References:

   ASTM A283 - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel
   ASTM A285 - Standard Specification for Pressure Vessel Plates, Carbon Steel Low and Intermediate Tensile Strength
   AWWA 219 - Bolted, Sleeve-Type Couplings for Plain End Pipe
   ANSI/NSF Standard 61 - Drinking Water System Components

1.03 SUBMITTALS:

A. Submittals required after award of contract and prior to installation:

   1. Technical bulletins and brochures on expansion joints, couplings, and tapping sleeves.

1.04 SHIPPING INSTRUCTIONS:

A. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.

B. All equipment and parts must be properly protected against any damage during a prolonged period at the site.

C. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

D. Storage and Protection: Take special care to prevent plastic and similar brittle items from being directly exposed to the sun, or exposed to extremes in temperature, preventing any deformation.

1.05 WARRANTY:

A. The equipment shall be warranted to be free from defects in workmanship, design and materials. If any part of the equipment should fail during the warranty period, it shall be replaced and the unit(s) restored to service at no expense to the Owner. Warranty shall be for a period of two years and begin on the Date of Final Acceptance.
PART 2 - PRODUCTS

2.01 EXPANSION JOINTS

A. Expansion joints shall meet or exceed the following design criteria:
   1. Working pressure = 150 psi
   2. Test pressure = 225 psi
   3. Coating requirement = fusion bonded epoxy powder coating, or equal
   4. Expansion length shall range from 5 to 10-inches
   5. Slip pipe shall be stainless steel

B. Expansion joint installed on ground storage tank inlet pipe shall be single end Smith-Blair series 611 or approved equal. Joint diameter shall be the same as adjoining pipe shown on plans.

C. The expansion joint shall be tied to the line and supported as shown on the plans.

D. Provide slip pipe, limit rods, gland bolts, washers and nuts and install according to the manufacturer’s recommendations.

E. Fusion bonded epoxy coatings, or approved equal are required where specified. Final coatings shall be field applied as required by the painting specifications.

2.02 STEEL COUPLINGS

A. Bolted steel couplings shall meet or exceed the following design criteria:
   1. Working pressure = 150 psi
   2. Test pressure = 225 psi
   3. Coating requirement = fusion bonded epoxy powder coating, or equal
   4. Sleeve length = 14-inches (unless specified)
   5. Steel couplings shall be manufactured by Smith-Blair

B. Provide control rods, control rod plates, washers and bolts and install according to the plans and manufacturer’s recommendations. Anchor studs are not allowed for restraint.

C. Apply paint to steel couplings as required for adjoining pipe.

D. Fusion bonded epoxy coatings, or approved equal are required where specified. Final coatings shall be field applied as required by the painting specifications.
2.03 TAPPING SLEEVES

A. Tapping sleeves shall meet or exceed the following design criteria:

1. Working pressure = 150 psi

2. Test pressure = 225 psi

3. Coating requirement = fusion bonded epoxy powder coating with an average thickness of 12 mils

4. Bolts and nuts shall be type 304 stainless steel

5. Gaskets shall be Grade 60 (Nitrile ASTM D2000)

6. Body shall be 3/8” Carbon steel ASTM 285 Grade A PVQ

7. Flanges shall be AWWA C207 class D, ANSI B16.1 class 125 drilling, recessed to accept standard tapping valves

B. Tapping sleeves shall be Smith–Blair Series 622 or approved equal.

C. Fusion bonded epoxy coatings, or approved equal are required where specified. Final coatings shall be field applied as required by the painting specifications.

2.04 FLANGE COUPLING ADAPTERS

A. Flange coupling adapters shall meet or exceed the following design criteria:

1. Working pressure = 150 psi

2. Test pressure = 225 psi

3. Coating requirement = fusion bonded epoxy powder coating with an average thickness of 12 mils

4. Bolts and nuts shall be type 304 stainless steel

5. Gaskets shall be Grade 30 standard

6. Body shall be ductile iron ASTM A536

7. Flanges shall be AWWA C207 class D, ANSI B16.1 class 125 drilling

B. Flange coupling adapters shall be Smith–Blair Series 913 or approved equal.

C. Fusion bonded epoxy coatings, or approved equal are required where specified. Final coatings shall be field applied as required by the painting specifications.
PART 3 - EXECUTION

3.01. All tapping sleeves, expansion joints, and couplings shall be installed in accordance with the instructions of the manufacturer and as shown on the drawings.

3.02. Testing: All tapping sleeves, expansion joints, and couplings shall be pressure tested as a part of the pipe.

END OF SECTION
PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required to completely install and put into operation, fire hydrant assemblies as specified herein and shown on the drawings.

1.02 QUALITY ASSURANCE

A. Reference Standards:

1. American Water Works Association (AWWA)

   AWWA C-502, Dry-Barrel Fire Hydrants
   AWWA M-17, Installation, Field Testing, and Maintenance of Fire Hydrants
   AWWA C-600, Installation of Ductile-Iron Water Mains and Their Appurtenances

1.03 SUBMITTALS

A. Submittals required after award of contract and prior to installation:

   1. Technical bulletins and brochures on fire hydrants.

B. Submittals required prior to final walk through:

   1. Operation and Maintenance Manuals.

1.04 SHIPPING INSTRUCTIONS

A. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.

B. All equipment and parts must be properly protected against any damage during a prolonged period at the site.

C. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

D. Storage and Protection: Take special care to prevent plastic and similar brittle items from being directly exposed to the sun, or exposed to extremes in temperature, preventing any deformation.

1.05 WARRANTY

A. The equipment shall be warranted to be free from defects in workmanship, design and materials. If any part of the equipment should fail during the warranty period, it shall be replaced and the unit(s) restored to service at no expense to the Owner. Warranty shall be for a period of two years and begin on the Date of Final Acceptance.
PART 2 – PRODUCTS

2.01. Materials

A. Fire hydrants shall be manufactured in accordance with AWWA C-502, Dry-Barrel Fire Hydrants.

B. Hydrants shall be manufactured such that all maintenance and adjustments can be performed without excavation and such that hydrants may be faced in any direction in relation to base.

C. Each fire hydrant shall have one (1) 4 1/2" pumper connection and two (2) 2 1/2" hose connections. Threads for hose connections shall be National Standard Threads. The hydrant shall open counter clockwise.

2. Painting

1. The fire hydrant bonnet shall be painted in accordance with the water line size that the fire hydrant lead is connected. The following colors are in accordance with Federal Standard 595.

<table>
<thead>
<tr>
<th>Water Line Size</th>
<th>Federal Standard 595</th>
</tr>
</thead>
<tbody>
<tr>
<td>6&quot; Line</td>
<td>Safety Red #11120</td>
</tr>
<tr>
<td>8&quot; Line</td>
<td>Safety Blue #15092</td>
</tr>
<tr>
<td>12&quot; Line or larger</td>
<td>Safety Green #14193</td>
</tr>
</tbody>
</table>

2. The fire hydrant body shall be painted high gloss alkyd aluminum (silver) #17173.

2.02. Manufacturers

A. Approved fire hydrants manufacturers are as follows:

1. Mueller (Super Centerion 200)
2. American Darling (B-84-B)
3. Clow (Medallion)

B. Approved paint manufacturers are as follows:

1. Glidden (ICI Dulux); alkyd industrial series 4308, primer series 4160
2. Tnemec; series 4338, primer series 4
3. Sherwin Williams

C. All other fire hydrants will be considered a substitution, and will be required to submit a substitution request. The Engineer shall be the sole judge of the acceptability of any substitution requested. If the substitution request is found to be unacceptable by the Engineer then the contractor shall provide the listed equipment at no additional expense to the owner. The Contractor shall be responsible for any delays as a result of a substitution request.
D. The listing above does not imply that the manufacturer’s standard product is acceptable. The successful manufacturer will be required to conform to all specifications.

PART 3 - EXECUTION

3.01. General

A. All fire hydrants shall be installed in accordance with the instructions of the manufacturer and as shown on the drawings.

B. Installation, field testing and maintenance shall be in accordance with AWWA M-17. The use of a 90° anchor or flange fitting shall be required unless otherwise approved by the Town Engineer.

C. Fire hydrants shall have a maximum buried depth of 7 feet including extension.

3.02. Location Markers

A. The location marker shall be placed in the center of the roadway opposite to the fire hydrant.

B. The installation of this reflector shall be in accordance with the manufacturer's recommendation.

C. Location markers shall be Stemsonite 1-88-55A or approved equal.

D. If placing markers within TxDOT right-of-way, the Contractor shall coordinate with Town of Flower Mound and TxDOT officials for proper placement.

END OF SECTION
PART 1 – GENERAL

1.01 Scope of Work:

Provide all labor, materials, equipment and incidentals required to prepare planting beds and install landscape planting in accordance with the plans and as specified.

1.02 Related Work Specified Elsewhere:

A. Section 02936 – Seeding of Lawns and Disturbed Areas

1.03 General Requirements:

A. Finish Grade: The Contractor will perform the fine grading and amend the soil as required by these specifications. The Contractor is responsible for any trees/shrubs that are planted prior to achieving final grade.

B. Comply with applicable Federal, State, County and local codes, ordinances and regulations governing landscape materials and work.

C. The work shall be coordinated with other trades to prevent conflicts.

D. All planting shall be performed by personnel familiar with planting procedures and under the supervision of a qualified landscape foreman.

E. Prior to the preparation of planting areas and plant pits, ascertain the location of all landscape underdrain trenches, electrical cable, conduits, utility lines, oil tanks, supply lines and other subsurface structures, so that proper precautions may be taken not to disturb or damage any of these elements or improvements.

F. Prior to bidding, the Contractor shall visit the site and ascertain all site conditions, including utilities, slopes, access and available work space to preclude any misunderstandings and ensure a trouble-free installation. It shall be the Contractor’s responsibility to avoid conflicts with existing underground and overhead utilities. The contractor shall notify all utilities servicing the work area at least 48 hours prior to any excavation so that underground utilities may be located.

G. Prior to commencing with planting of trees, obtain the Engineer’s approval of soil amendments and backfill soil; rototill to a minimum depth of 12” all areas that have been mechanically compacted 90% to 95% for construction purposes.

H. The Contractor shall take all necessary precautions to avoid damage to any building, building structure, or waterproofing while working adjacent to fixed buildings, walls, or other structures. The use of mechanical equipment within five (5) feet of any building or existing structure to move plants or materials shall be approved by the Engineer prior to its use. The Contractor shall be responsible for all damages to the subsurface utilities, buildings, or building footings caused by his operations.
1.04 Applicable Documents:

A. Plants:

1. Nomenclature: Shall conform to the names given in “Standardized Plant Names”, 1942 Editions, prepared by the American Joint Committee on Horticultural Nomenclature.

2. Names of varieties not included therein shall conform generally with names accepted in the nursery trade.

3. Substitutions will be permitted only upon submission of proof that any specified plant is not obtainable or suitable for the location as specified on the plan and upon written authorization of the City.

1.05 Quality Control:

A. Plants shall have a habit of growth that is normal for the species and shall be sound, healthy, vigorous and free from insect pest, fungi plant diseases and injuries.

B. Trees shall be heavily branched. All trees shall have a dominant leader and no crossing branches.

C. Plant material shall meet the standards outlined in the publication “The American Standard for Nursery Stock”.

D. The Engineer shall have the right, at any stage of the operations, to reject any and all work and materials, which, in their opinion do no meet the requirements of these specifications or aesthetically do not comply with design intent. Trees that are scarred or damaged during delivery or off loading will be rejected.

1.06 Certificate of Inspection:

A. All required inspection certificates shall accompany the bill of laden or invoices. Required transportation documents are to be submitted with invoices as back-up.

1.07 Soil Testing and Analysis:

A. The Landscape Contractor is required to take representative samples of the site soils.

B. Submit all samples to an independent testing laboratory for analysis. Test for soil pH, salts, magnesium, calcium, phosphorus, and potash. Report from laboratory will identify nutrient deficiencies and recommendations to correct the deficiencies and to adjust pH to comply with the specifications. Submittal of the Contractor’s fertilizer program for the maintenance period is required prior to acceptance.
1.08 Measurements:

A. The minimum acceptable size of all plants measured after pruning, with branches in normal positions, shall conform to the measurements as shown on landscape plans and conform to the grades and standards established by the “American Standard for Nursery Stock”.

B. Substantial deviations from these measurements must be approved by the Engineer.

C. The caliper of tree trunks is to be taken twelve inches above the ground level.

1.09 Shipment and Delivery:

A. Plant materials shall be protected from weather and adequately packed to prevent breakage and drying during transit.

B. The Engineer may exercise its option to inspect, select and assist the Contractor with the tagging of plant materials at the nursery.

C. Legible tags will be attached to at least one plant of each species. Packages, boxes, or bunches of plants will be identified with a similar tag attached. Plants which do not meet specifications for quality herein stated or plants that show improper handling or arrive on site in an unsatisfactory condition will be rejected. Rejected plants shall immediately be removed, disposed of and replaced with approved nursery stock of like variety, size and age. These plants shall be replaced without additional cost to the City.

PART 2 – PRODUCTS

2.01 Topsoil:

A. Topsoil material shall be free from subsequent hard clods, stiff clay, hard pan, stones larger than one (1) inch in diameter, noxious weeds and plants, including nutgrass and torpedo grass, sods, partially disintegrated debris, insects or any other undesirable material, plants, or seeds, that would be toxic or harmful to growth. All beds which contain topsoil contaminated with nut grass or torpedo grass shall have the top 24” of soil removed and replaced with uncontaminated soil or fumigated at no additional cost to the City. Topsoil shall be obtained from approved sources and shall contain 25% organic matter. pH shall range from 5.5 to 7.5 inclusive.

B. Topsoil Preparation:
   1. Contractor shall kill all vegetation prior to soil preparation.

   2. Tillage: Tillage shall be accomplished to loosen the soil, destroy existing vegetation, and prepare an acceptable seed/sprig/sod bed. All areas shall be tilled with a heavy duty disc or a chisel-type breaking plow, chisels set not more than ten (10”) inches apart. Initial tillage shall be done in a crossing pattern for double coverage, then followed by a disc harrow. Depth of tillage shall be five (5”) inches. A heavy duty rototiller may be used for areas to be planted with sod.
3. **Cleaning**: Soil shall be further prepared by the removal of debris, building materials, rubbish, weeds, and stones larger than one (1") inches in diameter.

4. **Fine Grading**: After tillage and cleaning, all areas to be planted shall be leveled, fine graded, and drug with a weighted spike harrow or float drag. The required result shall be the elimination of ruts, depressions, humps, and objectionable soil clods. This shall be the final soil preparation step to be completed before the commencement of fertilizing and planting.

5. **Rock Removal**: During the soil preparation process, a “Rock Pick” or other approved piece of machinery shall be used to gather surface stones as small as three-quarter (3/4") inch in diameter. The Contractor shall be responsible for the disposal of collected materials as waste.

### 2.02 Planting Bed Preparation:

A. All planting areas shall be backfilled with a mixture of prepared and approved plant mix as shown below. Terrasorb AG, or similar product, approved by the City, shall be added to all planting backfill mixes at the rate specified by the manufacturer.

   **Planting Bed Preparation:**
   
   3” of compost and organic fertilizer added to entire bed. Till bed to 6-8” depth.

B. All planting areas shall be stripped of all grass, weeds, trash, soil, etc. Ground cover beds shall be excavated and prepared with the soil mix as detailed.

C. All other planting and lawn areas shall be aerated by rototilling prior to any planting.

### 2.03 Plant Material:

A. The words “Plant Materials” or “Plants” refer to and include trees and shrubs.

B. Plant species shall conform to those indicated on the plans and in the specifications.

C. Plants shall be sound, healthy, vigorous, free from plant diseases, insect pests or their eggs and shall have healthy normal growth and root systems. Tree trunks shall have the specified caliper, straight with no fresh cuts, scrapes or scars, and shall have the specified clear trunk height.

D. Plants shall not be pruned prior to delivery except as approved by the City.

E. All shrubs are required to be container grown. Trees are required to be one of the following:

   **Container Grown:**
   1. Plastic containers: Trees grown in plastic containers should be well established in the container. Root bound container plants will not be accepted.
   2. Fabric containers: Trees grown in fabric bags should be hardened off in the nursery following harvesting for 60-90 days.
F. Collected plants shall not be used unless specifically called for in the specifications or approved in writing by the Engineer. The type, size and availability of specific species will be the basis of selection of any collected plants.

G. All plants for this project, which are secured outside of North Texas, are required to be acclimatized for a minimum period of six (6) months. The acclimatization of these plants must take place off-site at the Contractor’s secured property or certified nursery grower’s site. The cost of acclimatization and its scheduling are the responsibility of the contractor.

2.04 Quantities:

A. The quantities shown in the leader call outs in the plans govern the required installed quantities. The Plant List is provided as a reference only. The Contractor is responsible for his own take-off. Discrepancies must be brought to the Engineer’s attention, in writing, or be corrected by the Contractor at no additional expense to the City.

2.05 Fertilizer for Plantings:

A. All trees and shrubs shall be fertilized with Agriform 20-10-5 Tablets at time of planting (see table below for application rates). Tablets shall be placed at the mid-depth point of the plant pit.

1. Container grown trees, shrubs and ground covers: Agriform 21 gram tablets, rate of application as follows:

   - 7-10 gallon plants: 3 tablets
   - 30 gallon plants: 6 tablets
   - 45 gallon plants: 7 tablets
   - 65 gallon plants: 8 tablets

B. The fertilizer mixture shall contain the necessary minor elements suitable for the plants or trees being used.

C. Turfgrass Sod shall receive fertilizer application as follows:

   1. General: Fertilizer shall be a commercial product, uniform in composition, free flowing, and suitable for application with approved equipment. Fertilizer shall be delivered to the site in fully labeled original containers. Fertilizer which has been exposed to high humidity and moisture has become caked or otherwise damaged making it unsuitable for use will not be acceptable.

   2. Initial Planting Application: Fertilizer for the initial planting application shall be of an organic base containing by weight the following (or other approved) percentages of nutrients: 15-15-15 (N-P-K), also containing 10-15% sulphate and traces of iron and zinc as required and approved by the Owner.

   3. Specification Submittal: Submit a sample label or specification of the fertilizer proposed to be used for the Owner’s approval.
4. Post Planting Application: Fertilizer for the post planting application will be a chemical base fertilizer containing by weight the following percentages of nutrients: 21-0-0 (N-P-K) ammonium sulphate or the nitrogen equivalent of 33-0-0 ammonium nitrate.

5. Specification Submittal: Submit a sample label or specification of the fertilizer proposed to be used for the Owner's approval.

2.06 Mulch:

All plant beds shall receive a uniform 3” layer of #2 shredded hardwood mulch.

2.07 Turfgrass:

A. Sod: Turfgrass sod shall be “Cynodon dactylon” (Common Bermudagrass). Sod shall consist of stolons, leaf blades, rhizomes, and roots with a healthy, virile system of dense, thickly matted roots throughout the soil of the sod for a thickness not less than three-quarters (3/4”) inch. Sod shall be alive, healthy, vigorous, free of insects, disease, stones, and undesirable foreign materials and grasses. The grass shall have been mowed prior to sod cutting so that the height of the grass shall not exceed two (2”) inches. Sod shall have been produced on growing beds of clay or clay-loam topsoil. Sod shall not be harvested or planted when its moisture condition is so excessively wet or dry that its survival will be affected. All sod is to be harvested, delivered, and planted within a thirty-six (36) hour period of time. Sod shall be protected from exposure to wind, sun, and freezing. If sod is stacked, it shall be kept moist and shall be stacked roots-to-roots and grass-to-grass.

1. Dimensions: All sod shall have been machine cut to uniform soil thickness of one (1”) inch plus or minus one-quarter (1/4”) inch. All sod shall be of the same thickness. Rectangular sections of sod may vary in length, but all shall be of equal width and of a size that permits the sod to be lifted, handled, and rolled without breaking. Broken pads and torn, uneven ends will be unacceptable.

PART 3 – EXECUTION

3.01 General:

A. The Contractor’s work shall conform to accepted horticultural practices as used in the trade, unless specifically directed to the contrary by the contract documents or by the City.

B. Plants shall be protected upon arrival at the site by being thoroughly watered and properly maintained until planted. Plants shall not remain unprotected for a period exceeding 24 hours. At all times, workmanlike and customary horticultural practices shall be exercised.

3.02 Digging of Pits:

A. The existence and location of underground structures, elements and utilities are shown on drawings other than the landscape plans. All elements shall be investigated and verified in the field before starting work. Excavation in the vicinity of existing structures and utilities shall be
performed with due caution. Coordination with the City of all site excavation is required to address existing work and new work by other Contractors.

B. Should overhead or underground obstructions be encountered which interfere with the specified plantings, alternate locations or plan modifications will be selected and approved by the City.

C. Shrub and groundcover planting beds shall be rototilled to a depth of 6-8”. In order to control weed growth, all bedding areas shall be treated with a pre-emergent herbicide.

3.03 Tree Installation:

A. All tree pits shall be excavated to size and depth in accordance with the plans and details, and backfilled with topsoil as specified. Test all tree pits with water before planting to ensure proper drainage percolation is available. All tree pits shall drain fully within one hour after being filled with water. No allowance will be made for lost plants due to improper drainage.

B. No trees shall be planted prior to completion of final finish grading.

C. Trees shall be set plumb and held in position until the planting mixture has been flushed into place with slow full hose stream.

3.04 All Plant Materials:

A. Plants shall be set on prepared planting soil backfilled and brought to a height permitting planting at the same depth the plants grew in the nursery. Upright plants shall be kept in a vertical position. All trees shall be handled by a padded nylon strap for lifting purposes.

B. Circular receiving holes with vertical sides shall be excavated for all plants. After placing the plant in the pit, the planting soil specified herein shall be watered and firmly tamped to ensure the backfill mixture is surrounding the root ball. All tamping shall be such that no plants will settle below their original growing height and the finish grade specified.
C. Plants in containers shall be carefully removed from the pots, cans, boxes or other containers in a manner not to damage the roots or the rootball of soil formed by the container. Scarifying the rootball on the sides and bottom to stimulate new root growth outside of the existing rootball should be performed prior to placement into the pit. Plants shall be set in the pit with the planting mixture carefully washed and tamped around the base of each to fill voids.

D. All plants shall be thoroughly watered at the time of planting and kept adequately watered until time of acceptance. No additional allowances will be made for plant losses due to lack of adequate or proper watering.

E. Pruning shall be done after planting and with due regard to the natural form and growth characteristics of each species. Method and amount of pruning shall be determined by the Engineer. Trees with pruned terminal leaders will not be accepted.

F. During the course of planting, excess and waste materials shall be removed daily. All reasonable precautions shall be taken to avoid damage to structures and plantings. When planting in an area has been completed, the area shall be fully policed for debris and maintained in this finished state until Final Acceptance.

3.05 Mulching:

A. Plants and planting beds shall receive a layer of the specified mulch, entirely covering the area around each plant or the entire 3” minimum surface of each planting bed.

B. Mulch shall be placed between and around all newly planted trees and shrubs as shown on drawings and a specified. For individual plants, the mulch shall be spread to cover the saucer area and maintained until acceptance. Mulch shall be dept a minimum of 3” away from the trunks of all trees. When in place, the mulch is to be watered thoroughly.

3.06 Guying and Staking:

A. Guy and stake plant materials as specified and detailed to assure upright form.

B. Prevent plants from falling or being blown over, re-straighten and replant all plants which lean or fall, and replace all plants which are damaged due to lack of guying and staking.

C. If un-guyed plants are blown over by high winds, the Engineer will determine if the plant is to be replaced. Such decision shall not be cause for additional expense to the City. Damaged plants shall be replaced and guyed or staked at no additional cost to the City.

D. All stakes and staking material should be removed between the 16th and 18th months following planting, except of those trees identified by the City. The Contractor shall notify the City fourteen (14) days prior to removing stakes and staking material.

3.07 Maintenance Prior to Substantial Completion:
A. Maintenance shall commence after each plant is planted and shall continue until substantial completion. After substantial completion, the formal 12 month maintenance period shall commence and all maintenance operations shall be conducted consistent with Section 02952 Site Maintenance.

B. Plant maintenance shall include watering, pruning, weeding, cultivating, mulching, tightening and repair of guys, replacement of sick or dead plants, resetting plants to proper grades or upright position, restoration of the planting saucer, and all other care required for proper growth of the plants. Proper protection of lawn areas shall be provided and any damages resulting from planting or maintenance operations shall be repaired promptly by the Contractor at no additional cost to the City.

C. The Contractor shall be responsible for monitoring climate and plant moisture conditions and determining if watering beyond or less than the watering guideline described below shall be need. Not only plant survival, but plant health conditions optimum for plant growth.

D. The Contractor shall maintain the quality defined by “The American Standard for Nursery Stock” during the twelve (12) month watering period and shall guarantee plants through the end of the twelve (12) month period.

3.08 Guarantee and Replacement:

A. All work shall be guaranteed for a period of eighteen (18) months form the date of substantial completion. All plants shall be alive and in satisfactory growth throughout the guarantee period. If, at any time during the eighteen (18) month maintenance period, substandard or dead trees or plants are identified by the City, such trees and plants shall be replaced by the Contractor within fourteen (14) calendar days of notification, at no additional cost to the City.

B. The landscape Contractor shall notify the City in writing, ten (10) days prior to expiration of guarantee periods, and said guarantee period shall be continued until such time as written notification is received.

C. At the end of the guarantee period, an inspection will be made by the Contractor and the City. All plants that are dead or fail to meet the grade requirements initially specified or are otherwise considered in unsatisfactory condition, as determined by the City, shall be removed from the site and immediately replaced with approved plants meeting the original specifications.

D. All replacements shall be plants of the same species and size as specified in the Plant List. They shall be furnished and planted as specified with no additional cost to the City.

E. All replacement plants shall become guaranteed for a period of one year from the date of their acceptance. A written agreement is required to be submitted by the Contractor for this additional guarantee.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

   Drawings and General Provisions of Contract, including Division-1 Specifications sections.

1.02 DESCRIPTION OF WORK:

   A. Furnish all necessary material, equipment, electrical, controls, hardware and accessories as required for an automatic slide gate operator.

1.03 REFERENCE:

   Division 16 – Electrical.

1.04 SUBMITTALS:

   Submit manufacturer's product data, installation instructions, and O&M information under provisions of Section 01730.

1.05 WARRANTY

   The equipment shall be warranted to be free from defects in workmanship, design and materials. If any part of the equipment should fail during the warranty period, it shall be replaced and the unit(s) restored to service at no expense to the Owner. Warranty shall be for a period of two years and begin on the Date of Final Acceptance.

PART 2 - PRODUCTS

2.01 SLIDING GATE:

   A. Acceptable Manufacturers:

      1. Acceptable manufacturers shall include LiftMaster Elite (no approved equal).

      2. Substitutions: No substitutions will be allowed.

   B. Gate Operation and Controls:

      1. Slide gate operator shall be LiftMaster ELITE MODEL SL 3000-UL 1 hp slide gate operator. Gate speed shall be approximately one (1) foot/second. Inherent reverse system shall reverse direction of gate travel if an obstruction or entrapment is sensed in either the opening or closing cycle. Inherent reverse system shall not rely on any external or add on devices. The gate operator shall be located on the secured side of fence and have a fail-safe operation in case of power failure. Gate safety shall include the use of in-ground loops located where shown in the electrical plans. Loops shall prevent gate closure if vehicle is within gate’s path of travel. Exit shall be accomplished using an in-ground loop set where shown in the electrical plans, for which vehicle crossing loop will send an open signal to gate.
2. Operator Controlling Devices:
   

   b. Exterior and interior safety loop for sensing vehicles and operating open and safety features.

C. Gate Construction and Function:

   The gate shall be a one piece, all welded steel gate to match proposed fencing. Reference Plan Sheets.

PART 3 - EXECUTION

3.01 Provide fully functional gates, with a full warranty for two years by the manufacturer.

3.02 The total gate length and run shall depend on the manufacturer.

3.02 The gate installer shall be responsible for making all gates operational. Reference electrical for power and communication wiring and wire ways to each gate.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division-1 Specifications sections, apply to work of this section.

1.02 DESCRIPTION OF WORK:

Extent of decorative screen wall along the north, east and south property line of the subject site as indicated on the drawings. The wall shall be 8’-0” high above grade with a 4” gap between the bottom of wall and the top of ground. Wall manufacturer shall be responsible for designing connections between wall and other materials (i.e. steel tube fence, decorative columns).

1.03 QUALITY ASSURANCE:

Wall shall be precast concrete panel type wall and shall be provided by a manufacturer regularly engaged in the construction of concrete walls.

1.04 SUBMITTALS:

Product Data: Submit manufacturer's technical data and installation instructions.

PART 2 - PRODUCTS

2.01 GENERAL:

A. Dimensions for panel spans and wall thickness shall be per manufacturer’s recommendations. The wall manufacturer shall be responsible for wall integrity.

B. Available Manufacturers: Subject to compliance with requirements, acceptable manufacturers include Hawk Construction Company

2.02 EXTERIOR:

A. Wall color and pattern shall be selected by Owner during construction.

2.03 PIERS

A. Minimum pier requirements for the wall are shown in the drawings. Pier depth will NOT be allowed to be any less than that shown in the drawings regardless of manufacturer’s recommendations, but wall manufacturer shall be responsible for verifying pier design shown is adequate.
PART 3 - EXECUTION

3.01 INSTALLATION:

A. Do not begin installation and erection before final grading is completed, unless otherwise permitted.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including Special Provisions, apply to work of this section.

1.02 DESCRIPTION OF WORK INCLUDED IN THIS SECTION
A. Fine Grading
B. Soil Preparation
C. Seeding
D. Erosion Control Blanket
E. Maintenance
F. Warranty

1.03 QUALITY ASSURANCE
A. CONTRACTOR to follow standards set forth in the following references:

1.04 SUBMITTALS
A. CONTRACTOR shall submit for inspection the following items:
   1. Receipts for all fertilizer, grass seed, sod, and erosion control blanket.
   2. Technical Sheet on erosion control blanket.

1.05 WARRANTY
A. Provide a uniform stand of grass by watering, mowing, and maintaining lawn areas until final acceptance. Re-seed seeded areas which fail to provide a uniform stand of grass, reseed with specified materials until all affected areas are accepted by the ENGINEER.
PART 2 - PRODUCTS

2.01 FERTILIZER

A. Fertilizer shall be a commercial product, uniform in composition, free flowing, and suitable for application with approved equipment. Fertilizer shall be 10-20-10 or approved equal.

2.02 SEEDING

A. Lawn Seed: Fresh, clean and new crop seed mixture.

   1. Provide fresh, clean, new crop hulled seed tested to minimum percentages of purity and germination as established by Official Seed Analysts of North America. Provide seed of grass species, proportions and maximum percentages of purity, germination and be free of: Poa Annua, bent grass, and noxious weed seed.

      a. "Tifway 419" Bermuda Grass, 98% purity, 90% germination.

         Rate: 2 pounds per 1,000 square feet.

2.03 EROSION CONTROL BLANKET

A. Erosion Control Blanket shall be SC-150 as manufactured by North American Green or approved equal.

2.04 WATER

A. Free of substance harmful to plant growth. Hoses, pumps, sprinklers or other methods of transportation furnished by CONTRACTOR.

B. To use fire hydrant, a meter must be obtained from the Town of Flower Mound’s Utility Billing Division and a deposit must be paid. The CONTRACTOR must also comply with the Town’s current Water Conservation Ordinance No. 33-01.

2.05 TOPSOIL

A. General Topsoil:

   1. Furnish from stockpiled on-site material. If an insufficient quantity exists, furnish from offsite sources in quantities sufficient to complete the requirements specified.

   2. Natural, friable, fertile soil, characteristic of productive soil on-site, reasonably free of stones, clay lumps, roots and other foreign matter.
3. Proposed topsoil material shall be subject to approval by the ENGINEER.

**PART 3 - EXECUTION**

**3.01 SEEDING LAWNS OR DISTURBED AREAS**

A. Seeding Limits: All areas disturbed by construction operations.

B. Responsibility: The CONTRACTOR shall utilize all such measures as may be necessary, including, but not limited to, protective fencing, sod, or erosion control netting to produce a finished continuous blanket of turf over all areas designated to receive turf.

C. Fertilizer: No fertilizer shall be applied prior to seeding.

D. Seeding Operations:

1. Dry Seeding
   a. Seed immediately after preparation of bed. Acceptable seeding time for hulled Bermuda Grass is March 1 through September, or at such other times acceptable to the ENGINEER. Use unhulled Bermuda grass seed during times other than March 1 through September.
   b. Seed indicated areas, within contract limits and areas adjoining contract limits, disturbed as a result of construction operations.
   c. Perform seeding operations when the soil is dry and when winds do not exceed 5 miles per hour velocity.
   d. Apply seed evenly by sowing equal quantities in two directions, at right angles to each other.
   e. Sow grass seed at specified rate.
   f. After seeding, lightly rake or drag surface of soil to incorporate seed into top 1/8" of soil. Roll with light lawn roller.

E. Applying Erosion Control Blanket:

1. Apply erosion control blanket on seeded areas immediately after seeding.
2. Place erosion control blanket uniformly, as per industry standards.

**3.02 LAWN AND MAINTENANCE**

A. Maintain seeded areas until revegetation has been accepted by the OWNER.
B. Maintain seeded lawn areas, including watering, spot weeding, mowing, applications of herbicides, fungicides, insecticides and reseeding until a full, uniform stand of grass free of weeds, undesirable grass species, disease and insects is achieved and accepted by the ENGINEER.

C. Water regularly to maintain adequate surface soil moisture for proper seed germination. Continue watering until acceptance.

D. Repair, reseed, and reblanket all areas that are washed out, eroded, or do not catch.

E. Fertilize with organic fertilizer after germination, but prior to first mowing and acceptance.

3.03 FINAL ACCEPTANCE:

A. Inspection to determine final acceptance of seeded lawns will be made by the ENGINEER upon CONTRACTOR’s request. Provide notification at least 10 working days before requested inspection date.

1. Seeded areas will be acceptable provided all requirements, including maintenance, have been completed and a healthy, uniform, close stand of the specified grass is established, free of weeds, undesirable grass species, disease and insects.

2. In areas requested to be inspected, no individual lawn areas shall have bare spots or unacceptable cover totaling more than 10 square feet, with 85% total coverage over the entire project.

B. Upon final acceptance of the revegetation the owner or Homeowners Association will assume lawn maintenance.

END OF SECTION
PART 1 - GENERAL

1.01 WORK INCLUDED:

A. The contractor shall provide all labor, materials and appurtenances necessary for installation of hollow metal doors and frames where indicated in the plans.

1.02 RELATED DOCUMENTS:

A. Drawings, Conditions of Contract, and Technical Specifications, apply to work of this section.

1. Section 08710 - Finish hardware: Hardware locations.
2. Section 09900 - Painting.

1.03 REFERENCES:

A. American Society for Testing and Materials (ASTM):


B. National Fire Protection Association (NFPA):

2. NFPA 252, Fire Tests of Door Assemblies

C. Steel Door Institute (SDI):

1. SDI-100 - Recommended Specification for Standard Steel Doors and Frames
2. SDI-105 - Recommended Erection Instructions for Steel Frames
3. SDI-107 - Hardware for Steel Doors (Reinforcement - Application).

D. Underwriters Laboratories, Inc. (UL):

2. UL 10B -Fire Tests of Door Assemblies

E. Door Hardware Institute (DHI):

1. The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder’s Hardware.

1.04 QUALITY ASSURANCE:

A. Standard: Provide steel doors and frames complying with the Steel Door Institute SDI-100 and as herein specified.
B. Labeled Construction: Doors and frames required by schedule to be labeled shall be manufactured in accordance with specifications and procedures for doors and frames tested and rated by Underwriter’s Laboratories, Inc. Metal UL classification markers shall be attached to these doors and frames.

C. Fire Rating: Install frame and door assembly to conform to NFPA 252 or UL 10B for fire rated class indicated or scheduled.

D. Manufacturer: company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.05 SUBMITTALS

A. Shop Drawings: Submit in accordance with Section 01340. Include door size, frame type, details of construction, wall anchors and accessories required for installation.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver metal doors and frames to the project site with no dents or open seams and store upright in a protected dry area. Provide packaging and wrapping to protect hollow metal items.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Provide steel doors and frames as manufactured by one of the following:

   Ceco Corp.
   Curries Manufacturing, Inc.
   Fenestra Corp.
   Mesker Industries, Inc.
   Republic Builders Products Corp.
   Steelcraft by American-Standard

2.02 MATERIALS:

A. Sheet and Strip: ASTM A366, commercial quality, leveled, cold-rolled steel free of scale and other surface defects.

2.03 FABRICATION:

A. Steel Doors: Full flush type of welded seamless construction with no visible seams or joints on faces or vertical edges.

   1. Face sheets of 18 gage steel reinforced, stiffened and sound-deadened by laminating to small cell impregnated kraft honeycomb core completely filling the door or by formed steel vertical stiffeners
spaced 6” o.c. and attached to face sheets by spot welds and with the spaces between stiffeners filled with inorganic blanket insulation material.

2. Continuous vertical interlocking joints on lock and hinge edges with seams continuously welded, filled and dressed smooth. Bevel vertical edges.

3. Top and bottom edges closed with continuous recessed steel channels spot welded to both faces. Top edge of exterior doors sealed flush with closing channel to exclude water.

4. Fixed glass moldings welded to security side of door. Loose moldings of 20 gage steel fastened with countersunk flat head screws. Fabricate steps to receive vinyl gaskets.

5. Overlapping steel astragals for pairs of labeled doors as required by manufacturer to meet codes.

6. Louvers: Provide factory installed, inverted “V” or “Y” sight proof type fixed louvers. Louver blades shall be 18 gage and frame shall be 18 gage welded construction.

B. Steel Frames: Combination buck, frame and trim type of 16 gage steel for interior frames and 14 gage steel for exterior frames. Provide frames with face width, throat opening, backbend and jamb depth as per dimensions shown.

1. Brake-form to profile free of warp, buckles and fractures with corners square and sharp. Form stop integral with frame except where detailed otherwise. Dress sheared edges straight and smooth.

2. Close corner joints tight with trim faces mitered and continuously welded. Dress exposed welds flush and smooth.

3. Fabricate frames for large openings in knocked-down sections for field assembly with butt joints and internal reinforcing sleeves. Knocked-down frame assemblies shall be trial assembled in the shop.

4. Loose glazing stops shall be 16 gage steel, mitered corners, fastened with countersunk flathead screws. Fabricate stops to receive vinyl gaskets.

5. Weld 14 gage steel floor anchors inside each jamb with two holes each anchor for floor anchor bolts.

6. Furnish frames with steel spreader temporarily fastened to the feet of both jambs for rigidity during shipping and handling.

7. For each jamb in masonry construction provide 3 or more 16 gage adjustable jamb anchors of the T-strap type spaced not more than 30” apart. Furnish yoke type Underwriters anchors for labeled door openings only.

8. For each jamb in steel stud construction provide 4 or more 18 gage drywall type jamb anchors. Weld anchors inside each jamb and wire or bolt to the studs.
C. Shop Finish: After fabrication, doors and frames shall be degreased, phosphatized and factory painted inside and out with a rust inhibitive synthetic primer. Apply mineral filler to eliminate weld scars and other blemishes.

D. Fabricate frames and doors with hardware reinforcement plates welded in place. Provide mortar guard boxes.

E. Reinforce frames wider than 48” with roll formed steel channels fitted tightly into frame head, flush with top.

F. Prepare frame for silencers. Provide three single rubber silencers for single doors and mullions of double doors on strike side, and two single silencers on frame head at double doors without mullions.

G. Attach fire rated label to each frame and door unit.

H. Close top edge of exterior door flush with inverted steel channel closure. Seal joints watertight.

I. Fabricate frames for masonry wall coursing with 2” head member.

2.04 HARDWARE PREPARATION

A. Prepare doors and door frames for hardware. Mortising, reinforcing, drilling, and tapping shall be done at the factory for mortised hardware. Reinforcement shall be provided for surface-applied hardware, and the drilling and tapping for this hardware shall be done in the field. Provide plaster guards for hinge and strike reinforcements and cutouts on frames.

B. Reinforcement plates in doors and frames for hardware shall be 7 gage for hinges and 12 gage for all other hardware.

C. Punch for and install rubber silencers on all interior hollow metal door frames. Furnish 3 silencers for each single door and 2 silencers for each pair of doors. Set out and adjust strikes to provide clearance for the silencers. Omit silencers on exterior door frames.

2.05 CLEARANCES

A. Doors shall have pre-fit clearances of:

1. At Head and Lock Stile: 1/8”.
2. At Hinge Stile: 1/16”.
3. At Door Sill:
   a. Without Threshold: 1/8” from bottom of door to top of decorative floor finish or covering.
   b. With Threshold: 1/8” from bottom of door to top of threshold.
4. Between meeting edges of pair of doors: 1/8”.
B. Fitting Clearances for Fire-Rated Door; Comply with NFPA 80. Bevel fire-rated doors 1/8” in 2” in lock edge.

2.06 ACCESSORIES

A. Rubber Silencers: Resilient rubber.

B. Anchors: three per jamb, typically, of type to suit supportive construction.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Verify that opening sizes and tolerances are acceptable.

B. Verify surfaces and conditions are ready to receive work of this section. Notify Engineer of any existing conditions which will adversely affect execution. Beginning of execution will constitute acceptance of existing conditions.

3.02 INSTALLATION:

A. Install frames in accordance with SCI-105.

B. Install doors in accordance with DHI.

C. Install fire-rated frames and place fire-rated doors in accordance with NFPA 80.

D. Coordinate with masonry and wallboard construction for anchor placement.

E. Coordinate installation of glass and glazing.

F. Install doors accurately in frames, maintaining specified clearances.

G. Setting Frames:

1. Check frames for rack, twist and out-of-square, and correct.

2. Set frames accurately to maintain scheduled dimensions, hold head level and maintain jambs plumb and square.

3. Anchor frames securely to adjacent construction. Anchor to floor at each jamb with two bolts to prevent twist.

4. Leave spreader bars in place until frames have been permanently built into the walls.

5. Install fire-rated frames in accordance with NFPA 80.
H. Hanging Doors:

1. Fit and hang the doors to maintain specified door clearances. Metal hinge shims are acceptable to maintain clearances.

2. Doors shall operate smoothly and quietly after adjustment.

3. Place fire-rated doors with clearances as specified in NFPA 80.

3.03 TOLERANCES:

A. Maximum Diagonal Distortion: 1/8” measured with straight edge, corner to corner.

END OF SECTION
PART 1 - GENERAL

1.01 QUALITY ASSURANCE

A. Inserts and Anchorages: Furnish inserts and anchoring devices which must be built into construction for installation of units. Provide setting drawings, templates, instructions and directions for installation of anchorage devices.

B. Installer Qualifications: Engage an experienced installer who is an authorized representative of the overhead coiling door manufacturer for both installation and maintenance of units.

C. Wind Loading: Design and reinforce overhead coiling doors to withstand a 22 lbs. per sq. ft. wind loading pressure, acting inward and outward.

1.02 SUBMITTALS

A. Product Data: Submit in accordance with Section 01340. Include manufacturer’s installation instructions. Provide operating instructions and maintenance information.

B. Shop Drawings: Submit in accordance with Section 01340. Submit drawings for special components and installations not dimensioned or detailed in manufacturer’s data sheets.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide overhead coiling doors as manufactured by one of the following:

   a. The Cookson Co.
   b. Cornell Iron Works, Inc.
   c. Mahon Door Corp.
   d. Overhead Door Corp.
   e. J.G. Wilson Corp.
   f. Raynor Garage Doors
   g. Southwestern Steel Rolling Door Co.

2.02 CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtain: Fabricate of interlocking slats of continuous length for width of door without splices. Fabricate of structural quality, cold—rolled galvanized steel sheets complying with ASTM A 446, Grade A, with G90 zinc coating, complying with ASTM A 525, and phosphate treated before fabrication.

   a. Insulation: Fill slat with manufacturer’s standard rigid cellular polystyrene or polyurethane-foam-type thermal insulation complying with maximum flame—spread and smoke-
developed indices of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within metal slat faces.

B. Endlocks: Malleable iron castings galvanized after fabrication, secured to curtain slats with galvanized rivets. Provide locks on alternate curtain slats.

C. Windlocks: Malleable-iron castings secured to curtain slats with galvanized rivets or high-strength nylon, as required to comply with wind load.

D. Bottom bar shall consist of 2 galvanized steel angles, each not less than 1” x 1” x 1/8” thick, with replaceable gasket of flexible vinyl or neoprene between angles as a weather seal. Equip bottom bar with sensor edge.

E. Curtain Jamb Guides: Fabricate curtain jamb guides of steel angles, or channels and angles with sufficient depth and strength to retain curtain loading. Build-up units with minimum 3/16” thick steel sections, galvanized after fabrication.

F. Weather Seals: Provide vinyl or neoprene weatherstripping. At door heads, use 1/8” thick continuous sheet secured to inside of curtain coil hood. At door jambibs, use 1/8” thick continuous strip secured to interior and to exterior side of jamb guides.

G. Locking: Provide manufacturer’s standard slide bolt, designed to receive padlock.

2.03 COUNTERBALANCING MECHANISM

A. Counterbalance doors by means of adjustable steel helical torsion spring, mounted around a steel shaft and mounted in a spring barrel and connected to door curtain with required 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 carbon steel, welded or seamless pipe, of sufficient diameter and wall thickness to support roll-up of curtain without distortion of slats and limit barrel deflection to not more than 0.03” per ft. of span under full load. Provide spring balance of one or more oil-tempered, heat—treated steel helical torsion springs. Provide cast steel barrel plugs to secure ends of springs to barrel and shaft.

C. Brackets: Provide mounting brackets of manufacturer’s standard design, either cast iron or cold—rolled steel plate with bell mouth guide groove for curtain.

D. Hood: Form to entirely enclose coiled curtain and operating mechanism at opening head. Provide closed ends and intermediate support brackets as required to prevent sag. Fabricate hoods of 24 gage minimum hot-dip galvanized steel sheet with G90 zinc coating, complying with ASTM A 525. Phosphate treat before fabrication.

2.04 PAINTING

A. Shop clean and prime ferrous metal and galvanized surfaces, exposed and unexposed, except fraying and lubricated surfaces, with door manufacturer’s standard rust inhibitive primer.
PART 3 - EXECUTION

3.01 INSTALLATION

A. Install door and operating equipment complete with necessary hardware, jamb, and head mold strips, anchors, inserts, hangers, and equipment supports in accordance with manufacturer’s instructions and recommendations.

B. Upon completion of installation including work by other trades, lubricate, test and adjust doors to operate easily, free from warp, and twist of distortion.

END OF SECTION
PART 1 - GENERAL

1.01 WORK INCLUDED:

   A. The contractor shall provide all labor, materials and appurtenances necessary for installation of hardware to fully equip doors indicated in the plans.

1.02 RELATED DOCUMENTS:

   A. Drawings, Conditions of Contract, and Technical Specifications, apply to work of this section.

      1. Section 08111 – Steel Doors and Frames

1.03 REFERENCES:

   A. National Fire Protection Association (NFPA):


   B. Texas Civil Statutes:


   C. Underwriters Laboratories, Inc. (UL):


1.04 QUALITY ASSURANCE:

   A. Departures from Scheduled Designations: Only those products listed will be accepted. No substitutions will be accepted. Manufacturers listed as being acceptable must still meet the conditions of this specification.

   B. Underwriter’s Laboratories Requirements: Hardware for opening classes as requiring a UL label in the door schedule, or by code, shall be furnished and installed to meet the applicable requirements of NFPA 80. Hardware for fire doors shall be UL listed for usage with types and sizes of fire doors specified and scheduled.

   C. Provide the services of a qualified representative from the exit device manufacturer to be present at the project site to oversee the installation of exit devices on a pair of entrance doors. Upon acceptance, this installation shall set the standard for all exit device installations.

1.05 SUBMITTALS:

   A. Hardware Schedule: Submit in accordance with Section 01340. Hardware schedule shall be in the vertical format as outlined by the Door and Hardware Institute. Schedule items required for the entire
project. Include a picture or catalog cut of each item showing design and operation for each item of hardware. Provide manufacturer’s instructions for installation and for maintenance of operating parts and exposed finishes.

B. Templates: Upon receipt of reviewed hardware schedule, provide one copy of reviewed schedule with templates to each fabricator of doors and frames and other work affected by the hardware.

C. Accessibility Standards: Submit a letter verifying that the hardware submitted is in conformance with Article 9102, Texas Civil Statutes, Elimination of Architectural Barriers Act of Texas.

1.06 DELIVERY, STORAGE AND HANDLING:

A. Packaging and Labeling: Furnish hardware with the required screws, bolts, and fastenings, same finish as hardware item, necessary for its installation, packaged in the same package with the hardware. Legibly mark and label each package indicating the part of the work for which it is intended. Each marking shall correspond to the number shown on the approved hardware schedule.

1.07 WARRANTY:

A. Door closers shall carry a published ten-year limited factory warranty against defects in workmanship and operation.

B. Door Push and Pull Bars shall carry a published two-year factory warranty against defects in material and workmanship.

C. Exit devices shall carry a published three-year limited factory warranty against defects in workmanship and operation.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Butts and Hinges:

1. Furnish butts and hinges with flat button tips.

2. Provide hinges from one manufacturer.

3. The following are acceptable manufacturers:

   Hager Hinge Co.
   Lawrence Brothers
   McKinney Mfg.
   H. Soss & Co.
   Stanley Hardware, Division of The Stanley Works
4. Furnish hinges in size, weight and finishes listed in hardware set. Where scheduled as BB, provide ball bearing hinges. Oil-impregnated porous metal bearing hinges are not acceptable.

B. Door Stops:

1. Floor Stops:
   a. Floor stops shall be solid cast brass or bronze.
   b. Furnish and install floor stops with machine screws and expansion shield.
   c. As conditions require, provide necessary carpet risers.

2. Acceptable Manufacturers:
   - Baldwin Hardware Corp.
   - Brookline by Yale Security, Inc.
   - H.B. Ives
   - Quality Hardware Mfg. Co., Inc.
   - Trimco Builders Hardware

C. Fasteners:

1. Furnish necessary screws, bolts, and other fasteners of suitable size and type to anchor the hardware in position for long life under hard use.

2. Where necessary, furnish fasteners with toggle bolts, expansion shields, hex bolts, and other anchors, appropriate for the material to which the hardware is to be applied and according to the recommendations of the hardware manufacturer.

3. Fasteners shall be packaged with hardware.

4. Provide fasteners of the same material and finish as the hardware.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Fit and install hardware on doors in conformance with the following hardware schedule. Hardware shall be installed by tradesmen skilled in the application of commercial grade hardware.

1. Provide properly sized and accurately located mortises and drilled holes for hardware on wood doors, using appropriate jigs, templates and power equipment.

2. Metal frames shall be drilled and tapped accurately.

3. Fit hardware accurately, remove until painter’s finish is applied and then replace and adjust.
4. Ensure that operating parts move freely and smoothly without binding, sticking or excessive clearance.

5. Position and install the various hardware items on doors to agree with the locations specified in Section 08111, or as may be specifically detailed.

6. Keep knobs and pulls covered with heavy cloth or plastic wraps until final acceptance of the project. Upon completion, leave hardware clean, undamaged and in proper working order.

3.02 HARDWARE LOCATIONS

A. Locate hardware for doors as follows, unless specifically detailed otherwise:

1. Locks and Latches: 40” (+/-1”) floor to centerline of strike.
2. Hinges: Manufacturer’s standard locations.

3.03 ADJUST AND CLEAN

A. Adjust and clean the operating hardware at each door. Lubricate parts with lubricant recommended by manufacturer (graphite type, if no other recommended). Replace units which cannot be adjusted to operate freely and smoothly.

3.04 HARDWARE SCHEDULE

A. This schedule is intended to include hardware required. Verify doors shown and scheduled on the drawings with doors listed in this schedule. In the event of omissions in the schedule, furnish hardware of the kind, quantity, and quality scheduled for similar locations. Hardware for a complete installation is required, whether specifically mentioned herein or not.

B. Lock cores shall be keyed to match Owner’s existing keys.

C. Designations in hardware schedule are taken from the following manufacturers:

Hager (H)
Corbin Russwin (CR)
Yale Security, Inc. (Y)
D. Hardware Set No. 1:

Exterior Door

1 Lockset  ML2224** (CR)
1 Closer    2300BC  (Y)
1 Floor Stop 259F  (H)

** The lockset and hardware for the exterior door must be able to accommodate future magnetic card readers.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings, Conditions of Contract, and Technical Specifications, apply to work of this section.

1.02 SUMMARY

A. Section includes: On-the-job painting and finishing.

1. Included: Paint and finish the following materials, fittings and equipment items which are exposed to view inside and outside.

   a. Iron and steel
   b. Concrete masonry units
   c. Interior concrete ceiling and beam surfaces
   d. Interior concrete floors
   e. Gypsum board
   f. Interior caulked joints
   g. Bare and insulation covered piping and ductwork, conduit, hangers, grilles and registers, and primed metal surfaces and factory-finished surfaces of mechanical and electrical equipment.
   h. Exposed ductile iron pipe, fittings and equipment

2. Not Included: No painting is required on the following:

   a. Factory-finished metal lockers and finished light fixtures
   b. Architectural aluminum and stainless steel
   c. Galvanized metal
   d. Acoustic panel ceilings
   e. Pre-finished cabinets

3. Contractor shall examine the drawings for mechanical and electrical work, and all materials installed throughout the building which require painting shall be painted under this section of the specifications.

B. Related Sections:

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM):

   1. ASTM D 16 - Definitions of Terms Relating to Paint, Varnish, Lacquer and Related Products.
   3. ASTM D 4258 - Practice for Surface Cleaning Concrete for Coating.
   4. ASTM D 4262 - Test method for pH of Chemically Cleaned or Etched Concrete Surfaces.
   5. ASTM D 4263 - Test method for Indicating Moisture in Concrete by The Plastic Sheet Method.
B. NACE (National Association of Corrosion Engineers) - Industrial maintenance Painting.


E. SSPC (Steel Structures Painting Council) - Steel Structures Painting Manual.

1.04 SYSTEM DESCRIPTION

A. For purposes of this painting specification, the following areas and spaces are not considered finished, occupied areas and there will be no painting therein except for doors and frames and as may be specifically scheduled in article paint schedule.

1. Mechanical chases
2. Spaces above suspended ceilings
3. Under-floor crawl spaces

1.05 SUBMITTALS

A. Samples: Submit in accordance with Section 01300 - Submittals. Submit two 8 1/2” x 11” samples of each paint color. Samples shall be on heavy cardboard and shall be made with the actual mixed paints to be used on the project.

B. Paint Schedule: If painting materials other than those specified are proposed for use, submit a complete schedule of the materials to be substituted. This schedule, in triplicate, shall be in the same form as the paint schedule included in this section, and shall list materials by manufacturer, brand name and type for each surface to be finished.

C. Close-out Schedule: Upon completion of work, furnish a full schedule of paint types and colors actually used and formulas for each to the Owner.

1.06 QUALITY ASSURANCE

A. Product Manufacturer: Company specializing in manufacturing quality paint and finish products with 3 years experience.

B. Applicator: Company specializing in commercial painting and finishing with 2 years experience.

C. Product Labels: Include manufacturer’s name, type of paint, stock number, color and label analysis on label of containers.

D. Single Source Responsibility: Provide primers and other undercoat paint produced by same manufacturer as final coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.
E. Do not paint over code-required labels, such as Underwriters’ Laboratories and Factory Mutual, or equipment identification, performance rating, name or nomenclature plates.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials in original containers with seals unbroken and labels intact.

B. Storage: Contractor shall designate a specific space at the project site for storing and mixing materials. Protect this space and repair all damage resulting from use. Do not store kerosene nor gasoline in this space. Remove oily rags at the end of each day’s work.

1.08 PROJECT CONDITIONS

A. Environmental Requirements: Maintain the temperature inside the building at not less than 60º F during painting and finishing.

B. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 65º F for 24 hours before, during, and 48 hours after application of finishes, unless required otherwise by manufacturer’s instructions.

C. Minimum application temperatures for latex paints: 45º F for interiors; 50º F for exterior; unless required otherwise by manufacturer’s instructions.

D. Minimum application temperature for varnish and finishes: 65º F for interior or exterior, unless required otherwise by manufacturer’s instructions.

E. Provide lighting level of 80 ft.-candles measured mid-height at substrate surface.

F. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85%; or to damp or wet surfaces; unless otherwise permitted by the paint manufacturer’s printed instructions. Painting may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified during application and drying periods of 24 hours between coats and 72 hours after final coat.

G. Protection: provide sufficient drop cloths to fully protect adjacent finished work.

1.09 MAINTENANCE

A. Extra Materials: Upon completion of the work, deliver to project site 2 gallons of each type and color of paint applied to interior and exterior surfaces. Provide formula for custom match colors.
PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide paint as manufactured by one of the following:

   The Sherwin-Williams Co.
   Tnemec Co.

B. Materials described are based on the specifications of the above listed manufacturers, and are given to designate the quality of materials required. Materials of best quality grade are representative of the standard of quality required. Materials not displaying manufacturer’s identification as a first line, best-grade product will not be acceptable.

C. Colors: The Owner will select colors. Regardless of which brand of paint is selected for use, the Contractor shall intermix and blend as required to obtain an exact match to each color on the color schedule.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and substrate conditions are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report to Engineer any condition that may potentially affect proper application.

C. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

   1. Gypsum wallboard: 12 percent
   2. Interior located wood: 15 percent, measured in accordance with ASTM D 2016.

D. Test shop-applied primers for compatibility with subsequent cover materials.

E. Beginning of installation means acceptance of existing surfaces and substrate.

3.02 PREPARATION

A. Perform preparation and cleaning procedures in accordance with coating manufacturer’s instructions for each substrate condition.

B. Wash galvanized metal surfaces with mineral spirits to remove residual grease and oil.
C. Fill open joints, cracks and crevices on steel buck frames with metal putty and sand smooth before painting.

D. Sand woodwork surfaces smooth before priming.

F. Putty nail holes after the prime coat.

G. Remove hardware and accessories, plates, lighting fixtures and similar items which are not to be finish-painted or provide adequate surface-applied protection for these items in place.

H. Un-coated steel and iron surfaces: Remove grease, scale, dirt and rust. Where heavy coatings of scale are evident, remove by wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts and nuts are similarly cleaned. Spot prime paint after repairs.


J. Surface preparation of Existing Concrete Flooring (Acid Etching):
   1. Remove all surface contamination (ASTM D4258).
   2. Wet surface with clean water.
   3. Apply a 10-15% Muriatic Acid or 50% Phosphoric Acid solution at the rate of one gallon per 75 square feet.
   4. Scrub with a stiff brush.
   5. Allow sufficient time for scrubbing until bubbling stops.
   6. If no bubbling occurs, the surface is contaminated with grease, oil or a concrete treatment which is interfering with proper etching. Remove the contamination with a suitable cleaner (ASTM D4258) and then etch the surface.
   7. Rinse the surface three times. Remove the acid/water mixture after each rinse.
   8. Surface should have a texture similar to medium grit sandpaper.
   9. It may be necessary to repeat this step several times if a suitable texture is not achieved with one etching. Bring the pH (ASTM D4262) of the surface to neutral with a 3% solution of trisodium phosphate or similar alkali cleaner and flush with clean water to achieve a sound, clean surface.
   10. Allow surface to dry and check for moisture (ASTM D 4263)
3.03 APPLICATION

A. Workmanship shall be of the highest quality. Mix and apply paint materials in accordance with the manufacturer’s directions. Spread materials evenly, flow smoothly, and brush out without sags or runs.

B. Provide finish coats which are compatible with primer paints used. Provide barrier coats over incompatible primers where required.

C. When undercoats, stains or other conditions show through final paint coat, apply additional coats until paint film is of uniform color and sheen.

D. Finish the insides of wood cabinets, including backs of cabinet doors, as scheduled for the fronts and ends.

E. Between coats, sand enamel and lacquer finish on wood and metal surfaces to produce a smooth, even finish. Use #220 grit sandpaper or finer.

F. Tint priming coats and undercoats to approximate shade of final coat to assure uniformity of color in the finish. Touch up suction spots and “hot spots” before applying the last coat to produce an even result in the finish coat.

G. Exposed ductwork, piping and conduit in finished, occupied areas shall be painted the same color as the wall or ceiling against which it is installed, unless otherwise noted.

H. Apply the finish coat on gypsum board, plaster and concrete surfaces with rollers.

I. On concrete masonry unit wall surfaces without a block filler, apply the first coat of paint with a spray gun.

J. Do not paint moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sensing devices, motor and fan shafts.

K. Do not paint over code-required labels such as Underwriter’s Laboratories and Factory Mutual, or equipment identification, performance rating, name or nomenclature plates.

3.04 TOUCH UP AND CLEAN

A. Touching Up: On completion, carefully touch up all holidays, marred and damaged spots, and work over all surfaces that have been repaired by other trades.

B. Cleaning: Remove spilled, splashed and splattered paint from all surfaces. Do not mar surface finish of item being cleaned.

C. Reinstall the items removed under the provisions of paragraph above.

3.05 V.O.C. (VOLATILE ORGANIC COMPOUND) COMPLIANCE
A. Products listed in following schedule and/or substitutes proposed for use by Contractor must be formulated to meet all applicable ordinances and regulations regarding maximum V.O.C. content. Utilize products which have been specially formulated to meet such requirements.

3.06 RE-PAINTING

A. Locations and Extent: The re-painting of existing surfaces shall be as follows:

1. Painted wall, door and frame surfaces which have been reworked, cut into or patched, whether specifically designated on the drawings or not. Re-painting shall include all openings in existing walls.

2. Entire rooms/areas, as designated on the drawings.

B. Colors: Match existing colors of corresponding surfaces except where new colors are scheduled.

C. Preparation:

1. Clean surfaces to remove dust and dirt. Remove oil, grease, was and other contaminants which would inhibit paint bond. At ceiling grid to be re-painted, remove grease or oil with paint thinner.

2. Remove rust and loose and flaking paint by scraping and sanding.

3. Sand hard, glossy painted surfaces and ceiling grid to be painted, until dull or treat with surface conditioner to promote adhesion of new coat of paint.

4. Prime bare areas with suitable primer in conformance with the above paint schedule for new work.

D. Painting: Generally, apply one coat of finish paint over old and new surfaces, using the same materials scheduled in the above paint schedule for like new surfaces.

E. Verification: Verify the extent of re-painting work at the building and make due allowance for cutting and patching required for installation of mechanical and electrical work.

3.07 PAINT SCHEDULE

A. The products listed below represent top of the line products of each manufacturer. These products are not presented as being equivalent, as there are too many variables to match each product across the board. Manufacturer’s designations are:

   SW  The Sherwin-Williams Co.
   TN  Tnemec Co.
B. Interior Metal

1. Steel door frames, borrowed light frames, louvers and vision panel frames in doors, hollow metal doors, sound retardant doors and ladders.

   1 primer coat
   
   SW Macropoxy 646 FC  
   TN Series 20 - 1255 Beige Pota-Pox  

   2 finish coats
   
   SW Macropoxy 646 FC  
   TN Series 20 - Pota-Pox or FC20 Pota-Pox

2. Other exposed iron and steel

   1 primer coat
   
   SW Macropoxy 646 FC  
   TN Series 20 - 1255 Beige Pota-Pox

   1 finish coat
   
   TN Series 20 - Pota-Pox or FC20 Pota-Pox  
   SW Macropoxy 646 FC

3. Items of mechanical and electrical machinery and equipment

   1 finish coat
   
   SW Macropoxy 646 FC  
   TN Series 20 - Pota-Pox or FC20 Pota-Pox

4. Fire extinguisher cabinets, including door and frame inside and outside.

   1 finish coat
   
   SW Macropoxy 646 FC  
   TN Series 20 - Pota-Pox or FC20 Pota-Pox

5. Ductile iron pipe, fittings and equipment (e.g. butterfly valves, etc.)

   1st Coat - 3.0 – 4.0 dry mils of Tnemec Series 18 Enviro-Prime  
   or  
   4.0 – 5.0 dry mils of Sherwin-Williams DTM Acrylic Primer/Finish @ the rate of 290 sq.ft./gal.
2\textsuperscript{nd} Coat - 1.5 – 2.0 dry mils of Tnemec Series 28 Color Tufcryl  
or  
3.0 – 4.0 dry mils of Sherwin-Williams DTM Acrylic Coating @ the rate of 250 sq.ft./gal.

3\textsuperscript{rd} Coat - Tnemec only: 
1.5 – 2.0 dry mils of Tnemec Series 28 Color Tufcryl

C. Exterior Metal

1. Non-galvanized steel door frames, hollow metal doors, pipe handrails, railings, lintels, gates, and ladders.

1 primer coat

SW Macropoxy 646 FC  
TN Series 20 - 1255 Beige Pota-Pox

2 finish coats

SW Macropoxy 646 FC  
TN Series 20 - Pota-Pox or FC20 Pota-Pox

2. Steel pipe, conduit, hangers, supports and brackets.

1 primer coat

SW Macropoxy 646 FC  
TN Series 20 - 1255 Beige Pota-Pox

1 finish coats

SW Macropoxy 646 FC  
TN Series 20 - Pota-Pox or FC20 Pota-Pox

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings, Conditions of Contract, and Technical Specifications, apply to work of this section.

1.02 DESCRIPTION OF WORK:

A. This item will consist of repair and preparation of surfaces to be painted, application of interior and exterior paint systems, paint system materials and disinfection of surfaces which contact potable water.

1.03 REFERENCES:

A. The Society for Protective Coating’s *Steel Structures Painting Manual* and specifications contained within shall be referred to as SSPC.

B. American Water Works Association Standards shall be referred to as AWWA.

C. American Society for the Testing of Materials standards and specifications shall be referred to as ASTM.

D. U.S. Environmental Protection Agency shall be referred to as EPA.

E. American National Standards Institute shall be referred to as ANSI.

F. National Sanitary Foundation shall be referred to as NSF.

1.04 DEFINITIONS:

A. Interior surfaces include the underside of the roof plate, girders, rafters, columns, pipes, floor, appurtenances (including ladders), wall, inner surface, and the tank overflow and influent structures.

B. Exterior surfaces include the outside of the tank, and appurtenances (including ladders).

1.05 SYSTEM DESCRIPTION:

A. **Surface Preparation:** Contractor shall prepare all surfaces for painting in accordance with the SSPC *Steel Structures Painting Manual* except as amended herein. The finished quality of the interior surface preparation within the tank bowl shall conform to SSPC - SP10, "Near White Blast Cleaning." The finished quality of the exterior surface preparation shall conform to SSPC - SP6, "Commercial Blast Cleaning." All surfaces other than those inside the tank bowl shall be considered exterior surfaces.

B. **Painting:** All paint, primers and paint thinners, including primer for shop primed components, shall be from the same approved manufacturer.

All Paint shall conform to current state and federal regulations applicable to Volatile Organic Compounds (VOC’s).
1. **Interior Painting System**: Shall conform to AWWA Standard D102 for Inside Paint System No. 1, AWWA C210 and be acceptable for Potable Water Service by the EPA. Minimum dry film thickness and total dry film thickness shall be per the manufacturer's recommendation and shall comply with the requirements of AWWA D102. Coating shall meet ANSI/NSF Standard 61 approval for potable water storage.

2. **Exterior Painting System**: Shall have a minimum dry film thickness and total dry film thickness per the manufacturer's recommendation and shall comply with the requirements of AWWA D102. Colors of each coat shall be selected by Owner. Top coat shall be fade-resistant.

1.06 SUBMITTALS:

A. **Environmental Controls**: The Contractor shall submit to the Engineer a written plan describing environmental humidity and temperature climate controls for the tank interior. Submittal shall include equipment type, size, and power requirements. This submittal shall be for informational purposes only. Review of this submittal shall not constitute approval of the proposed method nor place any responsibility for the same upon the Engineer.

B. **Shrouding**: Contractor shall submit to the Engineer a written plan describing the type and performance of the proposed shrouding method. Performance data shall include time required to raise and lower shroud and containment efficiency. This submittal shall be for informational purposes only. Review of this submittal shall not constitute approval of the proposed method nor place any responsibility for the same upon the Engineer.

C. **Blast Cleaning**: Contractor shall submit to the engineer a written plan describing the materials and methods proposed for use in blast cleaning. A separate submittal shall be made for each method proposed.

D. **Paint**: The Contractor shall submit with his bid the proposed paint system. Contractor shall submit to the engineer manufacturer's technical information including paint label analysis and application instructions for each material to be used. In addition, Contractor shall submit color samples for review of color and texture. In addition, Contractor shall submit Certificate of Approval from the manufacturer stating their ability to apply the interior lining system.

E. **Paint Substitutions**: As part of the proof of equality, the Engineer may require at the cost of the Contractor certified reports from a nationally known reputable and independent testing laboratory conducting comparative tests as directed by the Engineer between the product specified and the requested substitution. Two comparative tests shall have been made within two years prior to award of contract.

F. **Welding Certification**: Welding procedures and welding operators shall be qualified in accordance with AWWA D100.

G. **TCEQ Notification**: Contractor shall satisfy the requirements as set forth in 30 TAC, Rule 111.135 prior to blasting.

H. **Overspray Plan**: Contractor shall submit a written plan to the Owner describing the measures to be taken to prevent oversprays, should they occur. The Contractor shall acknowledge in this submittal that any
damage caused by oversprays to the Town’s property and neighboring property shall be the responsibility of the Contractor.

I. General: The Contractor shall submit to the Engineer, prior to substantial completion of the project, certification from the manufacturer indicating that the quantity of each coating purchased was sufficient to properly coat all surfaces. Such certification shall make reference to the square footage figures provided to the manufacturer and the Engineer by the Contractor.

### 1.07 DELIVERY, STORAGE AND HANDLING:

A. All materials shall be brought to the job site in the original sealed and labeled containers of the paint manufacturer, and shall be subject to inspection by the Engineer on the job.

B. The Contractor shall use one convenient location for keeping all materials and doing all mixing, etc. Oily rags and waste shall be frequently removed, and under no circumstances shall they be allowed to accumulate.

C. All empty paint containers shall remain on the job site until such time as painting is complete and shall be subject to inspection by the Engineer on the job. Storage and disposal of empty paint containers must comply with TCEQ regulations.

D. Paint shall be stored in a secured area in compliance with paint manufacturer’s recommendation.

### 1.08 JOB CONDITIONS:

A. No paint shall be applied when the surrounding air temperature, as measured in the shade, is below 40 degrees Fahrenheit. No paint shall be applied when it can be anticipated that the temperature will drop below 40 degrees Fahrenheit within 18 hours after the application of the paint. No paint shall be applied when the temperature of the surface is below 50 degrees Fahrenheit or within 5 degrees Fahrenheit of the dew point, whichever is greater. Paint shall not be applied to wet or damp surfaces, and shall not be applied in rain, snow, fog or mist, or when the relative humidity exceeds 85 percent. Dew or moisture condensation should be anticipated, and, if such conditions are prevalent, painting shall be delayed until surfaces are dry. Paint shall not be applied to surfaces which are hot enough to cause blistering or pinholing of the film. Refer to manufacturer’s recommendations for the interior lining system and its recommended air temperature.

B. If the paint manufacturer’s requirements are more stringent, the Contractor shall follow them instead.

C. During periods of inclement weather, painting may be continued by enclosing the surface with temporary shelters and applying artificial heat provided allowable environmental conditions as described above can be maintained.

### 1.09 WARRANTY:

A. A paint manufacturer's representative shall be made available for an inspection annually for two years from the date of final acceptance of the project by the Owner at no cost to the Owner. The maintenance and/or warranty period stipulated within the contract documents shall remain in force.
PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. The following products are approved for use on this project and reflect the desired standards of quality. Products of other nationally known and reputable manufacturers will be considered as proposed substitutions subject to the provisions of the General Conditions and paragraph 1.06.D above. Primers and finish coats shall be manufactured by the same manufacturer and coatings shall be from the same batch. Coating manufacturers may provide their latest formulation of the specified coatings in lieu of those listed. Manufacturer's substitutions must provide at least the same performance characteristics as the specified coatings under the specified application conditions. All substitutions must be approved by the Engineer.

B. Epoxy Seam Sealants: Tnemec 63-1500 or Sherwin-Williams Steel Seam FT 910.

C. Paint and Thinners:

1. Interior Coatings:

   Interior Coatings must be ANSI/NSF Std. 61 approved for potable water storage.
   Decontamination: SSPC-SP1 “Solvent Cleaning”.
   Surface Preparation: SSPC-SP10 “Near-White Metal Blast Cleaning”.
   Colors: The color of the 2nd coat shall contrast with the 1st coat.

   1st Coat: a. Tnemec Series 91 H20 Hydro-Zinc applied at 2.5 to 3.5 dry mils.
             b. Sherwin Williams Corothane 1 Galvapac Two Pack applied at 3 to 4 dry mils.

   2nd Coat: a. Tnemec Series 22 or FC22 applied at 26.5 to 40 dry mils (Total dry mils = 30).
              b. Sherwin Williams Dura Plate UHS with OAP applied at 12 to 14 dry mils (Total dry mils = 15 to 18).

2. Exterior Coatings:

   Surface Preparation: SSPC-SP6 “Commercial Blast Cleaning”. All rough edges, weld seams and sharp corners shall be ground to a curve.
   Colors: to be selected by the City. The color of the 2nd coat shall contrast with the 1st and 3rd coat.

   1st Coat: a. Tnemec Series 91 H20 Hydro-Zinc applied at 2.5 to 3.5 dry mils.
             b. Sherwin Williams Corothane 1 Galvapac Two Pack applied at 3 to 4 dry mils.
NOTE: The first coat of primer may be shop applied. All preconstruction shop primers shall not be considered as the 1st coat.

2nd Coat:  
   a. Tnemec Series 73 applied at 2 to 3 dry mils.
   b. Sherwin Williams Acrolon 218 HS applied at 2 to 3 dry mils.

3rd Coat:  
   a. Tnemec Hydroflon Series 700 applied at 2 to 3 dry mils (Total dry mils = 6.5).
   b. Sherwin Williams Fluorokem applied at 2.5 to 3 dry mils (Total dry mils = 7.5).

Tank Logo:  The tank logo shall be applied in accordance with the details provided in these contract documents. Logo shall be applied using one coat of Tnemec Series 700 Hydroflon, with a dry film thickness of 2.0 - 3.0 mils or Sherwin Williams Fluorokem with a dry film thickness of 2.5 to 4.0 mils. Logo colors shall be selected by City.

2.02 EQUIPMENT:

A. Agitator: The Contractor shall provide a suitable mechanical agitator and shall agitate all paint until proper dispersion of materials is secured. All paint ingredients shall be in a satisfactory dispersed condition at the time of application. Use equipment that conforms to the paint manufacturer’s requirements.

2.03 MATERIALS:

A. Blast Cleaning Abrasives: Blasting shall be done with an abrasive material of non-silica composition. This abrasive material shall be clean, dry, and free of clay particles and other extraneous matter. The abrasive material must be approved by the Owner's representative before blasting begins.

B. Compressed Air used for blasting shall be free of detrimental amounts of water and oil. Adequate traps and separators shall be provided at the compressor.

C. A Rust Inhibitor compatible with the coating systems shall be included in water for wet blasting.

PART 3 - EXECUTION

The Contractor and all workmen employed by him shall conduct all operations in a clean and sanitary manner and in conformance with all aspects of the General Conditions. Contractor shall at all times provide dust and overspray controls for blasting and painting operations.

3.01 SURFACE PREPARATION:

A. All surfaces shall be prepared in accordance with the paint manufacturer's recommendations and as a minimum shall be cleaned free of all old paint, rust, corrosion, mill scale, oil and grease. During the cleaning or other operations inside the structure, all interior controls, floats, cathodic wiring, etc., to
remain must be protected from damage, and a cover shall be provided over the entrance of all pipes to prevent foreign matter from entering the pipes.

B. After the surface has been cleaned, it shall be inspected for any required structural repairs, and these areas shall be so marked as to enable repairs to be made. Such repairs will include, but are not limited to, leaks at riveted or welded seams, the interior ladder and controls. Epoxy seam sealer shall be used to seal all cracks and crevices which are not 100% sealed against moisture intrusion. Such places shall include, but not limited to, the structural roof supports, and bolt connections.

C. **Spot Cleaning:** All rust, peeled or cracked paint, overspray, runs, sags and non-adherent paint shall be removed. All exposed edges of the remaining paint shall be feathered, and spot cleaning shall be conducted in a manner to minimize damage to sound material. All foreign matter shall be removed from seams, pickets, joints and the bottom of the columns and plates.

D. In the case of new construction, the Contractor has the following option: The surface preparation may be done by acid treatment, and primer immediately following, or the surface preparation may be done by blast cleaning and primer immediately following. The cleaning and priming shall be done in the shop. All paint, primers and paint thinners, including primer for shop-primed components, shall be from the same approved manufacturer.

E. All surfaces to be painted shall receive a final brush blast immediately before applying the initial coating. The time limit between final blasting and initial coating shall be in accordance with the manufacturer’s recommendations, and in no case shall this time period exceed two hours.

3.02 **REPAIRS:**

A. **Pit and Seam Welding:** Pit welding shall include all pits with a depth equal to or greater than 1/2 the thickness of the plate. All other corrosion shall be repaired and seams rewelded as necessary to prevent future leaks and to protect the integrity of the coating system.

B. **Surface Grinding:** The Contractor shall grind and round all sharp edges.

C. **Weld Grinding:** All welds shall be continuous, ground to a curve and free of porosity, pockets, high spots, rough projections and ripples to provide a coatable surface. All welds shall be blended smoothly into plate surface. All weld slag, splatter and flux shall be removed prior to blasting.

3.03 **APPLICATION:**

A. **Ventilation:** The Contractor must provide adequate reverse chimney effect forced air ventilation while painting or coating the interior surfaces of a tank. The ventilation shall be adequate to remove fumes, prevent the possibility of an accumulation of volatile gases, protect workmen and prevent damage to the tank. The Contractor shall be held financially responsible for all damage to the tank caused by inadequate ventilation.

B. **Mixing:** Splitting paint kits and mixing of partial kits is not allowed. Mix only whole kits and discard any leftover paint. Mixing of all coatings must be performed in strict compliance with the manufacturer’s recommendations.
C. **General Application:** All paint and finishing materials shall be applied by skilled workmen and shall be brushed or sprayed in even, thorough coats without runs, crazing, sags or other blemishes. All coats, regardless of material, shall be thoroughly dry before applying succeeding coats. Full drying time as recommended by the manufacturer of the particular paint involved shall be allowed between coats. All products shall be applied in strict accordance with the manufacturer's recommendations. Painting systems shall be applied by one or more of the following described methods. However, spray application will not be permitted for exterior surfaces unless the Contractor contains overspray by a method acceptable to the Engineer. Application equipment shall meet manufacturer’s recommendations.

D. **Brush Application:** Only top quality hog hair or synthetic bristle brushes shall be used. All paint shall be applied so as to form a uniform film of a thickness which is consistent with the specified coverage for the paint being used. Sufficient cross brushing shall be used to insure filling of all surface irregularities and complete coverage. Particular care shall be used in painting corners and other restricted places to obtain uniform application. All final brushing strokes shall be made in the same direction and toward the previously applied paint.

E. **Roller Application:** Rollers used for applying coatings shall be of the highest quality and must be kept as clean as possible at all times. Any coating rolled on must form a uniform film and must give the same end results as a brushed on coat. Rolling shall be supplemented by brushing in areas where rolling could not give complete coverage, such as corners, edges, welds, crevices, bolts, rivets or other irregular surfaces.

F. **Spray Application:** When paint is applied by spraying, the air gun used shall be adjustable for regulation of the air and paint mixture. The equipment shall have a suitable water trap to remove moisture present in the compressed air. Paint pots shall be equipped with a hand agitator to keep the paint well mixed. All equipment shall be thoroughly cleaned at the end of each day's work. The width of the spray shall be not less than twelve (12) inches or more than eighteen (18) inches. The pressure shall be suitable for type of paint used. Frequent checks shall be made to insure maintenance of correct spreading rate; care shall be taken to see that edges, corners, and bolt heads are completely covered, and that there has been no bridging over the film. Airless spray application is acceptable with prior approval of the Engineer. The interior shall be applied with a plural component spray equipment. The plural component spray equipment shall be of the same type and setup used for certification of the contractor to apply the product.

G. **Cleanup:** At the completion of the work, the Contractor shall clean off all paint spots, oil and stains from surfaces and leave the entire project in a satisfactory condition. Special attention shall be given to the tank foundation in that it shall be protected at all times from paint splatter. Any overlapping of the paint onto the concrete shall be cleaned by grinding or other methods as approved by the Engineer.

### 3.04 DISINFECTION:

Prior to placing the tank in service, the structure shall be thoroughly disinfected by spray application of a chlorine and water solution as described in AWWA Specification C652-02, Section 4.3 - Chlorination Method 2.

### 3.05 FIELD QUALITY CONTROL:
A. General: All work and materials supplied under this specification shall be subject to inspection by the Owner or its representative. All parts of the work shall be accessible to the inspector. The Contractor shall correct such work or replace such material if found defective. Such inspection will not relieve the Contractor of the responsibility of furnishing qualified labor and materials in strict accordance with the specifications.

B. Threshold Inspections: At certain stages in the project the Contractor will not be allowed to proceed until a thorough inspection has been performed by the Owner's representative and the Owner's representative has approved the work up to that point. The following threshold inspections will be required:

- Surface Preparation and Repair Completion: After all repairs have been made and surfaces prepared in accordance with these specifications and the coating manufacturer's instructions. The project site or area to be painted (interior or exterior of tank) shall be cleaned and ready for coating operations to begin.

- Completion of Each Coat: After each prime coat application and touch up; when the tank is ready to receive the following coat.

- Substantial Completion: When all work and clean up is completed and prior to contractor moving equipment and manpower off the job.

The Contractor will notify the Owner 48 hours in advance of needing threshold inspection. Prior to scheduling the inspection, the Contractor shall have sufficiently reviewed his work and believe it to be ready for threshold inspection. The cost of additional threshold inspections required because work was not approved at the original threshold inspection will be borne by the Contractor. The threshold inspections will not relieve the Contractor of his responsibility to furnish qualified labor and materials in accordance with the specifications.

C. Quality Control Log: The Contractor shall maintain a quality control program to include a daily log and at a minimum the following quality control checks:

1. Daily compressed air blotter test.
2. Surface preparation visual checks using SSPC VIS 1-89.
3. Surface profile checks periodically using Testex Replica Tape.
4. Wet film thickness, periodically as coating is applied using an approved gauge.
5. Dry film thickness, daily and periodically as coating dries, using an Elcometer Thickness gauge or equal.
6. Holidays, daily and periodically as needed using an approved low voltage holiday detector.
7. Environmental condition, minimum of twice daily, once prior to beginning work and once in the afternoon to include:

   a. Ambient temperature.
   
   
   c. Steel surface temperatures on at least two opposite sides of tank using surface sensing thermometers.
   
   d. Wind speed and direction.

The Contractor's daily log shall be kept on site at all times and be made available for review by the Owner or Owner's representative on demand. The daily log shall include as a minimum the following information:

1. Date.
2. Name of Contractor.
3. Project Name.
4. Person's Name who Makes Log Entry.
5. Specific Progress

   - Areas of tank blasted
   - Repairs made including location
   - Coatings applied and location
   - Touch Up work and location

6. Environmental conditions as listed in Paragraph 3.05.C.7., and the time readings were taken.
7. Locations and results of all quality control checks.
8. Product manufacturer and batch numbers of coatings used that day.
9. Problems encountered and action taken as a result.

D. Testing Equipment: The Contractor shall furnish an approved type dry mil gauge apparatus to measure the dry film thickness. The Elcometer Thickness Gauge or equal shall be furnished to the Owner for his use. The Contractor shall also furnish to the Owner, for his use, holiday detector devices. Holiday detector devices shall be approved low-voltage type. All of the above inspection gauges shall be furnished and on the job before the Owner will permit painting operations to proceed and shall remain on the job until its completion and acceptance. The Contractor or his representative shall instruct the Owner on the proper use, care and calibration of all such gauges. The above-required testing gauges and calibration materials shall be furnished to Owner and are returnable to the Contractor upon completion of the job. The cost of furnishing all of the above required gauges to the Owner for his use shall be borne by the Contractor.

E. Bacteriological Testing: Following disinfection, the tank shall be filled and sampled by the Contractor for bacteriological testing, prior to being put into service. The testing shall be as described in AWWA Specification C652-92, Section 4.4 - Bacteriological Sampling and Testing. Results of the test shall be
reviewed by the Engineer. Final decision upon the suitability of the disinfection procedure shall rest with the Engineer. Should repeat of the disinfection procedure be required, additional cost of disinfection, testing and water to fill the tank shall be borne by the contractor at no additional cost to the Owner.
PART I - GENERAL

1.01 SCOPE OF WORK:

Provide an altitude and solenoid shut-off valve with return flow, and valve flow measurement system. Furnish all materials, equipment, and labor and incidentals necessary to provide, install and put into operation one altitude valve as specified herein and shown on the drawings.

1.02 REFERENCES:

ASTM A48   Gray Iron Castings.
ASTM A126   Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A436   Austenitic Gray Iron Casting
ASTM A536   Ductile Iron Casings.

1.03 SYSTEM DESCRIPTION:

A. This valve shall control the high water level in the elevated tank without the need for floats or other devices. It shall be a non-throttling type valve and remain fully open until the "shut-off" point in the reservoir is reached. This valve is designed for two-way flow and shall have a solenoid to override the altitude pilot causing valve closure. The valve shall be designed to shut off at the normal high level set point and return flow to the system under normal operating conditions. Upon receiving an electrical signal to the solenoid, the valve shall close at a controlled rate to prevent water from entering into the reservoir. The valve shall be normally open and energized to close.

B. The arrangement shown on the drawings is based upon the best information available to the Engineer at the time of design and is not intended to show exact dimensions to any specific equipment unless otherwise shown or specified. Therefore, it may be anticipated that the structural supports, foundations, and connected piping shown, in part of in whole, may have to be changed in order to accommodate the equipment furnished. No additional payment will be made for such changes. All necessary calculations and drawings for any related redesign shall be submitted to the Engineer for his approval prior to beginning the work.

1.04 QUALITY ASSURANCE:

A. The valve shall be the product of a manufacturer regularly engaged in the manufacture of hydraulic valves having similar service and size. The valves covered by the specifications are intended to be standard equipment of that has proven ability. Only the following manufacturers and models are acceptable.

Manufacturer

The valve shall be Cal-Val Model 210-27BYKCKVF Altitude Valve with 133VF, as manufactured by Cla-Val Co., Newport Beach, CA 92659-0325.
B. All other valves will be considered a substitution, and will be required to submit a substitution form as specified in Section 01630. The Engineer shall be the sole judge of the acceptability of any substitution requested. If the substitution request is found to be unacceptable by the Engineer then the contractor shall provide the listed equipment at no additional expense to the owner. The Contractor shall be responsible for any delays as a result of a substitution request.

C. The listing above does not imply that the manufacturer’s standard product is acceptable. The successful manufacturer will be required to conform to all specifications.

D. Unit Responsibility and Coordination:

The Contractor shall cause all equipment specified under this section to be furnished by the valve manufacturer who shall be responsible for the adequacy and compatibility of all unit components including but not limited to the valve, actuator and extension stems. Any component of each complete unit not provide by the valve manufacturer shall be designed, fabricated, tested, and installed by factory-authorized representatives experienced in the design and manufacture of the equipment. This requirement, however, shall not be construed as relieving the Contractor of the overall responsibility for this portion of the work.

1.05 SUBMITTALS:

A. Submittals required after award of contract and prior to shipping:

1. Technical bulletins and brochures.
2. Certification of compliance with specifications.

B. Submittals required prior to final walk through:


1.06 SPARE PARTS AND TOOLS:

A. None required.

1.07 SHIPPING INSTRUCTIONS:

A. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.

B. All equipment and parts must be properly protected against any damage during a prolonged period at the site.

C. The finished surfaces of all exposed flanges shall be protected by wooden blank flanges, strongly built and securely bolted thereto.
D. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

E. Storage and Protection: Take special care to prevent plastic and similar brittle items from being directly exposed to the sun, or exposed to extremes in temperature, preventing any deformation.

1.08 WARRANTY:

A. The equipment shall be warranted to be free from defects in workmanship, design and materials. If any part of the equipment should fail during the warranty period, it shall be replaced and the unit(s) restored to service at no expense to the Owner. Warranty shall be for a period of two (2) years and begin from the date of Final Acceptance.

PART 2 - PRODUCTS

2.01 MAIN VALVE:

The valve shall be hydraulically operated, single diaphragm actuated, globe pattern. The valve shall consist of three major components: the body with seat installed, the cover with bearing installed, and the diaphragm assembly. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. Packing glands and/or stuffing boxes are not permitted and there shall be no pistons operating the main valve or pilot controls. Valve body and cover shall be of cast material manufactured and machined in North America. No fabrication or welding shall be used in the manufacturing process. Valve shall have NSF 61 approval.

The valve shall contain a resilient, synthetic rubber disc, with a rectangular cross-section contained on three and one-half sides by a disc retainer and forming a tight seal against a single removable seat insert. No O-ring type discs (circular, square, or quad type) shall be permitted as the seating surface. The disc guide shall be of the contoured type to permit smooth transition of flow and shall hold the disc firmly in place. The disc retainer shall be of a sturdy one-piece design capable of withstanding opening and closing shocks. It must have straight edge sides and a radius at the top edge to prevent excessive diaphragm wear as the diaphragm flexes across this surface. No hourglass-shaped disc retainers shall be permitted and no V-type or slotted type disc guides shall be used.

The diaphragm assembly containing a non-magnetic 303 stainless steel stem of sufficient diameter to withstand high hydraulic pressures shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. The seat shall be a solid, one-piece design and shall have a minimum of a five-degree taper on the seating surface for a positive, drip-tight shut off. No center guides shall be permitted. The stem shall be drilled and tapped in the cover end to receive and affix such accessories as may be deemed necessary. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure.

The flexible, non-wicking, FDA approved diaphragm shall consist of nylon fabric bonded with synthetic rubber compatible with the operating fluid. The diaphragm must withstand a Mullins burst test of a minimum of 600 psi per layer of nylon fabric and shall be cycle tested 100,000 times to insure longevity. The diaphragm shall be fully supported in the valve body and cover by machined
surfaces which support no less than one-half of the total surface area of the diaphragm in either the fully open or fully closed position.

Valve seat in eight inch and larger size valves shall be retained by flat head machine screws for ease of maintenance. The seat shall be of the solid, one piece design and shall have a minimum of a five degree taper on the seating surface for positive drip tight shut-off. Pressed-in bearings and/or multi-piece seats shall not be permitted. To insure proper alignment of the valve stem, the valve body and cover shall be machined with a locating lip. No "pinned" covers to the valve body shall be permitted. All necessary repairs and/or modifications other than replacement of the main valve body shall be possible without removing the valve from the pipeline.

The valve manufacturer shall be able to supply a complete line of equipment from 1 1/4" through 24" sizes and a complete selection of complimentary equipment. The valve manufacturer shall also provide a computerized cavitation chart which shows flow rate, differential pressure, percentage of valve opening, Cv factor, system velocity, and if there will be cavitation damage. An orifice plate shall be provided upon determination of system characteristics and evaluation of system requirements and analysis.

### 2.02 MATERIAL SPECIFICATION:

- **Valve size:** 24"
- **Main Valve Body and Cover:** Ductile Iron / ASTM A-536
- **Main Valve Trim:** 316L Stainless Steel
- **Stem:** 303 Stainless Steel
- **End Detail:** ANSI B16.5 150 LB. FLG.
- **Pressure Rating:** 250 PSI
- **Temperature Range:** -40 to +180 Degrees F
- **Rubber Material:** Buna "N"
- **Coating:** Epoxy coated by baked on resin fusion method process 5-7 mils thick internal & external
- **Desired Options:** X105LCW

### 2.03 PILOT CONTROL SYSTEM:

The pilot control shall be of a diaphragm-actuated, three-way type that operates on the differential force between the height of the water in the reservoir and an adjustable spring-load. The spring-load shall be an arrangement of smaller springs on a plate within the control. At least five different adjustment ranges shall be available with this configuration. When actuated, the pilot control shall vent the cover of the main valve to atmosphere through the internal working of the pilot control to open the valve wide. When the desired level in the reservoir is reached, the static height of the tank shall head through a customer supplied sensing line connected directly to the reservoir. When the control shifts at high water level supply pressure shall be directed into the valve cover through the internal workings of the pilot control to close the valve. The pilot control senses the reservoir head by means of a sensing line connected between the pilot control and the reservoir. Additionally, a solenoid along with a three-way high capacity pilot shall close the valve upon a signal from an electrical source. The solenoid shall incorporate a manual operator for manual operation. Valve shall be equipped with an adjustable closing speed control. A full range of spring settings shall be available in ranges of 5 to 200 feet. A direct factory representative shall be made available for start-
up service, inspection and necessary adjustments.

2.04  MATERIAL SPECIFICATION FOR PILOT CONTROL:

Body & Cover: Cast Bronze ASTM B62  
Pressure Rating: 150 PSI  
Trim: 303 Stainless Steel  
Rubber Material: Buna “N”  
Tubing and Fittings: Bronze & Copper  
Operating Fluids: Potable Water  
Voltage: 120/60 Volt AC  
Adjustment Range: 0-100 PSI  
Enclosure Type: Nema IV Watertight

2.05  VALVE FLOW MEASUREMENT SYSTEM:

The Valve Flow Measurement System shall be model 133VF as manufactured by Cla-Val Co. It shall be installed on the valve and shall be capable of calculating flow in any measurement units. It shall use a valve mounted position transmitter rated NEMA type 6P for temporary submersible operation and shall track valve position from 0 to 100 %. It shall also be equipped with a differential pressure transmitter or an inlet and outlet pressure transmitter with a NEMA 4X rating and shall have infinite ranging ability. The transmitters shall also be capable of being zeroed in the field to compensate for elevation and temperature changes. Information from these transmitters shall be assimilated into a flow module capable of computing flow when the pressure differential is measured at the body bosses of the control valve or on the pipeline if located within three pipe diameters of the control valve. The flow module shall output a 4-20mA-flow signal. Power shall be 24VDC not to exceed 150 mA current draw.

PART 3 - EXECUTION

3.01.  INSTALLATION:

A.  The valve shall be installed in accordance with the instructions of the manufacturer and as shown on the drawings.

B.  Installation and adjustment shall be checked and approved by a manufacturer's direct factory representative. After acceptance, the representative shall address a letter to the Engineer outlining all installation and start up procedures. The letter shall include a statement that the valves are installed per the manufacturer's recommendations. The manufacturer or his qualified representative shall conduct training session for the Owner's personnel in the operation and maintenance of the valves.

C.  The valve manufacturer shall provide a direct factory representative to calibrate the valve and verify operation during start up.

END OF SECTION
PART I - GENERAL

1.01 SUMMARY

Contractor to furnish pre-cast, post-tensioned concrete transportable building. Building to be delivered and placed concrete slab foundation in accordance with manufacturer’s recommendations.

1.02 MANUFACTURER

Pre-cast building to be EASI-SET brand Model 1012 as manufactured by Lonestar Prestress Mfg., Inc., Houston, Texas or approved equal. Building to be provided by manufacturer with all necessary openings as specified in conformance with manufacturer's structural requirements.

1.03 CODES, STANDARDS AND REFERENCES

A. ACI-318-02, “Building Code Requirements for Structural Concrete”.
B. ASCE-7-02, “Minimum Design Loads for Buildings and Other Structures”.
D. PCI Design Handbook, Precast/Prestressed Concrete Institute.
E. UL 752, Standard for Safety for Bullet Resisting Equipment, Underwriters Laboratories Inc.
G. ASTM, American Society for Testing and Materials:
   2. C33 -Standard Spec. for Concrete Aggregates.
   4. A615 - Standard Spec. for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   5. A706 - Standard Spec. for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
   6. A416 - Standard Spec. for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete.

1.04 QUALITY ASSURANCE

A. Walls to be UL-752 Test Method Level 4 for bullet resistance, certified by an independent structural engineer.

B. Building fabricator must have a minimum of 10 years experience manufacturing pre-cast concrete buildings.

C. Building fabricator must be a producer member of the National Precast Concrete Association (NPCA).

1.05 DESIGN REQUIREMENTS

A. Dimensions:

   Exterior: 10' length, 10’ width, variable height based on slope of roof

   Interior: 9'-4" length, 9'-4" width, clear interior height of 8'-6" minimum

B. Standard Design Loads:

   1. Standard Wind Loading -140 MPH (ASCE 7-02, Category II, Exposure C, Enclosed Building)

   2. Standard Roof Live Load - 60 PSF

   3. Standard Floor Live Load - 250 PSF

   4. Seismic Design category ‘D’, Seismic use Group I

C. Roof: Roof shall have a gabled design and shall be sloped 3:1 downward from the centerline of the roof. The roof shall extend a minimum of 3" beyond the wall panel on each side and have a turndown design which extends 1/2" below the top edge of the wall panels to prevent water migration into the building along top of wall panels. Roof shall also have an integral architectural ribbed edge.

D. Floor: There shall be a 1/2” deep recess, the width of the wall panels, cast into the floor. The 1/2” recess makes the interior floor surface 1/2” higher than the joint between the wall panel and floor slab preventing intrusion of water.

E. Roof, floor and wall panels must each be produced as single component monolithic panels. No roof, floor, or vertical wall joints will be allowed, except at corners. Wall panels shall set on top of floor slab.

1.06 SUBMITTALS
A. Building engineering calculations that are designed and sealed by a professional engineer, licensed in the state of manufacture, shall be submitted for approval.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Concrete: Steel-reinforced, 6000 PSI minimum 28-day compressive strength.

B. Reinforcing Steel: ASTM A615, grade 60 or ASTM A185, grade 80 unless otherwise indicated.

C. Post-tensioning Strand: 41K Polystrand CP5O, .50, 270 KSI, 7-wire strand, greased plastic sheath, (ASTM A416), roof and floor to be each post-tensioned by a single, continuous tendon. Said tendon shall form a substantially rectangular configuration having gently curving corners and a corner where the tendon members are anchored. Tendons shall be greased and enclosed within a sheath.

1. If post-tensioning is not used in the roof panel, the following guidelines must be followed to ensure a watertight roof design.
   a. The entire pre-cast concrete roof panel surface must be cleaned and primed with a material that prepares the concrete surface for proper adherence to the coating material.
   b. The entire pre-cast concrete roof panel surface shall be sealed with a .045 EPDM continuous membrane cemented to the concrete with a compound designed for this purpose.

D. Caulking: All joints between panels shall be caulked on the exterior and interior surface of the joints. Caulking shall be SIKAFLEX-IA elastic sealant or equal. Exterior caulk joint to be 3/8" x 3/8" square so that sides of joint are parallel for correct caulk adhesion. Back of joint to be taped with bond breaking tape to ensure adhesion of caulk to parallel sides of joint and not the back.

E. Panel Connections: All panels shall be securely fastened together with 3/8” thick steel brackets. Steel is to be of structural quality, hot-rolled carbon complying with ASTM A36 and hot dipped galvanized after fabrication. All fasteners to be 1/2" diameter bolts complying with ASTM A307 for low-carbon steel bolts. Cast-in anchors used for panel connections to be Dayton-Superior #F-63, or equal. All inserts for corner connections must be secured directly to form before casting panels. Floating of connection inserts will not be allowed.

2.02 ACCESSORIES

A. Door and Hardware: Doors and hardware shall meet the requirements of Sections 08111 and 08710.

B. Additional Equipment – the building shall include the following additional accessories:

1. 12 gage wiring in U.L. listed non-metallic flexible, liquid tight conduit.
2. 125 A, main lug, 8 branch circuit panel in NEMA 3R thermoplastic enclosure.

3. Duplex 115V outlets.

4. Interior vapor-resistant light.

5. Non-metallic intake or exhaust fan with screened hood.

6. Outside weatherproof switch for fan and light.

7. Two screened aluminum vents in rear wall. Vents shall be SUNVENT #164FL or equal.

2.03 FINISHES

A. Interior of Building: Smooth steel form finish on all interior panel surfaces.

B. Exterior of Building: Architectural precast CMU finish: Finish must be imprinted in top face of panel while in form using an open grid impression tool similar to "EASI-Brick". Finished brick size shall be approximately 8” x 16” with vertical steel float or light broom finish. Joints between each brick must be 3/8" wide x 3/8" deep. Back of joint shall be concave to simulate a hand tooled joint. Each brick face shall be coated with an acrylic concrete stain: 1) Cementrate by FOSROC; or 2) Canyon Tone stain by United Coatings. Stain color shall be white unless specified otherwise. Stain shall be applied per manufacturer's recommendation. Joints shall be kept substantially free of stain to maintain a gray concrete color. As noted on drawings.

PART 3 - EXECUTION

3.01 SITE PREPARATION REQUIREMENTS (Cast-in-place floor)

A. Contractor to pour a concrete floor slab with turndown footing the same length and width of building. The floor slab shall be designed to support the anticipated load of the building walls and its contents.

B. The floor shall have a 1 1/2" deep recess, the width of the wall plus 3 1/2" wide cast into the floor around the perimeter except at doors. The 1 1/2" recess makes the interior floor surface 1 1/2" higher than the joint between the wall panel and the foundation preventing intrusion of water.

C. The finished floor slab elevation shall be above the exterior grade. The grade shall have a positive slope and drainage away from the building at all points.

D. Concrete slab to be steel reinforced and level within 1/8” in both directions.

E. Footer depth and reinforcement to be in accordance with design drawings.

3.02 ACCESS
A. Contractor must provide level unobstructed area large enough for crane and tractor/trailer to park adjacent to pad. Crane must be able to place outriggers within 5'-0" of edge of pad and truck and crane must be able to get side-by-side under their own power. No overhead lines may be within 75' radius of center of pad.
PART 1 - GENERAL

1.01 SUMMARY:

A. Work Included

1. This section includes the design, construction, testing, and commissioning of a Composite elevated tank and related work including foundations, painting, electrical, mechanical and appurtenances.

B. Related Documents

1. Plans and the general provisions of this document, including General Conditions, Special Provisions, and other Division 1 Sections apply to work in this section.

C. Related Sections

1. Section 09910: Steel Water Storage Tank Painting.

1.02 REFERENCES:

The latest version of the following Specifications, Codes and Standards are referenced in this section.

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1.03 SYSTEM DESCRIPTION:

A. Elevated Tank

1. The Composite elevated tank shall consist of the following: foundation, reinforced concrete support structure and a welded steel water tank. The support structure shall extend vertically from the foundation as a circular concrete wall. A domed concrete slab shall be provided as structural support for the steel tank within the perimeter of the wall. A reinforced concrete ring beam shall be provided to connect the steel tank, concrete dome and concrete support wall. The elevated tank shall be in accordance with the dimensions and details required by these specifications and drawings.

B. Operating Parameters

Minimum capacity within operating range 2,500,000 gallon
Maximum operating range 45.00 ft
Elevation - overflow/top capacity level 835.00 ft
- bottom capacity level 790.00 ft
- grade slab 656.00 ft
- final ground 655.00 ft
Inlet / Outlet Pipe Diameter 24 in.
Overflow Pipe Diameter 18 in.
Maximum fill and drain rate 10,000 gpm

C. General Design

1. Design Standards - The structural design of the elevated storage tank shall conform to the following design standards except as modified or clarified by this section.

   Foundations and Support Structure ACI 371 and ASCE 7
   Composite Elevated Tanks for Water Storage AWWA D107

2. Design Parameters - The applicable design parameters are:

   Earthquake Zone Zone 0
   Design Wind Speed 100 mph
   Design Snow Load 15 psf

D. Design Loads

Design loads shall be in accordance with D107 for Category IV (essential facility) structure.

1. Dead load shall be the estimated weight of all permanent construction.
2. Water load shall be the weight of water when the tank is filled to overflow.

3. Roof live load in addition to snow load: none.

4. Roof snow load shall be the larger of 15 psf or the snow load determined in accordance with D107. Ground snow load shall be determined from D107.

5. Wind loads shall be in accordance with D107 for wind exposure category C, and basic wind speed of 100 mph.

6. Horizontal and vertical seismic loads shall be in accordance with D107 and the Site Class as determined in the soil investigation report.
   a. Importance factor I = 1.50
   b. Response Modification Coefficient R = 3.0

E. Combination of Loads

1. The effect of combination of loads shall be considered in accordance the latest version of ACI 371 section 4.2 - Loads.

F. Third Party Geotechnical Investigation

1. The Contractor will provide a geotechnical report performed by an independent third party firm. The investigation described in Paragraph 1.07B herein is to establish bidding parameters only. The Contractor’s foundation design should be based on the results of his independent geotechnical recommendation.

2. The independent firm’s investigation shall, at a minimum, include the following:
   a. A minimum of 3-test holes
   b. Maximum allowable bearing pressure
   c. Settlement
   d. Uplift potential
   e. Foundation recommendation

3. The geotechnical report shall be sealed by a Professional Engineer licensed in the State of Texas.

4. If the Contractor’s geotechnical report yields results which vary from the original geotechnical report included in the bidding documents, the Contractor shall notify the Engineer in writing within 3 working days. In no case shall the design include allowable bearing pressure that is greater than the original report. In the case of substantial variation in the reports, the Engineer will direct the Contractor in procedures to coordinate results.
1.04 SUBMITTALS:

Unless otherwise specified, submit copies of all required submittals in accordance with Specification 01340, each stamped and approved by the Contractor. Submittals not stamped and approved by the Contractor will be returned and not reviewed.

A. Construction Drawings

1. Provide elevation, plan and sectional view drawings of the foundation, support structure, tank and all appurtenant equipment and accessories. Show the location, dimensions, tolerances, material specifications and finish requirements. The submission shall be sealed by a professional engineer licensed in the State of Texas.

2. Foundation details shall include excavation, soil protection and backfill requirements, all in accordance with the geotechnical report.

3. Reinforced concrete details shall include construction joints, openings and inserts. Reinforcement shall be clearly indicated on the structural drawings and identified by mark numbers that are used on the fabrication schedule. Location, spacing and splice dimensions shall be shown. Placement and fabrication details shall conform to ACI 318 and ACI 315.

4. Steel tank details shall include components, fabrications, weld joints and a layout showing all primary and secondary shop and field welds.

B. Design Data

1. Provide a table showing capacity of the tank in gallons at all levels in one-foot increments.

2. Provide a summary of the design for the foundation, support structure, tank and other components. Include the design basis, loads and load combinations and results that show conformance with specifications and referenced codes and standards. The submission shall be sealed by a professional engineer licensed in the State of Texas.

3. Provide a finite element analysis that accurately models the intersecting elements of the interface region. The interface region includes those portions of the concrete support structure and steel tank affected by the transfer of forces from the tank cone and the tank floor to the concrete support wall. The analysis shall provide results including the shear, moment, and compression or tension caused by the intersecting elements in the interface region.

4. Provide design calculations for all components of the tank overflow system and tank ventilation system.

C. Construction Procedures

1. Provide design, detail drawings and procedures for the support structure forming system. Details shall include location of form and construction joints, rustications and ties. Procedures shall include form removal criteria and minimum elapsed time for adjacent concrete placement.
2. Provide shop and field weld procedures for all structural joints on the steel tank. The submission shall be sealed by a professional engineer licensed in the State of Texas.

D. Product Data

1. Provide a separate concrete mix design for each specified concrete compressive strength indicated on the drawings. Include acceptable ranges for concrete slump testing, calculations and test reports for trial batches.

2. Provide technical data and color samples of all coating products.

3. Provide fabrication details and manufacturers descriptive information for appurtenant equipment and accessories. These include, but are not limited to:
   a. Piping, Valves and Fittings
   b. Ladders, Walkways and Railings
   c. Electrical
   d. Telemetry
   e. Site Improvements
   f. Tank Nameplate
   g. Doors and Hatches

E. Reports/Certification

1. Provide documentation of all tests, inspections and certifications required by this section. These include, but are not limited to:
   a. Geotechnical Report performed by Contractor
   b. Concrete Test Reports
   c. Weld Test Reports and Radiographs
   d. Steel Mill Certificates
   e. Painting Inspection Reports
   f. Hydrostatic Test Reports
   g. Manufacturers Certificates and Field Reports
   h. Welder Qualifications
   i. Density Reports for Backfill

G. Operation/Maintenance

1. Provide six (6) manuals that include operating instructions and maintenance procedures for the elevated tank and all applicable appurtenant equipment, mechanical components and accessories. Include tank information; dimensioned drawings, piping diagrams and design data.

1.05 QUALITY ASSURANCE:

A. Qualification of Manufacturer
1. The work described in this section shall be performed by a Contractor with proved experience in the construction of composite elevated storage tanks.

B. Regulatory Requirements

1. The standards, specifications, procedures, codes and regulations of the entities referenced in Paragraph 1.02 shall be observed and followed as applicable and as specified.

2. The elevated tank shall be designed and constructed in compliance with the governing building code and with other applicable federal, state and local regulations.

3. Personnel safety equipment shall be provided in accordance with OSHA requirements and manufacturers documentation.

C. Personnel Requirements

1. The Contractor shall have a single, local full-time project manager employed by the Contractor as a regular employee on-site throughout the entire project.

1.06 DELIVERY, STORAGE & HANDLING:

A. Handling and Shipping

1. The Contractor shall handle materials and fabricated components in a manner that will protect them from damage. Allow painted materials adequate cure time prior to stacking or shipping.

B. Storage and Protection

1. Protect delivered materials and equipment from damage. Store in well-drained areas and provide blocking to minimize contact with the ground. Repair any surfaces that show evidence of deterioration or contamination.

2. All appurtenances shall be stored in accordance with the manufacturers’ recommendation.

1.07 PROJECT CONDITIONS:

A. Permits and Easements

1. Permits, licenses, and easements required for permanent structures, changes in existing facilities or advancement of the construction as specified shall be secured and paid for by the Owner prior to the start of construction. These include building permits, airspace authority approval, site access easements, highway crossing permits, etc.

2. Licenses or permits of a temporary nature required by specific trades shall be the responsibility of the Contractor.

B. Existing Conditions
1. A geotechnical investigation has been carried out at the site. The foundation recommendations are included in the report prepared by the Geotechnical Engineer. The Contractor shall be responsible for performing an additional geotechnical investigation as described in Paragraph 1.03.F herein.

C. Access

1. The Contractor shall provide an all-weather access from public roads to the tank site for construction equipment and Town maintenance vehicles.

D. Working Conditions

1. Safety and Health - The Contractor shall comply with safe working practices and all health and safety regulations of OSHA, state and local health regulatory agencies and Material Safety Data Sheets (MSDS). Provide protective and lifesaving equipment for persons working at the site.

2. Times for Work - Times for work shall comply with local, state and federal regulations and laws, as well as the General Conditions of Agreement.

1.08 SEQUENCING AND SCHEDULING:

A. Schedule

1. The Contractor shall provide a bar chart showing the anticipated schedule for design, submittals, site work and the major components of construction including foundation, support structure and steel tank. In addition, show tank painting, electrical installation and other significant activities. Update the schedule monthly, or as requested by Owner and Engineer.

B. Notification

1. The Contractor shall provide notification of the intent to start work at least seven days prior to commencing each major phase of work.

2. The Contractor shall provide a schedule or notification of the time and day for each concrete pour. The Contractor shall notify the Engineer of any change in schedule or cancellation.

C. Certifications

1. Provide certification from the engineer of record that the elevated tank has been designed in accordance with the requirements of the specification.

2. Provide certification that the project has been constructed in accordance with the contract documents, specifications and approved submittals.

3. Provide certification that testing and inspection requirements of 3.07 have been performed and the results comply with the requirements of the specification.
1.09  GUARANTEES

1. The Contractor shall guarantee the structure, appurtenant equipment and accessories provided under this section against defective design, workmanship or materials for a period of two years from the date of acceptance of work in the contract Maintenance Bond. If notified within this period, the Contractor shall repair any defects at no cost to the Owner. Defects caused by damaging service conditions are not covered.

2. All guarantees for materials, equipment and accessories provided under this section shall be obtained by the Contractor and submitted.

PART 2 - PRODUCTS

2.01  MATERIALS:

A. Reinforced Concrete

1. Concrete materials and reinforcement shall comply with ACI 318, except as modified in this section.

B. Steel Tank

1. Steel tank components, including steel plates, sheets, structural shapes and filler metals shall be in accordance with AWWA D107, Section 5, "Steel Tank." Isolation kits shall be installed between any tank connections with dissimilar metals.

C. Piping and Fittings

1. All materials to come in contact with potable water shall be tested in accordance with NSF 61. Piping and fittings shall conform to:

   Steel Pipe                  AWWA C200
   Ductile Iron Pipe          AWWA C150 & C151
   Ductile Iron Fittings      AWWA C110
   Concrete Pressure Pipe, Bar-Wrapped Steel Cylinder Type AWWA C303
   PVC Pipe                   AWWA C900/C905

2.02  CONCRETE FOUNDATION:

The concrete foundation shall be designed in accordance with ACI 318. Minimum specified compressive strength shall be as required by design, but not less than 4000 psi at 28 days. The service load reinforcement tension stress shall not exceed 30,000 psi under dead plus water load unless flexural cracking is otherwise controlled in accordance with ACI 318.
2.03 CONCRETE SUPPORT STRUCTURE (PEDESTAL):

The cast-in-place concrete support structure shall be designed in accordance with ACI 318. The specified compressive strength of concrete shall be as required by design, but not less than 4,000 psi at 28 days. The maximum specified compressive strength of concrete for the wall and dome shall be 5,000 and 4,000 psi respectively. Minimum concrete cover to reinforcement shall be per ACI 318, Section 7.7.1.

A. Support Wall

1. Support wall shall be reinforced concrete with a minimum thickness of 8 inches exclusive of any rustication or architectural relief. Wall thickness shall be provided such that the average compressive stress due to the weight of the structure and stored water is limited to 25% of specified compressive strength, but not greater than 1000 psi. A minimum total wall reinforcement of 0.15% vertically and 0.20% horizontally shall be distributed approximately equally to each face.

B. Tank Floor

1. Tank floor shall be a reinforced concrete dome not less than 8 inches thick. The average compressive stress due to the weight of the structure and stored water shall not exceed 15% of the specified compressive strength, nor greater than 550 psi. Minimum total reinforcement in orthogonal directions shall be 0.40% distributed approximately equally to each face. Additional reinforcement shall be provided as required for stress caused by edge restraint effects.

C. Openings

1. The effects of openings in the wall shall be considered in the design. Not less than 60% of the interrupted reinforcement in each direction shall be placed each side of the opening. Reinforcement shall extend past the opening not less than half the transverse opening dimension.

2. Openings wider than 3 ft. 6 in. shall be subjected to a rigorous analysis taking into account the stress concentrations and diminished lateral support that exist in the vicinity of such openings. Each side of the opening shall be designed as a column in accordance with ACI 318.

3. Openings 8 ft. 0 in. or wider used for vehicle access shall be strengthened against vehicle impact and local buckling by means of an internal buttress located on each side of the opening. The buttress shall consist of a thickened, reinforced concrete wall section that is integrally formed and placed with the support wall. The buttress section shall be not less than 3 ft. 0 in. wide and 6 in. thicker than the nominal wall dimension.
2.04 CONCRETE SUPPORT STRUCTURE / STEEL TANK INTERFACE:

A. Interface Region

1. The interface region includes those portions of the concrete support structure and steel tank affected by the transfer of forces from the tank cone and the tank floor to the concrete support wall. This includes a ring beam and connection details. The Contractor shall provide evidence that a thorough review of the interface region has been performed. Finite element and finite difference analyses are the required methods for examining such local stresses in detail.

2. The geometry of the interface shall provide for positive drainage and not allow either condensate or precipitation to accumulate at the top of the concrete wall or ring beam.

B. Ring Beam

1. The ring beam shall be reinforced concrete with a nominal width and height of at least two times the support wall thickness. Minimum radial and circumferential reinforcement shall be 0.25%. For direct tension, reinforcement shall be provided such that the average service load stress in tension reinforcement due to the weight of the structure and stored water does not exceed 12,750 psi.

2. Ring beam design shall consider unbalanced forces from the steel tank cone and concrete dome, load conditions varying with water level, eccentricity of loads resulting from design geometry, and allowance for variations due to construction imperfection and tolerance.

2.05 STEEL TANK:

A. General

1. The steel tank shall be all welded construction and shall be designed in accordance with applicable sections of AWWA D107. The required capacity and dimensions of the tank are noted on the drawings and in this section of the specifications. All exposed lap joints shall be fully seal welded on both sides. Drip rings shall be provided on the top and bottom of the tank shell.

B. Plate Thickness

1. All members shall be designed to safely withstand the maximum stress to which they may be subjected during erection and operation. The minimum thickness of any steel plate in contact with water shall be 1/4 in., except that plate used as a membrane over the structural concrete floor shall have a minimum thickness of 3/16 in.
C. Roof Details

1. The roof of the steel tank shall be conical or dome-shaped. For a conical shape, the roof shall contain a slope ranging from 8:1 to 12:1. The intersection of the vertical wall plate and the roof shall be configured with a 2’-6” high by 1’-6” wide transition knuckle. A flat domed roof with a 2’-6” pressed knuckle transition is also acceptable.

2. All structural members supporting the roof of the steel tank shall be flat bar or sealed square tubular sections. Support beams shall be seal welded to the underside of the roof plate along the entire length of the beam.

2.06 APPURTENANCES AND ACCESSORIES:

A. General

1. Accessories shall comply with the minimum requirements of the Specifications, Codes and Standards listed in 1.02, current applicable safety regulations, and the operating requirements of the structure.

B. Ladder Access

1. Ladders shall be provided from the structural floor inside the base of the support wall to the upper walkway platform located below the tank floor. The tank floor manhole shall be provided with ladder access from the upper platform. A ladder shall extend from the upper platform through the access tube interior to the roof.

   Ladder shall be accessible from intermediate floor. Provide a 6’ opening in the safety cage for access to ladder at intermediate floor.

2. A ladder mounted on the access tube exterior shall be provided for access to the tank interior, extending from the roof manhole to the tank floor.

3. Ladders that terminate at platforms or landings shall extend a minimum of 48 in. beyond the platform elevations. A safety extension shall be provided at the top of the ladder under hatch(s). The safety extension shall be a Ladder Up Safety Post as manufactured by Bilco or Engineer’s approved equal. The post shall extend 42-inches above the top of the ladder and be constructed of hot dip galvanized steel. Mounting hardware shall be galvanized.

4. Ladders located in the concrete support structure and access tube interior shall be galvanized steel. Tank interior ladders shall be coated in accordance with the tank interior coating system.

5. Ladder side rails shall be a minimum 3/8-in. by 2 in. with a 16 in. clear spacing. Rungs shall be minimum 3/4-in. diameter, spaced at 12 in. centers and plug welded into holes drilled in the side rails. Tank interior ladders shall be provided with 1-in. diameter rungs and 1/2 in. x 2-in. side rails and shall be fully seal welded. Rungs shall be skid resistant. All ladder widths shall be a minimum of 16-inches.
6. Ladder shall be secured to the adjacent structure by brackets located at intervals not exceeding 10 ft. Brackets shall be of sufficient length to provide a minimum distance of 7 in. from the center of rung to the nearest permanent object behind the ladder. Ladder brackets located on the access tube exterior shall be reinforced at the access tube shell so that potential ice damage is confined to the ladder and bracket and not the access tube shell.

7. Platform, handrails and ladder shown on plans for access to drain line gate valve shall be aluminum or galvanized steel. Platform shall be self-supporting structure. Tank manufacturer shall be responsible for determine supports required.

C. Safe Climbing Device

1. High strength aluminum, rigid rail safe climbing devices shall be provided on all ladders. Pole or cable devices will not be accepted. Rails shall be center mounted and extend from 3 ft. above the ladder bottom to the top of the ladder section. Mounting brackets, fasteners and splice bars shall be provided as required for a rigid installation.

2. Three trolleys with snap hooks shall be provided that are designed to be operated with the aluminum rail. A safety body harness with front and side rings shall be supplied for each trolley.

3. Safe climbing system shall be SAF-T-CLIMB 80704 or equal, as approved by the Owner.

4. A caution sign shall be provided at the lowest point of access to the ladder requiring safe climbing devices. The sign shall read “CAUTION-Safety Equipment Required when Climbing Ladder”. The sign shall be secured to the wall.

5. Contractor shall provide the Owner with two (2) harnesses for safety climb system.

D. Intermediate Platforms and Ladder Cages

1. Provide intermediate offset platforms on the support wall ladder at maximum 20 ft. intervals and at light locations. Also provide receptacle outlets at light locations on separate circuit than light fixture. Platforms shall be a minimum 3 ft. x 5 ft. and provided with handrails, midrails and toe plates in accordance with OSHA requirements. Grating shall be used for the walking surfaces. All components shall be galvanized steel, aluminum, or stainless steel.

E. Upper Platform

1. A 4 ft. wide upper walkway platform shall be located at the top of the support wall to provide access from the support wall ladder to the roof access ladder located on the interior of the access tube and to the inlet, outlet, and overflow piping as shown in the plans. Platforms shall be provided with handrails, midrails and toe plates in accordance with OSHA requirements. Grating shall be used for the walking surface. All components shall be galvanized steel. A fixed lanyard shall be provided at platforms to provide fall prevention.

F. Support Wall Doors
1. Personnel door and associated finish hardware shall be in accordance with Sections 08111 and 08710.
   a. Door locks shall incorporate a security system to assure that keys used during construction will not open doors after occupancy. All locks shall be keyed in accordance with the Owner’s requirements.
   b. Quantity and location of personnel door(s) shall be as shown on the drawings.

2. Overhead door shall be in accordance with Section 08330. Install exterior safety posts to protect the door opening.
   a. Size, quantity and location of vehicle door(s) shall be as shown on the drawings.

G. Tank Openings

1. Floor - Provide a 30-in. diameter manhole through the tank floor. The manhole shall open into the tank and be operable from a ladder located on the upper platform and shall be designed to withstand the pressure of the tank contents without leakage. The manhole assembly shall include a stainless steel handwheel operator and threaded components.

2. Roof - Provide two 36-in. wide square access hatches on the roof of the tank. One hatch shall allow egress from the access tube to the roof. The second hatch, located adjacent to the first, shall allow access to the interior of the tank via the ladder mounted on the exterior of the access tube. The opening shall have a minimum 4-in. curb. Provide aluminum covers with a 2 in. down turned edge, stainless steel hardware, hold open arm, and a locking mechanism. Material shall be minimum 3/16-inches thick ASTM A36 or Engineer’s approved equal. Minimum opening shall be 3-foot square. Hatch to be Bilco E-4AL, or Engineer’s approved equal. A 24” painter’s exhaust flange shall be installed where shown in the Plans.

H. Access Tube

1. Provide a minimum 60-in. diameter centrally located access tube through the steel tank to provide access to the tank roof from the upper walkway platform. The access tube shall incorporate a 2 in. by 2 in. channel or other system approved by the Owner and Engineer to collect condensation that may form on the interior surface. A flexible ¾ in. PVC hose complete with backflow preventer shall drain the channel to the overflow pipe.

I. Roof Railing

1. A 42-in. high roof guardrail shall be provided to enclose all centrally located roof accessories. Guardrail shall be a minimum of 24 ft. in diameter.

2. Provide a 4-in. kickplate and coat guardrail per the tank exterior system.

J. Antenna Cable Provisions

1. Provide the following for antenna cable routing. This work includes the following:
a. Provide an interior rigging rail suitable for rolling trolleys at the top of the support wall accessible from the upper platform.

K. Antenna Conduit Entry and Feed Thru Plate

1. A bundle of six 6” Sch 40 PVC conduits complete with long radius (min 24”) 90 degree bend and end caps as shown on the drawings. Size and location of the wall opening shall allow the conduit to terminate as close to the support wall as possible. This grouping of conduits shall serve as the pedestal entry location suitable for a single provider and is typical of four (4) locations.

2. Provide antenna conduit feed thru plates for wireless communication conduit. The number and orientation of the conduit feed-thru plates shall be coordinated with the Owner and Engineer. At a minimum, four (4) plates spaced 90 degrees apart around the perimeter of the pedestal shall be installed. The elevation of the plates shall be pre-approved by the Owner. Contractor shall submit structural shop drawings for both appurtenances.

L. Rigging Access

1. Provide a 24-in. x 36-in. opening at the top of the support wall. This opening shall be accessible from a platform and shall provide access to the exterior rigging rail located at the tank/support wall intersection. The access opening shall be provided with a hinged stainless steel cover or a removable vent in accordance with 2.06.G.2.

2. A minimum 24-in. diameter opening shall be provided on the tank roof to provide access to the tank interior rigging rails. This access opening may be combined with a pressure/vacuum relief mechanism.

M. Piping

1. Inlet/Outlet Pipe

   a. Provide an inlet/outlet pipe that extends from the base of the support structure to the tank floor elevation. Provide a minimum of 6-in. high removable silt stop where the inlet and outlet pipes enter the tank. The bottom capacity level of the tank's operating range shall be at or above the elevation of the top of the silt stop. Pipe material within the support structure shall be Schedule 10S Type 304L stainless steel. Pipe material below the grade slab shall be as shown in the Plans.

   b. The inlet and outlet pipes shall be designed to support all related static and dynamic loads. Suitable stainless steel brackets, guides and hangers shall be provided on the support wall and tank floor at intervals not exceeding 20 feet.

   c. The inlet and outlet pipes shall be designed and constructed to accommodate any differential movement caused by settlement and by thermal expansion and contraction over the range of extreme temperature differences expected for the support wall and pipes. The required flexibility shall be provided by an expansion joint located near grade in the vertical section of pipes.
2. Overflow Pipe

a. The top of the overflow shall be located within the tank at the overflow elevation. It shall run vertically beside the central access tube and extend through the tank floor, at which point it shall turn 90° and run under the tank floor to the support wall. This horizontal run shall be sloped to drain. The pipe shall then turn 90° and run vertically beside the support wall to grade. A base elbow shall direct the overflow through the support wall, where the pipe shall be terminated with a flap valve and a concrete drain box. The flap valve shall open under an unseating head of 0.5-ft min. to 5 ft maximum. Pipe material within the support structure shall be Type 304L (minimum 11 gauge) stainless steel. If the top of overflow is located above top capacity level, the tank shall be designed for the additional capacity provided by the difference.

b. The entrance to the overflow pipe shall be designed for the maximum inlet flow rate specified in 1.03B. The design shall be based on the water level cresting within 6 in. above the overflow elevation. A weir structure shall be provided if the entrance capacity of the overflow pipe diameter is not adequate. A vortex prevention device shall be used.

c. The overflow shall be designed to support all related static and dynamic loads. Suitable galvanized steel brackets, guides and hangers shall be provided on the support wall and tank floor at intervals not exceeding 20 ft. The overflow and weir section within the tank shall be supported by the central access tube.

d. The overflow pipe shall be designed and constructed to accommodate any differential movement caused by settlement and by thermal expansion and contraction over the range of extreme temperature differences expected for the support wall and pipe. A layout with sufficient upper offset to accommodate differential movement is acceptable. If this method is not applicable, the required flexibility shall be provided by an expansion joint located near grade in the vertical section of pipe.

3. Inlet / Outlet and Overflow Piping Connection

a. Provide an 8 in. lateral pipe with gate valve with hand wheel that connects the inlet and overflow near grade to provide a means of draining the tank.

4. Washdown Riser

a. Provide a washdown riser that extends from the base of the support structure to the tank floor elevation. Pipe material within the support structure shall be Schedule 10S Type 304L stainless steel.

b. The washdown riser shall be designed to support all related static and dynamic loads. Suitable galvanized steel brackets, guides and hangers shall be provided on the support wall and tank floor at intervals not exceeding 20 ft.

c. The washdown riser shall be designed and constructed to accommodate any differential movement caused by settlement and by thermal expansion and contraction over the range
of extreme temperature differences expected for the support wall and pipe. A layout with sufficient upper offset to accommodate differential movement is acceptable. If this method is not applicable, the required flexibility shall be provided by an expansion joint located near grade in the vertical section of pipe.

5. Stainless Steel Requirements

a. Pipe and fittings shall be Type 304L stainless steel fabricated from material meeting the requirements of ASTM A-240. Fabrication, inspection, testing, marking and certification of pipe and fittings shall be in accordance with ASTM A-778 and A-774 respectively. All fitting less than 18-inches shall be smooth flow. Fittings larger than 18-inches may be of five section miter construction. Backing flanges shall be in accordance with ASTM A285-C drilled to ANSI B16.5 Class 150. Pipe, fittings and welds shall be cleaned and passivated.

b. Pipe, fittings and flange thickness shall be in accordance with the manufacturers certified pressure rating for the applicable service pressures. The design pressure rating shall be 150 psi minimum except for overflow piping.

c. Dielectric flanged fittings (isolation kits) shall be provided between any connections of stainless steel and steel or ductile iron.

6. Floor Drain

a. A floor drain shall be installed directly below the proposed altitude valve. The finish floor in the immediate vicinity of the altitude valve shall be sloped to drain to this floor drain. All other portions of the finish floor shall be sloped as specified in the plans. A four inch drain pipe shall extend from the floor drain to the proposed overflow structure and shall be equipped with a flap valve.

7. Tank Drain

a. A tank drain shall be provided to completely drain the tank contents if the inlet/outlet pipe does not intersect the low point of the tank. A four inch drain pipe located at the low point of the tank bowl floor shall be fitted with a threaded plug and tee handle. Flexible stainless steel piping shall connect and drain to the overflow pipe.

N. Ventilation

1. Tank Ventilation

a. Tank vent shall be provided, located centrally on the tank roof above the maximum weir crest elevation. It shall consist of stainless steel or aluminum components, including a support frame, screened area and cap. The support shall be fastened to a flanged opening in the tank roof. The vent cap shall be provided with sufficient overhang to prevent the entrance of wind driven debris and precipitation. A minimum of 4 in. shall be provided between the roof surface and
the vent cap.

The tank vent shall have an intake and relief capacity sized to prevent excessive pressure differential during the maximum flow rate of water, either entering or leaving the tank. The overflow pipe will not be considered as a vent. The maximum flow rate of water entering the tank is specified in 1.03B. The maximum flow rate of water exiting the tank shall be calculated assuming a break in the inlet/outlet at grade when the tank is full. The vent shall be provided with an insect screen. Vent capacity shall be determined based on open area provided by the screen.

b. In addition to the tank vent, a pressure/vacuum relief mechanism shall be provided that will operate in the event of vent failure. The mechanism shall be designed to return automatically to its original position after operation. The pressure/vacuum relief mechanism shall be located on the tank roof above the maximum weir crest elevation, and may be incorporated in the vent assembly.

2. Support Structure Ventilation

   a. Ventilation within the support structure shall comply with the governing building code requirements, based on occupancy classification. As a minimum, one louvered vent shall be provided at the top of the support wall. This vent shall be accessible from the upper platform and may also be designed to provide access to the exterior rigging rails located at the tank/support wall intersection. Vents shall be accessible from the interior ladders, platforms or floors provided. Vents shall be stainless steel or aluminum and provided with a removable insect screen.

O. Interior Floors

1. Provide a minimum 6 in. thick, 3500 psi concrete floor slab in the base of the support structure. The slab shall be supported on select fill or constructed as a structural slab and shall have minimum #4 reinforcing steel at 12 in. centers each way. If supported on granular fill, a minimum 6-inch thick layer of granular material shall be provided on top of the proposed subgrade prior to tank floor construction, to a tolerance of +0, -1/2 inch of the bottom of the floor and footing elevation. The granular material shall extend 1-foot beyond the footing. The granular material shall be a well graded crushed rock with 100% passing 1” and not more than 8% passing No. 200 U.S. sieve. Provide 1/2 in. expansion joint between floor slab and support wall and at pipes and supports that extend through the floor. Place cap strip and sealant over the expansion joint. Provide 1 ¾ in. deep sawed contraction joints at 12’ maximum centers. The slab shall be sloped at 0.5% toward the overhead door for drainage.

2. Structural Floor - Provide a composite construction structural floor located 25 ft. above the slab on grade. The design shall comply with the applicable requirements of AISC S335. It shall be designed for a minimum uniform live load of 125 psf. The floor shall consist of a concrete slab supported by a galvanized formed steel deck and galvanized steel girders.

   The structural floor shall be a clear span design supported entirely by the concrete support
wall. All loads transferred from the structural floor to the support wall shall be considered in the design. The wall shall be strengthened as required in the vicinity of connections causing point load or eccentric conditions. Loads transferred from the structural floors to the foundation shall be considered in the design of the foundation.

Unless structural floor and supports are isolated from the wall, loads on the wall caused by thermal stresses in these members shall be considered. An analysis of the lateral loading condition shall be performed and the wall strengthened accordingly.

Provide a galvanized steel access stairway adjacent to the support wall. Access openings through the structural floor shall be protected with 42 in. high galvanized steel handrails.

P. Pedestal Windows

1. Fixed panel non-operable, clear double glazed windows complying with requirements of AAMA Classification A2, for "Commercial" type buildings. Alloy and temper recommended by window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000 psi ultimate tensile strength and not less than 0.62" thickness at any location for main frame and sash members in accordance with ASTM B221. Provide manufacturer's standard fabrication and accessories which comply with indicated standards and are reglazable without dismantling of sash framing, except to extent more specific or more stringent requirements are indicated. Include complete system for assembly of components and anchorage of window units, and prepare sash for glazing except where pre glazing at factory is indicated. Set units plumb, level, and true to line, without warp or rack of frames or sash. Anchor securely in place. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action. Comply with manufacturer's specifications and recommendations for installation of windows units, hardware, operators, and other components of work.

2. Size, quantity, profile requirements and location of window(s) shall be as shown on the drawings. There shall be fifteen (15) windows evenly spaced around the pedestal capable of being opened.

Q. Level and Pressure Monitoring

1. General - Provide four (4) 1 in. taps connected to the pipe as indicated on the plans. Each tap shall be provided with a stainless steel nipple and an isolation gate valve.

2. Level Transmitter – Provide one (1) level transmitter in accordance with Section 16910, and as indicated on the plans.

3. Pressure Gauge - Provide one (1) pressure gauge in accordance with ASME B40.1 Grade 2A. The dial shall be 4 1/2 in. diameter with black markings on white background. Pressure range is 0-100 psi and 0-220 feet of water, calibrated at intervals of two feet, or less. Install gauge four feet above the finished floor with gauge facing access door, as indicated on the plans.

R. Lightning Protection
1. Refer to Section 16455 for general lightning protection.

2. Lightning protection for obstruction lights shall consist of an air terminal mounted on the support and formed to fit around the fixture. The 1/2 inch diameter copper air terminal shall extend a minimum of 10 inches above the light fixture and shall connect to a copper conductor that terminates in a bonding plate secured to the tank roof.

S. Nameplate

1. Provide a bronze tank nameplate with raised lettering on the exterior of the pedestal near the personnel door. The lettering width shall be a minimum of ¼ in. The Contractor shall submit a layout of the nameplate for approval. The following information shall be displayed on the nameplate:

   Town of Flower Mound, Texas
   2.5 Million Gallon Elevated Tank
   Year
   Tank Dimensions Including:
   - Tank Diameter & Head Range
   - Height to Overflow/Elevation
   - Pedestal Diameter M.S.L.
   Contractor’s Name
   Consultant’s Name

T. Antenna Provisions

1. Provide antenna cable hangers at 10 ft. intervals adjacent to the access ladder. Cable hanger consists of a ¼ in. x 4 in. x 12-in. plate secured horizontally with a 1-in. spacer.

2. Provide 4 pc. 4 in. diameter couplings with brass plug through the tank roof plate covering the access tube. Couplings shall be seal welded and located such that threaded conduit or weatherheads for antenna cable may be attached.

3. Provide a minimum of ten (10) pick-hole penetrations near the top of the pedestal for antenna conduit spaced evenly around pedestal.

U. Obstruction Lighting

1. Obstruction lighting shall be provided in accordance with FAA standards. The obstruction light shall be centrally located on the roof of the tank above all permanent installations. It shall be a steady burning, dual fixture type with a lamp-out relay switch. The fixture shall be weather sealed and corrosion resistant. A pilot light located near the electrical panel shall be provided to indicate when the primary bulb has failed.

2.07 ELECTRICAL AND LIGHTING

Electrical and lighting shall be provided in accordance with Division 16 and the drawings. All
work shall be performed and all materials shall be provided in accordance with national Electric Code and governing electrical, safety and inspection codes, regulations and ordinances.

2.08 PEDESTAL INTERIOR FINISHES, MECHANICAL, AND PLUMBING

Interior finishes, mechanical, and plumbing for the tank pedestal shall be provided in accordance with the drawings and other specifications in these Contract Documents.

2.09 STEEL TANK PAINTING

The paint system schedules of Section 09910 Steel Water Storage Tank Painting shall apply to all exposed interior and exterior surfaces of the steel tank including steel accessories and appurtenances. Galvanized, stainless steel and concrete surfaces are not coated. Colors and location of the logo shall be selected by the Owner.

2.10 SOURCE QUALITY CONTROL

A. Tests

1. Review mill test certifications of all steel plate, structural components and reinforcement to ensure compliance with specification requirements.

B. Inspections

1. Provide inspection of shop fabricated components in accordance with AWWA D100.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Foundation Excavation

1. The foundation bearing surface and excavation shall be inspected by a representative of the geotechnical engineer prior to foundation construction. Verification of the applicable design and construction recommendations are required. The geotechnical engineer shall be retained by the Contractor and approved by the Owner. After verification of the foundation bearing surface, provide a 2-inch thick concrete working slab within the lower excavation limits. Grade the site to prevent runoff from entering the excavation.

B. Environmental Conditions

1. Prior to performing any work, verify the expected temperature, humidity and weather conditions are within the specified limitations for executing the work.

C. Elevated Tank Components

1. After completion of each major component and prior to proceeding with the next stage of construction, verify that tolerance inspections and material quality control tests conform to
3.02 REINFORCED CONCRETE CONSTRUCTION:

A. Reinforcement

1. Fabrication, placement, development and splicing of reinforcement shall be in accordance with ACI 318 and ACI 117.

B. Formwork

1. Formwork design, installation and removal shall comply with the minimum requirements of ACI 318 and ACI 117 and with the applicable requirements of ACI 347.

2. Forming systems shall be designed with the provision of ties and bracing such that concrete components conform to the correct dimensions, shape, alignment and elevation without leakage of mortar. Formwork systems shall be designed to safely support all loading conditions. Embedded items shall be properly positioned and secured. Form surfaces shall be cleaned of foreign materials and coated with a release agent prior to placing reinforcement.

C. Concrete

1. Concrete proportioning, production, placement, quality control and curing procedures shall comply with ACI 318 and ACI 117. Concrete shall satisfy the specific structural, durability and architectural requirements of the completed components.

2. Proportioning

a. The proportions of materials for concrete shall be established to provide adequate workability and proper consistency to permit concrete to be worked readily into the forms and around reinforcement without excessive segregation or bleeding. Unless otherwise specified, concrete without high range water reducer shall be proportioned to produce concrete slumps at the point of placement between 2 and 4 in. If high range water reducer is used, concrete slump prior to addition shall be 3 to 4 in. The slump, after addition of high range water reducer, shall be a maximum of 7 in. Air shall be entrained to provide concrete with 3.5% to 6.5% air content.

3. Production

a. Concrete that arrives at the project with slump below that suitable for placing, may have water added within the limits of the maximum permissible water-cement ratio. Maximum slump shall not be exceeded. The water shall be incorporated by additional mixing equal to at least half of the total mixing time required. For concrete with site-administered high range water reducer, the preplasticized minimum slump requirement shall be attained as permissible by addition of water and mixing prior to the addition of the water reducer.

4. Placement
a. Prior to concrete placement, all snow, ice, water or other foreign material shall be removed from the spaces that the concrete will occupy. Concrete shall be deposited in its final position in accordance with ACI 318. Drop chutes shall be used in walls and columns to prevent free-fall of the concrete and to allow the concrete to be placed through the cage of reinforcing steel without form splatter. These shall be moved at short intervals to prevent stacking of concrete.

b. All concrete shall be consolidated by vibration so that the concrete is thoroughly worked into the corners of forms and around the reinforcement and embedded items to eliminate all air or stone pockets which may cause honeycombing, pitting, or planes of weakness. Internal vibrators shall be the largest practical size that can be used in the work and they shall be operated by competent workmen.

D. Weather

1. Concrete shall not be placed during precipitation or extreme temperatures unless protection is provided.

2. During cold weather the recommendations of ACI 306 shall be followed.

3. During hot weather the recommendations of ACI 305 shall be followed.

3.03 FOUNDATION:

A. Excavation

1. Depth of excavation shall be based on the foundation type recommended by the Geotechnical Engineer. Grade the site to prevent runoff from entering the excavation.

B. Concrete Construction

1. For shallow foundations, reinforcement placed adjacent to a concrete working slab shall have a 2 in. minimum cover, and shall be supported by precast concrete block, metal or plastic bar supports.

2. The sides of foundations shall be formed using any suitable system conforming to ACI 318. Earth cuts shall not be used as forms for vertical surfaces. Forms shall be provided on top sloping surfaces steeper than 2.5 horizontal to 1 vertical. Straight form panels may be used to form circular foundation shapes. The minimum design radius shall be maintained at all sections.

C. Finish

1. Formed surfaces shall have a smooth form finish when exposed and a rough form finish when not exposed.

2. Unformed surfaces shall have a troweled finish when exposed and floated finish when not exposed.
D. Backfill

1. Backfill foundation in lifts not to exceed 6 in. in depth to the grade established on the plans. Compact each lift to 95% standard proctor density per ASTM D698. Place compacted backfill evenly all around the tank. Compaction by ponding or jetting is not acceptable.

2. Excavated material meeting site grading specifications may be used to complete site grading. Remove and dispose of all undesirable or excess materials.

3.04 CONCRETE SUPPORT STRUCTURE:

A. Architectural Concrete Construction

1. The exposed exterior surface of the concrete support wall is designated architectural concrete. The concrete and formwork requirements of this section shall be strictly enforced to ensure concrete of the highest practicable structural and architectural standards. Concrete proportioning, placing, and finishing shall be in accordance with the ACI 301, Chapter 18, except as modified by this Section. Formwork design, installation and removal shall comply with the minimum requirements of ACI 318, ACI 117 and the applicable requirements of ACI 347, except as modified by this Section.

2. Attention shall be given to ensure the same concrete design mix is used throughout the support wall. The proportion, type and source of cement and aggregates shall not be changed. Uniform moisture content and placing consistency shall be maintained.

3. Place all wall concrete vertically and directly inside the reinforcement cage with drop chutes to prevent form splatter and surface finish variation. Placement methods that introduce concrete horizontally through wall reinforcement are prohibited. Vertical pour rate shall be a minimum of 15 feet per hour.

4. Support wall reinforcement shall be installed with plastic supports. Maximum spacing of supports for welded wire fabric shall be 5 ft. centers, horizontal and vertically.

5. Forming systems shall be designed with the provision of ties and bracing such that concrete components conform to the correct dimensions, shape, alignment and elevation. Embedded items shall be properly positioned and secured. Form surfaces shall be thoroughly cleaned of concrete residue and coated with a release agent prior to placing reinforcement. Do not allow excessive release agent to accumulate on the form. Steel forms shall be coated with a non-staining, rust preventative form oil or otherwise protected. Rust stained steel formwork shall not be used.

6. The forming system for the pedestal wall shall be fully engineered and detailed with procedures to meet the increased demands of architectural concrete. The support wall shall be constructed with a jump form process using form segments prefabricated to match the wall curvature. Concrete pour height shall be a minimum of 4 ft. and a maximum of 10 ft. Form panels shall extend the full height of the concrete pour using only vertical panel joints. Form
system shall be designed to lap and be secured to the previous wall pour. The space between
the form and the previous pour shall be sealed to prevent grout leakage. Wall forms shall
incorporate a positive means of adjustment to maintain dimensional tolerances specified.
Wall forms shall be adjusted for vertical plumb and circularity and locked into position with
through wall form ties prior to concrete placement. Panels shall be designed for lateral
pressures associated with full height plastic concrete head, and support and bracing shall be
provided for construction related impact loads and wind loads. Working platforms that allow
safe access for inspection and concrete placement shall be provided. Form facing material
shall be metal, or plywood faced with plastic or fiberglass.

7. The form system shall incorporate a uniform pattern of vertical and horizontal rustications to
provide architectural relief to the exterior wall surface. Rustication strips shall be sealed to
the form face to eliminate the grout leakage that results in broken corners, color variations
and rock pockets. Broken edges and chamfers will not be accepted. All construction joints
and panel joints shall be located in rustications. Vertical panel joints shall be sealed using
closures, which combine with the form pattern to prevent grout leakage and panel joint lines.
All joints shall be grout tight. The vertical and horizontal rustications shall be proportioned
and combined to impart a symmetrical architectural pattern to the completed structure. Form
ties shall be located in a uniform pattern. No architectural form treatment is required on the
interior surface.

8. Support wall concreting shall incorporate segmented placement procedures. Temporary
vertical bulkheads shall divide the wall pour into segments corresponding to a single batch
(truckload) of concrete. The bulkheads shall be located at rustications, braced rigid and tight
to maintain vertical alignment under concrete load without grout leakage. Wall segment
concrete shall be placed continuously to full form height from a single load. Placement from
multiple batches is not permitted. Temporary bulkheads shall not be removed until adjacent
concrete is placed. Support wall concreting operations shall occur a maximum of once per
day. Multiple form movements and concrete placements within a day are not permitted.

9. Wall forms shall not be disturbed or removed until the concrete has attained sufficient
strength to prevent forming operations or environmental loads from causing surface damage
or excessive stress. Form removal shall be based on early age concrete strength testing. The
minimum concrete strength shall be established by the Contractor, based on an analysis of
stress at critical stages throughout the forming and concrete operations. Early age concrete
testing shall be in accordance with ACI 228.1R-89. Pull Out testing in accordance with
ASTM C 900-99, Maturity Method testing in accordance with ASTM C 1074-93, or field
cured cylinders compressive strength tested in accordance with ASTM C 172 are the
acceptable methods to determine early concrete strength.

10. The formwork system for the domed structural floor shall be designed to support all
construction loads. Adequate shoring and bracing shall be provided to transfer loads without
appreciable movements. Form surfaces shall be steel, plastic or fiberglass coated material.
Shoring and forms for the structural dome slab shall remain in place until the concrete has
gained sufficient strength to carry the floor weight without damaging deflections.

11. Concrete surfaces shall be protected in accordance with the recommendations of ACI 306
until the component attains 35% of the specified compressive strength. At this time,
protection may be removed subject to the allowable temperature differential. A reasonable temperature differential shall be defined, based on component thickness and restraint conditions.

B. Finish

1. Provide a smooth form finish without rub for the interior and exterior support wall. Tie holes shall be plugged using grout on the interior and manufactured plugs on the exterior which match the color of the cured concrete as closely as possible. Provide a light sandblast to the exposed exterior concrete support wall surface.

2. Provide a smooth form finish without rub for the interior dome slab. The unformed surface shall have a floated finish.

3. No tie holes, defects voids larger than 3/8-in. diameter or fins shall be visible on the interior or exterior of the concrete support structure, as viewed from grade. All concrete surfaces shall be cleaned as required to remove surface contamination.

C. Dimensional Tolerances

1. Support structure concrete construction shall conform to the following:

   a. Variation in thickness:
      i. Wall  -3.0% to +5.0%
      ii. Dome -6.0% to +10%

   b. Support wall variation from plumb:
      i. in any 5 feet of height 3/8 inch
      ii. in any 50 feet of height 1 inch
      iii. maximum in total height 2 inches

   c. Support wall diameter variation 0.4%
      i. not to exceed 3 inches

   d. Dome floor radius variation 1.0%

   e. Level alignment variation:
      i. from specified elevation 1 inch
      ii. from horizontal plane 1/2 inch

   f. Offset between adjacent pieces of formwork:
      i. exterior exposed surfaces 1/8 inch
      ii. interior exposed surfaces 1/4 inch

D. Mock Up Panel

1. A mock up panel shall be constructed using the proposed form work, concrete and placement methods. Minimum size will be 4 ft. wide by 7 ft. high. This panel shall be agreed upon by
the Owner, Contractor and Engineer as the reference standard with which to judge surface 
quality, appearance and uniformity of texture and color.

2. Review and acceptance of formed concrete surface must be made immediately upon form 
removal. Succeeding pours shall not be place until the most recent wall pour has been 
stripped and the form surface approved. The Contractor shall be responsible to inform the 
Engineer and Owner as to the pour schedule. The Engineer shall not delay the Contractor by 
lack of attendance.

3. Concrete with surface defects exceeding limitations specified herein or not meeting the 
standard represented by the mock-up panel shall be repaired to meet that standard, or 
removed and replaced at the expense of the Contractor.

3.05 STEEL TANK:

A. Welding

1. Welding procedures and general welding requirements shall be in accordance with AWWA 
D107, Section 5.4, "Fabrication and Construction Requirements".

2. No structural welding is permitted to any steel embedded in hardened concrete, unless the 
weld is at least 2 ft. from the embedment interface.


B. Fabrication

1. Layout, cutting, forming, edge preparation and workmanship for steel tank components and 
fabrications shall be in accordance with AWWA D107, Section 5.4, "Fabrication and 
Construction Requirements".

C. Tank Erection

1. Steel tank erection procedures and general requirements shall be in accordance with AWWA 
D107, Section 5.4, "Fabrication and Construction Requirements".

D. Tolerances

1. Steel tank tolerances shall be in accordance with the requirements of AWWA D107 and API 
650, Section 5.5.

2. Steel cone shall be constructed to the following tolerance. The deviation from the theoretical 
conical surface shall not exceed 0.032√RT, when measured in the radial direction over length 
4√RT, where R is the radius normal to the plate surface at the point of consideration, and T is 
the plate thickness.

E. Grouting

1. The interface between the steel tank floor plate and the supporting structural concrete slab
shall be constructed with a minimum 1 in. void. Subsequent to testing, the void shall be filled with a flowable grout mix.

3.06 STEEL TANK PAINTING:

A. Surface Preparation

1. The surface preparation and paint application requirements of Section 09910 shall apply to all exposed interior and exterior surfaces of the steel tank including steel accessories and appurtenances. Galvanized surfaces are not included.

2. Shop cleaning and priming of steel is acceptable per the conditions of Section 09910.

3.07 FIELD QUALITY CONTROL:

A. Concrete Testing and Inspection

1. The evaluation and acceptance of concrete shall be in accordance with Section 5.6 of ACI 318 and ACI 117, except as modified in this section.

2. Tests for slump and air content shall be made for each truck to check for conformance with paragraph 3.02C. Measurements shall be taken prior to the addition of site administered high range water reducer and prior to depositing the concrete.

3. No concrete shall be placed if slump and air content have not been measured or do not meet the requirements.

4. Samples for strength tests shall be taken for each individual concrete placement. Provide at least one sample for each 100 cubic yards of concrete. Three cylinders shall be made from each sample required. A 7-day compressive strength test shall be used to supplement the 28 day tests.

5. Slump, air and compressive cylinder testing shall be performed by an independent laboratory approved by the Owner and retained by the Contractor.

6. The support wall radius, plumb and thickness shall be verified for each concrete lift at 45 degree intervals. An inspection report certified by the tank designer shall be provided at project completion.

B. Steel Tank Testing & Inspection

1. Inspection procedures for the steel tank shall be as required by AWWA D107, Section 9, “Inspection and testing”. Radiographic inspection of full penetration butt-welded joints shall be made by an independent inspection company approved by the Owner and retained by the Contractor.

2. Erection tolerance of the steel cone in the radial direction shall be measured. Provide field measurements at 30 degree intervals.
3. Weld joints of plate over the structural concrete floor shall be tested for leaks by vacuum box / soap solution testing, or equivalent method prior to grouting.

C. Tank Painting Inspection and Testing

1. Adequate illumination shall be provided while work is in progress, including explosion proof lights and electrical equipment. Temporary ladders and scaffolding shall conform to applicable safety requirements. They shall be erected to facilitate inspection and moved by the Contractor as required.

2. Inspection and testing shall generally be in accordance with AWWA D102. The Contractor shall provide inspection devices in good working condition for measurement of dry film thickness of coatings. Contractor shall also furnish U.S. Department of Commerce, National Bureau of Standards certified thickness calibration plates to test the accuracy of dry film thickness measurement device.

3. A nondestructive holiday detector shall be used for inspecting the interior coating below the overflow level. All holidays shall be marked, repaired in accordance with the manufacturer's printed recommendations and retested. No holidays or other irregularities shall be permitted in the final coating. Additional testing information is provided in Section 09910.

3.08 CLEANING:

A. Site

1. The project site shall be kept in a clean and safe condition at all times. The Contractor shall remove all construction equipment and debris at project completion.

B. Tank Disinfection

1. The proposed chlorination method shall be communicated to the owner’s representative prior to disinfection. The owner shall be notified a minimum of three weeks in advance of proposed date of commencing tank disinfection. Water and sufficient pressure for flushing, cleaning, initial testing and disinfection shall be supplied by the Owner at no cost to the Contractor. However, Contractor shall be aware that after tank disinfection, the water used for disinfection may not be able to be placed into the water system and may need to be de-chlorinated and discharged from the tank. Any costs associated with de-chlorination and discharge from the tank shall be the sole responsibility of the Contractor.

2. Disinfection shall be performed after interior coatings have been applied and allowed to thoroughly cure. All solvent vapors shall be completely removed by suction-type exhaust fans and blowers. The complete interior shall be washed down and flushed out.

3. Following disinfection, the tank shall be filled and sampled by the Contractor for bacteriological testing, prior to being put into service. The testing shall be as described in AWWA Specification C652, latest edition, Section 4.4 – Bacteriological Sampling and Testing. Results of the test shall be reviewed by the Engineer. Final decision of the
suitability of the disinfection procedure shall rest with the Engineer. Should repeat of the disinfection procedure be required, additional cost of disinfection, testing and water to fill the tank shall be borne by the Contractor at no additional cost to the Owner.

Contractor shall be allowed to fill the elevated storage tank once for testing without being required to pay for the water necessary. If the event the tank must be drained and re-fill for any reason, the contractor will be required to pay for water needed to fill the tank.

END OF SECTION
1.01 GENERAL CONDITIONS

A. The General Conditions and Requirements, Special Provisions, are hereby made a part of this Section.

B. The Electrical Drawings and Specifications under this Section shall be made a part of the Contract Documents. The Drawings and Specifications of other sections 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 the above documents will be on file at the office of the Owner's representative and shall be examined by all the bidders. Failure to examine all documents shall not relieve the responsibility or be used as a basis for additional compensation.

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 the intent of the Contract Documents 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 Contract Documents.

G. The definition of terms used throughout the Contract Documents shall be as specified by the following agencies:
   1. Underwriters Laboratories
   2. National Electrical Manufacturers Association
   3. American National Standards Institute
   4. Insulated Power Cable Engineers Association
   5. National Electrical Code

H. The use of the terms "as (or where) indicated", "as (or where) shown", "as (or where) specified", or "as (or where) scheduled" shall be taken to mean that the reference is made to the Contract Documents, either on the Drawings or in the Specifications, or both documents.

I. The use of the words "furnish", "provide", or "install" shall be taken to mean that the item or facility is to be both furnished and installed under Division 16, unless stated to the contrary that
the item or facility is to be either furnished under another Division or under another Contract, furnished under this Division and installed under another Division or under another Contract, or furnished and installed under another Division or under another Contract.

1.02 PERMITS AND CODES

A. Secure all permits, licenses, and inspection 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.

PART 2 - PRODUCTS

2.01 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 (UL)
2. National Electrical Manufacturer's Association (NEMA)
3. American National Standards Association (ANSI)
4. Insulated Cable Engineers Association (ICEA)

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. All other products shall be UL labeled. Motor control centers, switchboards, and switchgear shall have UL labels by the manufacturer. Custom panels, modified motor starters, control panels, and instrument panels and the like shall be manufactured by a fabricator approved as a UL508A shop and shall bear a UL 508A (UL Industrial Control Panel) label.

D. When the Contractor provides a product for this project he shall be bound by the terms and conditions of the Contract Documents and he shall agree to warrant and to be liable for the merchantability and fitness of his product to the applications to which his product is applied under the Contract Documents.
2.02  SHOP DRAWINGS AND SUBMITTALS

A. Shop drawings and submittals shall comply with the Contract GENERAL CONDITIONS in the CIVIL SECTION and as specified herein.

B. Shop drawings shall be taken to mean detailed drawings with dimensions, schedules, weights, capacities, installation details and pertinent information that will be needed to describe the material or equipment in detail.

C. Submittals shall be taken to mean catalog cuts, general descriptive information, catalog numbers and manufacturer's name.

D. Submit for review all shop drawings and submittals as hereinbefore called for.

E. Review of submittals or shop drawings shall not remove the responsibility for furnishing materials or equipment or proper dimensions, quantity and quality, nor will such review remove the responsibility for error in the shop drawings or submittals.

F. Failure to process submittals or shop drawings on any item and/or items specified shall make the Contractor responsible for the suitability for the item and/or items, even though the item and/or items installed appear to comply with the Contract Documents.

G. Assume all costs and liabilities which may result from the ordering of any material or equipment prior to the review of the shop drawings or submittals, and no work shall be done until the shop drawings or submittals have been reviewed. In case of correction or rejection, resubmit until such time as they are accepted by the Owner's Representative, and such procedures will not be cause for delay.

H. Submittals and shop drawings shall be compiled from the manufacturer's latest product data. Should there be any conflicts between this data and the Contract Documents, report this information for each submittal and/or shop drawing.

I. Shop drawings and submittals will be returned and unchecked if the specific items proposed are not clearly marked, or if the General Contractor's approval stamp is omitted.

J. When requested, furnish samples of materials for acceptance review. If a sample has been reviewed and accepted, then that item of material or equipment installed on the job shall be equal to the sample; if it is found that the installed item is not equal, then replace all such items with the accepted sample equivalent.

2.03  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 judgement 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 material or equipment. If any other than the first listed material 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.

E. Substitutions of products under other sections may occur. Make necessary adjustments and additions to work under Division 16 to accommodate those substitutions. Such adjustments and additions shall be performed in compliance with Division 16 Specifications at no additional charge.

F. Energy efficiency of each item of power consuming equipment shall be considered one of the standards for evaluation.

PART 3 - EXECUTION

3.01 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 use core drills for small round cuts in concrete.

C. Where openings are cut through masonry walls, provide lintel or other structural support 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 angle around the opening.

E. Patch concrete openings that are to be filled with nonshrinking cementing compound. Finish concrete patching shall be troweled smooth and shall be uniform with surrounding surfaces.

3.02 WATERPROOFING

Provide waterproof flashing for each penetration of exterior walls and roofs.

3.03 CONSTRUCTION REQUIREMENTS

A. Except where specifically noted or shown, the locations and elevations of equipment are approximate and are subject to small revisions as may prove necessary or desirable at the time the work is installed. Locations changed substantially from that shown on the drawings shall be
confirmed with the Engineer in advance of construction.

B. Where equipment is being furnished under another Division, request from Engineer an accepted drawing that will show exact dimensions of required locations or connections. Install the required facilities to the exact requirements of the accepted drawings.

C. All work shall be done in the best and most workmanlike manner by qualified, careful electricians who are skilled in their trade. The standards of work required throughout shall be of the first class only.

D. Unless shown in detail, the Drawings are diagrammatic and do not necessarily give exact details as to elevations and routing of raceways, nor do they show all offsets and fittings; nevertheless, install the raceway system to conform to the structural and mechanical conditions of the construction.

E. Holes for raceway penetration into sheet metal cabinets and boxes shall be accurately made with an approved tool. Cutting openings with a torch or other device that produces a jagged, rough cut will not be acceptable.

F. Cabling inside equipment shall be carefully routed, trained and laced. Cables so placed that they obstruct equipment devices will not be acceptable.

G. Equipment shall be set level and plumb. Supporting devices installed shall be set and so braced that equipment is held in a rigid, tight-fitting manner.

3.04 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 and made watertight. All outlet boxes and cabinets shall be kept free of concrete, plaster, dirt and debris.

D. Equipment shall be covered and tightly sealed against entrance of dust, dirt and moisture.

E. All dry-type transformers prior to energization shall be protected against moisture and dirt absorption by a suitable covering. Also, maintain heat inside the covering by means of 100 watt minimum lamps.

F. Interiors of and motor control centers shall be kept clean and dry prior to energization. Maintain heat inside each unit with one (1) 150 watt lamp located at bottom of each vertical section or energize section space heaters.

3.05 COOPERATION WITH WORK UNDER OTHER DIVISIONS

A. Cooperate with all other trades so as to facilitate the general progress of their work. Allow all
other trades every reasonable opportunity for the installation of their work and the storage of their materials.

B. The work under this section shall follow the general building construction closely. Set all pipe sleeves, inserts, etc., and see that openings for chases, pipes, etc., are provided before concrete is placed or masonry installed.

C. Work with other trades in determining exact locations of outlets, conduits, fixtures, and pieces of equipment to avoid interference with lines as required to maintain proper installation of other work.

D. Make such progress in work that will not delay the work of other trades. Schedule the work so that completion dates as established by the Engineer are met. Furnish sufficient labor or work overtime to accomplish these requirements if directed to do so.

3.06 INSTALLATION OF WORK UNDER ANOTHER DIVISION

A. Verify the electrical capacities of all motors and electrical equipment furnished under other sections, or furnished by the Owner, and request wiring information from the Engineer if wiring requirements are different from that specified under this Section. Do not make rough-ins until equipment verification has been received.

B. Install all motors, controllers, terminal boxes, pilot devices, and miscellaneous items of electrical equipment that are not integrally mounted with the equipment furnished under other divisions. All such equipment shall be securely mounted and adequately supported in a neat and workmanlike manner.

3.07 CONTINUOUS SERVICE

A. Continuous service shall be maintained on all existing circuits and equipment affected by the work shown on the Contract Documents, except where the Owner will permit outage for a specific time. Obtain Owner's written permission before removing any circuit from continuous service. Where duration of proposed outage cannot be tolerated by the Owner, provide temporary connections or portable generators as required to maintain service.

B. Remove all existing electrical equipment and materials made obsolete by the work called for in the Plans and Specifications (including the Civil Drawings). All obsolete exposed conduit and wiring shall be removed back to the source or point of concealment. If removed back to point of concealment, the conduit shall be capped and identified with a permanent tag as to destination. Obsolete wiring shall be removed back to source. Obsolete Breakers in panelboards shall be marked as spares in directory and obsolete units in motor control centers shall be marked as spare with permanent engraved nameplates that match existing nameplates.

3.08 CHANGE ORDERS

A. In the event change orders are prepared, they shall each be itemized as to quantities in addition to labor, materials, and overhead.
B. Pricing of change orders shall be done in compliance with the latest edition of "Means Electrical Cost Data" and pricing shall not exceed values tabulated therein.

3.09 CLEAN-UP

A. 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 of equipment shall be left on the premises.

B. Equipment paint scars shall be repaired with paint kits supplied by the equipment manufacturer or with an approved paint.

C. Clean interiors of each item of electrical equipment. At completion of work all equipment interiors shall be free from dust, dirt and debris.

3.10 TESTS

A. Test all systems furnished under Division 16 and repair or replace all defective work. Make all necessary adjustments to the systems and instruct the Owner's personnel in the proper operation of the system.

B. Make all circuit breaker and protective relay adjustments and settings.

C. Make the following minimum tests and checks prior to energizing the electrical equipment:
   1. Check all wire and cable terminations for tightness.
   2. Test all wiring as specified in 16120.
   3. Test grounding system as specified in Section 16450.
   4. Set all transformer taps as required to obtain the proper secondary voltage.
   5. Carefully check all interlocking, control and instrument wiring for each system to ascertain that the system will function properly as indicated by schematics, wiring diagrams, or as specified herein.
   6. Mechanical inspection of all low voltage circuit breakers, disconnect switches, motor starters, control equipment, etc. for proper operation.
   7. Provide all instruments and equipment for the above tests.
   8. Allow in bid for third party testing firm to test operation of switchboard, automatic transfer/bypass switch, and motor control center equipment including motor starters, contactors, and circuit breakers. Testing shall be by current injection and shall be compared to relay settings in co-ordination study specified in the applicable other Division 16 specifications. Testing shall be in accordance with NETA standards. Testing firm shall be Shermco, ETI, or approved equal. Furnish test report documentation.

3.11 RECORD DRAWINGS

A. At the start and during the progress of the job, keep one separate set of complete contract issued
prints for making construction notes and mark-ups.

B. Show conduit routing and wiring runs as constructed and identify each.

C. Record all deviations from the Contract Documents.

D. Submit set of marked-up drawings for review. The final payment will not be made until the review is complete.

3.12 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 as spare parts lists.

B. Submit copies for review as hereinbefore specified.

C. Preliminary Operations and Maintenance Manuals shall be included with the initial shipments of equipment to the contractor shop or site.
PART 1 - GENERAL

1.01 SCOPE

A. This section shall include raceways, enclosures, supporting devices, ancillary fittings and appurtenances. Furnish and install the complete raceway systems as shown on the Drawings and as specified herein.

B. Raceway is a broad-scope term that shall be defined by the National Electrical Code under Article 100.

1.02 APPLICATIONS

A. Except as otherwise shown on the Drawings, or otherwise specified, all underground and in-slab conduit raceways shall be of the following type:

1. Except as otherwise specified, all power and control underground conduit runs shall be made with schedule 80 PVC. Bends to grade shall be made with schedule 80 PVC adapter connected to a PVC coated rigid steel conduit with sleeved coupling with one side of the sleeve removed where connected underground to the schedule 80 PVC conduit.

2. All instrumentation underground conduit runs shall be made with plastic coated rigid galvanized steel conduit.

B. Except as otherwise shown on the Drawings, or otherwise specified, all above grade conduit raceways shall be of the following type:

1. Indoor exposed power and control conduit shall be rigid aluminum conduit. Instrumentation, signal, and communication conduit shall be rigid steel conduit.

2. Outdoor exposed power, control, and instrumentation, signal, and communication conduit shall be rigid steel conduit, except where areas are denoted as corrosive or NEMA 4X. In those areas, furnish plastic coated rigid steel conduit, fittings, and boxes.

3. Conduit concealed in masonry shall be with plastic coated rigid steel.

1.03 SUBMITTALS AND SHOP DRAWINGS

A. Process catalog submittals for the following:

1. Rigid Metallic Aluminum Conduit
2. Plastic Jacketed Rigid Steel Conduit
3. Rigid Non-Metallic Conduit
4. Liquid-tight Flexible Conduit
5. Liquid-tight Fittings
6. Conduit Bushings
7. Conduit Bodies
8. Conduit Sealing Fittings
9. Expansion-Deflection Fittings
10. Expansion Fittings
11. Cast Metal Boxes
12. Tape Products
13. Wiring Devices
14. Supporting Devices
15. Labels
16. Grounding Devices
17. Foam Sealant

1.04 SAMPLES

A. Process samples for the following:
   1. Plastic coated rigid metallic steel conduit (12" long with coupling for 3/4" C)
   2. Liquid tight flex (12" long with box connector for 3/4" C.)

B. Submit samples along with submittals.

PART 2 - PRODUCTS

2.01 RACEWAYS

A. Rigid metallic aluminum conduit shall be manufactured of 6063 alloy, T-1 temper, with no more than 0.02% copper content. All conduit couplings shall be threaded aluminum. All such conduit shall be listed with UL and comply with UL-6 and ANSI C80.5. Aluminum conduit shall be Easco, Indalex, or equal.

B. Rigid metallic steel conduit shall be hot-dip galvanized inside and outside and over threads. All such conduit shall comply with U.L. Standard UL-6, Federal Specification WWC-581-D, ANSI C80.1, and NEMA RN1-1980. Furnish Wheatland, Allied or equal.

C. Plastic coated rigid steel conduit shall consist of rigid steel body that complies with above specifications for rigid metallic steel conduit, plus conduit shall have 40 mil thick heat-fused PVC over outside and 2 mil coat of fully catalyzed phenolic inside. The inside coat shall have the chemical resistance of the outer coating and shall not dissolve in lacquer thinner. All couplings shall be equipped with PVC sleeves that extend one pipe diameter or 2", whichever is less, beyond the end of the coupling. All plastic coated conduit shall conform to NEMA Standard #RN1 (Type A) and such conduit shall be Robroy "Plastibond Red", or equal.

D. Non-metallic rigid conduit shall be Schedule 40 PVC. Such conduit shall be UL listed for 90 degrees C and shall conform to NEMA TC-2 and UL-651 standards. Furnish Carlon, Sedco, or equal. Furnish manufacturer's approved solvent for joining couplings.

E. Liquid-tight flexible conduit shall consist of hot-dipped galvanized, flexible interlocking steel core with thermoplastic cover, integral copper ground wire (through 1-1/4" trade size) and shall be Anamet Anaconda seatite "UA", Electra-flex Liquatite “LA” or equal.
2.02 CONDUIT FITTINGS

A. NEMA 4 locknuts for rigid metallic conduit shall consist of galvanized steel body with neoprene sealing ring. Furnish Crouse-Hinds, T&B, or equal.

B. NEMA 1 locknuts for rigid metallic conduits shall be galvanized steel for use with galvanized steel conduit and hardened aluminum for use with aluminum conduit.

C. Conduit field-applied hubs for sheet metal enclosures shall be aluminum body with recessed neoprene sealing ring, threaded NPT insert, and shall be, T&B 370 AL series, or equal products by OZ/Gedney.

D. Conduit hubs for non-metallic enclosures shall be fiberglass polyester reinforced with galvanized steel core, complete with locknut and grounding bushing. All such hubs shall be Crouse-Hinds Type NHU, or equal.

E. Rigid metallic conduit chase nipples, split couplings, slip fittings, unions, reducers, and enlargers, shall be hot-dip or mechanically galvanized malleable iron.

F. Rigid metallic conduit short els and long els shall be hot-dip galvanized malleable iron with NPT threaded hubs and male ends. Throats shall be smooth and free from burrs. All such fittings shall be OZ/Gedney Type "9" Series, Appleton, or equal.

G. Rigid metallic conduit split couplings shall have threaded body with split tightening shelves with neoprene sandwich. Furnish malleable iron mechanically galvanized body. Such fittings shall be OZ type "SSP", or equal.

H. Rigid metallic conduit grounding bushings shall be aluminum body with threaded hub, bakelite insulated throat, and tin-plated copper ground lug. Furnish OZ/Gedney type ABLG, or equal.

I. Liquid-tight flexible conduit fittings shall be hot-dip galvanized steel body with internal locking ring and ground cone plus external ground wire fitting. Furnish straight or angle connectors as required. All such connectors shall be OZ/Gedney 4Q series, or equal.

J. Rigid metallic conduit expansion/deflection fittings shall consist of galvanized malleable iron hubs with heat-fused epoxy coating, flexible neoprene joining sleeve banded to hubs with stainless steel bands, and with internal bonding jumper and guide cones. Furnish Crouse-Hinds type "XD" or equal.

K. Rigid metallic conduit expansion fittings shall consist of metallic barrel joined to hubs at each end. One hub shall be threaded to barrel and other hub shall have slip fit to allow up to four (4") inches of conduit lateral movement. Provide external bonding jumper for each expansion joint. Furnish Crouse-Hinds type "XJ", OZ Type "AX", or equal.

L. Conduit waterstops for sealing inside of conduit runs shall consist of aluminum pressure discs with sandwiched neoprene seal and with 316 stainless steel hardware. Furnish OZ/Gedney type "CS" series products, as indicated.
2.03 CONDUIT BODIES AND BOXES

A. Conduit bodies such as "C", "LB", "T" and the like pulling fittings shall be zinc coated with malleable iron or aluminum (material shall match conduit). Covers for damp and/or wet location use shall be gasketed cast metal with "wedge-nut" clamps. Covers for dry locations shall be cast aluminum and hardware shall be 316 stainless steel. All covers shall be equipped with clamp type clevises. Furnish Crouse-Hinds Form 7, or Appleton Form "FM7" products.

B. Conduit bodies for use in corrosive areas shall be as specified above but shall have 40 mil plastic coated PVC jacket and 2 mil interior coating as specified for plastic coated rigid steel conduit. Furnish Robroy Plasti-bond Red fittings or equal.

C. Conduit bodies such as "GUA", "GUAT", "GUAL", and the like pulling/splicing fittings shall be cast aluminum with threaded cast aluminum covers. All such conduit bodies shall be Killark "GE" series, or equal products by Crouse-Hinds or Appleton.

D. 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 or zinc coated sand-cast malleable iron. All boxes shall have threaded hubs. Furnish Crouse-Hinds "FD" style condulets, Appleton "FD" style Unilets, or equal.

E. Covers for cast metal boxes shall be gasketed cast metal covers with 316 stainless steel screws and shall be suitable for use in wet or damp locations.

2.04 PULL AND JUNCTION BOXES

A. Pullboxes and junction boxes whose volume is less than 100 cubic inches shall be furnished as specified hereinbefore except where sheet metal types are shown, in which case, furnish such sheet metal enclosures in NEMA 4X 304 stainless steel construction with gasketed covers of same material.

B. Pullboxes and junction boxes whose volume is 100 cubic inches and greater shall be NEMA 4X 304 grade stainless steel type with gasketed stainless steel covers. Provide print pocket and interior back panel for mounting of terminal strips where terminal strips are called for on the drawings. Sheet metal boxes shall be as manufactured by Hoffman or equal.

C. Covers for sheetmetal pullboxes and junction boxes over 100 cubic inches (and for smaller sized where shown) shall have hinged doors. All hardware shall be stainless steel.

D. Cast metal junction boxes shall be cast aluminum type with gasketed, cast metal covers and with stainless steel cover screws.

2.05 LABELS

A. Buried conduit marking tape for marking path of secondary buried conduits shall be four (4") inch nominal width strip of polyethylene with highly visible, repetitive marking "BURIED CONDUIT" or similar language, repeated along its length.
B. Voltage warning labels for cabinets shall be waterproof vinyl strips with adhesive back and shall have "DANGER (VOLTAGE) - DISCONNECT ALL SOURCES OF POWER BEFORE ENTERING". Letters shall be highly visible red color on white background.

2.06 SUPPORTING DEVICES

A. Mounting hardware, nuts, bolts, lockwashers, and washers, shall be Grade 304 stainless steel.

B. Unless otherwise indicated, channel framing and supporting devices shall be manufactured of ASTM 6063, TO6 grade aluminum; 1-5/8" wide x 3-1/4" deep (double opening type). Clamp nuts for use with channels shall be grade 304 stainless steel.

C. Where indicated, furnish grade 304 stainless steel slotted channel members 1-5/8" wide x 1-5/8" deep or 1 5/8" x 3 1/4" deep, double-faced type. All hardware and conduit clamps shall be grade 316 stainless steel.

D. Conduit clamp supports for terminating conduits onto cable trays shall be mechanically galvanized malleable iron with adjustable angle clamp. Fittings shall be provided with 316 stainless steel hardware. Furnish OZ/Gedney type CTC products.

E. All such channel members and fitments shall be B-Line, Unistrut or equal.

F. Conduit straps, and associated nuts, lockwashers and bolts for use with channels shall be 304 stainless steel with 316 stainless steel hardware. Furnish B-Line products or equal.

G. After-set concrete inserts (drilled expansion shields "D.E.S.") shall consist of two types. For anchors to accommodate 5/16" diameter bolts and smaller, provide HILTI "HDI" series 304 stainless steel anchors. For anchors to accommodate 3/8" diameter and larger bolts, provide HILTI "HVA" series with 316 stainless steel threaded inserts.

H. Hanger rod shall be 3/8" minimum diameter Type 304 stainless steel all-thread.

I. Nest-back or clamp-back conduit supports shall be two-piece hot-dip galvanized malleable iron devices. Furnish Crouse-Hinds "MW+CB", OZ/Gedney 140NG Series, or equal.

J. One-hole conduit clamps shall be hot-dip galvanized malleable iron type, Crouse-Hinds Type "MW", T&B 1270/1280 Series, OZ/Gedney "14G" Series, or equal cast aluminum products.

K. Conduit beam clamps shall be hot-dip galvanized malleable iron and shall be as follows:

<table>
<thead>
<tr>
<th>TYPE</th>
<th>MANUFACTURER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Angle</td>
<td>OZ/Gedney Type &quot;UBCG&quot;, or equal.</td>
</tr>
<tr>
<td>Parallel</td>
<td>OZ/Gedney Type &quot;UPCG&quot;, or equal.</td>
</tr>
<tr>
<td>Edge</td>
<td>OZ/Gedney Type &quot;UECG&quot;, or equal.</td>
</tr>
</tbody>
</table>

L. Hanger rod beam clamps shall be clamp type with hardened steel, bolt, Steel City "500" Series,
Crouse-Hinds type "MW", or equal. Furnish swivel stud for each rod make-up.

M. Conduit "J" hangers shall consist of steel straddle with detachable bolt. Finish shall be electro-galvanized. Furnish Kindorf type "C-149", Unistrut "J-1200" Series, or equal.

N. Conduit "U" bolts shall be hot-dip galvanized steel with 304 stainless steel hex-head bolts.

O. Equipment stands for supporting devices such as control stations, device boxes and the like, shall consist of a welded structural steel c-channel and plate steel floor plate as detailed on the 2.07 drawings. Equipment stands shall be hot-dipped galvanized after fabrication.

2.07 MISCELLANEOUS MATERIAL

A. Double bushings for insulating wiring through sheet metal panels shall consist of mating male and female threaded phenolic bushings. Phenolic insulation shall be high-impact thermosetting plastic rated 150 degrees C. Furnish OZ Type "ABB", or equal.

B. Conduit pull-cords for use in empty raceways shall be glass-fiber reinforced tape with foot-marked identification along its length. Furnish Thomas, Greenlee, or equal products.

C. Conduit thread coating compound shall be conductive, non-galling, and corrosion-inhibiting. Furnish Crouse-Hinds Type "STL", Appleton Type "ST", or equal.

D. Plastic compound for field-coating of ferrous material products shall be PVC in liquid form that sets-up semi-hard upon curing. Furnish Rob Roy "Rob Kote" or equal.

E. Zinc spray for coating galvanized steel threads shall be Valspar MZ4, Tenemec 90-96 or equal conductive zinc-rich spray enamel product.

F. Foam sealant for waterproofing uses shall be Avanti International AV280 or equal.

PART 3 - EXECUTION

3.01 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. Conduit shall be installed such that it does not create a tripping hazard or an obstruction for headroom.
E. All runs of rigid conduit shall be threaded, and all male threads shall be coated with non-galling thread compound prior to assembly.

F. Plastic coated metallic conduit lengths shall be joined with threaded metallic coupling that shall be each equipped with a 40 mil thickness sleeve that shall extend over the threads of the joined conduit. Each joint shall be watertight.

G. Field-cut threads in runs of plastic coated metallic conduit shall be cut with a special die that has rear reamed out oversize so as to slip over plastic coating. Do not attempt to cut threads on plastic coated conduit with regular dies, whereby plastic coating is skinned back to allow the incorrect die to be used. Coat all field-cut threads with cold-galvanizing spray, use two coats to provide 1-mil minimum coating thickness.

H. Conduit runs made in concrete pours or surface-mounted runs that are attached to the structure, shall be equipped with an expansion/deflection fitting where they cross an expansion joint, or at every 100 feet.

I. Unless otherwise shown, conduit penetrations through floors located below enclosures, shall be made each with couplings set flush with the outside faces of the concrete pour. Each pair of couplings shall be joined with a threaded spool piece. Use coated aluminum or galvanized steel couplings.

J. 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. Coat all male threads with Crouse-Hinds "STL" or equal, conductive lubricant prior to joining.

K. All conduit runs shall be watertight over their lengths of run, except where drain fittings are indicated. In which cases, install specified drain fittings.

L. 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 three (3’) feet.

M. Where plastic jacketed flex is installed, make up terminal ends with liquid-tight flex connectors. In wet locations, install sealing gaskets on each threaded male connector. Each flex connector shall be made-up tightly so that the minimum pull-out resistance is at least 150 lbs. Install external spirally-wrapped ground wire around each run of liquid-tight flex and bond each end to specified grounding-type fittings.

N. Empty conduits shall have pull-tapes installed. Identify each terminus as to location of other end and trade size of conduit. 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.

O. 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.

P. 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.
Q. 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, jagged edges, and torn metal.

R. 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.

3.02 CONDUIT BODIES AND BOXES

A. Conduit bodies such as "LB", "T", "GUAT", 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. GUA series pulling bodies rather than LB fittings and the like, shall be used for splicing purposes as well as pulling access.

B. Covers for all conduit bodies shall be installed with gasketed cast metal type where located in damp or wet locations.

C. All conduit boxes installed whose inside volume is less than 100 cubic inches shall be cast metal type with gasketed cast metal cover, unless otherwise indicated.

D. All conduit boxes whose inside volume exceeds 100 cubic inches shall be sheet metal type except where gasketed cast metal type, stainless steel or fiberglass reinforced polyester are indicated.

3.03 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 by the NEC, unless shorter intervals are otherwise indicated, or unless conditions require shorter intervals of supports.

B. Multiple runs of surface mounted conduit on concrete or masonry surfaces shall be supported off the surface by means of aluminum channels. Attach each slotted channel support to concrete surface by means of two (2) 1/4" diameter stainless steel bolts into drilled expansion shields.

C. Single runs of surface mounted conduit on concrete or masonry surfaces shall be supported with hot-dipped malleable iron conduit clamps and nest-back spacers. Furnish plastic coated malleable iron conduit clamps and nest backs where corrosive areas are called out.

D. Conduit runs that are installed along metallic structures shall be supported by means of hot-dipped galvanized beam clamps as specified herein.

3.04 LABELING

A. In addition to labeling requirements as specified throughout this and other Sections, install wiring and raceway labeling as follows:

1. Apply write-on identification to empty conduits to identify each conduit as to terminus of other end and also to identify trade size of conduit.

2. Where active conduits terminate into bottoms of motor control centers, install label on each
conduit terminus and show number and size of wiring and function of circuitry and trade size of conduit.

END OF SECTION
PART 1 - GENERAL

1.01 SCOPE

This section shall include wire and cable, terminating devices, splice kits, labeling, and appurtenances.

1.02 SUBMITTALS AND SHOP DRAWINGS

Process catalog submittals for the following:

1. Power and control cable
2. Instrument cable
3. Conductor Connectors
4. Tape Products
5. Labels

PART 2 - PRODUCTS

2.01 WIRE AND CABLE

A. All conductors shall be soft-drawn annealed copper, Class B stranding that meets ASTM B-8. Copper conductors shall be uncoated, except as otherwise specified.

B. Single conductor cable for power, control, and branch circuits shall have cross-linked polyethylene insulation, rated for 600 volts. Cable shall be NEC type XHHW. All such cable shall be rated for wet or dry use. Cable insulation shall be color coded with factory pigmented colors below size #6 awg. Color coding shall be as specified under Part 3 of this section. Cable shall be as manufactured by Southwire or equal.

C. Instrument cable for analog circuits, shall be #16 awg, twisted shielded pairs or triads with PVC insulation and overall jacket. Cable assembly shall be rated for 600 volts wet or dry locations. Furnish Okonite "Okoseal-N Type P-OS" or approved equal.

D. Single conductor cable for 24 volt dc control shall be minimum size #16. Furnish MTW type insulation for panel wiring and THWN insulation for field wiring in conduits.

E. Ground mat and associated upcomers and grounding conductors shall be tin-plated stranded copper.

F. Cable for RS485 applications shall be Belden #9841.

G. Cables for the turbidity metering equipment and transit time flow meters shall be as required by the vendor of the equipment.
2.02 CONNECTORS

A. Mechanical connectors for 600V class wiring shall be tin-plated copper alloy bolted pressure type with bronze tin-plated hardware. Furnish connectors as follows:

<table>
<thead>
<tr>
<th>TYPE</th>
<th>MANUFACTURER &amp; TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single conductor to flat-plate connector</td>
<td>Blackburn LH</td>
</tr>
<tr>
<td>Multiple conductor to flat-plate connector</td>
<td>Blackburn L2H, L3H, L4H</td>
</tr>
<tr>
<td>Split-bolt connector</td>
<td>Blackburn HPS</td>
</tr>
<tr>
<td>Two-bolt parallel connector with spacer</td>
<td>Blackburn 2BPW</td>
</tr>
<tr>
<td>Cross Connector</td>
<td>Blackburn XT</td>
</tr>
<tr>
<td>Splice Connector</td>
<td>Blackburn S</td>
</tr>
<tr>
<td>Flush ground connector</td>
<td>OZ Type &quot;VG&quot;</td>
</tr>
</tbody>
</table>

B. Insulated spring wire connectors, "wire-nuts", for small building wire taps and splices shall be plated spring steel with thermoplastic jacket and pre-filled sealant. Connector shall be rated for 600 volts, 75 degrees C continuous. Furnish King Technology, or equal.

C. 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 "Scotchlok", or equal.

D. Terminal strips for miscellaneous field terminations of control and instrumentation circuits shall consist of 12 point box lug terminals with marking surface. Terminal assembly shall accept #18 to #12 awg and shall be rated 600 volts. Furnish Allen-Bradley #1492-HJ812 terminal blocks.

2.03 INSULATING PRODUCTS

A. Tape products shall be furnished as hereinafter specified and shall be Plymouth-Bishop, Okonite, 3M, or equal.

B. General purpose electrical tape shall be 7 mil thick stretchable vinyl plastic, pressure adhesive type, Plymouth-Bishop Premium 111, 3M, Scotch 33+, or equal.
C. Insulating void-filling tape and high voltage bedding tape shall be stretchable ethylene propylene rubber with high-tack and fast fusing surfaces. Tape shall be rated for 90 degrees C continuous, 130 degrees C overload, and shall be moisture-proof. Void filling tape shall be Plymouth-Bishop W963 Plysafe, 3M Scotch 23, or equal.

D. High temperature protective tape shall be rated 180oC continuous indoor/outdoor, stretchable, self-bonding silicone rubber. High temperature tape shall be Plymouth-Bishop 20 Plysil, 3M Scotch 70, or equal.

E. Insulation putty filler-tape shall be Plymouth-Bishop 125 Filler Tape, 3M Scotchfill, or equal.

F. Arc and fireproofing tape shall be Plymouth-Bishop 20 Plysil, 3M Scotch #70 or equal.

2.04 LABELS

A. Colored banding tape shall be 5 mil stretchable vinyl with permanent solid color. Colors shall be as hereinafter specified. Tape shall be Plymouth-Bishop Premium 37, 3M Scotch #35, or equal.

B. Numbered wire marking labels shall be PVC sleeve-type markers, T&B, Brady or equal.

C. Cable identification ties shall be weather resistant polyester with blank write-on space, T&B, Brady or equal.

2.05 MISCELLANEOUS MATERIAL

A. Cable grips shall be grip-type wire mesh with machined metal support. Furnish Kellems, Appleton, or equal products.

B. 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.

PART 3 - EXECUTION

3.01 POWER AND CONTROL CABLE

A. Power and control conductors shall be sized as shown and where no size is indicated, the conductor size shall be #12 awg for power circuits, #14 awg for 120 vac control circuits, and #16 awg for instrumentation circuits.

B. Equipment grounding conductors shall be installed with type XHHW or THHN insulated stranded copper conductors and the insulation color shall be green in sizes up to and including #10 awg.
C. Color coding shall be as follows. Non-factory color coded cables shall be marked with specified color tape. Use the following colors:

<table>
<thead>
<tr>
<th>CONDUCTOR</th>
<th>120/208V SYSTEMS</th>
<th>480V SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase A or L1</td>
<td>Black</td>
<td>Brown</td>
</tr>
<tr>
<td>Phase B or L2</td>
<td>Red</td>
<td>Orange</td>
</tr>
<tr>
<td>Phase C</td>
<td>Blue</td>
<td>Yellow</td>
</tr>
<tr>
<td>Neutral</td>
<td>White</td>
<td>N/A</td>
</tr>
<tr>
<td>Ground</td>
<td>Green</td>
<td>Green</td>
</tr>
</tbody>
</table>

D. Branch circuits may be spliced for receptacle, lighting and small appliance load inside appropriate junction boxes. Feeders shall be installed without splice.

E. 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 waterproofed by filling interstices around wires with silicone rubber and further insulating with an envelope of stretched piece of EPR tape around each wire. Then, apply one-half lapped layer of electrical tape over all.

F. 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, of high temperature tape over connector barrel and down one (1") inch over wires.

G. Taps, splices, and connections 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.

H. 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.

I. Each wire connection shall be made up tightly so that resistance of connection is as low as equivalent length of associated conductor resistance.

J. Numbered marking labels shall be installed to identify circuit numbers from panelboards. Install labels on each wire in each panelboard, junction, pullbox and device connection.

K. Label each wiring run with write-on waterproof labels inside motor control center. Install write-
on label ties around wire group at conduit entrance and write-on label the wire size, conduit size and service.

L. Install PVC sleeve type numbered marking on each control wire 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.

M. All wiring inside equipment enclosures shall be neatly trained and laced with nylon tie-wraps.

3.02 INSTRUMENTATION WIRING

All 4-20mA analog pairs shall have shields grounded at the instrumentation panel and insulated on the field end unless otherwise required by instrument supplier. Single point grounding shall be maintained.

3.03 GROUND WIRING

A. Each item of equipment shall be adequately and thoroughly grounded. Comply with Article 250 of N.E.C., except where higher standards of grounding have been specified. In addition to following requirements as specified under Section 16450, install grounding for general wiring systems.

B. Equipment grounding conductors (EGC) shall be installed in each run of power and control conduits. These wires shall be green colored in sizes #6 AWG and smaller and green banded in larger sizes. Ground wires shall be type THHN or XHHW insulated copper wires.

C. EGC runs into equipment shall be grounded to equipment bus where available, or to equipment ground lugs.

D. Where grounding type bushings are installed, bond EGC thereto, and furthermore, ground each bushing lug to equipment ground bus or ground lug, or ground rod.

E. In each motor terminal box, install equipment ground lug and connect EGC thereto.

3.04 LABELING

A. In addition to labeling requirements as specified throughout this Section, install wiring and raceway labeling as follows:

1. Apply numbered wire marking labels to control wiring terminations for each termination in each item of equipment. Use PVC sleeve type labels.

2. Apply numbered wire marking labels to power and control wiring terminations in motor control centers, panelboards, and at outlets, to identify circuit numbers. Use PVC sleeve type labels.

3. Apply write-on identification labels to wiring sets in each motor control center, and in each Motor Control Center (MCC) switchboard, to identify the wiring set.

4. Apply numbered wire marking labels to each signal wire termination in each instrument junction box, and in each item of equipment served by instrumentation circuits. Use PVC sleeve type labels.

5. Apply write-on identification labels to wiring sets in each motor control center, and in each Motor Control Center (MCC) switchboard, to identify the wiring set.
6. pullbox and junction box. Show wire size, conduit size, and line and load information. Use waterproof plastic write-on labels with nylon tie-wraps.

3.05 TESTING

A. Each run of 600V class power and control wiring shall be tested prior to connection of line and load. Make tests with 1000V dc hand-crank or motor driven ohmmeter. Each run of wiring shall be tested phase-to-phase and/or phase-to-neutral, and phase-to-ground. Test results for each test shall be equal to or greater than 25,000,000 ohms with 1000V dc applied. All tests shall be made in the presence of the Owners representative or Engineer.

B. Test all runs of signal wiring with 250V dc megger. Insulation values shall meet or exceed 1,000,000 ohms per 100 feet (cable to shield).

C. Should any cable or circuit fail to meet the above tests, replace wire and retest.

END OF SECTION
PART 1 - GENERAL

1.01 SCOPE

A. This section shall include disconnect switches, wiring devices, equipment stands, main circuit breaker panels, combination motor starter, and high resistance ground detection.

B. Furnish and install all such devices and completely connect and wire each device.

1.02 SUBMITTALS AND SHOP DRAWINGS

A. Process catalog submittals, and equipment data for the following:
   1. Wiring Devices
   2. Wiring Device Covers
   3. Wiring Device Boxes
   4. Disconnect switches
   5. Terminal strips
   6. Wireways
   7. Light fixtures

B. Submit shop drawings for light poles, and equipment stands.

PART 2 - PRODUCTS

2.01 WIRING DEVICES

A. All wiring devices shall be specification grade and shall meet NEMA WD-1 requirements. Color shall be brown, unless otherwise indicated.

B. Cover plates for wiring devices shall be Appleton FSK series unless otherwise noted on the drawings. Boxes shall be Appleton type FD, cast metal, raised-lid type. Furnish integral mounting feet where called for on the drawings. Furnish multi-gang units for two or more switches.

C. Furnish the following miscellaneous wiring devices:
   1. Single-pole, single-throw, 20A toggle switch shall be Arrow-Hart #1221, or equal.
   2. Single-pole, double-throw (three-way) 20A toggle switch shall be Arrow-Hart #1223, or equal.

D. Weather proof GFCI receptacles shall each consist of the following:
   1. 1-gang FS cast aluminum metal box with mounting feet.
   2. Pass & Seymour #2095 DSWRBK Spec Grade, 20 Amp GFCI Receptacle.
   3. Weatherproof flip lid deep cover meeting NEC article 410-57b (suitable for wet locations
2.02 TERMINAL STRIPS

A. Terminal strips for installation in junction boxes and the like shall be 600 volt, rated for 25 amps with tin-plated copper box lugs.

B. Furnish Allen-Bradley type 1492-HJ812 or equal in quantities as required.

2.03 EQUIPMENT STANDS

A. Equipment stands for mounting control stations (if required) shall be constructed of structural members welded together as called for on the drawings.

B. Each equipment stand shall be installed with anchor bolts or 3/8” anchors. Furnish grout and mastic bottom coating as indicated on the drawings.

2.04 ENCLOSED CIRCUIT BREAKER DISCONNECTS

A. Enclosed circuit breaker disconnects shall have a NEMA 4X stainless steel enclosure and a minimum interrupting rating of 22 kA rms symmetrical.

B. All enclosed circuit breakers shall have metal nameplates, front cover mounted, that contain a permanent catalog and maximum rating. Provide padlock as shown or indicated in the drawings.

C. Enclosed circuit breaker disconnects shall be as manufactured by General Electric, Square D, Cutler-Hammer, Siemens, or equal.

2.05 SPD (TVSS) PANEL

A. SPD (TVSS) Panel at service entrance disconnect shall be Current Technology Type I Surge Protective Device as specified with included disconnect and event monitor in a NEMA 4X SS box. Connection to incoming disconnect switch shall be as close as possible with minimum #6 AWG wire size.

B. SPD (TVSS) Panel shall comply with the latest edition of the applicable provisions and recommendations of UL 1449 Third Edition.

C. SPD (TVSS) Panel shall be installed per Current Technology installation requirements.

2.06 PANELBOARDS

A. Furnish and install panelboards as shown on the drawings and as specified herein.

B. Submit outline and dimensional drawings, catalog literature, and wiring diagrams, to Engineer for review.

C. Enclosures shall be NEMA 3R.

D. Buses shall be tin plated copper. Mains shall be as indicated on the drawings.
E. Furnish all circuit breakers and spaces as scheduled or indicated on the drawings. Panelboards shall have an integrated interrupting rating as shown. Panelboards as noted or scheduled.

F. Install panelboards where shown on the drawings and adequately support. Use stainless steel bolt and hardware.

G. All conduits shall have grounding bushings installed and grounded to ground bus. Vacuum clean insides of each panelboards after all connections are made.

H. Panelboards shall be Cutler-Hammer (Eaton), General Electric, Square-D, or equal.

I. Panelboard shall include an SPD (TVSS) Type II module without changing the available spaces in the panel as shown on the drawing sheet panel schedule. The SPD shall be rated as shown on the drawings and shall include form C alarm contacts for SCADA RTU input.

2.07 LIGHTING

A. Furnish and install light fixtures and accessories as called for on the drawings.

B. Light fixtures shall be furnished with lamps.

PART 3 - EXECUTION

3.01 WIRING DEVICES

A. Install wiring devices where shown and support each box to wall with stainless steel hardware into typical drilled expansion shields.

B. Set each wiring device with axis plumb and install with yoke screws so as to adequately support each device.

3.02 TERMINAL STRIPS

A. Install terminal strips as herein before specified. Mount to enclosures or backpans with stainless steel hardware.

B. Label each terminal directory with numbers corresponding to wire numbers landed.

3.03 SPARE PARTS

A. Furnish one extra overload relay for each type used.

B. One control relay for every three or less of each range and type installed complete with mounting socket.

END OF SECTION
PART 1 - GENERAL

1.01 SCOPE

A. The Town of Flower Mound Elevated Storage tank shall be served by Oncor Electric Delivery. The service voltage is 120/240vAC single-phase. The Contractor shall allow in bid for furnishing and installing all work associated with the modifications for the new service as specified herein and as required by Oncor Electric Delivery.

B. The Contractor’s electric utility service work at the Elevated Storage Tank shall include furnishing and installing a new main Service Entrance enclosed circuit breaker with distribution panelboard from a new electrical underground service. The Contractor shall install service connections to the new service entrance location. The Contractor shall co-ordinate with Oncor Electric Delivery the scheduling and the sequencing of work so as to minimize downtime.

C. Contractor shall begin the installation only after verifying that easement and right of way requirements have been met.

D. The Contractor shall furnish and install the associated new incoming conduits from Oncor Electric Delivery service location to the service entrance enclosed circuit breaker in the elevated storage tank pedestal. If required by ONCOR Electric Delivery, Contractor shall install electrical vault.

E. Contractor shall furnish (as required by Oncor Electric Delivery) supports, conduit and wiring as located on the electrical drawing sheets and as required by Oncor Electric Delivery.

F. The Contractor shall install conduits to the Contractor furnished and installed new service entrance main enclosed circuit breaker. The contractor shall furnish the metering (as required by Oncor Electric Delivery), enclosed circuit breaker, and necessary conduits, sleeves, bonding wires, extra cable lengths, connectors, grounding, and supports. The new service entrance disconnect shall be located as shown on the drawings. Installation of the new service equipment shall be verified by the Contractor to meet the requirements of Oncor Electric Delivery. The installation shall meet the requirements of the latest NFPA 70 (NEC) approved by the authority having jurisdiction. Scheduling, sequencing of work and inspection required by Oncor Electric Delivery and the Owner shall be done by the Contractor in co-ordination with Oncor Electric Delivery.

G. The Contractor shall make arrangements for obtaining the meter socket and installation as required for the mounting on the elevated storage tank pedestal as required by Oncor Electric Delivery. This work shall be as specified herein and per ONCOR specifications and shall be verified by the Contractor to meet the requirements of ONCOR “Electric Service Guidelines Book”, latest edition (see Construction Guidelines on the internet at www.oncor.com under Delivering Electricity and Construction & Development). Wiring from the transformer pole to the service will be by Oncor Electric Delivery and will be connected at the electrical service in co-ordination with the Contractor at the elevated storage tank. Contact Oncor Electric Delivery, Larry Redick, Phone: (972) 323-8917, Email: larry.redick@Oncor.com.

H. The Contractor shall coordinate a schedule with Oncor Electric Delivery to provide power to meet project schedule requirements.
PART 2 - PRODUCTS

2.01 RACEWAYS

Raceways shall be as specified under Section 16110, and as shown on the drawings and verified as acceptable by Oncor Electric Delivery for the underground to the pole mounted transformer.

2.02 WIRE AND CABLE

Service wire and cable (120/240 volt) shall be 600 volt rated as specified under Section 16120.

2.03 UNDERGROUND

Underground shall be as specified under Section 16410 and as specified herein.

PART 3 - EXECUTION

3.01 GENERAL

A. Underground conduit (if required) shall be installed per Section 16410.

B. Coordinate with electric utility (Oncor Electric Delivery) inspector for inspection of underground connections and underground work prior to trenching and backfilling and as otherwise required by utility.

C. Pull a mandrel through each conduit to check and clear blockage. Install a mule tape (pull tape - a flat ribbon, consecutively numbered in feet, which is usually made of polyester or aramid yarn and may be coated with plastic for waterproofing) in the empty conduit for use by Oncor Electric Delivery.

END OF SECTION
PART 1 - GENERAL

1.01 SCOPE OF WORK

Furnish and install a system of underground raceways and wiring as shown on the drawings.

1.02 APPLICATIONS

Except as otherwise shown on the Drawings, or otherwise specified, all underground and in-slab conduit raceways shall be of the following type:

1. Except as otherwise specified, all power and control underground conduit runs shall be made with schedule 80 PVC. Bends to grade shall be made with a schedule 80 PVC adapter connected to a PVC coated rigid steel conduit with sleeved coupling with one side of the sleeve removed where connected underground to the schedule 80 PVC conduit.

2. All instrumentation underground conduit runs shall be made with plastic coated rigid galvanized steel conduit.

1.03 SUBMITTALS

Process submittals for the following:

1. Non Metallic conduit
2. Metallic conduit
3. Grounding Bushings
4. Buried conduit marker tape
5. Conduit supporting saddles

1.04 RELATED WORK SPECIFIED UNDER OTHER SECTIONS

A. Refer to Section 16110 for raceways.
B. Refer to Section 16120 for wiring.
C. Refer to Section 16450 for grounding.

PART 2 - PRODUCTS

2.01 RACEWAYS

Raceways shall be as specified in Section 16110.

2.02 MISCELLANEOUS

A. Gravel for underbedding of conduits shall be washed type pea gravel.

B. Plastic saddles for spacing and supporting conduits shall be interlocking types as manufactured by Cantex.
C. Plastic marker label tape for buried conduits shall be yellow background with black letters with repetitive marking "ELECTRIC LINE" on yellow background, continuous along its length. Furnish T&B #NA-0608, or equal tape.

PART 3 - EXECUTION

3.01 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 has been installed.

B. All excavations shall be made to proper depth, with allowances made for floors, forms, beams, piping, finished grades, etc. Ground under conduits shall be undisturbed earth or if disturbed, mechanically compacted to a density ratio of 95% before conduits are installed.

C. All backfilling shall be made with selected soil, free of rocks and debris, and shall be pneumatically tamped in six (6") inch layers to secure a field density ratio of 95%.

D. 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.

E. Furnish concrete covered ductbank for conduits where indicated on the drawings.

3.02 RACEWAYS

A. All underground conduits shall be PVC schedule 80 unless otherwise noted. All bends to grade shall be made with schedule 80 PVC and shall extend to 3” above grade. Conduits shall be watertight over the entire length of the underground run.

B. Install all power, control, and signal wiring. Label each single conductor wire at each connection with PVC sleeve type wire labels. Label each signal cable at each end with plastic waterproof write-on type label to identify terminal connection and function and device served.

C. Where empty conduits terminate into equipment install blank "disc" under grounding bushing and bring specified foot-marked pull tape through disc. Label each end of each pull tape with waterproof plastic label to identify terminus of other end and also show conduit size.

3.03 WIRING

All underground wiring runs shall be installed from line to load without splice.

END OF SECTION
PART 1 - GENERAL

1.01 SCOPE

A. Furnish and install grounding systems in accordance with Article 250 of the National Electrical Code as shown on the Drawings and as specified herein.

B. Provide ground mat grounding electrode system as shown on the drawings and as specified herein.

1.02 SUBMITTALS

A. Submit manufacturers' catalog sheets with catalog numbers marked for the items furnished, which shall include:
   1. Ground well casings
   2. Ground rods
   3. Terminal lugs and clamps
   4. Exothermal welding materials
   5. Ground cable
   6. Ground connection hardware

PART 2 - PRODUCTS

2.01 GROUNDING ELECTRODES

A. All ground mat grounding electrodes and grounding electrode conductors shall consist of tin plated stranded copper.

B. All ground rods shall be copper clad steel products, 3/4" diameter x 10 foot long, unless otherwise indicated. Ground rods shall be Blackburn #6258, or equal. Provide heavy duty ground rod clamps equal to Blackburn #GG58 where vertical connections are installed and #GUV where U-bolt connectors are installed to serve horizontal connections.

2.02 GROUNDING DEVICES

A. Connectors shall be furnished as specified under Section 16120.

B. Conduit grounding bushings shall be furnished as specified under Section 16110.

C. Equipment grounding conductors shall be furnished as specified under Section 16120.

Flush cast metal grounding plates shall consist of bronze body with flat plate on top and bolted clamp connector on bottom. Furnish OZ type "VG", or equal flush connectors. Each such connector shall be furnished with silicon bronze connector bolts for installation of top-mounted grounding connectors.
D. Exothermal welding kits shall be "Cadweld" products as manufactured by Erico. Molds, cartridges, powder, and accessories shall be as recommended by the manufacturer.

2.03 GROUND TEST WELLS

A. Ground test wells shall be furnished each ground rod for the purpose of field testing the ground mat system.

B. Ground test wells shall each consist of ground rod with connector attached to upcomer as shown on drawings from the ground mat and contained within an access well with labeled top.

C. Ground test well enclosures shall be Brooks-Oldcastle product #3RT series, or equal. Enclosures shall be 10 1/4" diameter and shall include cast iron cover with integrally cut "GROUND TEST WELL" in top of cover.

PART 3 - EXECUTION

3.01 GROUND MATS AND GROUND WELLS

A. Install ground mat around the perimeter and under the new foundations as shown. Use tin-plated copper stranded conductors in sizes as indicated for the ground mat. Install upcomer with indicated wire sizes of tin plated copper conductors. Exothermally weld all connections. The ground mat wire shall have a minimum cover of 24”.

B. Unless other larger sizes are indicated on the drawings, install #2 upcomers from ground mat to RTU, and other equipment indicated on the drawings. Install "VG" flush floor connector to serve each upcomers and run #2 stingers from top side of each "VG" to ground bus in equipment. Bond VG to rebar in concrete.

C. Install ground rods in test wells where indicated on the drawings.

3.02 TRANSFORMER

A. Bond transformer neutral to cabinet.

B. Install grounding electrode conductor from each transformer neutral to system ground and to local electrodes as shown. Run #2 ground wire to ground mat.

3.03 WIRING SYSTEMS GROUNDING

A. All equipment enclosures, motor and transformer frames, metallic conduit systems and exposed structural steel systems shall be grounded.

B. Equipment grounding conductors shall be run with all wiring. Sizes of equipment grounding conductors shall be based on Article 250 of the N.E.C. except where larger sizes may be shown.
Bond each equipment grounding conductor to the equipment grounds at each end of each run.

C. Liquid tight flexible metal conduit in sizes 1" and larger shall be equipped with external bonding jumpers. Use liquid tight connectors integrally equipped with suitable grounding lugs.

D. Where conduits enter into equipment free of the metal enclosure, install grounding bushing on each conduit and bond bushing lug to equipment ground bus.

E. Where conduits enter equipment enclosures, equip each penetration inside with grounding bushing. Install bonding jumper from each grounding bushing to ground bus.

F. Equipment enclosures that do not come furnished with a ground bus, install ground lug in each enclosure that shall be bonded to the metal cabinet or backpan of the enclosure.

G. Separately derived systems shall be each grounded as shown and shall comply with Article 250 of the NEC except where higher standards are shown.

3.04 TESTING

A. All exothermic weld connections shall successfully resist moderate hammer blows. Any connection which fails such test or if upon inspection, weld indicates a porous or deformed connection, the weld shall be remade.

B. All exothermic welds shall encompass 100 percent of the ends of the materials being welded. Welds which do not meet this requirement shall be remade.

C. Test the ground resistance of the system. All test equipment shall be furnished by Contractor and be approved by Engineer. Test equipment shall be as manufactured by Biddle or approved equal. Dry season resistance of the system shall not exceed five ohms. If such resistance cannot be obtained with the system as shown, provide additional grounding as directed by Engineer.

END OF SECTION
PART 1 - GENERAL

1.01 SCOPE

A. Furnish and install complete lighting protection system for the elevated tank.

1.02 STANDARDS

A. The following specifications and standards of the latest issue form a part of the specification:
   1. Lightning Protection Institute (LPI) Installation Code, LPI 175 and clamps
   3. Underwriter Laboratories, Inc. Installation Code, UL96A

1.03 SYSTEM DESIGN

The work covered by this section of the specifications consists of system design and furnishing all labor, materials, and items of service required for the completion of a functional lightning protection system as approved by the engineer, and in strict accordance with this section of the specifications.

1.04 SUBMITTALS

A. Complete design and drawings showing the type, size, and locations of all grounding, down conductors, down conductors, and painters rail connectors and other miscellaneous components shall be submitted to the engineer for approval.

B. Submit shop drawings for all roof penetration details.

1.05 QUALITY ASSURANCE

Upon completion of the installation, the lightning protection installer shall submit the Underwriters Laboratories, Inc. Master Label certification and the Lightning Protection Institute Certified System certification. Submit record drawings with the LPI forms LPI-C1-01, -02, and -03.

1.06 STANDARDS

The system to be furnished under this specification shall be the standard product of manufacturers regularly engaged in the production of lightning protection equipment and shall be the manufacturer's latest approved design. The equipment shall be UL listed and properly UL labeled. All equipment shall be new, and of a design and construction to suit the application where it is used in accordance with accepted industry standards and LPI, UL, NFPA, and NEC code requirements.

PART 2 - PRODUCTS

2.01 GENERAL

A. All materials shall be copper and bronze and of the size, weight, and construction to suit the application. Bolt type connectors and splicers shall be suitable for use on Class I structures. Pressure squeeze clamps are not acceptable. All mounting hardware shall be stainless steel to prevent corrosion.
B. The system shall consist of a complete system and shall include connectors, splicers, bonds, copper down leads, and proper ground terminals.

2.02 LIGHTNING PROTECTION DEVICES

A. All equipment shall be Thompson Lightning Protection products or equal. Lightning protection devices shall be unobtrusive in appearance and shall be concealed as much as possible. Cable may be exposed inside the Elevated Tank Column. Structural steel may be utilized as permitted by UL, NFPA, and LPI.

B. Down conductors shall be Thompson Lightning Protection #32 STRANDED, ground rods #TL3510. Ground rod connections shall be cadwelded. Provide cable holders #186X and #166 as necessary to support all downlead, and bonding cables at 3 feet on center maximum. Verify compatibility of any proposed adhesive with roofing system in use. Furnish all fittments and appurtenances as required for a complete installation.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Down conductors shall be placed at least 8 feet from the edge of the access platform. At the bottom elevation of the platform fasten a lead with a cast bonding copper connector over to a Y connection at the down conductor.

B. Three down conductors shall be installed placed 120 degrees apart or as otherwise designed to meet the lightning protection requirements. Down conductors shall exit the interior of the concrete structure below grade to the ground rods.

C. Each down conductor shall consist of not less than 28 wires of soft drawn copper being not less than 14 gauge and not less than 6 ounces per foot.

D. Down conductors shall be fastened to the concrete structure with strap fasteners of at least 20 gauge copper, 1/2 inch width, and distance between fasteners shall not exceed 3 feet.

E. Anchor 6 inches both sides of any change in direction of conductor.

F. All equipment shall be installed in a neat, workmanlike manner. Work with other trades to insure a correct, neat, and unobtrusive installation.

G. Place all down conductors no closer than 6 feet from any metal object in the interior of the concrete structure.

H. Installation shall comply in all respects to LPI Code 175. Installation shall be made by or under supervision of an LPI Certified Master Installer. Completed installation shall receive system certification including submittal of Forms LIP-C1-01, LPI-C1-02, and LPI-C1-03.

END OF SECTION
PART 1 - GENERAL

1.01 SCOPE

A. This section covers the general requirements for the instrumentation.

B. Auxiliary and accessory devices necessary for system operation or performance, such as relays, din connectors, or terminals to interface with other Sections of these Specifications, shall be included.

1.02 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of products of this type, and whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer: Qualified with at least 5 years of successful installation experience on projects with work similar to that required for this project.

C. NEC Compliance: Comply with the National Electrical Code, NFPA 70, as applicable to wiring and other electrical construction of the unit.

D. UL Compliance: Provide components with UL listing and labeling for applicable UL categories. Custom panels, control panels, and instrument panels and the like shall be manufactured by a fabricator approved as a UL508A shop and shall bear a UL 508A (UL Industrial Control Panel) label.

E. Provide complete unit and installation to conform with NFPA-90A.

1.03 SUBMITTALS

A. Submit catalog literature, specification material and installation and operation manual for each instrument and device specified herein.

B. Submit outline and dimensional drawings and wiring diagrams to Engineer for review.

C. Submit shop drawings for including wiring and dimensional outlines. Shop drawings shall include ISA loop drawings. Loop drawings shall include all device terminal numbers and wire numbers.

1.04 SYSTEM RESPONSIBILITY

The contractor shall assume complete "SYSTEM RESPONSIBILITY" for the instrumentation system. "System Responsibility" shall mean that the Contractor is responsible for the overall operation, satisfactory performance, and integration of the individual components into the whole system so that the entire system functions in whole and in its parts as intended by the Contract Documents.

1.05 SYSTEM RESPONSIBILITY

16920 RTU Radio
PART 2 - PRODUCTS

2.01 SURGE SUPPRESSORS

A. Surge suppressors for protecting 120vac circuits shall meet UL 1449, UL 1283, NEMA LS-1 1992, and ANSI/IEEE C62.41 and C62.45. Load current rating shall be 20 amps at 120vac.

B. Surge suppressors shall be series connected and shall have a surge current capacity of 45,000 amps. High frequency noise filtration shall be as follows:

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<td>6db</td>
<td>6db</td>
<td>16db</td>
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C. Surge suppressor shall be Current Technology model MSU45-120-1G-20A-3 or equal.

2.02 ENCLOSURES

A. Enclosures for RTU and instrumentation equipment shall be hinged door type and shall have interior mounting sub panel. Enclosure shall be Hoffman or equal. Enclosure shall be sized to house the specified equipment, but shall not be less than the size indicated on the drawings.

B. Enclosure rating for air-conditioned and ventilated locations in the elevated tank pedestal shall be NEMA 12. Enclosure rating for damp locations such as dry pits, etc. shall be NEMA 4X and shall be constructed of 304 stainless steel.

2.03 PERSONEL DOORWAY & GATE OPERATOR INSTRUMENTATION

A. Pedestal doorways leading outside the building shall be equipped with intrusion switches, card reader, card reader programmer, and door opening striker control.

B. Intrusion switches shall be as specified in 2.07 D below.

C. Card reader and card reader programmer assembly shall be EntryProx by HID. The Controller Keypad shall be seperated from the card reader to be installed inside the doorway above the door for programming the card access. The magnetic card reader shall be installed outdoors in a box mounted adjacent to the door lock. The doorway card reader shall be connected to the SCADA system (12 Volts DC). To control the doorway access and notify of access into the building.

D. A doorway striker shall be Hes 5000 12 volt DC controlled from the SCADA system (12 volts DC). Contractor to coordinate with the doorway frame vendor on the addition of the striker control to verify sizes and fit.

E. Card reader for the gate operator shall be installed in a card key access unit with sun/rainshield at gate entrance. Keypad shall be installed in a NEMA 4X stainless steel key lockable junction box adjacent to the gate controller. Access via the gate will be via the SCADA system (12 volts).
2.04 LEVEL AND PRESSURE CONTROL.

A. Furnish two pressure transmitters for the elevated tank. One shall be used for measuring system pressure on the distribution side of the valve and the other shall be used on the tank side to measure level in the bowl.

B. Both pressure transmitters shall be Endress & Hauser Model PMC41 pressure transmitters with model 84600540 bleed and block valves, indicator scaled in engineering units. The pressure transmitter shall be of the loop powered type with an operating voltage range of 11.5-45VDC and shall be capable of driving 20MA into a load of 600 ohms while operating on 24VDC. The transmitter shall incorporate an integral LCD digital display reading in engineering units. The transmitter shall be provided with a ½-inch MNPT and ¼-inch FNPT pressure connection of 316L stainless steel with a ceramic measuring diaphragm. The transmitter electronics enclosure shall be epoxy coated cast aluminum with a ½-FNPT conduit entry and glass viewing window for the integral LCD display and shall be suitable for NEMA 4X operation. The pressure transmitter shall have an accuracy of 0.2% with a 10:1 turndown and zero adjustability of –10 to +100%. Pressure transmitters shall have transient protectors.

C. The system pressure transmitter shall have a range of 0 to 150 psi. The pressure transmitter used for bowl level measurement shall suppress the pressure in the standpipe and provide a 4-20ma output of the bowl level only. The range shall be 0 to 35°. The transmitter shall be field programmable using integral pushbuttons as well as a HART hand held programmer. The pressure transmitter shall be provided with a pressure range suitable for the intended application as well as a 316 stainless steel bleed and block manifold valve.

D. Outputs shall be a 4-20 mA signal proportional to pressure or level. Provide integral digital display scaled in engineering units.

2.05 UN-INTERRUPTIBLE POWER SUPPLIES

A. Un-interruptible power supplies (UPS) for the RTU, SCADA, and Instrumentation system shall be rated 400 watts minimum at 120 vac. Backup time shall be 1 hour at 50 watts, and at least 10 minutes at half load.

B. The UPS shall be in a NEMA 12 enclosure with a subpanel and receptacle for the circuit feeding the UPS. In addition, the panel shall have a cord cap and terminals for wiring external circuits and shall be configured so that the UPS can be bypassed by plugging the cord cap into the supply receptacle.

C. The UPS shall be APC model BP700UC or approved equal.

2.06 HEAT TRACING

A. Water lines for Cla-VAL flow altitude valve, tank level and pressure pilot sensing lines (tubing) shall be heat traced and insulated. Electric heat tracing shall be self-limiting type, 120 v AC, and shall be rated 5 watts per foot unless otherwise indicated on the drawings. Wrap each transmitter and the pressure switch. Furnish Thermon type FP with braid and overall jacket. Secure heat tape to piping with aluminum tape.

B. Furnish Thermon ETI Automatic Temperature Controller GPT-3 Freeze Protection Control Unit
for the heat tracing. Insulation for transmitters shall be O’Brien Flexpak or equal. Insulation for sensing lines shall be O’Brien Flexpak strip insulation. Insulation for chlorine sensing lines shall be ½” closed cell polyethylene therma-cel. Furnish Therma-Cel Insul-Tube or approved equal.

C. Provide Thermon end of line indicator lights to indicate that heat tracing is operating.

2.07 MISCELLANEOUS

A. Terminal strips for connection of field wiring shall be DIN rail mounted channel mounted terminals suitable for connecting #22 to #12 wire sizes. Terminals shall be solderless box lug type with pressure plate and removable terminal marking strips. Box lugs shall be tin plated copper. Terminals shall be Allen Bradley 1492 HMI series with required DIN rail mounting channel and end clamps. Fused terminals for 24 volt dc instrumentation circuits shall be rated 10 57 volts dc, shall have blown fuse LED indicator and shall be Allen Bradley 1492 H5 series. Fused terminals for 120 volt ac circuits shall be rated 300 volts ac, shall have neon blown fuse indicator and shall be Allen Bradley 1492 H4 series. Terminal strips shall have factory terminal markers.

B. Control relays shall be 3 pole double throw with pin base and matching socket. Furnish Potter & Brumfield model RR3P with 120 volt coil.

C. Furnish control panel devices as indicated in the drawings. 120vac pushbuttons, selector switches, and pilot lights shall be oil tight, Allen Bradley type 800H or equal. Pilot lights shall be transformer type and shall have push to test option.

D. Furnish intrusion detection devices for equipment panels and doorways to be located as indicated in the drawings. Intrusion Detectors shall be Class 9007 heavy duty limit switches by Square-D, or SENTROL 2200 Series Miniature Surface Mount Intrusion Detectors with stainless steel armored cable (McMaster Carr Cat. # 8039A51).

PART 3 - EXECUTION

3.01 INSTALLATION GENERAL

A. Permanently mount the instruments, and all required appurtenances in accordance with manufacturer’s requirements. All work shall be done in accordance with industry standards, the NEC, ISA recommendations and in a workmanship like manner.

B. Calibrate, and test all instruments.

C. Certify that all instrument installations and calibrations are done in accordance with ISA and the manufacturer’s recommendations.

D. Provide completed ISA calibration sheets for all new instruments provided.

E. All surge suppression devices shall be grounded with minimum #8 ground wire.

3.02 OPERATIONS AND MAINTENANCE MANUALS

A. Six (6) weeks prior to the completion of the project, compile an Operations and Maintenance
Manual on the instrumentation equipment. These manuals shall include detailed instructions, periodic calibration requirements and maintenance, as well as recommended spare parts lists.

B. Submit for review per Contract General Conditions Section 6.17.

END OF SECTION
PART 1 - GENERAL

1.01 SCOPE

A. This section covers radio systems, antenna, antenna supports and antenna cable. Furnish and install all equipment and materials as shown on the drawings and specified herein. Work shall include all necessary materials, equipment, labor, and services.

B. Auxiliary and accessory devices necessary for system operation or performance, such as relays din connectors, or terminals to interface with other Sections of these Specifications, shall be included.

1.02 QUALITY ASSURANCE

A. Comply with Section 16910, Part 1.02

1.03 RELATED WORK

Section 16910, Instrumentation

1.04 SUBMITTALS AND SHOP DRAWINGS

Process catalog submittals, and equipment data for the following:

1. Radios
2. Antenna
3. Antenna cable
4. Surge protectors
5. Antenna poles

B. Submit shop drawings for:

1. Wiring diagrams for pin-out connections
2. Antenna poles

PART 2 - PRODUCTS

2.01 RADIOS

Radios for the Town of Flower Mound shall match existing radios. The radio shall be mounted in SCADA RTU enclosure and powered off of the DC power supply which shall be backed up by a UPS. All cables, connectors, etc. required for operation shall be furnished.

2.02 DIRECTIONAL ANTENNAS

A. Directional antennas shall be as required by the City of Flower Mound to be mounted on the top of the tank.
B. Yaggi antennas shall be configured for correct polarization.

2.03 ANTENNA CABLE AND ACCESSORIES

A. Antenna cable for the remote sites shall be 1/2" Andrew Heliax #LDF4 50A coaxial cable.

B. Antenna cable for the omnidirectional antennas shall be 7/8” Andrew Helliax.

C. Each antenna cable shall be grounded outside of the RTU with a Decibel Products #DB11600 series grounding strap kit.

D. Each antenna cable shall have a Polyphasor model IS 50NX C2 grounded surge arrester at the bottom of the RTU or radio enclosure.

E. Connectors shall be N type, Andrew 7/16 DIN.

F. Furnish 1/2” foam superflex, Andrew #FSJ4 50A for final connections to antenna and radio and where indicated on the drawings. Superflex shall have factory installed connectors.

PART 3 - EXECUTION

3.01 ANTENNA INSTALLATION

A. Antenna shall be mounted to handrail on top of tank.

B. All poles and antennas shall be grounded as required by local and national codes.

3.02 ANTENNA AND CABLE INSTALLATION

A. Weatherproof all outdoor connectors with shrink tubing, Decibel Products VB 8 Vapor Bloc. Carefully inspect installed cable for nicks and kinks.

B. Check VSWR (voltage standing wave ratio) at each site after installation and submit test results to engineer for review.

3.03 RADIO INSTALLATION AND CONFIGURATION

A. Radio configuration. Configure radios for full duplex to match existing system configuration.

B. Run poll test, link test and sync test with manufacturer's diagnostic software and submit results to Engineer for review.

END OF SECTION
PART 1 - GENERAL

1.01 SCOPE

A. This section covers remote telemetry units (RTU), and accessories. Furnish and install all equipment and materials as shown on the drawings and specified herein. Work shall include all necessary materials, equipment, labor, and services.

B. Auxiliary and accessory devices necessary for system operation or performance, such as relays DIN connectors, or terminals to interface with other Sections of these Specifications, shall be included.

1.02 QUALITY ASSURANCE

A. Comply with Section 16910, Part 1.02

B. Allow in bid for Prime Controls, Inc. to provide RTU and SCADA equipment. Contact Jim McMillon, Prime Controls, Inc. Phone (972) 221-4849x206, fax (972) 420-4842, Email j.mcmillon@prime-controls.com.

1.03 RELATED WORK

Section 16910, Instrumentation
Section 16920, RTU Radio
Section 16940, Computers and HMI Systems

1.04 SUBMITTALS AND SHOP DRAWINGS

A. Process catalog submittals, and equipment data for the following:
   1. RTU’s
   2. FEP’s
   3. Input/output modules
   4. Input/output racks
   5. Power supplies
   6. Uninterruptable Power Supplies

B. Submit shop drawings for I/O connection wiring. Wiring shall comply with 16910.

PART 2 - PRODUCTS

2.01 RTU (REMOTE TERMINAL UNITS)

A. RTU at the new site shall be as typical to Town of Flower Mound. Radios shall be as specified under Section 16920.
B. RTU shall have I/O modules as required to accommodate the I/O scheduled plus 10% spares on the drawings.

2.02 MASTER RTU

The master RTU is existing at Flower Mound waste water plant.

2.03 I/O MODULES

A. Analog input modules shall have isolated 4-20mA inputs.

B. Analog output modules shall have isolated 4-20mA outputs.

2.04 OPERATOR INTERFACE

A. Operator Interface (OI) panel shall be 4” color graphic touch screen. Furnish Maple Silver Series or equal product.

2.05 POWER SUPPLIES AND BATTERIES

A. See UPS requirements - Instrumentation.

B. Provide Motorola “ACE” Battery system.

PART 3 - EXECUTION

3.01 GENERAL RTU PROGRAMMING

A. Program the master RTU to poll the new RTU. Program the new RTU to perform logic functions as described on the drawings and to perform data and alarm gathering for computer system and HMI (Human Machine Interface).

B. Configure software disagreement alarms if a valve open or close command is issued and the valve does not respond after a time delay.

3.02 TESTING

A. A field acceptance test (FAT) shall be conducted for the SCADA equipment and computer system. Allow in bid to incorporate Owners comments into system.

B. The Owner and Engineer shall be given 10 days prior notice of FAT test.

END OF SECTION
PART 1 - GENERAL

1.01 SCOPE

A. This section covers computer systems and HMI (human machine interface software). Work shall include all necessary materials, equipment, labor, and services. The computers and master RTU are existing at the Flower Mound HMI location, Flower Mound waste water plant.

B. Auxiliary and accessory devices necessary for system operation or performance, such as relays, din connectors, or terminals to interface with other Sections of these Specifications shall be included.

1.02 QUALITY ASSURANCE

Comply with Section 16930, Part 1.02, Paragraph B.

1.03 RELATED WORK

Section 16910, Instrumentation
Section 16920, Radio Equipment
Section 16930, SCADA Equipment

1.04 SUBMITTALS AND SHOP DRAWINGS

A. Submit graphic screens in color for review.

PART 2 - PRODUCTS

2.01 SOFTWARE

A. Computer system and software packages are existing.

PART 3 - EXECUTION

3.01 CONFIGURATION

A. Computer system configuration. The system shall monitor all points at the new elevated tank and alarm all points indicated as alarm points on the RTU I/O Schedule. In addition configure high and low level alarms for the elevated tank. HMI work shall match existing methodology and shall include but not be limited to:

1. Define the database as required to incorporate the scheduled I/O at the new site.
2. Build a graphic screen to show the piping, tank, etc and the instrumentation for the scheduled I/O.
3. Provide storage and display of historical data.
4. Verify and test the proper operation of the SCADA HMI system.
5. Disagreement alarms for equipment that fails to operate when called for.
6. Trending, and archiving of all pressures, levels, and flows.
7. Totalization of all flowmeter signals.
8. Communication status, alarms, and failures.
9. Incorporation of the new site into the existing master graphic screen with menu driven links to sub-master screens for the new pump station.
10. "Hot Links" shall be configured between master screens and new sub-master screens.
11. Status screens and trending screens shall be printable and shall have a hot key to print a copy.

B. Screen colors for animated objects linked to I/O or process shall match existing methodology. Where no existing methodology is applicable, the following shall apply:
3. For valves in transition between open and closed, the red and green indicators shall blink.
4. Devices that fail to activate after a control command is issued shall blink yellow.
5. Analog values which are questionable due to open or shorted loops shall blink yellow.

C. Real-time and historical trending. Create graphical trend displays of real-time or historical data. The work shall include but not be limited to the following:
1. Configure approximately 5 real time historical trend groups or screens.
2. Trend displays shall be made for flow rates and pumping to determine approximate efficiency of pumping scheme at each pump station.

D. Report generation shall match existing reporting for existing elevated tanks.

3.02 FAT TEST

Perform Field Acceptance Test of computer system and HMI software. Reference Section 16930. The FAT test shall consist of simulating inputs and outputs through software and testing RTU and HMI systems. The primary purpose of the FAT test is to allow Owner’s operators to review HMI screens before final installation in the field. Allow in bid to incorporate Owner’s and Engineer’s FAT Test comments into the SCADA system.

3.03 DOCUMENTATION

The final software configuration shall be fully documented and annotated. This documentation shall include the RTU programming and radio system settings. Furnish printouts in O&M manuals.

END OF SECTION
APPENDIX A – GEOTECHNICAL REPORT
GEOTECHNICAL ENGINEERING STUDY
WATER LINE FOR
WESTERN ELEVATED WATER TANK
FREEMAN ROAD
FLOWER MOUND, TEXAS

Presented To:
Kimley-Horn and Associates, Inc.

May 2010

PROJECT NO. 103-09-100
May 3, 2010
Report No. 103-09-100

Kimley-Horn and Associates, Inc.
12700 Park Central Drive, Suite 1800
Dallas, Texas 75251

Attn: Mr. Anthony Samarripas, P.E.

GEOTECHNICAL ENGINEERING STUDY
WATER LINE FOR WESTERN ELEVATED WATER TANK
FREEMAN ROAD
FLOWER MOUND, TEXAS

Dear Mr. Samarripas:

Submitted here are the results of a geotechnical engineering study for the referenced project. This study was performed in general accordance with CMJ Proposal 08-2694 dated September 8, 2009. The geotechnical services were authorized on February 11, 2010 for Kimley Horn and Associates, Inc. Individual Project Order Number 061000091.

Engineering analyses and recommendations are contained in the text section of the report. Results of our field and laboratory services are included in the appendix of the report. We look forward to performing the second phase of investigating the actual elevated tank site.

We appreciate the opportunity to be of service to Kimley-Horn and Associates, Inc. Please contact us if you have any questions or if we may be of further service at this time.

Respectfully submitted,
CMJ ENGINEERING, INC.
TEXAS FIRM REGISTRATION NO. E-9177

Charles M. Jackson, P.E.
Senior Engineering Consultant
Texas No. 46088

copies submitted: (3) Mr. Anthony Samarripas, P.E.; Kimley-Horn and Associates, Inc (by mail)
(1) Mr. Anthony Samarripas, P.E.; Kimley-Horn and Associates, Inc (by e-mail)
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## APPENDIX A

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1.0 INTRODUCTION

1.1 Project Description

The project site is located along Freeman Road, north of Cross Timbers Road (FM 1171) in Flower Mound, Texas. The project, as currently planned, consists of approximately 1,000 feet of wastewater main that will come from a future elevated water tank site to FM 1171. The locations of the borings are illustrated on Plate A.1, Plan of Borings.

1.2 Purpose and Scope

The purpose of this geotechnical engineering study has been to determine the general subsurface conditions, evaluate the engineering characteristics of the subsurface materials encountered, and develop general recommendations for earthwork.

To accomplish its intended purposes, the study has been conducted in the following phases: (1) drilling sample borings to determine the general subsurface conditions and to obtain samples for testing; (2) performing laboratory tests on appropriate samples to determine pertinent engineering properties of the subsurface materials; and (3) performing engineering analyses, using the field and laboratory data to develop geotechnical recommendations for the proposed construction.

1.3 Report Format

The text of the report is contained in Sections 1 through 6. All plates and large tables are contained in Appendix A. The alpha-numeric plate and table numbers identify the appendix in which they appear. Small tables of less than one page in length may appear in the body of the text and are numbered according to the section in which they occur.

Units used in the report are based on the English system and may include tons per square foot (tsf), kips (1 kip = 1,000 pounds), kips per square foot (ksf), pounds per square foot (psf), pounds per cubic foot (pcf), and pounds per square inch (psi).
2.0 FIELD EXPLORATION AND LABORATORY TESTING

2.1 Field Exploration

Subsurface materials at the project site were explored by two vertical soil borings drilled to depths of 10 feet below existing grade along the proposed line. The borings were drilled using continuous flight augers at the approximate location shown on the Plan of Borings, Plate A 1. The boring logs are included on Plates A.4 and A.5 and keys to classifications and symbols used on the logs are provided on Plates A.2 and A.3.

Undisturbed samples of cohesive soils were obtained with nominal 3-inch diameter thin-walled (Shelby) tube samplers at the locations shown on the log of boring. The Shelby tube sampler consists of a thin-walled steel tube with a sharp cutting edge connected to a head equipped with a ball valve threaded for rod connection. The tube is pushed into the soil by the hydraulic pulldown of the drilling rig. The soil specimens were extruded from the tube in the field, logged, tested for consistency with a hand penetrometer, sealed, and packaged to limit loss of moisture.

The consistency of cohesive soil samples was evaluated in the field using a calibrated hand penetrometer. In this test a 0.25-inch diameter piston is pushed into the relatively undisturbed sample at a constant rate to a depth of 0.25 inch. The results of these tests, in tsf, are tabulated at respective sample depths on the log. When the capacity of the penetrometer is exceeded, the value is tabulated as 4.5+.

2.2 Laboratory Testing

Laboratory soil tests were performed on selected representative samples recovered from the boring. In addition to the classification tests (liquid limits and plastic limits), moisture content, unit weight, and unconfined compressive strength tests were performed. Results of the laboratory classification tests, moisture content, unit weight, and unconfined compressive strength tests conducted for this project are included on the boring logs.

The above laboratory tests were performed in general accordance with applicable ASTM procedures, or generally accepted practice.
3.0 SUBSURFACE CONDITIONS

3.1 Soil Conditions

Specific types and depths of subsurface strata encountered at the boring location are shown on the boring log in Appendix A. The generalized subsurface stratigraphies encountered in the boring are discussed below. Note that depths on the boring refer to the depth from the existing grade or ground surface present at the time of the investigation, and the boundaries between the various soil types are approximate.

Near surface soils encountered in the borings consist of various brown, light brown, reddish-brown, tan, gray or dark gray clayey sands, sandy clays, and shaly clays. Surficial clayey soils are stiff to hard (soil basis) in consistency with pocket penetrometer readings of 125 to over 45 tsf. The various soils had tested Liquid Limits (LL) of 51 to 73 with Plasticity Indices (PI) of 31 to 50, and are classified as CH by the USCS. Tested dry unit weight values were 102 to 104 psf and unconfined compressive strength test values were 1,470 to 3,420 psf.

The Atterberg Limits tests indicate the various clays encountered at this site are generally active to highly active with respect to moisture induced volume changes.

3.2 Ground-Water Observations

The borings were drilled using continuous flight augers in order to observe ground-water seepage during drilling. Table 3.2-1 presents a summary of water observations.

<table>
<thead>
<tr>
<th>TABLE 3.2-1</th>
<th>Ground-Water Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boring No.</td>
<td>Seepage During Drilling (ft.)</td>
</tr>
<tr>
<td>B-1</td>
<td>Dry</td>
</tr>
<tr>
<td>B-2</td>
<td>Dry</td>
</tr>
</tbody>
</table>

While it is not possible to accurately predict the magnitude of subsurface water fluctuation that might occur based upon these short-term observations, it should be recognized that ground-water conditions will vary with fluctuations in rainfall.
Fluctuations of the ground-water level can occur due to seasonal variations in the amount of rainfall; site topography and runoff; hydraulic conductivity of soil strata; and other factors not evident at the time the boring was performed. The possibility of ground-water level fluctuations should be considered when developing the design and construction plans for the project.

Water traveling through the soil (subsurface water) is often unpredictable. This could be due to seasonal changes in ground water and due to the unpredictable nature of ground-water paths. Therefore, it is necessary during construction for the contractor to be observant for ground-water seepage in excavations in order to assess the situation and take appropriate action.

4.0 EARTHWORK

4.1 Site Preparation

The subgrade should be firm and able to support the construction equipment without displacement. Soft or yielding subgrade should be corrected and made stable before construction proceeds. The subgrade should be proof rolled to detect soft spots, which if exist, should be excavated to provide a firm and otherwise suitable subgrade. Proof rolling should be performed using a heavy pneumatic tired roller, loaded dump truck, or similar piece of equipment. The proof rolling operations should be observed by the project geotechnical engineer or his/her representative.

4.2 Placement and Compaction

Fill material should be placed in loose lifts not exceeding 8 inches in uncompacted thickness. The uncompacted lift thickness should be reduced to 4 inches for structure backfill zones requiring hand-operated power compactors or small self-propelled compactors. The fill material should be uniform with respect to material type and moisture content. Clods and chunks of material should be broken down and the fill material mixed by diskng, blading, or plowing, as necessary, so that a material of uniform moisture and density is obtained for each lift. Water required for sprinkling to bring the fill material to the proper moisture content should be applied evenly through each layer.

The on-site soils are suitable for use in general site grading. Imported fill material under the structures should be flexible base or graded stone and no rock greater than 4 inches in maximum dimension. The fill materials should be free of vegetation and debris.
Flexible base or soil fill material should be compacted to a minimum density of 95 percent of maximum dry density as determined by ASTM D 698, Standard Proctor. Graded stone should be compacted to a minimum of 70 percent relative density per ASTM D 4253 and D 4254. In conjunction with the compacting operation, the fill material should be brought to the proper moisture content. The moisture content for general earth fill should range from 2 percentage points below optimum to 5 percentage points above optimum (-2 to +5). These ranges of moisture contents are given as maximum recommended ranges. For some soils and under some conditions, the contractor may have to maintain a more narrow range of moisture content (within the recommended range) in order to consistently achieve the recommended density.

Field density tests should be taken as each lift of fill material is placed. 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 2 tests per lift should be required. The earthwork operations should be observed and tested on a continuing basis by an experienced geotechnician working in conjunction with the project geotechnical engineer.

Each lift should be compacted, tested, and approved before another lift is added. The purpose of the field density tests is to provide some indication that uniform and adequate compaction is being obtained. 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 filing operations.

4.3 Trench Backfill

Trench backfill for pipelines or other utilities should be properly placed and compacted. Overly dense or dry backfill can swell and create a mound along the completed trench line. Loose or wet backfill can settle and form a depression along the completed trench line. Distress to overlying structures, pavements, etc. is likely if heaving or settlement occurs. On-site soil fill material is recommended for trench backfill. Care should be taken not to use free draining granular material, to prevent the backfilled trench from becoming a french drain and piping surface or subsurface water beneath structures, pipelines, or pavements. If a higher class bedding material is required for the pipelines, a lean concrete bedding will limit water intrusion into the trench and will not require compaction after placement. The soil backfill should be placed in approximately 4- to 6-
inch loose lifts. The density and moisture content should be as recommended for fill in Section 4.3, Placement and Compaction, of this report. A minimum of one field density test should be taken per lift for each 150 linear feet of trench, with a minimum of 2 tests per lift.

4.4 Excavation

The side slopes of excavations through the overburden soils should be made in such a manner to provide for their stability during construction. Existing structures, pipelines or other facilities, which are constructed prior to or during the currently proposed construction and which require excavation, should be protected from loss of end bearing or lateral support.

Temporary construction slopes and/or permanent embankment slopes should be protected from surface runoff water. Site grading should be designed to allow drainage at planned areas where erosion protection is provided, instead of allowing surface water to flow down unprotected slopes.

Permanent slopes at the site should be as flat as practical to reduce creep and occurrence of shallow slides. The following slope angles are recommended as maximums.

<table>
<thead>
<tr>
<th>Height (ft)</th>
<th>Horizontal to Vertical</th>
</tr>
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<tbody>
<tr>
<td>0 – 3</td>
<td>1:1</td>
</tr>
<tr>
<td>3 – 6</td>
<td>2:1</td>
</tr>
<tr>
<td>6 – 9</td>
<td>3:1</td>
</tr>
<tr>
<td>&gt; 9</td>
<td>4:1</td>
</tr>
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</table>

The above angles refer to the total height of a slope. Site improvement should be maintained away from the top of the slope to reduce the possibility of damage due to creep or shallow slides.

4.5 Acceptance of Imported Fill

Any soil imported from off-site sources should be tested for compliance with the recommendations for the particular application and approved by the project geotechnical engineer prior to the materials being used. The owner should also require the contractor to obtain a written, notarized certification from the landowner of each proposed off-site soil borrow source stating that to the best of the landowner's knowledge and belief there has never been contamination of the borrow source site with hazardous or toxic materials. The certification should be furnished to the owner prior to
proceeding to furnish soils to the site. Soil materials derived from the excavation of underground petroleum storage tanks should not be used as fill on this project.

4.6 Soil Corrosion Potential

Specific testing for soil corrosion potential was not included in the scope of this study. However, based upon past experience on other projects in the vicinity, the soils at this site may be corrosive. Standard construction practices for protecting metal pipe and similar facilities in contact with these soils should be used.

4.7 Erosion and Sediment Control

All disturbed areas should be protected from erosion and sedimentation during construction, and all permanent slopes and other areas subject to erosion or sedimentation should be provided with permanent erosion and sediment control facilities. All applicable ordinances and codes regarding erosion and sediment control should be followed.

4.8 Utilities

Care should be taken that utility cuts are not left open for extended periods, and that the cuts are properly backfilled. Backfilling should be accomplished with properly compacted on-site soils, rather than granular materials. Trench excavations should be sloped or braced in the interest of safety. Attention is drawn to OSHA Safety and Health Standards (29 CFR 1926/1910), Subpart P, regarding trench excavations greater than 5 feet in depth.

5.0 CONSTRUCTION OBSERVATIONS

In any geotechnical investigation, the design recommendations are based on a limited amount of information about the subsurface conditions. In the analysis, the geotechnical engineer must assume the subsurface conditions are similar to the conditions encountered in the borings. However, quite often during construction anomalies in the subsurface conditions are revealed. Therefore, it is recommended that CMJ Engineering, Inc. be retained to observe earthwork and foundation installation and perform materials evaluation during the construction phase of the project. This enables the geotechnical engineer to stay abreast of the project and to be readily available to evaluate unanticipated conditions, to conduct additional tests if required and, when necessary, to recommend alternative solutions to unanticipated conditions. Until these
construction phase services are performed by the project geotechnical engineer, the recommendations contained in this report on such items as final foundation bearing elevations, proper soil moisture condition, and other such subsurface related recommendations should be considered as preliminary.

It is proposed that construction phase observation and materials testing commence by the project geotechnical engineer at the outset of the project. Experience has shown that the most suitable method for procuring these services is for the owner or the owner's design engineers to contract directly with the project geotechnical engineer. This results in a clear, direct line of communication between the owner and the owner's design engineers and the geotechnical engineer.

6.0 REPORT CLOSURE

The boring logs shown in this report contain information related to the types of soil encountered at specific locations and times and show lines delineating the interface between these materials. The logs also contain our field representative's interpretation of conditions that are believed to exist in those depth intervals between the actual samples taken. Therefore, these boring logs contain both factual and interpretive information. Laboratory soil classification tests were also performed on samples from selected depths in the borings. The results of these tests, along with visual-manual procedures were used to generally classify each stratum. Therefore, it should be understood that the classification data on the logs of borings represents visual estimates of classifications for those portions of each stratum on which the full range of laboratory soil classification tests were not performed. It is not implied that these logs are representative of subsurface conditions at other locations and times.

With regard to ground-water conditions, this report presents data on ground-water levels as they were observed during the course of the field work. In particular, water level readings have been made in the borings at the times and under conditions stated in the text of the report and on the boring logs. It should be noted that fluctuations in the level of the ground-water table can occur with passage of time due to variations in rainfall, temperature and other factors. Also, this report does not include quantitative information on rates of flow of ground water into excavations, on pumping capacities necessary to dewater the excavations, or on methods of dewatering excavations. Unanticipated soil conditions at a construction site are commonly encountered and cannot be fully predicted by mere soil samples, test borings or test pits. Such unexpected
conditions frequently require that additional expenditures be made by the owner to attain a properly
designed and constructed project. Therefore, provision for some contingency fund is
recommended to accommodate such potential extra cost.

The analyses, conclusions and recommendations contained in this report are based on site
conditions as they existed at the time of our field investigation and further on the assumption that
the exploratory borings are representative of the subsurface conditions throughout the site; that is,
the subsurface conditions everywhere are not significantly different from those disclosed by the
borings at the time they were completed. If, during construction, different subsurface conditions
from those encountered in our borings are observed, or appear to be present in excavations, we
must be advised promptly so that we can review these conditions and reconsider our
recommendations where necessary. If there is a substantial lapse of time between submission of
this report and the start of the work at the site, if conditions have changed due either to natural
causes or to construction operations at or adjacent to the site, or if structure locations, structural
loads or finish grades are changed, we urge that we be promptly informed and retained to review
our report to determine the applicability of the conclusions and recommendations, considering the
changed conditions and/or time lapse.

Further, it is urged that CMJ Engineering, Inc. be retained to review those portions of the plans and
specifications for this particular project that pertain to earthwork and foundations as a means to
determine whether the plans and specifications are consistent with the recommendations
contained in this report. In addition, we are available to observe construction, particularly the
compaction of structural fill, or backfill and the construction of foundations as recommended in the
report, and such other field observations as might be necessary.

The scope of our services did not include any environmental assessment or investigation for the
presence or absence of wetlands or hazardous or toxic materials in the soil, surface water, ground
water or air, on or below or around the site.

This report has been prepared for use in developing an overall design concept. Paragraphs,
statements, test results, boring logs, diagrams, etc. should not be taken out of context, nor utilized
without a knowledge and awareness of their intent within the overall concept of this report. The
reproduction of this report, or any part thereof, supplied to persons other than the owner, should
indicate that this study was made for design purposes only and that verification of the subsurface
conditions for purposes of determining difficulty of excavation, trafficability, etc. are responsibilities of the contractor.

This report has been prepared for the exclusive use of the Kimley-Horn and Associates, Inc. for specific application to design of this project. The only warranty made by us in connection with the services provided is that we have used that degree of care and skill ordinarily exercised under similar conditions by reputable members of our profession practicing in the same or similar locality. No other warranty, expressed or implied, is made or intended. These recommendations should be reviewed once a grading plan is finalized.

* * * *

Report No. 103-09-100

CMJ Engineering, Inc.
PLAN OF BORINGS
WESTERN ELEVATED WATER TANK
FM 1171 AT FREEMAN ROAD
FLOWER MOUND, TEXAS

CMJ ENGINEERING, INC.
CMJ PROJECT NO. 103-09-100
<table>
<thead>
<tr>
<th>Major Divisions</th>
<th>Grp Sym.</th>
<th>Typical Names</th>
<th>Laboratory Classification Criteria</th>
</tr>
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<tbody>
<tr>
<td>Gravels</td>
<td>GW</td>
<td>Well-graded gravels, gravel-sand mixtures, little or no fines</td>
<td>liquid and plastic limits below &quot;A&quot; line or P I greater than 7</td>
</tr>
<tr>
<td></td>
<td>GP</td>
<td>Poorly graded gravels, gravel-sand mixtures, little or no fines</td>
<td>liquid and plastic limits above &quot;A&quot; line with P I greater than 7</td>
</tr>
<tr>
<td></td>
<td>GM</td>
<td>Silty gravels, gravel-sand-silt mixtures</td>
<td>liquid and plastic limits between 4 and 7 are borderline cases requiring use of dual symbols</td>
</tr>
<tr>
<td></td>
<td>GC</td>
<td>Clayey gravels, gravel-sand-clay mixtures</td>
<td>liquid and plastic limits below &quot;A&quot; line or P I greater than 7</td>
</tr>
<tr>
<td></td>
<td>SW</td>
<td>Clean sands, little or no fines</td>
<td>liquid and plastic limits above &quot;A&quot; line with P I greater than 7</td>
</tr>
<tr>
<td></td>
<td>SP</td>
<td>Poorly graded sands; gravelly sands, little or no fines</td>
<td>liquid and plastic limits below &quot;A&quot; line or P I greater than 7</td>
</tr>
<tr>
<td></td>
<td>SM</td>
<td>Silty sands, sand-silt mixtures</td>
<td>liquid and plastic limits above &quot;A&quot; line with P I greater than 7</td>
</tr>
<tr>
<td></td>
<td>SC</td>
<td>Clayey sands, sand-clay mixtures</td>
<td>liquid and plastic limits above &quot;A&quot; line with P I greater than 7</td>
</tr>
<tr>
<td>Sands</td>
<td>ML</td>
<td>Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity</td>
<td>liquid and plastic limits between 4 and 7 are borderline cases requiring use of dual symbols</td>
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<tr>
<td></td>
<td>CL</td>
<td>Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, and lean clays</td>
<td>liquid and plastic limits above &quot;A&quot; line with P I greater than 7</td>
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<tr>
<td></td>
<td>OL</td>
<td>Organic silts and organic silty clays of low plasticity</td>
<td>liquid and plastic limits above &quot;A&quot; line with P I greater than 7</td>
</tr>
<tr>
<td></td>
<td>MH</td>
<td>Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts</td>
<td>liquid and plastic limits above &quot;A&quot; line with P I greater than 7</td>
</tr>
<tr>
<td></td>
<td>CH</td>
<td>Inorganic clays of high plasticity, fat clays</td>
<td>liquid and plastic limits above &quot;A&quot; line with P I greater than 7</td>
</tr>
<tr>
<td></td>
<td>OH</td>
<td>Organic clays of medium to high plasticity, organic silts</td>
<td>liquid and plastic limits above &quot;A&quot; line with P I greater than 7</td>
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<tr>
<td></td>
<td>Pt</td>
<td>Peat and other highly organic soils</td>
<td>liquid and plastic limits above &quot;A&quot; line with P I greater than 7</td>
</tr>
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**Plasticity Chart**

Liquid Limit

Plasticity Index

Plate A.2
### SOIL OR ROCK TYPES

<table>
<thead>
<tr>
<th>GRAVEL</th>
<th>LEAN CLAY</th>
<th>LIMESTONE</th>
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<tbody>
<tr>
<td>SAND</td>
<td>SANDY</td>
<td>SHALE</td>
</tr>
<tr>
<td>SILT</td>
<td>SILTY</td>
<td>SANDSTONE</td>
</tr>
<tr>
<td>HIGHLY PLASTIC CLAY</td>
<td>CLAYEY</td>
<td>CONGLOMERATE</td>
</tr>
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</table>

**TERMS DESCRIBING CONSISTENCY, CONDITION, AND STRUCTURE OF SOIL**

#### Fine Grained Soils (More than 50% Passing No. 200 Sieve)

<table>
<thead>
<tr>
<th>Descriptive Item</th>
<th>Penetrometer Reading, (tsf)</th>
</tr>
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<tbody>
<tr>
<td>Soft</td>
<td>0.0 to 1.0</td>
</tr>
<tr>
<td>Firm</td>
<td>1.0 to 1.5</td>
</tr>
<tr>
<td>Stiff</td>
<td>1.5 to 3.0</td>
</tr>
<tr>
<td>Very Stiff</td>
<td>3.0 to 4.5</td>
</tr>
<tr>
<td>Hard</td>
<td>4.5+</td>
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</table>

#### Coarse Grained Soils (More than 50% Retained on No. 200 Sieve)

<table>
<thead>
<tr>
<th>Penetration Resistance (blows/foot)</th>
<th>Descriptive Item</th>
<th>Relative Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 4</td>
<td>Very Loose</td>
<td>0 to 20%</td>
</tr>
<tr>
<td>4 to 10</td>
<td>Loose</td>
<td>20 to 40%</td>
</tr>
<tr>
<td>10 to 30</td>
<td>Medium Dense</td>
<td>40 to 70%</td>
</tr>
<tr>
<td>30 to 50</td>
<td>Dense</td>
<td>70 to 90%</td>
</tr>
<tr>
<td>Over 50</td>
<td>Very Dense</td>
<td>90 to 100%</td>
</tr>
</tbody>
</table>

#### Soil Structure

- **Calcareous**: Contains appreciable deposits of calcium carbonate; generally nodular
- **Slickensided**: Having inclined planes of weakness that are slick and glossy in appearance
- **Laminated**: Composed of thin layers of varying color or texture
- **Fissured**: Containing cracks, sometimes filled with fine sand or silt
- **Interbedded**: Composed of alternate layers of different soil types, usually in approximately equal proportions

### TERMS DESCRIBING PHYSICAL PROPERTIES OF ROCK

#### Hardness and Degree of Cementation

- **Very Soft or Plastic**: Can be remolded in hand; corresponds in consistency up to very stiff in soils
- **Soft**: Can be scratched with fingernail
- **Moderately Hard**: Can be scratched easily with knife; cannot be scratched with fingernail
- **Hard**: Difficult to scratch with knife
- **Very Hard**: Cannot be scratched with knife
- **Poorly Cemented or Friable**: Easily crumbled
- **Cemented**: Bound together by chemically precipitated material; Quartz, calcite, dolomite, siderite, and iron oxide are common cementing materials.

#### Degree of Weathering

- **Unweathered**: Rock in its natural state before being exposed to atmospheric agents
- **Slightly Weathered**: Noted predominantly by color change with no disintegrated zones
- **Weathered**: Complete color change with zones of slightly decomposed rock
- **Extremely Weathered**: Complete color change with consistency, texture, and general appearance approaching soil

**KEY TO CLASSIFICATION AND SYMBOLS**

*PLATE A.3*
<table>
<thead>
<tr>
<th>Stratum Description</th>
<th>Clayey Sand, reddish-brown w/ fine drusy calcite nodules, very stiff</th>
<th>0.25</th>
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</thead>
<tbody>
<tr>
<td>REC %</td>
<td></td>
<td>4.25</td>
</tr>
<tr>
<td>RQD %</td>
<td></td>
<td>3.0</td>
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<td>Blows/Ft. or Pen Reading, T.S.F.</td>
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<td>13</td>
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<td>Passing No 200 Sieve, %</td>
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<td>51</td>
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<td>Liquid Limit, %</td>
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<td>Plastic Limit, %</td>
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<td>31</td>
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<tr>
<td>Plasticity Index</td>
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<tr>
<td>Moisture Content, %</td>
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<tr>
<td>Unit Dry Wt., Lbs./Cu. Ft.</td>
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<td>420</td>
</tr>
<tr>
<td>Unconfined Compression Pounds/Sq. Ft.</td>
<td></td>
<td>344</td>
</tr>
<tr>
<td>Depth, Ft.</td>
<td>Symbol</td>
<td>Stratum Description</td>
</tr>
<tr>
<td>-----------</td>
<td>--------</td>
<td>------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>0.0</td>
<td></td>
<td>SANDY CLAY, brown and light brown w/ ironstone nodules, stiff to very stiff</td>
</tr>
<tr>
<td>2.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.5+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.5 - 10</td>
<td></td>
<td>SHALY CLAY, dark gray and tan w/ ironstains and calcareous nodules, very stiff</td>
</tr>
<tr>
<td>4.5+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
January 26, 2011
Report No. 103-09-100a

Kimley-Horn and Associates, Inc
12700 Park Central Drive, Suite 1800
Dallas, Texas 75251

Attn: Mr. Anthony Samarrpas, P.E.

GEOTECHNICAL ENGINEERING STUDY
WESTERN ELEVATED WATER TANK
NORTH OF FM 1171
FLOWER MOUND, TEXAS

Dear Mr. Samarrpas:

Submitted here are the results of a geotechnical engineering study for the referenced project. The geotechnical services were conducted in general accordance with CMJ Proposal 08-2694 dated September 8, 2009. Authorization to proceed was provided via Kimley-Horn and Associates, Inc. Project Order Number 061000091 on February 11, 2010.

Engineering analyses and recommendations are contained in the text section of the report. Results of our field and laboratory services are included in the appendix of the report. We would appreciate the opportunity to be considered for providing the materials engineering and geotechnical observation services during the construction phase of this project.

We appreciate the opportunity to be of service to Kimley-Horn and Associates, Inc. Please contact us if you have any questions or if we may be of further service at this time.

Respectfully submitted,
CMJ ENGINEERING, INC.
TEXAS FIRM REGISTRATION NO. E-9177

Charles M. Jackson, P.E.
Senior Engineering Consultant
Texas No. 46088

copies submitted: (1) Mr. Anthony Samarrpas, P.E.; Kimley-Horn and Associates, Inc. (by e-mail)
(3) Mr. Anthony Samarrpas, P.E.; Kimley-Horn and Associates, Inc. (by mail)
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<td>Key to Classification and Symbols</td>
<td>A 3</td>
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<td>Logs of Borings</td>
<td>A 4 – A 8</td>
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<td>Free Swell and Pressure Swell Test Results</td>
<td>A 9</td>
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<tr>
<td>Consolidation Test Results</td>
<td>A 10 – A 11</td>
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1.0 INTRODUCTION

1.1 Project Description

The project site is located north of FM 1711 (Cross Timbers Road) along Freeman Road in Flower Mound, Texas. The project, as currently planned, consists of construction of a 3.0-million gallon elevated water tank. The tank will be a composite structure. The location of the site and boring locations are illustrated on Plate A.1, Plan of Borings.

1.2 Purpose and Scope

The purpose of this geotechnical engineering study has been to determine the general subsurface conditions, evaluate the engineering characteristics of the subsurface materials encountered, and develop recommendations for the type or types of foundations suitable for the project.

To accomplish its intended purposes, the study has been conducted in the following phases: (1) drilling sample borings to determine the general subsurface conditions and to obtain samples for testing; (2) performing laboratory tests on appropriate samples to determine pertinent engineering properties of the subsurface materials; and (3) performing engineering analyses, using the field and laboratory data to develop geotechnical recommendations for the proposed construction.

1.3 Report Format

The text of the report is contained in Sections 1 through 9. All plates and large tables are contained in Appendix A. The alpha-numeric plate and table numbers identify the appendix in which they appear. Small tables of less than one page in length may appear in the body of the text and are numbered according to the section in which they occur.

Units used in the report are based on the English system and may include tons per square foot (tsf), kips (1 kip = 1,000 pounds), kips per square foot (ksf), pounds per square foot (psf), pounds per cubic foot (pcf), and pounds per square inch (psi).
2.0 FIELD EXPLORATION AND LABORATORY TESTING

2.1 Field Exploration

Subsurface materials at the project site were explored by five vertical soil borings drilled to depths of 50 feet below existing grade. The borings were drilled using continuous flight augers at the approximate locations shown on the Plan of Borings, Plate A 1. The boring logs are included on Plates A 4 through A 8 and keys to classifications and symbols used on the logs are provided on Plates A 2 and A 3.

Undisturbed samples of cohesive soils were obtained with nominal 3-inch diameter thin-walled (Shelby) tube samplers at the locations shown on the logs of borings. The Shelby tube sampler consists of a thin-walled steel tube with a sharp cutting edge connected to a head equipped with a ball valve threaded for rod connection. The tube is pushed into the soil by the hydraulic pulldown of the drilling rig. The soil specimens were extruded from the tube in the field, logged, tested for consistency with a hand penetrometer, sealed, and packaged to limit loss of moisture.

The consistency of cohesive soil samples was evaluated in the field using a calibrated hand penetrometer. In this test a 0.25-inch diameter piston is pushed into the relatively undisturbed sample at a constant rate to a depth of 0.25 inch. The results of these tests, in tsf, are tabulated at respective sample depths on the logs. When the capacity of the penetrometer is exceeded, the value is tabulated as 4.5+

Disturbed samples of the noncohesive granular or stiff to hard cohesive materials were obtained utilizing a nominal 2-inch O.D. split-barrel (split-spoon) sampler in conjunction with the Standard Penetration Test (ASTM D 1586). This test employs a 140-pound hammer that drops a free fall vertical distance of 30 inches, driving the split-spoon sampler into the material. The number of blows required for 18 inches of penetration is recorded and the value for the last 12 inches, or the penetration obtained from 50 blows, is reported as the Standard Penetration Value (N) at the appropriate depth on the logs of borings.

To evaluate the relative density and consistency of the harder formations, a modified version of the Texas Cone Penetration test was performed at selected locations. Texas Department of Transportation (TXDOT) Test Method Tex-132-E specifies driving a 3-inch diameter cone with a 170-pound hammer freely falling 24 inches. This results in 340 foot-pounds of energy for each blow. This method was modified by utilizing a 140-pound hammer freely falling 30 inches. This
results in 350 foot-pounds of energy for each hammer blow. In relatively soft materials, the penetrometer cone is driven 1 foot and the number of blows required for each 6-inch penetration is tabulated at respective test depths, as blows per 6 inches on the log. In hard materials (rock or rock-like), the penetrometer cone is driven with the resulting penetrations, in inches, recorded for the first and second 50 blows, a total of 100 blows. The penetration for the total 100 blows is recorded at the respective testing depths on the boring logs.

2.2 Laboratory Testing

Laboratory soil tests were performed on selected representative samples recovered from the borings. In addition to the classification tests (liquid limits and plastic limits), moisture content, unit weight, and unconfined compressive strength tests were performed. Results of the laboratory classification tests, moisture content, unit weight, and unconfined compressive strength tests conducted for this project are included on the boring logs.

Free swell and pressure swell testing was performed to check the expansive soil potential of onsite soils. These test results are summarized on Plate A.9.

Consolidation testing was performed on selected samples of the cohesive soils. The consolidation test was used in determining the settlement response of the clay soils. The results of the consolidation tests are provided on Plates A 10 and A.11.

The above laboratory tests were performed in general accordance with applicable ASTM procedures, or generally accepted practice.

3.0 SUBSURFACE CONDITIONS

3.1 Soil Conditions

Specific types and depths of subsurface strata encountered at the boring locations are shown on the boring logs in Appendix A. The generalized subsurface stratigraphies encountered in the borings are discussed below. Note that depths on the borings refer to the depth from the existing grade or ground surface present at the time of the investigation, and the boundaries between the various soil types are approximate.
The upper 4 to 10 feet consists of multi-layered clayey sands, sandy clays, silty clays, and cemented sands. From this zone to depths of 13 to 18 feet, a 4-foot to 11-foot zone of sandy/silty clays and shaly clays is present. Relative continuous very dense cemented sands are present below these clays and continues to depths of 44 to 50 feet. The soils below the cemented sands are very dense clayey sands and hard shaly clays. The shaly clays are blocky and slickensided and contain sand or silt seams. The various clays had tested Liquid Limits (LL) of 25 to 76 and Plasticity Indices (PI) of 10 to 51 and are classified as CH to CL by the USCS. The various clayey soils were generally very stiff to hard (soil basis) in consistency with pocket penetrometer readings of 2.5 to over 4.5 tsf. Tested unit weight values ranged from 95 to 123 pcf and unconfined compressive strengths varied from 1,750 to 19,290 psf. Most strength tests failed on sand seams or slickensided/blocky planes; therefore, actual field strength will be greater than tested values.

The Atterberg Limits tests indicate the various clays encountered at this site are moderately to highly active with respect to moisture induced volume changes. Active clays can experience volume changes (expansion or contraction) with fluctuations in their moisture content.

### 3.2 Ground-Water Observations

The borings were drilled using continuous flight augers in order to observe ground-water seepage during drilling. Ground-water seepage was encountered in all borings at 46 to 48 feet during drilling and water was noted at 46 to 48½ feet at completion. While it is not possible to accurately predict the magnitude of subsurface water fluctuation that might occur based upon these short-term observations, it should be recognized that ground-water conditions will vary.

Fluctuations of the ground-water level can occur due to seasonal variations in the amount of rainfall; site topography and runoff; hydraulic conductivity of soil strata; and other factors not evident at the time the borings were performed. The possibility of ground-water level fluctuations should be considered when developing the design and construction plans for the project.

### 4.0 FOUNDATION RECOMMENDATIONS

#### 4.1 General Foundation Considerations

Two independent design criteria must be satisfied in the selection of the type of foundation to support the proposed structure. First, the ultimate bearing capacity, reduced by a sufficient factor of safety, must not be exceeded by the bearing pressure transferred to the foundation soils.
Second, due to consolidation or expansion of the underlying soils during the operating life of the structure, total and differential vertical movements must be within tolerable limits.

The near-surface soils encountered consist of interlayered sands, clayey sands, and moderately to highly plastic sandy clay soils. As seasonal moisture changes occur, these soils will shrink or swell. The soils are currently in a variable dry to semi-dry state. In this state, they exhibit a moderate to high potential for swelling.

4.2 Expansive Soil Movements

The expansive soils encountered at this site can shrink and swell as the soil moisture content fluctuates during seasonal wet and dry cycles. Additionally, the site environment is impacted by grading and drainage, landscaping, ground-water conditions, paving and many other factors which affect the structure during and after construction. Therefore, the amount of soil movement is difficult to determine due to the many unpredictable variables involved. The following estimates are based on conditions, as if all recommendations are followed.

Estimates of soil movements for this site have been performed using data from the Texas Department of Transportation (TxDOT) procedure TEX-124-E for estimating Potential Vertical Rise (PVR), swell testing, and engineering judgment and experience. Vertical soil movements ranging from approximately 1\(\frac{1}{8}\) to 2\(\frac{1}{2}\) inches have been estimated for the clay soils in a dry condition.

The greatest preponderance of expansive soil movement magnitude is anticipated to occur in the top 6 to 10 feet of soils. Below the 10-foot depth, the natural soil overburden reduces the expansive soil movement magnitude. Furthermore, with any footings at or below a 10-foot depth, the actual loads of the footings add to the overburden pressure to further restrict expansive soil movement. Using natural overburden soil pressure and approximated footing pressures, vertical soil movements below a 10-foot depth are estimated at less than ½ inch. If soils are moist or do not significantly change moisture content, this estimate would be less.

The estimated soil movements are based on the subsurface conditions revealed by the borings and on seasonal moisture fluctuations. Soil movements, significantly larger than estimated, could occur due to in adequate site grading, poor drainage, ponding of rainfall, and/or leaking pipelines.
4.3 Shallow Foundations

4.3.1 Design Criteria

A reinforced concrete mat foundation may be used to support structural loads for the tank. The foundation may be founded using the following criteria:

<table>
<thead>
<tr>
<th>Depth Below Ground (ft.)</th>
<th>Allowable Bearing Pressure (ksf)</th>
<th>Estimated Settlement (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>6.0</td>
<td>$\frac{3}{4} - 1$</td>
</tr>
<tr>
<td>10</td>
<td>7.0</td>
<td>1 - 1½</td>
</tr>
<tr>
<td>10</td>
<td>8.0</td>
<td>1¼ - 1½</td>
</tr>
</tbody>
</table>

These bearing pressures assume a factor of safety above 3. Allowable pressures for transient loads may be increased by 1/3. Differential settlement of the foundation is anticipated to be negligible. A modulus of subgrade reaction of 250 to 300 psi/in may be used.

4.3.2 Spread/Mat Foundation Construction

Spread or mat foundation construction should be monitored by a representative of the geotechnical engineer to observe, among other things, the following items:

- Identification of bearing material
- Adequate penetration of the foundation excavation into the bearing layer
- The base and sides of the excavation are clean of loose cuttings
- If seepage is encountered, whether it is of sufficient amount to require the use of excavation dewatering methods

Precautions should be taken during the placement of reinforcing steel and concrete to prevent loose, excavated soil from falling into the excavation. Concrete should be placed as soon as practical after completion of the excavating, cleaning, reinforcing steel placement and observation. Excavation for a spread foundation should be filled with concrete before the end of the workday, or sooner if required, to prevent deterioration of the bearing material. Prolonged exposure or inundation of the bearing surface with water will result in changes in strength and compressibility characteristics. If delays occur, the excavation should be deepened as necessary and cleaned, in order to provide a fresh bearing surface. If more than 24 hours of exposure of the bearing surface...
is anticipated in the excavations, a mud slab should be used to protect the bearing surfaces. If a mud slab is used, the foundation excavations should initially be over-excavated by approximately 4 inches and a lean concrete mud slab of approximately 4 inches in thickness should be placed in the bottom of the excavations immediately following exposure of the bearing surface by excavation. The mud slab will protect the bearing surface, maintain more uniform moisture in the subgrade, facilitate dewatering of excavations if required, and provide a working surface for placement of formwork and reinforcing steel.

The concrete should be placed in a manner that will prevent the concrete from striking the reinforcing steel or the sides of the excavation in a manner that would cause segregation of the concrete.

5.0 SITE DRAINAGE

An important feature of the project is to provide positive drainage away from the structures, pipe supports, pump pads, slabs or foundations. Positive surface drainage should be provided around the perimeter of the tank. Water must not be allowed to pond near the tank during or after construction. If water is permitted to stand next to or below the structures, pipe trenches, and similar facilities, excessive soil movements can occur. This could result in excessive vertical movements and damage or distortion of the structures or other facilities. Ponding water can result in soil movements exceeding those previously given. A slope of 1.5 to 3 percent should be provided, such that the soil slopes away from the proposed structure, foundations, and excavations.

6.0 SEISMIC CONSIDERATIONS

Based on the conditions encountered in the borings for the above referenced project the IBC-2000 site classification is TYPE C for seismic evaluation.

7.0 EARTHWORK

7.1 Site Preparation

The subgrade should be firm and able to support the construction equipment without displacement. Soft or yielding subgrade should be corrected and made stable before construction proceeds. The subgrade should be proof rolled to detect soft spots, which if exist, should be excavated to provide a firm and otherwise suitable subgrade. Proof rolling should be performed using a heavy
pneumatic tired roller, loaded dump truck, or similar piece of equipment. The proof rolling operations should be observed by the project geotechnical engineer or his/her representative.

7.2 Placement and Compaction

Fill material should be placed in loose lifts not exceeding 8 inches in uncompacted thickness. The uncompacted lift thickness should be reduced to 4 inches for structure backfill zones requiring hand-operated power compactors or small self-propelled compactors. The fill material should be uniform with respect to material type and moisture content. Clods and chunks of material should be broken down and the fill material mixed by disk, blading, or plowing, as necessary, so that a material of uniform moisture and density is obtained for each lift. Water required for sprinkling to bring the fill material to the proper moisture content should be applied evenly through each layer.

The on-site soils are suitable for use in site grading. Imported fill material should be clean soil with a Liquid Limit less than 50 and no rock greater than 4 inches in maximum dimension. The fill materials should be free of vegetation and debris.

The fill material should be compacted to a density ranging from 95 to 100 percent of maximum dry density as determined by ASTM D 698, Standard Proctor. In conjunction with the compacting operation, the fill material should be brought to the proper moisture content. The moisture content for general earth fill should range from 2 percentage points below optimum to 5 percentage points above optimum (-2 to +5). These ranges of moisture contents are given as maximum recommended ranges. For some soils and under some conditions, the contractor may have to maintain a more narrow range of moisture content (within the recommended range) in order to consistently achieve the recommended density.

Field density tests should be taken as each lift of fill material is placed. 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 2 tests per lift should be required. The earthwork operations should be observed and tested on a continuing basis by an experienced geotechnician working in conjunction with the project geotechnical engineer.

Each lift should be compacted, tested, and approved before another lift is added. The purpose of the field density tests is to provide some indication that uniform and adequate compaction is being
obtained. 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 filling operations.

7.3 Trench Backfill

Trench backfill for pipelines or other utilities should be properly placed and compacted. Overly dense or dry backfill can swell and create a mound along the completed trench line. Loose or wet backfill can settle and form a depression along the completed trench line. Distress to overlying structures, pavements, etc. is likely if heaving or settlement occurs. On-site soil fill material is recommended for trench backfill. Care should be taken not to use free draining granular material, to prevent the backfilled trench from becoming a french drain and piping surface or subsurface water beneath structures, pipelines, or pavements. If a higher class bedding material is required for the pipelines, a lean concrete bedding will limit water intrusion into the trench and will not require compaction after placement. The soil backfill should be placed in approximately 4- to 6-inch loose lifts. The density and moisture content should be as recommended for fill in Section 7.2, Placement and Compaction, of this report. A minimum of one field density test should be taken per lift for each 150 linear feet of trench, with a minimum of 2 tests per lift.

7.4 Excavation

The side slopes of excavations through the overburden soils should be made in such a manner to provide for their stability during construction. Existing structures, pipelines or other facilities, which are constructed prior to or during the currently proposed construction and which require excavation, should be protected from loss of end bearing or lateral support.

Temporary construction slopes and/or permanent embankment slopes should be protected from surface runoff water. Site grading should be designed to allow drainage at planned areas where erosion protection is provided, instead of allowing surface water to flow down unprotected slopes.

Permanent slopes at the site should be as flat as practical to reduce creep and occurrence of shallow slides. The following slope angles are recommended as maximums.
Table 7.4-1 Maximum Permanent Slopes

<table>
<thead>
<tr>
<th>Height (ft.)</th>
<th>Horizontal to Vertical</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 3</td>
<td>1:1</td>
</tr>
<tr>
<td>3 – 6</td>
<td>2:1</td>
</tr>
<tr>
<td>6 – 9</td>
<td>3:1</td>
</tr>
<tr>
<td>&gt; 9</td>
<td>4:1</td>
</tr>
</tbody>
</table>

The above angles refer to the total height of a slope. Site improvement should be maintained away from the top of the slope to reduce the possibility of damage due to creep or shallow slides.

7.5 Acceptance of Imported Fill

Any soil imported from off-site sources should be tested for compliance with the recommendations for the particular application and approved by the project geotechnical engineer prior to the materials being used. The owner should also require the contractor to obtain a written, notarized certification from the landowner of each proposed off-site soil borrow source stating that to the best of the landowner's knowledge and belief there has never been contamination of the borrow source site with hazardous or toxic materials. The certification should be furnished to the owner prior to proceeding to furnish soils to the site. Soil materials derived from the excavation of underground petroleum storage tanks should not be used as fill on this project.

7.6 Soil Corrosion Potential

Specific testing for soil corrosion potential was not included in the scope of this study. However, based upon past experience on other projects in the vicinity, the soils at this site may be corrosive. Standard construction practices for protecting metal pipe and similar facilities in contact with these soils should be used.

7.7 Erosion and Sediment Control

All disturbed areas should be protected from erosion and sedimentation during construction, and all permanent slopes and other areas subject to erosion or sedimentation should be provided with permanent erosion and sediment control facilities. All applicable ordinances and codes regarding erosion and sediment control should be followed.
7.8 Utilities

Care should be taken that utility cuts are not left open for extended periods, and that the cuts are properly backfilled. Backfilling should be accomplished with properly compacted on-site soils, rather than granular materials. A positive cut-off at the building line is recommended to help prevent water from migrating in the utility trench backfill.

Trench excavations should be sloped or braced in the interest of safety. Attention is drawn to OSHA Safety and Health Standards (29 CFR 1925/1910), Subpart P, regarding trench excavations greater than 5 feet in depth.

8.0 CONSTRUCTION OBSERVATIONS

In any geotechnical investigation, the design recommendations are based on a limited amount of information about the subsurface conditions. In the analysis, the geotechnical engineer must assume the subsurface conditions are similar to the conditions encountered in the borings. However, quite often during construction anomalies in the subsurface conditions are revealed. Therefore, it is recommended that CMJ Engineering, Inc. be retained to observe earthwork and foundation installation and perform materials evaluation during the construction phase of the project. This enables the geotechnical engineer to stay abreast of the project and to be readily available to evaluate unanticipated conditions, to conduct additional tests if required and, when necessary, to recommend alternative solutions to unanticipated conditions. Until these construction phase services are performed by the project geotechnical engineer, the recommendations contained in this report on such items as final foundation bearing elevations, proper soil moisture condition, and other such subsurface related recommendations should be considered as preliminary.

It is proposed that construction phase observation and materials testing commence by the project geotechnical engineer at the outset of the project. Experience has shown that the most suitable method for procuring these services is for the owner or the owner's design engineers to contract directly with the project geotechnical engineer. This results in a clear, direct line of communication between the owner and the owner's design engineers and the geotechnical engineer.
9.0 REPORT CLOSURE

The boring logs shown in this report contain information related to the types of soil encountered at specific locations and times and show lines delineating the interface between these materials. The logs also contain our field representative’s interpretation of conditions that are believed to exist in those depth intervals between the actual samples taken. Therefore, these boring logs contain both factual and interpretive information. Laboratory soil classification tests were also performed on samples from selected depths in the borings. The results of these tests, along with visual-manual procedures were used to generally classify each stratum. Therefore, it should be understood that the classification data on the logs of borings represent visual estimates of classifications for those portions of each stratum on which the full range of laboratory soil classification tests were not performed. It is not implied that these logs are representative of subsurface conditions at other locations and times.

With regard to ground-water conditions, this report presents data on ground-water levels as they were observed during the course of the field work. In particular, water level readings have been made in the borings at the times and under conditions stated in the text of the report and on the boring logs. It should be noted that fluctuations in the level of the ground-water table can occur with passage of time due to variations in rainfall, temperature and other factors. Also, this report does not include quantitative information on rates of flow of ground water into excavations, on pumping capacities necessary to dewater the excavations, or on methods of dewatering excavations. Unanticipated soil conditions at a construction site are commonly encountered and cannot be fully predicted by mere soil samples, test borings or test pits. Such unexpected conditions frequently require that additional expenditures be made by the owner to attain a properly designed and constructed project. Therefore, provision for some contingency fund is recommended to accommodate such potential extra cost.

The analyses, conclusions and recommendations contained in this report are based on site conditions as they existed at the time of our field investigation and further on the assumption that the exploratory borings are representative of the subsurface conditions throughout the site; that is, the subsurface conditions everywhere are not significantly different from those disclosed by the borings at the time they were completed. If, during construction, different subsurface conditions from those encountered in our borings are observed, or appear to be present in excavations, we must be advised promptly so that we can review these conditions and reconsider our recommendations where necessary. If there is a substantial lapse of time between submission of
this report and the start of the work at the site, if conditions have changed due either to natural causes or to construction operations at or adjacent to the site, or if structure locations, structural loads or finish grades are changed, we urge that we be promptly informed and retained to review our report to determine the applicability of the conclusions and recommendations, considering the changed conditions and/or time lapse.

Further, it is urged that CMJ Engineering, Inc. be retained to review those portions of the plans and specifications for this particular project that pertain to earthwork and foundations as a means to determine whether the plans and specifications are consistent with the recommendations contained in this report. In addition, we are available to observe construction, particularly the compaction of structural fill, or backfill and the construction of foundations as recommended in the report, and such other field observations as might be necessary.

The scope of our services did not include any environmental assessment or investigation for the presence or absence of wetlands or hazardous or toxic materials in the soil, surface water, ground water or air, on or below or around the site.

This report has been prepared for use in developing an overall design concept. Paragraphs, statements, test results, boring logs, diagrams, etc. should not be taken out of context, nor utilized without a knowledge and awareness of their intent within the overall concept of this report. The reproduction of this report, or any part thereof, supplied to persons other than the owner, should indicate that this study was made for design purposes only and that verification of the subsurface conditions for purposes of determining difficulty of excavation, trafficability, etc. are responsibilities of the contractor.

This report has been prepared for the exclusive use of Kimley-Horn and Associates, Inc. for specific application to design of this project. The only warranty made by us in connection with the services provided is that we have used that degree of care and skill ordinarily exercised under similar conditions by reputable members of our profession practicing in the same or similar locality. No other warranty, expressed or implied, is made or intended.

*****
<table>
<thead>
<tr>
<th>Major Divisions</th>
<th>Grp Sym.</th>
<th>Typical Names</th>
<th>Laboratory Classification Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gravels (More than half of coarse fraction is larger than No. 200 sieve size)</td>
<td>GW</td>
<td>Well-graded gravels, gravel-sand mixtures, little or no fines</td>
<td>$D_{90} \times D_{10}$ greater than 4: $C_L = \frac{D_{90}}{D_{10}}$ between 1 and 3</td>
</tr>
<tr>
<td></td>
<td>GP</td>
<td>Poorly graded gravels, gravel sand mixtures, little or no fines</td>
<td>Not meeting all gradation requirements for GW</td>
</tr>
<tr>
<td></td>
<td>GM</td>
<td>Silty gravels, gravel-sand-silt mixtures</td>
<td>Liquid and Plastic limits below &quot;A&quot; line or P 1 greater than 4</td>
</tr>
<tr>
<td></td>
<td>GC</td>
<td>Clayey gravels, gravel-sand-clay mixtures</td>
<td>Liquid and Plastic limits above &quot;A&quot; line with P 1 greater than 7</td>
</tr>
<tr>
<td>Sands (More than half of coarse fraction is smaller than No. 4 sieve size)</td>
<td>SW</td>
<td>Well-graded sands, gravelly sands, little or no fines</td>
<td>More than 12 percent, borderline cases requiring use of dual symbols</td>
</tr>
<tr>
<td></td>
<td>SP</td>
<td>Poorly graded sands, gravelly sands, little or no fines</td>
<td>Less than 5 percent, borderline cases requiring use of dual symbols</td>
</tr>
<tr>
<td></td>
<td>SM</td>
<td>Silty sands, sand-silt mixtures</td>
<td>Liquid and Plastic limits below &quot;A&quot; line or P 1 less than 4</td>
</tr>
<tr>
<td></td>
<td>SC</td>
<td>Clayey sands, sand-clay mixtures</td>
<td>Liquid and Plastic limits above &quot;A&quot; line with P 1 greater than 7</td>
</tr>
<tr>
<td>Fine-grained soils (More than half of material is smaller than No. 200 sieve size)</td>
<td>ML</td>
<td>Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CL</td>
<td>Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, and lean clays</td>
<td></td>
</tr>
<tr>
<td></td>
<td>OL</td>
<td>Organic silts and organic silty clays of low plasticity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MH</td>
<td>Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CH</td>
<td>Inorganic clays of high plasticity, fat clays</td>
<td></td>
</tr>
<tr>
<td></td>
<td>OH</td>
<td>Organic clays of medium to high plasticity, organic silts</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pt</td>
<td>Peat and other highly organic soils</td>
<td></td>
</tr>
</tbody>
</table>

**Plasticity Chart**

- **CH**
- **CL**
- **ML**
- **OH and MH**
- **ML and CL**

**Liquid Limit**

**Plastic Index**

**UNIFIED SOIL CLASSIFICATION SYSTEM**

**PLATE A.2**
### SOIL OR ROCK TYPES

<table>
<thead>
<tr>
<th>GRAVEL</th>
<th>LEAN CLAY</th>
<th>LIMESTONE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAND</td>
<td>SANDY</td>
<td>SHALE</td>
</tr>
<tr>
<td>SILT</td>
<td>SILTY</td>
<td>SANDSTONE</td>
</tr>
<tr>
<td>HIGHLY PLASTIC CLAY</td>
<td>CLAYEY</td>
<td>CONGLOMERATE</td>
</tr>
</tbody>
</table>

### TERMS DESCRIBING CONSISTENCY, CONDITION, AND STRUCTURE OF SOIL

#### Fine Grained Soils
(More than 50% Passing No. 200 Sieve)

<table>
<thead>
<tr>
<th>Descriptive Item</th>
<th>Penetrometer Reading, (tsf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft</td>
<td>0.0 to 1.0</td>
</tr>
<tr>
<td>Firm</td>
<td>1.0 to 1.5</td>
</tr>
<tr>
<td>Stiff</td>
<td>1.5 to 3.0</td>
</tr>
<tr>
<td>Very Stiff</td>
<td>3.0 to 4.5</td>
</tr>
<tr>
<td>Hard</td>
<td>4.5+</td>
</tr>
</tbody>
</table>

#### Coarse Grained Soils
(More than 50% Retained on No. 200 Sieve)

<table>
<thead>
<tr>
<th>Penetration Resistance (blows/foot)</th>
<th>Descriptive Item</th>
<th>Relative Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 4</td>
<td>Very Loose</td>
<td>0 to 20%</td>
</tr>
<tr>
<td>4 to 10</td>
<td>Loose</td>
<td>20 to 40%</td>
</tr>
<tr>
<td>10 to 30</td>
<td>Medium Dense</td>
<td>40 to 70%</td>
</tr>
<tr>
<td>30 to 50</td>
<td>Dense</td>
<td>70 to 90%</td>
</tr>
<tr>
<td>Over 50</td>
<td>Very Dense</td>
<td>90 to 100%</td>
</tr>
</tbody>
</table>

### Soil Structure

- **Calcareous**: Contains appreciable deposits of calcium carbonate; generally nodular
- **Slickensided**: Having inclined planes of weakness that are slick and glossy in appearance
- **Laminated**: Composed of thin layers of varying color or texture
- **Fissured**: Containing cracks, sometimes filled with fine sand or silt
- **Interbedded**: Composed of alternate layers of different soil types, usually in approximately equal proportions

### TERMS DESCRIBING PHYSICAL PROPERTIES OF ROCK

#### Hardness and Degree of Cementation

- **Very Soft or Plastic**: Can be remolded in hand; corresponds in consistency up to very stiff in soils
- **Soft**: Can be scratched with fingernail
- **Moderately Hard**: Can be scratched easily with knife; cannot be scratched with fingernail
- **Hard**: Difficult to scratch with knife
- **Very Hard**: Cannot be scratched with knife
- **Poorly Cemented or Friable**: Easily crumbled
- **Cemented**: Bound together by chemically precipitated material; Quartz, calcite, dolomite, siderite, and iron oxide are common cementing materials.

#### Degree of Weathering

- **Unweathered**: Rock in its natural state before being exposed to atmospheric agents
- **Slightly Weathered**: Noted predominantly by color change with no disintegrated zones
- **Weathered**: Complete color change with zones of slightly decomposed rock
- **Extremely Weathered**: Complete color change with consistency, texture, and general appearance approaching soil

### KEY TO CLASSIFICATION AND SYMBOLS
**Stratum Description**

<table>
<thead>
<tr>
<th>Depth, Ft.</th>
<th>Symbol</th>
<th>Surface Elevation</th>
<th>Type</th>
<th>ROD %</th>
<th>REC %</th>
<th>Blow-N Per 100 ft</th>
<th>Proctor %</th>
<th>Plasticity Index</th>
<th>Liquid Limit</th>
<th>Plastic Limit</th>
<th>Massive Content</th>
<th>Unit Dr. Wt., Lbs./Cu. Ft.</th>
<th>Unconfined Compress. Strength, Psi</th>
</tr>
</thead>
<tbody>
<tr>
<td>50.0'</td>
<td></td>
<td></td>
<td>Auger: B-47</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45.75'</td>
<td></td>
<td></td>
<td>CLAYEY SAND brown, w/ gravel</td>
<td>4.0</td>
<td>11</td>
<td>111</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45.0'</td>
<td></td>
<td></td>
<td>SANDY CLAY light brown, very stiff to hard</td>
<td>4.0</td>
<td>23</td>
<td>119</td>
<td></td>
<td></td>
<td></td>
<td></td>
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Stratum Description

CLAYEY SAND brown, w/ gravel
SILTY SANDY CLAY reddish-brown w/ ironstone seams, hard
SAND tan, brown, and reddish-brown w/ shaly clay lenses, cemented, very dense
SANDY SHALY CLAY light brown and grayish-brown, slickensided, hard
SAND tan and brown, cemented, w/ occasional thin clay seams, very dense
SANDY SHALY CLAY grayish-brown, w/ sand seams, slickensided, hard
SAND tan and brown, cemented, very dense
- w/ ironstone seams 26-1/2' to 37-1/2'
- grades w/ grayish-brown color and clay seams 37-1/2' - 46'

CLAYEY SAND/SANDY CLAY brown, very dense/hard

Boring No. T-2
Project Elevated Water Tank
Location Flower Mound, Texas
Completion Date 1-3-11

Water Observations
Seepage at 47' during drilling, water at 48-1/2' at completion; water at 47-1/2' at end of day

LOG OF BORING NO. T-2
PLATE A.5
**Stratum Description**

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- w/ clays seams 37' to 50'

- w/ sandy or shaly clay seams 44' - 50'
**Stratum Description**

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</tr>
</tbody>
</table>

- **CLAYEY SAND**: brown and light brown w/ gravel
- **SANDY CLAY**: reddish-brown and light reddish-brown, w/ cemented sand and sand seams, very stiff to hard
- **SAND**: brown and tan, cemented
- **SANDY CLAY**: reddish-brown, hard
- **SAND**: brown tan, and reddish-brown, cemented, very dense
- **SANDY CLAY**: light brown and reddish-brown, very stiff to hard
- w/ sand and sandstone deposits, 19'-22 1/2'
- **SAND**: brown and tan, cemented, w/ occasional thin clay seams, very dense
- **SAND**: reddish-brown w/ cemented sand seams, very dense
- **SAND**: reddish-brown, cemented, very dense
- clayey, 48'-50'
Stratum Description

**CLAYEY SAND** brown, w/ gravel

**SANDY CLAY** reddish-brown w/ ironstone nodules, very stiff to hard

**SANDY SHALY CLAY** light brown and gray, w/ ironstains, slightly slickensided, very stiff to hard

**SAND** brown and tan, cemented, very dense

**SHALY CLAY** gray and dark gray, w/ sand seams and lignite deposits, very stiff to hard

**SAND** gray, reddish-brown and tan, cemented, very dense

- w/ clay seams. 23' to 37'

**SAND** brown and tan, w/ cemented sand and clay seams, very dense

**SAND** brown and tan, cemented, very dense

**SHALY CLAY** brown and gray, w/ sandy clay seams, hard

### Depth, Ft.

<table>
<thead>
<tr>
<th>Depth, Ft.</th>
<th>Symbol</th>
<th>Samples</th>
</tr>
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<tbody>
<tr>
<td>50.0'</td>
<td>50.0'</td>
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</tr>
<tr>
<td>50/2.75'</td>
<td>50/2.75'</td>
<td></td>
</tr>
<tr>
<td>50/1.75'</td>
<td>50/1.75'</td>
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</tr>
<tr>
<td>50/1'</td>
<td>50/1'</td>
<td></td>
</tr>
<tr>
<td>50/1.25'</td>
<td>50/1.25'</td>
<td></td>
</tr>
<tr>
<td>50/2'</td>
<td>50/2'</td>
<td></td>
</tr>
<tr>
<td>50/1.5'</td>
<td>50/1.5'</td>
<td></td>
</tr>
</tbody>
</table>

### Stratum Description

**Auger: B-53**

Seepage at 47' during drilling; water at 48-1/2' at completion

### Location

See Plate A.1

### Completion Date

1-3-11

### Surface Elevation

**Type**

**CLAYEY SAND** brown, w/ gravel

**SANDY CLAY** reddish-brown w/ ironstone nodules, very stiff to hard

**SANDY SHALY CLAY** light brown and gray, w/ ironstains, slightly slickensided, very stiff to hard

**SAND** brown and tan, cemented, very dense

**SHALY CLAY** gray and dark gray, w/ sand seams and lignite deposits, very stiff to hard

**SAND** gray, reddish-brown and tan, cemented, very dense

- w/ clay seams. 23' to 37'

**SAND** brown and tan, w/ cemented sand and clay seams, very dense

**SAND** brown and tan, cemented, very dense

**SHALY CLAY** brown and gray, w/ sandy clay seams, hard

### Test Results

<table>
<thead>
<tr>
<th>Parameter</th>
<th>REC %</th>
<th>ROD %</th>
<th>Basement Penetration, T.S.F.</th>
<th>passing No 200 sieve %</th>
<th>Liqui Limit %</th>
<th>Plastic Limit %</th>
<th>Plastic Index</th>
<th>Moisture Content %</th>
<th>Unit Dry Wt., Lbs. Cu. Ft.</th>
<th>Unconfined Compr., Pounds/Sq. Ft.</th>
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</thead>
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<tr>
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<td>3.5</td>
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<td></td>
<td>12</td>
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<td>12</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>50/1.75'</td>
<td></td>
<td></td>
<td>17</td>
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<td>4.0</td>
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<td>76</td>
<td>25</td>
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<td>7</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>50/1.25'</td>
<td></td>
<td></td>
<td>6</td>
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</tr>
<tr>
<td></td>
<td>50/2'</td>
<td></td>
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<td>7</td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>50/1.5'</td>
<td></td>
<td></td>
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</table>
FREE SWELL TEST RESULTS

PROJECT: WESTERN ELEVATED WATER TANK
SOUTH OF FM 1711
FLOWER MOUND, TEXAS

PROJECT NO.: 103-09-100A

<table>
<thead>
<tr>
<th>Boring No.</th>
<th>Depth Interval (ft.)</th>
<th>Sample Description</th>
<th>Liquid Limit LL</th>
<th>Plastic Limit PL</th>
<th>Plasticity Index PI</th>
<th>Moisture Content %</th>
<th>Percent Swell (%)</th>
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</thead>
<tbody>
<tr>
<td>T - 1</td>
<td>3 - 4</td>
<td>Sandy Clay</td>
<td>75</td>
<td>24</td>
<td>51</td>
<td>18.6</td>
<td>21.4</td>
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<tr>
<td>T - 4</td>
<td>7 - 8</td>
<td>Sandy Clay</td>
<td>34</td>
<td>15</td>
<td>19</td>
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<td>18.4</td>
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</table>

Free swell tests performed at approximate overburden pressure

PRESSURE SWELL TEST RESULTS

Boring No.: T-2
Depth: 9 – 10 feet

<table>
<thead>
<tr>
<th>Pressure (psf)</th>
<th>Swell (%)</th>
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</thead>
<tbody>
<tr>
<td>1,770</td>
<td>0.0</td>
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<td>1,220</td>
<td>0.0</td>
</tr>
<tr>
<td>670</td>
<td>0.6</td>
</tr>
<tr>
<td>120</td>
<td>3.5</td>
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</table>
# CONSOLIDATION TEST REPORT

## MATERIAL DESCRIPTION

Sandy shaly clay, grayish brown and brown

<table>
<thead>
<tr>
<th>Natural Sat.</th>
<th>Dry Dens (pcf)</th>
<th>LL</th>
<th>PI</th>
<th>Sp. Gr</th>
<th>Overburden (tsf)</th>
<th>( P_c ) (tsf)</th>
<th>( C_c )</th>
<th>( C_r )</th>
<th>Swell Press. (tsf)</th>
<th>Swell %</th>
<th>( e_0 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>62.4 %</td>
<td>10.4 %</td>
<td>114.8</td>
<td>56</td>
<td>37</td>
<td>2.65</td>
<td>1.20</td>
<td>0.05</td>
<td>0.01</td>
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<td>0.442</td>
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</tbody>
</table>

## Project Details

**Project No.** 103-09-100  
**Client:** Kimley - Horn and Associates, Inc  
**Project:** Elevated Water Tank  
**Location:** T-1 24-25'  

---

**CMJ ENGINEERING, INC.**  
Fort Worth, Texas  
PLATE A.10
CONsolidation Test Report

MATERIAL DESCRIPTION
Shaly clay, gray and dark gray

<table>
<thead>
<tr>
<th>Natural Sat.</th>
<th>Moist.</th>
<th>Dry Density (pcf)</th>
<th>LL</th>
<th>PI</th>
<th>Sp. Gr</th>
<th>Overburden (tsf)</th>
<th>Cc</th>
<th>Cr</th>
<th>Swell Pressure (tsf)</th>
<th>Swell %</th>
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<tbody>
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<td>87.2 %</td>
<td>22.3 %</td>
<td>98.7</td>
<td>76</td>
<td>51</td>
<td>2.65</td>
<td>1.94</td>
<td>0.05</td>
<td>0.01</td>
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Project No. 103-09-100  Client: Kimley - Horn and Associates, Inc.
Project: Elevated Water Tank
Location: I-5 14-15'

CMJ ENGINEERING, INC.
Fort Worth, Texas

PLate A.11
APPENDIX B – CATHODIC PROTECTION
February 15, 2011

Mr. Anthony Samarripas  
Kimley-Horn & Associates  
12700 Park Central Drive  
Suite 1800  
Dallas, Texas 75251  

Reference: Corrosivity Study and Corrosion Protection Design  
30” Western Elevated Storage Tank Water Line Project  
Flower Mound, Texas  

Mr. Samarripas:

Enclosed you will find a copy of the corrosivity study and corrosion protection design document, including specifications and drawings for the above referenced project.

We appreciate this opportunity to provide our services to Kimley-Horn & Associates. Should you have any questions or need additional information please do not hesitate to contact the undersigned at 713-460-6000.

Very truly yours,

Corrpro Companies, Inc.  

Rafael Rodriguez  

Rafael E. Rodriguez, MSE  
Project Manager
CORROSIVITY STUDY AND
CORROSION PROTECTION DESIGN
WESTERN ELEVATED STORAGE TANK
WATER LINE PROJECT
FLOWER MOUND, TEXAS

PREPARED FOR
KIMLEY-HORN & ASSOCIATES
FORT WORTH, TEXAS

PREPARED BY
CORRPRO COMPANIES, INC.
HOUSTON, TEXAS

FEBRUARY, 2011
TABLE OF CONTENTS

1.0 Introduction

2.0 Executive Summary

3.0 Corrosivity Evaluation
   3.1 Results and Analysis
   3.2 Corrosion Protection Requirements

4.0 Design Report
   4.1 Summary
   4.2 Protective Coating
   4.3 Pipe Bedding and Backfill
   4.4 Cathodic Protection
   4.5 Joint Bonding and Electrical Isolation
   4.6 Test Stations
   4.7 Conclusions and Recommendations

Appendices

Appendix A  Field Data
Appendix B  Laboratory Data
Appendix C  Specification Section 15640 – Joint Bonding and Electrical Isolation
Appendix D  Specification Section 15641 – Corrosion Control Test Stations
Appendix E  Specification Section 15642 - Magnesium Anode Cathodic Protection System
Appendix F  Specification Section 15643 - Polyethylene Encasement
1.0 INTRODUCTION

Corrpro Companies Inc. has been retained by Kimley-Horn & Associates to perform corrosivity evaluation and corrosion protection design services for the proposed 30” diameter water line associated with the Western Elevated Storage Tank Water Line Project in Flower Mound, Texas. The proposed 30” diameter water line has an approximate length of 1,353 feet and is routed from the corner of Cross Timbers (FM 1171) and Freeman Road to the proposed Western Elevated Storage Tank.

The water line will be offered for bid with the following pipe material alternatives:

- Bar-Wrapped Concrete Cylinder Pipe (AWWA C303).
- Ductile Iron Pipe (AWWA C151).

Upon completion of the corrosivity evaluation, a corrosion protection design was prepared including the requirements for joint bonding, electrical isolation, corrosion control test stations, and cathodic protection.

This report presents the results of the corrosivity evaluation and corrosion protection design.

2.0 EXECUTIVE SUMMARY

2.1. Soils along the pipeline route are considered corrosive to the concrete cylinder pipe (CCP) and ductile iron pipe (DIP) material options. Corrosion protection measures are recommended for both pipe alternatives to help preserve the integrity of the water lines.

2.2. The mortar coating on the CCP provides corrosion protection for the embedded steel components. Nevertheless, moisture and low soil resistivity may compromise the level of corrosion protection over time, making the steel susceptible to corrosion. Therefore, it is recommended that the CCP option be cathodically protected.

2.3. Based on our DDM™ analysis, the annealing oxide and asphaltic shop coating typically present on the DIP option should be supplemented with the installation of polyethylene encasement along the entire pipe.
2.4. Joint bonding of the CCP and DIP options is required to maintain the electrical continuity throughout the entire length of the water line.

2.5. The evaluation indicates that AC or DC interference is not a concern for the water line. No overhead electrical transmission lines or cathodically protected foreign pipeline crossings were observed during the site survey.

2.6. Test stations should be installed at galvanic anode groundbed locations, at cased crossings and at all buried in-line isolators to monitor the effectiveness of the corrosion protection system.

3.0 CORROSIVITY EVALUATION

The soil corrosivity analysis and corrosion control recommendations presented in this report are based on the field soil resistivity survey and laboratory soil analysis conducted by Corrpro Companies, Inc. During the field evaluation, Corrpro also investigated the possibility of interference due to stray DC currents which might affect the integrity of the planned water lines.

The evaluation performed is the basis for determining the corrosion protection requirements for the concrete cylinder pipe (CCP) and ductile iron pipe (DIP) material options.

3.1 RESULTS AND ANALYSIS

Field and laboratory testing were performed to collect chemical and electrical data pertaining to the corrosivity of the proposed pipeline alignment with respect to the CCP and DIP options.

Soil resistivity measurements were recorded from grade to depths of five, ten, and fifteen feet at three (3) locations along the proposed pipe alignment. This data is recorded in Appendix A.

Using the Barnes Layer procedure, soil resistivities were calculated for the 5 to 10 feet and 10 to 15 feet layers. Statistical distribution of the soil resistivity for the layers of interest is summarized as follows:
Western EST Water Line Project  
Flower Mound, Texas  
Soil Resistivity

<table>
<thead>
<tr>
<th></th>
<th>5-10 Feet</th>
<th>10-15 Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>1,621 ohm-cm</td>
<td>2,212 ohm-cm</td>
</tr>
<tr>
<td>Maximum</td>
<td>2,839 ohm-cm</td>
<td>2,984 ohm-cm</td>
</tr>
<tr>
<td>Average</td>
<td>2,221 ohm-cm</td>
<td>2,675 ohm-cm</td>
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<tr>
<td>Std. Deviation</td>
<td>609 ohm-cm</td>
<td>409 ohm-cm</td>
</tr>
<tr>
<td>Percent &lt; 1,000</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Percent &lt; 2,000</td>
<td>33.3%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Percent &lt; 3,000</td>
<td>100.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Percent ≥ 3,000</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

Two (2) soil samples collected by CMJ personnel along the pipeline right-of-way were tested in the laboratory for moisture content, pH, chloride ion concentration, sulfide ion concentration, conductivity and resistivity. Laboratory test results are tabulated in Appendix B.

With respect to the chemical properties of the soil, the test results of the samples indicate:

- Moisture content from 15.0% to 17.0%.
- A pH from 6.4 to 7.0.
- Chloride ion concentration of 78 to 160 ppm.
- No detectable sulfide ions.
- Conductivities from 570 to 1,200 microhmos.
- Resistivities from 800 to 1,754 ohm-cm.

Considering each of the chemical and electrical soil properties that are tested in the field and the laboratory, general guidelines for interpreting the results are as follows:

- Soil Moisture - The higher the soil moisture content, the greater the anticipated rate of corrosion. Moisture contents can range from 1% (very dry sands) to 40% (clays holding a great deal of moisture). Typical values are 10 to 15% with over 20% moisture considered high.
- pH - Acidic soils and groundwater are more conducive to galvanic corrosion of ferrous materials than alkaline soils and groundwater.

- Chloride Concentrations - Chloride ions are cathode depolarizers, which enhance the rate of corrosion. The higher the concentration, the greater the rate of corrosion. Many soils have chloride concentrations less than 10 ppm. Concentrations over 50 ppm are significant from a corrosion standpoint.

- Sulfide Concentration - Any detectable concentrations of sulfide ions are indicative of anaerobic conditions that may support high rates of metal dissolution due to microbiologically influenced corrosion.

- Conductivity - For a given corrosion cell with a fixed potential difference between the anode and cathode, the higher the conductivity, the greater the metal loss. Conductivities over 350 microhm/cm (equivalent to a resistivity of 2850 ohm-cm) are considered high.

- Soil Resistivity - Resistivity is a common parameter for evaluating the corrosiveness of the soil. Resistivity is the inverse of conductivity and is measured in units of ohm-centimeters. Corrosivity is often an inverse function of resistivity with low resistivity soils usually more corrosive than high resistivity soils. Resistivity is also related to the concentration of salts with low resistivity indicating high levels of salt.

It should be stressed that there is no single chemical or electrical property of the soil that determines the rate of corrosion. Consideration of the interrelationship of all of the above factors is important to an accurate assessment of the potential rates of corrosion and the design of corrosion protection systems.

Observations performed during the field survey indicate that the possibility of DC and/or AC interference is negligible. No overhead high voltage electrical transmission lines or cathodically protected foreign pipeline crossings were observed during the site survey.

Corpro’s corrosion control design analysis included the use of our risk-based Design Decision Model (DDM™) to evaluate soil corrosivity and the consequences of a corrosion failure. These data are then analyzed along with other considerations to develop specific corrosion control recommendations for the pipeline alignment. While the development of the detailed DDM™ protocol and algorithms is unique to ductile iron pipe, the same basic approach has been used to determine optimum corrosion protection design requirements for all pipe material options.
3.2 CORROSION PROTECTION REQUIREMENTS

An analysis of the field data, laboratory data and of the types of proposed pipe materials was made to determine the requirements for and types of cathodic protection that could be considered for the water lines.

The CCP and DIP options are electrically discontinuous along their length because of the dielectric sealing materials used at each pipe joint. Joint bonding is therefore required to establish and maintain electrical continuity along the entire length of the pipeline for both material options.

The high pH of the mortar coating on the CCP option provides corrosion protection for the embedded steel components. However, moisture and low soil resistivity may compromise the level of corrosion protection, making the steel susceptible to corrosion. Therefore, cathodic protection should be applied to the entire length of the pipeline.

The annealing oxide and asphaltic shop coating typically present on the ductile iron pipe surface are the primary barriers against corrosion. Polyethylene encasement should be used to supplement the corrosion protection provided by the annealing oxide and asphaltic shop coat throughout the length of the DIP option.

In summary, it is recommended that cathodic protection be installed over the entire pipe length for the CCP material option. Polyethylene encasement should also be installed on the entire length of the DIP option.

It is necessary to electrically isolate the water line at all tie-ins to other buried metallic pipelines. In addition, where the pipe may pass through casings the carrier pipe in the casings must be electrically isolated from the steel casing.

Monitoring test stations should be installed at galvanic anode groundbed locations, cased crossings and at all buried in-line pipeline isolation fittings.

4.0 CORROSION PROTECTION DESIGN REPORT

4.1 SUMMARY

The proposed water pipelines will be offered based with the following alternative configurations:

- Bar-wrapped concrete cylinder pipe (AWWA C303): A corrosion control system consisting of galvanic anode cathodic protection, joint continuity bonds, monitoring test stations, and electrical isolation at connections to existing pipelines is recommended for this pipeline configuration.
• Ductile iron pipe: A corrosion control system consisting of polyethylene encasement throughout the pipe length, joint continuity bonds, monitoring test stations, and electrical isolation at connections to existing pipelines and electrical isolation at cased crossings is recommended for this pipeline configuration.

4.2 PROTECTIVE COATINGS

The mortar coating on the CCP option provides a high pH environment, which is protective of the steel embedments. The mortar coating should be applied in accordance with AWWA Standards to make certain that it is of low porosity and low permeability. The pipe should be handled without cracking the mortar and the joints must be properly diapered.

The ductile iron pipe option shall be protected with polyethylene encasement throughout its length in accordance with the AWWA C-105/A21.5 standard. A high-density, cross-laminated polyethylene film is recommended for this application.

4.3 PIPE BEDDING & BACKFILL

There may be places along the pipeline right-of-way where the pipe will be installed in rocky areas. It is essential that the pipe be provided with proper bedding to prevent physical damage to the pipe, mortar, or encasement. It is recommended that bedding materials such as clean river sand be used for this purpose. Backfill material should also be finely graded to prevent damage to either the mortar coating or encasement.

4.4 CATHODIC PROTECTION

For the bar-wrapped CCP option, the recommended galvanic anode cathodic protection system shall include two (2) groundbeds, each consisting of ten (10) 32-pound, 3” x 3” x 45” prepackaged high potential magnesium anodes, installed vertically at a depth of 10 feet, and spaced 10 feet (center-to-center). The anode groundbeds shall be installed at or near pipe stations 5+15 and 10+30.

Cathodic protection is not being recommended for the DIP material option.

Refer to Appendix E, Specification for galvanic anode cathodic protection systems.

4.5 JOINT BONDING AND ELECTRICAL ISOLATION

The CCP and DIP options require either two (2) welded steel clips or bonding cables across all mechanical pipeline joints to establish and maintain electrical
continuity. The water line should be electrically isolated from existing mains and laterals.

Refer to Appendix C, Joint Bonding and Electrical Isolation.

4.6 TEST STATIONS

Test stations will allow periodic monitoring of the effectiveness of the cathodic protection system and future monitoring of possible interference for any of the pipe material alternatives.

Test stations are required for all pipe materials at cathodically protected foreign line crossings, cased crossings, galvanic anode groundbed locations, and buried electrical pipeline isolation joints. See project drawings for test station schedules for all pipe options.

Test Station types are as follows:

1. **TS** - Standard pipe-to-soil potential measurement test station at groundbed locations. See details on the cathodic protection drawings.

2. **PTS** - Standard pip-to-soil potential measurement test station. See details on the cathodic protection drawings.

3. **CP** - Test station installed at the ends of metallic pipeline casings with lead wires to the pipeline and lead wires to the casing (see Tunnel or Cased Crossing Test Station detail on the cathodic protection drawings). CP test stations shall be installed at both ends of all metallic casings.

4. **IF** - Test station installed across buried isolation joints. See IF type test station on the cathodic protection drawings.

4.7 CONCLUSIONS AND RECOMMENDATIONS

4.7.1. The installation of galvanic anodes on the CCP material option will supplement the external corrosion protection provided by the mortar coating.

4.7.2 Installation of a polyethylene encasement is recommended for the DIP option. Cathodic protection is not required for the DIP option.

4.7.3 The water lines should be electrically isolated from existing metallic transmission mains and laterals.

4.7.3 Installation of bonding clips or bonding cables across all mechanical joints is required for both pipe material options.
4.7.4 Proper monitoring of the cathodic protection system will be achieved through test stations installed at cased crossings, galvanic anode groundbed locations, and buried electrical isolation fittings. In addition, permanent reference cells will assist in monitoring of pipe-to-soil potential measurements at groundbed locations. Monitoring test stations are recommended for both pipe material alternatives.
APPENDIX A

FIELD DATA
Variation in Soil Resistivity as a Function of Distance and Depth
Town of Flower Mound Western Elevated Storage Tank Project
Proposed 24" Water Line

Soil Resistivity (Ohm-cm)

Station Number

Layer Resistivity (ohm-cm) From 0' to 5'
Layer Resistivity (ohm-cm) From 5' to 10'
Layer Resistivity (ohm-cm) From 10' to 15'
TOWN OF FLOWER MOUND  
WESTERN ELEVATED STORAGE TANK PROJECT  
Proposed 24" Diameter Water Line  

Soil Resistivity Data Summary

<table>
<thead>
<tr>
<th>Ref #</th>
<th>Station No.</th>
<th>Layer Resistivity (ohm-cm)</th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>From 0' to 5'</td>
<td>5' to 10'</td>
<td>10' to 15'</td>
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<tr>
<td>1</td>
<td>2+00</td>
<td>7756</td>
<td>1621</td>
<td>2830</td>
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<tr>
<td>2</td>
<td>7+75</td>
<td>6224</td>
<td>2204</td>
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<tr>
<td>3</td>
<td>13+53</td>
<td>6894</td>
<td>2839</td>
<td>2212</td>
<td></td>
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<tr>
<td></td>
<td>5' - 10'</td>
<td>10' - 15'</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>----------</td>
<td>-----------</td>
<td></td>
<td></td>
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<tr>
<td>Minimum</td>
<td>1,621</td>
<td>2,212</td>
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<td>Maximum</td>
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<td>Soil Layer Depth (ft)</td>
<td>Measured Resistance (ohms)</td>
<td>Total Depth Factor (191.5 x Depth)</td>
<td>Calculated Resistivity (ohm-cm)</td>
<td>Conductivity (mhos)</td>
<td>Conductivity Change (mhos)</td>
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<td>-----------------------</td>
<td>-----------------------------</td>
<td>-----------------------------------</td>
<td>-------------------------------</td>
<td>---------------------</td>
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<td>5.0</td>
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<td>2.729</td>
<td>1.053</td>
<td>0.338</td>
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## SOIL RESISTIVITY MEASUREMENT INFORMATION

**CLIENT:** Kimley-Horn  
**JOB NO.:** 306809  
**LOCATION:** 7+75  
**INSTRUMENT USED:** NILSSON SOIL RESISTIVITY METER, M400  
**DATA BY:** TJ  
**DATE:** 11/8/10

### 4-PIN SOIL RESISTIVITY DATA

| SOIL LAYER DEPTH FROM SURFACE (FT) OR ACTUAL PIN SPACING (FT) | MEASURED RESISTANCE (OHMS) | TOTAL DEPTH FACTOR (191.5 X DEPTH) | CALCULATED RESISTIVITY (OHM-CM) | CONDUCTIVITY (MHOS) | CONDUCTIVITY CHANGE (MHOS) | RESISTANCE CHANGE (OHMS) | LAYER THICKNESS FACTOR (191.5 X FEET) | LAYER RESISTIVITY (OHM-CM) | SOIL LAYER RANGE FROM SURFACE (FT) |
|---|---|---|---|---|---|---|---|---|---|---|
| 5.0 | 6.50 | 957.5 | 6.224 | 0.154 | 0.154 | 6.500 | 957.5 | 6.224 | 0.0 TO 5 |
| 10.0 | 1.70 | 1,915.0 | 3.256 | 0.588 | 0.434 | 2.302 | 957.5 | 2.204 | 5 TO 10 |
| 15.0 | 1.10 | 2,872.5 | 3.160 | 0.909 | 0.321 | 3.117 | 957.5 | 2.984 | 10 TO 15 |
## SOIL RESISTIVITY MEASUREMENT INFORMATION

**CLIENT:** Kimley-Horn  
**JOB NO.:** 306809  
**LOCATION:** 13+53  
**INSTRUMENT USED:** NILSSON SOIL RESISTIVITY METER, M400  
**DATA BY:** TJ  
**DATE:** 11/8/10

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<th>SOIL LAYER DEPTH FROM SURFACE (FT) OR ACTUAL PIN SPACING (FT)</th>
<th>4-PIN SOIL RESISTIVITY DATA</th>
<th>BARNES PROCEDURE FOR SOIL RESISTIVITIES BY LAYERS</th>
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<td>SOIL LAYER DEPTH FROM SURFACE (FT) OR ACTUAL PIN SPACING (FT)</td>
<td>TOTAL DEPTH FACTOR (191.5 X DEPTH)</td>
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<td>15.0</td>
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APPENDIX B

LABORATORY DATA
## Spreadsheet Reference Number: 123456789

### Soil Sample No.
- B-1
- B-2

### Station No. (x+y) e.g. for "5+67" enter "567"
- 0+00
- 13+53

### Interval to Prior - Feet
- 1353

### Miles from Start
- 0.00
- 0.26

### Soil Sample Depth - Feet
- 7'-8'
- 9'-10'

### Soil Type
- Clay
- Clay

### Soil Color
- Gray & yellow
- Gray & yellow

### DDM Likelihood Factors:

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<th>Value</th>
<th>Value</th>
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<td>Calculated Lab Resistivity (conductivity meter) - Ohm-Cm</td>
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<td>Lab Resistivity - Quad Box - As Received - Ohm-Cm</td>
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<td>Lab Resistivity - Quad Box - Saturated - Ohm-Cm</td>
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<tr>
<td>Sulfides - ppm</td>
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<td>Redox Potential - Field Measured #2 - Millivolts</td>
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<td>Aquamate Conductivity - As Received - Micromho-Cm^-1</td>
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<td>Aquamate Conductivity - Saturate - Micromho-Cm^-1</td>
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<td>Aquamate Calculated Resistivity - As Received - Ohm-Cm</td>
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<td>Aquamate LPR-Corrosion Rate - Saturated -mpy</td>
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<tr>
<td>Aquamate LPR-Imbalance - Saturated</td>
<td>0.79</td>
<td>9.26</td>
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</table>

**Corrpro Contact/Phone:** James Johnston / 713-460-6012

**Office:** Houston

**Reviewed By:** Nancy Jacob

**Client:** Kimley-Horn

**Date Samples Received:** 11/15/2010

**Project/Job No:** Western EST Water Line-Flower Mound, TX -- # 306809

**Project Start Station No:** 0+00

**Project End Station No:** 13+53

**Lab Analysis By:** Nancy Jacob
APPENDIX C

SPECIFICATION SECTION 15640

JOINT BONDING AND

ELECTRICAL ISOLATION
SECTION 15640

JOINT BONDING AND ELECTRICAL ISOLATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Joint bonding requirements for electrical continuity of bar-wrapped concrete cylinder pipe (AWWA C-303), mortar coated steel pipe, dielectrically coated steel pipe and ductile iron pipe.

B. Electrical isolation devices for installation at connections to existing piping, at laterals, at cased crossings and at tunnels.

1.02 RELATED SECTIONS

A. Section 15641 - Corrosion Control Test Stations.

B. Section 15642 - Specification for Magnesium Anode Cathodic Protection Systems.

1.03 REFERENCES

A. ASTM D 1248 - Polyethylene Plastics Molding and Extrusion Material.

B. AWWA C207 - Steel Pipe Flange for Waterworks Service.

C. AWWA M9 Manual - Concrete Pressure Pipe.


E. ANSI B16.5 - Pipe Flange and Flanged Fittings.

1.04 SUBMITTALS

A. Submittals: Submittals shall conform to the requirements of the Western EST Water Line Project.

B. Catalogue Cut Sheets: Manufacturer's catalog cut sheets shall be submitted for each item. The catalog cut sheets shall include the manufacturer's name and provide sufficient information to show that the materials meet the requirements of the drawings and specifications. Where more than one item or catalog number appears on a catalog cut sheet, clearly identify the item proposed.

C. Test Results: Electrical continuity and flange isolation test results shall be submitted to the owner or its designated representative.
1.05 QUALITY CONTROL

A. Provide certification that all electrical continuity bonding meets the requirements of the drawings and specifications. Reference certification to applicable section of specifications and applicable standard detail.

B. Provide certification that all pipeline isolation devices meet the published material specifications.

C. All materials, fabrication, and installations are subject to inspection and testing by the owner or its designated representative.

PART 2 PRODUCTS

2.01 DESCRIPTION OF MATERIALS

A. Joint bonding and electrical isolation materials to be incorporated into the project include, but are not limited to, the following:

1. Electrical continuity bonds.
2. Flange isolation assemblies.
3. Casing spacers.
4. Casing end seals.

2.02 ELECTRICAL CONTINUITY BONDS

A. Applications: Applications for electrical continuity bonding include the following:

1. Bonding across bolted joint assemblies.
2. Bonding across gasketed joint assemblies.

B. Preparation of Concrete Pipe for Bonding:

1. General:

   a) Fabrication: Use concrete pipe for this project that has been fabricated in such a manner as to establish electrical continuity between metallic components of pipe and joints.

   b) Acceptable Methods: Establish electrical continuity as indicated in drawings and specifications.

2. Criteria for Electric Continuity:

   a) Tensile Wire: Pipe manufacturer to obtain a resistance no greater than 0.03 ohms between any wire and steel joint ring at end of pipe farthest from that wire. Manufacturer to report values obtained and method of measurement.
b) Internal Pipe Joint Components: Pipe manufacturer to obtain resistance of less than 0.03 ohms between any component and steel pipe cylinder.

3. Tensile Wire Continuity:

   a) Establish continuity between tensile wire coils and steel cylinder on embedded cylinder type prestressed pipe by tightly wrapping tensile wire over longitudinal mild steel straps during pipe manufacture.

      1) Use and install two continuous straps 180° apart longitudinally along the pipe. These straps must maintain electrical continuity between metallic components.

      2) Use steel straps made of mild steel and free of grease, mill scale, or other high resistance deposits.

      3) Make longitudinal straps electrically continuous with pipe cylinder by steel fasteners of suitable dimensions placed between steel cylinder and longitudinal straps. Connect fasteners so as to remain intact during pipe fabrication process.

4. Steel Cylinder Continuity:

   a) Establish continuity of all joint components and steel cylinder. These components include the following:

      1) Anchor socket brackets.

      2) Anchor socket.

      3) Spigot ring.

      4) Bell ring.

   b) If mechanical contact does not provide a resistance of less than 0.03 ohms between components, tack weld component to provide electrical continuity.

C. Preparation of Steel Pipe for Bonding: Bonding wires are not required for welded steel pipe. Mechanical jointed steel pipe requires the installation of bond wires across the joint as shown on the project drawings.

D. Preparation of Ductile Iron Pipe for Bonding: Install insulated bond wires as shown on the project drawings.

E. Electrical Bond Wires: Electrical bond wires are to be a minimum No. 4 AWG, seven stranded, copper cable with THHN insulation. Remove one inch of THHN insulation from each end of the bond wire. Exothermic weld the bond wires to the pipeline. Provide the minimum number of bond wires as shown on drawings for steel or ductile iron pipe.
2.03 FLANGE ISOLATION

A. Required applications of dielectric flange isolation assemblies include but are not limited to selected locations where new piping is mechanically connected to existing piping.

B. For concrete cylinder pipe, provide electrical isolation through the installation of the following materials:
   1. Flange connection to Lock Joint bell adapter.
   2. Flange connection to Lock Joint spigot adapter
   3. Insulating Gasket:
      a) For piping 30 inches diameter and greater, provide Pyrox G-10 with nitrile seal, Type "E" LineBacker gasket as manufactured by Pipeline Seal and Insulator, Inc., or approved equal.
      b) For piping between 12 inches and 24 inches diameter, provide Phenolic PSI with nitrile seal, Type "E" LineBacker gasket as manufactured by Pipeline Seal and Insulator, Inc., or approved equal.
      c) Alternately, provide plain-faced phenolic gasket, as manufactured by Pipeline Seal and Insulator, Inc., or approved equal. Place phenolic gasket between two full-faced gaskets. Provide cloth-inserted rubber gasket material, 1/8 inch thick in accordance with AWWA C207. Use factory cut gaskets of proper dimensions.
   4. Sleeves and Washers:
      a) For piping 30 inches diameter and greater, provide full length mylar sleeves with Pyrox G-10 washers, double washer sets as manufactured by Pipeline Seal and Insulator, Inc., or approved equal.
      b) For piping between 12 inches and 24 inches diameter, provide full length Mylar sleeves with Phenolic washers, double washer sets as manufactured by Pipeline Seal and Insulator, Inc., or approved equal.

C. For steel pipe, provide electrical isolation through installation of the following materials:
   1. Isolation Gasket:
      a) For piping 30 inches diameter and greater, provide Pyrox G-10 with nitrile seal, Type "E" LineBacker gasket as manufactured by Pipeline Seal and Insulator, Inc., or approved equal.
      b) For piping between 12 inches and 24 inches diameter, provide Phenolic PSI with nitrile seal, Type "E" LineBacker gasket as manufactured by Pipeline Seal and Insulator, Inc., or approved equal.
      c) Alternately, provide a plain-faced phenolic gasket, as manufactured by Pipeline Seal and Insulator, Inc., or approved equal. Place phenolic gasket between two full-faced gaskets. Provide cloth-inserted rubber gasket material, 1/8 inch thick in accordance with AWWA C207. Use factory cut gaskets of proper dimensions.
   2. Sleeves and Washers:
      a) For piping 30 inches diameter and greater, provide full length mylar sleeves with Pyrox G-10 washers, double washer sets as manufactured by Pipeline Seal and Insulator, Inc., or approved equal.
      b) For piping between 12 inches and 24 inches diameter, provide full length Mylar sleeves with Phenolic washers, double washer sets as manufactured by Pipeline Seal and Insulator, Inc., or approved equal.

D. For ductile iron pipe, provide electrical isolation through installation of the following materials:
1. Isolation Gasket:
   a) For piping 30 inches diameter and greater, provide Pyrox G-10 with nitrile seal, Type "E" LineBacker gasket as manufactured by Pipeline Seal and Insulator, Inc., or approved equal.
   b) For piping between 12 inches and 24 inches diameter, provide Phenolic PSI with nitrile seal, Type "E" LineBacker gasket as manufactured by Pipeline Seal and Insulator, Inc., or approved equal.
   c) Alternately, provide a plain-faced phenolic gasket, as manufactured by Pipeline Seal and Insulator, Inc., or approved equal. Place phenolic gasket between two full-faced gaskets. Provide cloth-inserted rubber gasket material, 1/8 inch thick in accordance with AWWA C207. Use factory cut gaskets of proper dimensions.

2. Sleeves and Washers:
   a) For piping 30 inches diameter and greater, provide full length mylar sleeves with Pyrox G-1 washers, double washer sets as manufactured by Pipeline Seal and Insulator, Inc., or approved equal.
   b) For piping between 12 inches and 24 inches diameter, provide full length Mylar sleeves with Phenolic washers, double washer sets as manufactured by Pipeline Seal and Insulator, Inc., or approved equal.

E. Coatings for buried isolation flanges shall be Densyl Tape system manufactured by Carboline, consisting of Densyl Mastic, Densyl Paste, and Densyl Tape, or approved equal.

2.04 CASING SPACERS

A. For piping installed in tunnels or cased crossings, install casing spacers between the piping and the casing or tunnel liner to provide electrical isolation.

B. Inside diameter of casing or tunnel liner must be a minimum of 4 inches greater in diameter than the outside diameter of the piping. In the case of mechanically coupled piping, the casing must be a minimum of 4 inches greater in diameter than the outside diameter of the coupling at its largest point.

C. For welded steel pipes 12-inch diameter and smaller, use injection molded polyethylene insulators, Model PE as manufactured by Pipeline Seal and Insulator, Inc. or approved equal.

D. For all other pipe materials 12 inch diameter and smaller, use 8 inch wide steel insulators with 2 inch wide glass reinforced runners, Model C8G-2 as manufactured by Pipeline Seal and Insulator, Inc. or approved equal.

E. For all piping greater than 12 inch diameter, use 12 inch wide steel insulators with 2 inch wide glass reinforced runners, Model C12G-2 as manufactured by Pipeline Seal and Insulator, Inc. or approved equal.

2.05 CASING END SEALS

A. For all piping less than 24 inch diameter, use hard rubber seals, Model PL Link Seal as manufactured by the Thunderline Corporation or approved equal.

B. For all piping 24 inch diameter and greater, use pull-on, 1/8 inch thick, synthetic rubber end seals, Model C, as manufactured by Pipeline Seal and Insulator, Inc. or approved equal.
C. Casing End Seals shall be as shown on the project plans.

PART 3 - EXECUTION

3.01 INSTALLATION OF ELECTRICAL CONTINUITY BONDS

A. Inspection: Use continuous bond wires with no cuts or tears in the insulation covering the conductor.

B. General: Attach bond wires at required locations by thermite welding process.

C. Thermite Welding Methods: Perform thermite welding of bond wires to piping in the following manner:

1. Clean and dry pipe to which wires are to be attached.
2. Use grinding wheel to remove all coating, mill scale, oxide, grease, and dirt from an area approximately 3 inches square. Grind surface to bright metal.
3. Remove approximately 1 inch of insulation from each end of wire to be thermite welded to pipe, exposing clean, oxide-free copper for welding.
4. Select proper size thermite weld mold as recommended by manufacturer. Place wire or strap between graphite mold and the prepared metal surface.
5. Place metal disk in bottom of mold.
6. Pour thermite weld charge into the mold. Squeeze bottom of cartridge to spread ignition powder over charge.
7. Close mold cover and ignite starting powder with flint gun.
8. After exothermic reaction, remove thermite weld mold and gently strike weld with a hammer to remove weld slag. Pull on wire or strap to assure a secure connection. If weld is not secure or the bond breaks, repeat procedure with new wire or strap.
9. If weld is secure, coat all bare metal and weld metal with ThermoCap as manufactured by ThermoWeld, or approved equal.

D. Post-Installation Inspection: Post-installation inspection of all electrical continuity bonds shall be made through a visual examination of each thermite weld connection for strength and suitable coating prior to backfilling. In addition, perform one or more of the following tests:

1. Circulate current through pipe using DC power supply. Calculate resistance through known length of pipe. Resistance must not exceed 150% of theoretical resistance for pipe and bonds.
2. Measure resistance through select bonded joints with a digital low resistance ohmmeter (DLRO). Resistance of 0.001 ohms or less is acceptable.

3. Position a copper sulfate electrode (CSE) at a stationary location adjacent to bonded pipeline. Impress a temporary current on pipe. Record the static, current-applied, and “instant off” pipe-to-soil potential measurements along the pipe relative to a stationary CSE.
   
   a. Static potential measurements referenced to a stationary CSE must be nearly identical along the pipe to indicate electrical continuity.
   
   b. “Instant off” potentials referenced to a stationary CSE must be nearly identical along pipe to indicate electrical continuity.
   
   c. The difference between the “instant off” and the static potential referenced to stationary CSE must be equal at each point of contact to pipe to indicate electrical continuity.

4. If any of the above procedures indicates a poor quality bond connection, reinstall the bond.

5. Record results and submit to the owner or its designated representative for approval prior to backfilling.

E. Backfilling of Bonded Joints:

1. Perform backfilling of bonded piping in manner that prevents damage to the bonds and all connections to the metallic structures.
   
   a. Use appropriate backfill material to completely cover the electrical bond.
   
   b. Provide protection so that future construction activities in the area will not destroy the bonded connections.

2. If construction activity damages a bonded connection, install new bond wire.

3.02 INSTALLATION OF PIPELINE FLANGE ISOLATION DEVICES

A. Placement: Install isolation joints at the locations shown in the test station schedule on the drawings.

B. Assembly: Place gasket, sleeves, and washers as recommended by the manufacturer. Follow manufacturer's recommendations for even tightening to proper torque.

C. Testing: Immediately after an electrical isolation fitting has been installed, test electrical isolation effectiveness with a Gas Electronics model 601 meter, or approved equal. Fully document all test results.

D. Painting: Do not use metal base paints on electrical isolation devices.
E. Encapsulation: Encapsulate below-grade isolation joints with the Carboline Densyl tape system, or approved equal, after the isolation joint has been tested for effectiveness.

3.03 TESTING OF JOINT CONTINUITY BONDS AND ISOLATION JOINTS

A. General: After the completion of the continuity bonding of individual joints but before the pipe is backfilled, each bonded joint shall be tested for electrical continuity.

B. A DC current shall be impressed on the pipe on one side of the joint under test using a portable 12-volt battery and a driven ground rod. The battery shall be connected such that the positive terminal is connected to the ground rod and the negative terminal is connected to the pipe section under test. The magnitude of test current is not important as long as it causes a change in pipe-to-soil potential on the section of pipe that is in the test current circuit.

C. The pipe-to-soil potential shall be measured on each side of the isolation joint using a high impedance voltmeter and portable copper/copper sulfate reference electrode with the test current “on” and “off”.

D. A joint is considered electrically continuous if the “on” and “off” potentials are the same on either side of the joint under test.

E. This same procedure shall be used to test individual isolation joints except that the joint is considered effective if the pipe-to-soil potential is not the same when measured on each side of the joint when the test current is “on”.

3.04 INSTALLATION OF CASING SPACERS

A. Assemble and securely fasten casing spacers to the pipeline to be installed in casings or tunnels.

B. Avoid inadvertent metallic contact between casing and carrier pipe. Place spacers close enough to ensure that the pipe is adequately supported throughout its length, particularly at the ends, to offset settling and possible electrical shorting. The end spacer must be within 6 inches of the end of the casing pipe, regardless of size of casing and pipe or type of spacer used. Install spacers on PVC pipe at the insertion line to prevent over-insertion of the spigot into the bell.

C. Grade the bottom of the trench adjacent to each end of the casing to provide a firm, uniform and continuous support for the pipe. If the trench requires some backfill to establish the final trench bottom grade, place the backfill material in 6-inch lifts and compact each layer.

D. After the casing or tunnel liner has been placed, pump dry and maintain dry until the casing spacers and end seals are installed.

E. Install casing spacers in accordance with the manufacturer's instructions. Correctly assemble, evenly tighten, and prevent damage during tightening of the insulators and pipe insertion.
F. Insulator Spacing:
   1. Maximum distance between spacers to be 10 feet for pipe sizes 6 inches and smaller, and 6 feet for pipe sizes greater than 6 inches.
   2. For ductile-iron pipe, flanged pipe, or bell and spigot pipe, install spacers within one foot on each side of the bell or flange, and one in the center of the joint where 18 foot or 20 foot long joints are used.
   3. If the casing or pipe is angled or bent, reduce the spacing.

3.05 INSTALLATION OF END SEALS

A. Assemble hard rubber Link-Seals around the pipe and slide into the annular space between the pipe and casing. Evenly tighten the bolts to provide a positive seal.

B. Place pull-on synthetic rubber end seals on the pipe and pull over the end of the casing. Securely fasten stainless steel bands.

3.06 CASING TO CARRIER PIPE ISOLATION TESTS

A. Immediately after the pipe has been installed in the casing, but prior to connecting the line, perform an electrical continuity test to determine that the casing is electrically isolated from the pipeline. The continuity check shall be fully documented and approved by the owner or its designated representative prior to backfilling.

B. If the electrical isolation between carrier pipe and casing is not effective, the cause shall be immediately investigated, and the situation remedied. Under no circumstances shall a shorted casing be backfilled.

END OF SECTION
APPENDIX D

SPECIFICATION SECTION 15641

CORROSION CONTROL TEST STATIONS
SECTION 15641

CORROSION CONTROL TEST STATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Test station materials and installation requirements.

B. Locations requiring test stations are foreign pipeline crossings, cased crossings, galvanic anode groundbeds, and below-grade pipeline electrical isolation joints.

1.02 RELATED SECTIONS

A. Section 15640 - Joint Bonding and Electrical Isolation.

B. Section 15642 – Specification for Magnesium Anode Cathodic Protection Systems.

1.03 REFERENCES

A. ASTM D1242 - Polyethylene Plastic Molding and Extrusion Material.

B. NACE SP0169-2007 - Recommended Practice, Control of External Corrosion on Underground or Submerged Metallic Piping Systems.

C. UL 83 - Thermoplastic Insulated Wires.

D. UL 426A - Wire Connectors for Use with Copper Conductors.

1.04 SUBMITTALS

A. Submittals: Submittals shall conform to the requirements of the Western EST Water Line Project.

B. Catalogue Cut Sheets: Manufacturer's catalog cut sheets shall be submitted for each item. The catalog cut sheets shall include the manufacturer's name and shall provide sufficient information to show that the materials meet the requirements of the drawings and specifications. Where more than one item or catalog number appears on a catalog cut sheet clearly identify the item proposed.

C. Drawings: As-built drawings of the corrosion control test stations shall be maintained by the Contractor during installation and construction. Drawings shall be revised to show exact locations of all wiring, connections, anodes, test stations and reference electrodes. All items of equipment and material shall be properly identified. The original as-built drawings shall be submitted to the owner or its designated representative.
1.06 QUALITY CONTROL

A. Provide manufacturer's certifications that all components of the corrosion control system meet the requirements of the drawings and specifications. The certification shall reference the applicable section of the specifications and the applicable standard details.

B. The drawings for the corrosion control system are diagrammatic and shall not be scaled for exact locations, unless scales are explicitly stated on the specific drawing. Field conditions, non-interference with other utilities or mechanical and structural features shall determine exact locations. Contractor shall note other existing utilities in the area and during excavation, shall not damage these utilities. Any damaged utilities shall be repaired to the satisfaction of the owner at the Contractor's expense.

C. All materials, fabrication, and installations are subject to inspection and testing by the owner or its designated representative.

PART 2 PRODUCTS

2.01 FLUSH MOUNT TEST STATIONS

A. Test stations shall consist of test wires, a terminal head and a traffic box as shown on the drawings.

B. The terminal head shall be a seven (7) terminal Big Fink as manufactured by Cott Manufacturing Company or approved equal.

C. The test station shall be installed in a 24" x 24" x 6" concrete pad

D. The Precast Concrete traffic box shall be a 10.25-inch diameter 3-RT with a cast iron cover marked "CP Test" as manufactured by Brooks Products, Inc or approved equal.

E. Install a marker sign adjacent to all flush-mounted test stations.

2.02 ABOVE-GRADE TEST STATIONS

A. At test station locations where flush mounted structures cannot be installed, or where stated on drawings, an above-grade test station shall be used, and placed such that possible damage from vandalism, traffic, etc. is minimized.

B. The test station shall be a seven- (7) terminal "Big Fink" as manufactured by Cott Manufacturing or approved equal.

C. The “Big Fink” test station shall be mounted on a 5-foot length of 3-inch diameter concrete filled galvanized steel conduit.

E. The test station shall be installed adjacent to a permanent structure, if available, for physical protection.

F. The interior of the test station conduit shall be filled with Portland cement concrete after the installation of the test and bond wires.
G. The test station conduit shall be installed with a 24" x 24" x 6" concrete pad.

2.03 PERMANENT REFERENCE ELECTRODES

A. The permanent reference electrode shall be a copper sulfate Permacell Plus double membrane ceramic cell in a geomembrane package as manufactured by Corrpro Companies, Inc. or approved equal.

H. The electrode shall be equipped with No. 14 AWG stranded copper wire with blue HMWPE insulation of suitable length to attach to the terminal board of the test station.

C. A permanent reference electrode shall be installed at each test station associated with the galvanic magnesium anode groundbeds.

2.04 TEST STATION LEAD WIRES

A. Test station lead wires of all sizes shall have TW, THW, THHN or HMWPE insulation.

B. Type insulation shall be color coded based upon connection to underground structures:
   1. Water piping: white.
   2. Foreign structures: red.
   5. Anode header cable: black

C. Test station lead wires shall be terminated on the test station terminal board utilizing crimped on solderless ring terminals.

C. All terminal boards shall be wired by the installer as shown on the drawings.

2.05 THERMITE WELD EQUIPMENT

A. Charges and Molds: Weld charges and mold size shall be specified by the manufacturer for the specific surface configuration. Use only the correct charges for the specific application. Welding charges and molds shall be Erico, Cadweld or Continental Industries Thermoweld.

B. Weld Coating: Coating for all welds shall be ThermoCap as manufactured by ThermoWeld, or approved equal.
PART 3 EXECUTION

3.01 APPLICATIONS

A. Required applications of corrosion control test stations include locations where future testing is anticipated for the following reasons:

1. Testing to determine the effectiveness of the installed cathodic protection systems and to allow for startup adjustments.

2. Testing to determine interference effects from and on adjacent or crossing foreign underground structures.

3. Testing to determine sources and magnitude of stray DC currents and required mitigative measures.

4. Periodic monitoring to determine status of existing cathodic protection systems, stray current, and foreign line influence.

B. Install test stations at each of the locations scheduled on the drawings. As a minimum, test stations are required at each of the following locations:

1. At all major underground metallic pipeline crossings.

2. At all cased crossings and tunnels (both ends).

3. At all underground isolation flanges.

4. At all galvanic magnesium anode groundbed locations.

3.02 GENERAL

A. Install test stations at locations indicated on drawings. If a flush mounted test station is not feasible in a particular location, then an above-grade test station may be used, subject to approval by the owner or its designated representative.

B. Use continuous test station lead wires without cuts or tears in the insulation.

C. Locate test stations as indicated on drawings, as close to the pipe as possible. If the pipe is installed under a road, place the test station at the curb for easy access.

D. Attach test lead wires to the pipe by thermite welding.

E. Attach test wires to the pipe prior to backfilling.

F. Use color coded test wires as indicated on the drawings and in the specifications.

G. Wire test station terminal board configurations as shown on the drawings.

H. At foreign pipeline crossing test stations, the owners of the pipeline must be notified and must give permission before the test leads are connected to their pipeline. The foreign pipeline owner should have a representative present. Contractor shall not install lead wires or bond wires on foreign pipelines.
3.03 FLUSH-MOUNT TEST STATIONS

A. Install flush-mount test stations as shown on the drawings.

B. Sufficient slack shall be coiled beneath the test station to allow for soil settlement and to prevent damage to the leads during backfilling. Additional slack shall be left to allow for withdrawal of the terminal board a minimum of 18 inches above the top of the precast concrete traffic box for test purposes.

C. Install flush-mount test stations with permanent copper sulfate reference electrodes where indicated on the drawings.
   1. Install permanent reference electrode approximately 6 inches from the pipe.
   2. Compact native soil by hand around the electrode. The balance of the backfill shall be select granular backfill material.
   3. Saturate the backfilled permanent reference electrode with 5 gallons of water.

D. Set test stations installed outside areas of permanent paving materials in a Portland cement concrete pad. The concrete pad shall be a minimum of 24 inches square and no less than 6 inches thick.

3.04 ABOVE-GRADE TEST STATIONS

A. Install above-grade test stations where a flush mounted test station cannot be located. Use and location of above-grade test stations shall be approved by the owner or its designated representative.

B. Locate test station adjacent to a permanent structure (e.g. a power pole), if available, for physical protection.

C. Coil sufficient slack beneath the test station to allow for soil settlement and to prevent damage to the leads during backfilling.

D. Pour a 24" x 24" x 6" concrete pad at grade around the test station conduit.

E. Fill the interior of the 3" above-grade test station steel galvanized conduit with Portland cement concrete after installation of the test stations wires.

3.05 TEST LEAD WIRE ATTACHMENT

A. Attach test leads to the pipe by thermite welding directly to the pipe on steel and DIP pipelines. See drawings.

B. The pipe to which the wires are to be attached shall be clean and dry.

C. When connecting directly to the pipe, use a grinding wheel to remove all coating, mill scale, oxide, grease, and dirt from an area approximately 3 inches square. Grind the surface to bright metal.
D. The wires to be thermite welded to the pipe shall have approximately 1 inch of insulation removed from each end, exposing clean, oxide-free copper for welding.

E. Using the proper size thermite weld mold as recommended by the manufacturer, place the wire between the graphite mold and the prepared metal surface. Use a copper sleeve crimped over the wire for all No. 10 AWG or smaller wires.

F. Place the metal disk in the bottom of the mold.

G. Pour the thermite weld charge into the mold. Squeeze the bottom of the cartridge to spread ignition powder over the charge.

H. Close the mold cover and ignite the starting powder with a flint gun.

I. After the exothermic reaction, remove the thermite weld mold and gently strike the weld with a hammer to remove the weld slag. Pull on the wire to assure a secure connection. If the weld is not secure or the wire breaks, repeat the procedure.

J. If the weld is secure, coat all bare metal and weld metal with ThermoCap as manufactured by ThermoWeld, or approved equal.

Note: Lead wires and bond wires are to be installed on the foreign pipelines by the foreign pipeline owners. The water line owner will make arrangements with the foreign pipeline owners (if any) for installation of lead wires and bond wires on the foreign pipelines. Contractor SHALL NOT install lead wires or bond wires on foreign pipelines.

3.06 POST INSTALLATION BACKFILLING OF TEST STATION - LEAD WIRES.

A. Protect test station wires to prevent damage to the wire insulation and conductor integrity during backfilling.

B. After completion of the backfilling of the test wires to the pipe, verify the connection by measuring and recording a pipe-to-soil potential.

C. Replace any test wire found to have a high resistance connection.

END OF SECTION
APPENDIX E

SPECIFICATION SECTION 15642

MAGNESIUM ANODE CATHODIC PROTECTION SYSTEMS
SECTION 15642

MAGNESIUM ANODE CATHODIC PROTECTION SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for cathodic protection systems on concrete cylinder pipes, carbon steel pipes and ductile iron pipes using magnesium anodes.

B. Work performed under this specification shall consist of providing all supervision, labor, equipment and materials as well as providing all operations necessary to install and test the required cathodic protection system components for the exterior surfaces of the water line project. The work shall be performed in accordance with the provisions of the specifications, applicable plans, codes and standards, and subject to other terms and conditions for the project.

C. Cathodic protection components shall be as shown on the project drawings for the Western EST Water Line Project. The cathodic protection system shall include but not be limited to the following:
   1. Materials and installation.
   2. Post-installation survey.
   3. Final Report to include recommendations.

1.02 REFERENCES

A. NEC 70 - National Electrical Code

B. NACE SP-0169-2007 - Recommended Practice, Control of External Corrosion on Underground or Submerged Metallic Piping Systems.

C. UL 83 – Thermoplastic-Insulated Wires.

D. UL 486A – Wire Connectors and Soldering Lugs for Use with Copper Conductors.

1.03 QUALITY CONTROL

A. Installer Qualifications: Cathodic protection installer shall have a minimum of 5 years of documented experience in the type of cathodic protection work required for the project.

B. Cathodic Protection Tester: Cathodic protection tester shall provide instructions for installation of anodes, field splices, and thermite welding. NACE International certified corrosion personnel shall complete all testing.

C. All materials, fabrication and installations are subject to inspection and testing by the owner or its designated representative.
D. The drawings for the cathodic protection system are diagrammatic and shall not be scaled for exact locations unless scales are explicitly stated on the specific drawing. Field conditions, non-interference with other utilities or mechanical and structural features shall determine exact locations. Contractor shall note other existing utilities in the area. Care shall be taken during excavation not to damage these utilities. Any damaged utilities shall be repaired to the satisfaction of the owner at the Contractor's expense.

PART 2 ANODES

2.01 SACRIFICIAL ANODES - MAGNESIUM

A. Magnesium Anodes: Use 32 lb. 3” x 3” x 45” high potential prepackaged magnesium anodes. The metallurgical composition of the magnesium anodes shall conform to the following:

<table>
<thead>
<tr>
<th>Element</th>
<th>Content %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al</td>
<td>0.010</td>
</tr>
<tr>
<td>Mn</td>
<td>0.50 to 1.30</td>
</tr>
<tr>
<td>Cu</td>
<td>0.02 Maximum</td>
</tr>
<tr>
<td>Ni</td>
<td>0.001 Maximum</td>
</tr>
<tr>
<td>Fe</td>
<td>0.03 Maximum</td>
</tr>
<tr>
<td>Other</td>
<td>0.05 each or 0.3 Maximum Total</td>
</tr>
<tr>
<td>Magnesium</td>
<td>Remainder</td>
</tr>
</tbody>
</table>

B. Magnesium Anode Current Capacity: Magnesium anodes require a current capacity of no less than 500 amp-hours per pound of magnesium.

C. Anode Backfill Material: Use chemical backfill material around all galvanic anodes. Backfill provides a reduced contact resistance to earth, provides a uniform environment surrounding the anode, retains moisture around the anode, and prevents passivation of the anode.

1. All galvanic anodes come prepackaged in a backfill material conforming to the following composition:
   a) Ground hydrated gypsum: 75 percent
   b) Powdered bentonite: 20 percent
   c) Anhydrous sodium sulfate: 5 percent.
2. Have a grain size backfill such that 100 percent is capable of passing through a 20-mesh screen and 50 percent is retained by a 100-mesh screen.
3. Completely surround the anode with the backfill mixture within a cotton bag.
4. For cast magnesium ingots, the required weight of backfill shall be as follows:

<table>
<thead>
<tr>
<th>Anode Weight (Pounds)</th>
<th>Backfill Weight (Pounds)</th>
<th>Total Weight (Pounds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>32</td>
<td>58</td>
<td>90</td>
</tr>
</tbody>
</table>
D. Anode Lead Wires: For the lead wire for the magnesium anodes, use a 20-foot length of No. 12 AWG solid copper wire equipped with TW of THW insulation.

E. Lead Wire Connection to Magnesium Anode:

1. Cast magnesium anodes with a 20 gauge galvanized steel core.
2. Extend one end of the core beyond the anode for the lead wire connection.
3. Silver-solder the lead wire to the core and fully insulate the connection.

2.02 SPLICING TAPE

Tape used for covering anode lead wire to anode header cable connections shall be two (2) layers of Scotch 130C rubber splicing tape. Then two (2) layers of Scotch 88 vinyl electrical tape as manufactured by 3M Scotch, or approved equal. Taped splices shall be covered with a coating of 3M Scotchkote electrical coating, or approved equal.

2.03 CRIMPING LUGS

Crimping lugs used to connect the anode lead wire to anode header cable shall be copper compression crimpit Catalog No. YC10C10 as manufactured by Burndy or approved equal.

2.04 ANODE HEADER CABLE

Anode header cables routed between the anode groundbed and the test stations shall be #10 AWG stranded copper conductors with type HMWPE insulation (Black).

2.05 TEST STATIONS

A. Test stations shall consist of test wires, a terminal head and a traffic box as shown on the drawings.

B. The terminal head shall be a five (5) terminal Big Fink as manufactured by Cott Manufacturing Company or approved equal.

C. The Precast Concrete traffic box shall be a 10.25-inch diameter 3-RT with a cast iron cover marked "CP Test" as manufactured by Brooks Products, Inc or approved equal.

D. If the area is not paved, the test station shall be installed in a 6” x 24” x 24” square concrete pad.

E. Install a marker sign adjacent to all flush-mounted test stations.

2.06 SHUNT

A. Monitoring shunt shall be a 0.01-ohm Type RS shunt as manufactured by Holloway or approved equal.
B. There shall be two (2) shunts in each magnesium anode test station.

2.07 TEST LEAD WIRE

A. Test station lead wires shall be #12 AWG stranded copper cable with type THHN, TW, or THW insulation black in color.

2.08 PERMANENT REFERENCE ELECTRODE

A. The permanent reference electrode shall be a copper sulfate Permacell Plus as manufactured by Corrpro Companies or approved equal.

B. The permanent reference electrode shall be equipped with No. 14 AWG stranded copper wire with blue HMWPE insulation of suitable length to attach to the terminal board of the test station.

C. The permanent reference electrode shall have a minimum design life of 15 years and a stability of 5 millivolts under a 3.0 microamp load.

2.09 THERMITE WELD EQUIPMENT

Materials required for thermite welding and coating of the welds are described in the following sections.

A. Charges and Molds: Weld charges and mold size shall be as specified by the manufacturer for the specific surface configuration. Care shall be taken during installation to be sure correct charges are used. Welding charges and molds shall be the product of a manufacturer regularly engaged in the production of such materials.

B. Weld Coating: Coating for all welds shall be ThermoCap as manufactured by ThermoWeld, or approved equal.

PART 3 CATHODIC PROTECTION SYSTEM INSTALLATION

3.01 INSTALLATION OF SACRIFICIAL ANODES

A. The location of the cathodic protection magnesium anode groundbeds are indicated in the test station schedules on the project drawings.

B. Placement: Each anode shall be installed vertically in an 8 inch diameter by 10 foot deep hole as shown on the project drawings. Anode spacing shall be ten feet center-to-center. Centerline of the anode shall be at a minimum of 10 feet from the centerline of the pipe. Anodes shall be installed within the pipeline right-of-way.

C. Augured Hole: The anode hole diameter shall easily accommodate the anode.

D. Backfilling: After the hole is augured, the packaged anode shall be lowered into the hole and the soil shall be firmly tamped around the package so that it is in intimate contact with the package. Then a minimum of 5 gallons of water is to be poured in the anode hole. Backfilling of the remained of the anode hole can then be completed.
E. Anode Lead Wire: Lead wires from the anodes shall be run underground at a minimum depth of 24 inches. Each anode lead wire shall be connected to an anode header cable as indicated on the project drawings.

F. Handling: Anodes shall be handled in a manner that will avoid damaging anode materials and wire connections.

3.02 INSTALLATION OF PERMANENT REFERENCE ELECTRODE

A. Location: One permanent copper sulfate reference electrode shall be installed at each anode groundbed. The permanent reference electrode shall be within 6” of the pipe at pipe depth. The permanent reference electrode shall be prepared and installed in strict accordance with the manufacturers recommendations.

B. Placement: The permanent reference electrode shall be placed in the same ditch with the water line and carefully covered with the same soil as the pipeline backfill.

C. Lead Wire: The permanent reference electrode lead wire shall be protected during backfill operations and routed to the test station along with the water line test leads and anode groundbed cables.

3.03 INSTALLATION OF WIRE AND CABLE

A. Depth: All underground wire and cable shall be installed at a minimum of 24 inches below final grade with a minimum separation of 6 inches from other underground structures.

B. Anode Header Cable: Each anode lead wire shall be connected to a #10 AWG/HMWPE header cable which shall be routed into a flush-to-grade test station.

C. Anode Lead Wire to Header Cable Connection: Each anode lead wire to header cable connection shall be made using a copper compression connector. Each connection shall be taped using rubber tape, vinyl tape and coated with Scotchkote electrical coating as shown on the project drawings.

D. Anode-to-Pipeline Connection: Each group of anodes shall be connected to the pipeline through a test station as shown on the project drawings. A 0.01 ohm shunt shall be used to connect the anode header cable to the pipeline as shown on the project drawings.

E. A 3” wide, yellow, non-detectable warning tape labeled “Cathodic Protection Cable Buried Below” shall be buried at a depth of 18” below the surface and along the length of all cathodic protection cable trenches.

3.04 TEST LEAD WIRE ATTACHMENT

A. Test lead cables shall be attached to the pipe by thermite welding.

B. The pipe to which the wires are to be attached shall be clean and dry.
C. A grinding wheel shall be used to remove all coating, mill scale, oxide, grease and dirt from the structure over an area approximately 3 inches square. The surface shall be cleaned to bright metal.

D. The wires to be thermite welded to the pipe shall have approximately 1 inch of insulation removed from each end, exposing clean, oxide-free copper for welding.

E. Using the proper size thermite weld mold as recommended by the manufacturer, the wire shall be placed between the graphite mold and the prepared metal surface. All wires No. 12 AWG size shall use a copper sleeve crimped over the wire.

F. The metal disk shall be placed in the bottom of the mold.

G. The cap from the weld charge container shall be removed and the contents poured into the mold. Squeeze the bottom of the weld charge container to spread ignition powder over the charge.

H. Close the mold cover and ignite the starting powder with a flint gun. The mold should be held firmly in place until all of the charge has burned and the weld has cooled slightly.

I. Remove the thermite weld mold and gently strike the weld with a hammer to remove the weld slag. Pull on the wire to assure a secure connection. If the weld is not secure or the wire breaks, repeat the procedure.

J. If the weld is secure, coat all bare metal and weld metal with ThermoCap as manufactured by ThermoWeld, or approved equal.

3.05 FLUSH-TO-GRADE TEST STATIONS

A. Flush-to-grade test stations shall be installed as shown on the drawings. Test stations shall be installed in a 6” x 24” x 24” square concrete pad.

B. Sufficient slack shall be coiled beneath the test station to allow for soil settlement and to prevent damage to the leads during backfilling. Additional slack shall be left to allow for withdrawal of the terminal board a minimum of 12” above the top of the concrete pad for test purposes.

3.06 POST INSTALLATION BACKFILLING OF CABLES

A. General: During the backfilling operation, cables shall be protected to prevent damage to the wire insulation and conductor integrity.

3.07 POST INSTALLATION TESTING OF THE CATHODIC PROTECTION SYSTEMS

A. General: As soon as possible after the cathodic protection equipment has been installed, the system shall be inspected, energized and adjusted (commissioned).
B. Commissioning: The commissioning of the cathodic protection system shall be performed by a corrosion engineer hired by the contractor to achieve compliance with the referenced corrosion control standards set forth by NACE International and/or AWWA.

C. Method: The Corrosion Engineer shall:

1. Measure native state structure-to-soil potentials along the water line using the permanent reference electrodes at each anode groundbed test station. Native state structure-to-soil potentials shall also be measured at above grade pipeline appurtenances prior to energizing the cathodic protection system with a portable CSE.
2. Energize the cathodic protection system by connecting each magnesium anode groundbed to the pipeline lead in the test station junction box. Record each anode groundbed current using the 0.01-ohm shunt.
3. Allow a minimum of two weeks for the pipeline to polarize.
4. Adjust, if necessary, the cathodic protection current output in each anode test station to satisfy the criteria of a minimum of 100 millivolts of polarization from the native state structure-to-soil potential, or an “Instant Off” potential at least as negative as -850 millivolts CSE.
5. Record all final current outputs measured at each test station.
6. Verify that all electrical isolation devices are operating properly including flange isolators, and casing spacers.
7. Verify that interference does not exist with foreign structures. Perform joint tests with owners of the foreign structures (if any) and mitigate any interference detected. If necessary, foreign line test stations shall be provided to facilitate the interference testing and installation of any necessary resistance bonds. It is the corrosion engineers’ responsibility to coordinate the interference testing with the owners of foreign structures.

D. Verification and Responsibilities
1. Contractor shall correct, at his expense, any deficiencies in materials or installation procedures discovered during the post-installation inspection.
2. Corrosion Engineer shall provide written documentation of any deficiencies discovered during the post installation inspection.

E. Equipment: All cathodic protection testing instruments shall be in proper working order and calibrated according to factory specifications.

F. Report: The results of all commissioning procedures along with documentation of anode groundbed current outputs, pipe-to-soil potentials, results of interference testing, results of electrical isolation joint tests and as built drawings shall be compiled in a final report and furnished to the owner along with operating and maintenance instructions.

END OF SECTION
APPENDIX F

SPECIFICATION SECTION 15643

POLYETHYLENE ENCASEMENT
SECTION 15643

POLYETHYLENE ENCASEMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Polyethylene encasement is a part of the corrosion protection system for the DIP option.

B. Specifications for materials and installation of polyethylene encasement for pipe, valves, fittings, and other appurtenances for the DIP option.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices. No separate payment will be made for polyethylene encasement. Include cost of polyethylene encasement in unit price for pipes and fittings to be encased.

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.

1.03 REFERENCES


G. ANSI/AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
1.04 SUBMITTALS

A. Product Data: Submit product data for proposed film, and tape or plastic tie straps for approval. All film to be used in accordance with this standard specification shall be manufactured from virgin polyethylene, shall not be recycled and shall be purchased new for the project, clean, sound and without defects.

B. Samples: Submit samples of polyethylene tube and/or sheet for approval. Provide one sample of tube for each pipe diameter and one sample of each sheet material to be used. Samples shall be a minimum of 40 square feet of standard production material.

C. Quality Assurance Plan: Submit quality assurance plans for film manufacturing and field application.

   a. Film Manufacturing: The manufacturer of polyethylene film for corrosion protection encasement of ductile iron pipe shall have a verifiable quality control system to assure that film is produced from only virgin polyethylene and that it complies with all requirements of this specification. Documentation of Quality Control procedures and test results shall be submitted and shall be made available for inspection for at least one year. A current ISO certificate may be used in lieu of other quality control documentation.

   b. Field Application: The contractor shall develop, and submit for approval, a comprehensive Quality Assurance Plan for installation of polyethylene encasement. Address all aspects of material and pipe handling, bedding, preparation of pipe surface, film installation and anchoring, service taps and backfill. Include written procedures to be used by installers.

D. Manufacturer’s Certification: Submit polyethylene film manufacturer's certification of compliance with this Section. The polyethylene film manufacturer shall provide a notarized statement from an officer of the company that the film meets the inspection and all applicable material specifications of this specification. The manufacturer’s statement of compliance must be verifiable. Statements from distributors or contractors shall not be accepted in lieu of a statement from the original manufacturer of the polyethylene film.

E. Installer Qualifications: Polyethylene encasement shall only be installed by qualified persons who have been trained in the proper procedures described in Part 3 of these specifications.

F. Qualified Persons: Qualified persons shall be those that have had training and experience in the installation of polyethylene encasement for corrosion protection of ductile iron pipe. Such persons may be qualified by the Ductile Iron Pipe Research Association, ductile iron pipe manufacturers or engineering/inspection firms who offer training courses in the proper method(s) of installation. Proof of qualifications shall be submitted with the shop drawings and shall be provided to project inspectors upon request.
PART 2  PRODUCTS

2.01  MATERIALS

A. Polyethylene Film: Tubular or sheet form without tears, breaks or defects, conforming to the following requirements.

1. High-Density, Cross-Laminated, Polyethylene: High–density, cross-laminated polyethylene film manufactured from virgin polyethylene material conforming to the following:

   a. Raw Material. Raw materials to meet the requirements of ASTM D 4976:

      1. Group: 2 (Linear)

      2. High-density: 0.940 to 0.960 g/cm³

      3. Volume Resistivity: $10^{15}$ ohm-cm minimum

   b. Physical Properties: Physical properties of finished film to be as follows:

      1. Tensile Strength: 6,300 psi. minimum in machine and transverse direction (ASTM D 882)

      2. Elongation: 100 percent minimum in machine and transverse direction (ASTM D 882) as measured using rubber lined grips.

      3. Dielectric Strength: 800 volts/mil thickness minimum (ASTM D 149)

      4. Impact Resistance: 800 grams minimum (ASTM D 1709 Method B)

      5. Propagation Tear Resistance: 250 grams force minimum in machine and transverse direction (ASTM D1922)

   c. Thickness: High-density, cross-laminated polyethylene film shall have a minimum thickness of at least 0.004 in. (4 mils).

   d. Color: Supply white polyethylene film with a minimum 2 percent hindered-amine ultraviolet inhibitor. Where a color other than white is required for purposes of identification, it shall comply with the raw material and physical property requirements of this specification, shall not be manufactured with pigments containing controlled substances, and shall not degrade under ultraviolet exposure during storage and while on the project site.

   e. Polyethylene Tube and Sheet Size: For push-on joint pipe, polyethylene tube and sheet sizes to conform to the following:

...
2. Large Bell Circumferences: Where bell ends of the pipe are larger than the tube or sheet sizes listed above, use sufficiently large tubes or sheets to cover the joints.

3. Marking: The polyethylene film shall be clearly marked every two feet with the following information:

   a. Manufacturer's name or trademark
   b. Year of manufacture
   c. ANSI/AWWA C105/A21.5
   d. Minimum film thickness and material type (HDCLPE or LLDPE)
   e. Applicable range of nominal pipe diameter size(s)
   f. Warning – Corrosion Protection – Repair Any Damage

   Letters and numerals used for marking items "a" through "e" shall not be less than 1 inch in height and item "f" shall not be less than 1 1/2 inches in height.

B. Polyethylene Tape: Provide 1-½-inch wide, plastic-backed, adhesive tape for fitting and anchoring the encasement. Acceptable tapes are Fulton No. 355, Polyken No. 900, Scotchwrap No. 50, or other approved tape. Fulton Tie Strips are an approved alternative to tape. For patching or repairing the polyethylene film, use only polyethylene tape.
PART 3 EXECUTION

3.01 PREPARATION

A. Remove lumps of clay, mud, and cinders from pipe surface prior to installation of polyethylene encasement. Prevent soil or embedment material from becoming trapped between pipe and polyethylene.

B. Fabric slings and padded forks shall be used for transport of wrapped pipe. Chains or cables shall not be used. Do not damage the polyethylene encasement.

C. For installations below the water table or in areas subject to tidal actions tube form polyethylene encasement shall be used. Completely seal both ends of the polyethylene tube with adhesive tape at joint overlap. Circumferentially wrap with tape or plastic tie straps every two feet along the barrel.

3.02 INSTALLATION

A. Tubular Type (Method A):

1. Cut polyethylene tube to a length approximately 2 feet longer than pipe section. Slip tube around pipe, centering tube to provide 1-foot overlap on each adjacent pipe section. Bunch accordion-fashion lengthwise until it clears pipe ends.

2. Make shallow bell hole at joints to facilitate installation of polyethylene tube completely around pipe. Lower pipe into trench and make up pipe joint with preceding section of pipe. Methods other than bell holes shall be allowed, provided the polyethylene tube completely encases the pipe joints, including a minimum overlap of 1-foot.

3. After assembling pipe joint, make overlap of polyethylene tube. Pull bunched polyethylene from preceding length of pipe, slip it over end of adjoining length of pipe, and secure in place. Then slip end of polyethylene from adjoining pipe section over end of first wrap until it overlaps joint at end of preceding length of pipe. Secure overlap in place.

4. For each pipe length, take up slack width at top of pipe to make a snug, but not tight, fit along barrel of pipe, securing fold with tape at quarter points. Avoid a tight fit to prevent stretching the polyethylene where it bridges irregular surfaces, such as bell and spigot joints, restrained and bolted joints, and fittings; and to prevent damage to film during backfilling. The length of tape to secure wrap shall be no less than 1-foot.

5. Repair cuts, tears, punctures, or other damage to polyethylene. Proceed with installation of next section of pipe in same manner.
B. Tubular Type (Method B)

1. Cut polyethylene tube to a length approximately 1 foot shorter than pipe section. Slip tube around pipe, centering it to provide 6 inches of bare pipe at each end. Take up slack width at top of pipe to make a snug, but not tight, fit along barrel of pipe, securing fold at quarter points; secure ends.

2. Make shallow bell hole at joints to facilitate installation of polyethylene tube completely around pipe. Lower pipe into trench and make up pipe joint with preceding section of pipe. Methods other than bell holes shall be allowed, provided the polyethylene tube completely encases the pipe joints, including a minimum overlap of 1-foot.

3. Take up slack width at top of pipe to make a snug, but not tight, fit along barrel of pipe, securing fold with tape at quarter points. Avoid a tight fit to prevent stretching the polyethylene where it bridges irregular surfaces, such as bell and spigot joints, restrained and bolted joints, and fittings; and to prevent damage to film during backfilling. The length of tape to secure wrap shall be no less than 1-foot.

4. Before making up joint, slip 4-foot length of polyethylene tube over end of preceding pipe section, bunching in accordion-fashion lengthwise. After completing joint, pull 4-foot length of polyethylene over joint, overlapping polyethylene previously placed on each adjacent section of pipe by at least 1 foot; make each end snug and secure.

5. Repair cuts, tears, punctures, or other damage to polyethylene. Proceed with installation of next section of pipe in same manner.

C. Sheet Type (Method C) – Applicable to Valves, Tees, Elbows and Other Fittings Only:

1. Cut polyethylene sheet to a length approximately 2 feet longer than pipe section. Center length to provide 1-foot overlap on each adjacent pipe section, bunching sheet until it clears pipe ends. Wrap polyethylene around pipe so that sheet circumferentially overlaps top quadrant of pipe. Secure cut edge of polyethylene sheet at intervals of approximately 3 feet.

2. Lower wrapped pipe into trench and make up pipe joint with preceding section of pipe. Make shallow bell hole at joints to facilitate installation of polyethylene. After completing joint, make overlap and secure ends.

3. Repair cuts, tears, punctures, or other damage to polyethylene. Proceed with installation of next section of pipe in same manner.
D. Installation in Directional Drilled Bore:

1. Install as described in 3.02A. Tubular Type (Method A) with the exception that the polyethylene encasement overlap must face away from the pull direction to avoid the under film accumulation of drilling mud and other foreign matter.

2. Attach pulling head to spigot end of the leading pipe length.

3. Securely anchor the polyethylene tube to the end of the barrel of the leading pipe length by continuously taping the leading two feet of the barrel with overlapping tape wrap. Anchor the first wraps of tape directly on to the barrel of the pipe and extend the continuous taping on to the polyethylene encasement. For the remainder of the leading pipe length, overlap circumferential wraps of tape every one foot.

4. The drilling fluid and cuttings shall not enter under the polyethylene tube during the pull back or other operations. At assembled joints, the polyethylene overlap shall always have the forward pipe’s polyethylene tube overlap the next following pipe’s tube. The polyethylene on both sides of the joint shall be secured with circumferential wraps of tape or plastic tie straps.

5. Continue process by wrapping tape on each side of successive joints and every two feet along barrel.

E. Pipe-shaped Appurtenances: Cover bends, reducers, offsets, and other pipe-shaped appurtenances with polyethylene in same manner as pipe.

F. Odd-shaped Appurtenances: When it is not practical to wrap valves, tees, crosses, and other odd-shaped pieces in tube, wrap with flat sheet or split length of polyethylene tube by passing sheet around appurtenance and encasing it. Make seams by bringing edges together, folding over twice, and taping down. Tape the polyethylene encasement securely in place at valve stem and other penetrations.

G. Openings in Encasement: Create openings for branches, saddles, service taps, blowoffs, air valves, and similar appurtenances by making an X-shaped cut in polyethylene and temporarily folding back film. After appurtenance is installed, tape slack securely to appurtenance and repair cut, as well as other damaged area in polyethylene, with tape.

H. Hydrant Drain Relief: For hydrant relief holes and similar orifices, apply 3 wraps of tape completely around the polyethylene encased pipe, then, with a utility knife, cut a hole in the tape and polyethylene that is 1-inch larger in diameter than the orifice/opening.

I. Direct Service Taps: For direct service taps, apply 3 wraps of tape completely around the polyethylene encased pipe to cover the area where the tapping machine and chain will be mounted. After the tapping machine is mounted, install the corporation stop directly
through the tape and polyethylene. After the direct tap is completed, the entire circumferential area shall be closely inspected and repaired as needed.

J. Service Connections: Wrap service lines of copper and other dissimilar metals with polyethylene or suitable dielectric tape for a minimum clear distance of 3 feet away from the cast or ductile iron pipe. Surface preparation and method of application shall follow tape manufacturer’s written instructions.

K. Junctions between Wrapped and Unwrapped Pipe: Where polyethylene-wrapped pipe joins an adjacent pipe that is not wrapped, extend polyethylene wrap to cover adjacent pipe for at least 3 feet. Secure end with circumferential turns of tape.

L. Installation of Pipe through Casings: Polyethylene encasement shall be used for pipe through casings. Use a single layer of polyethylene film. Casing spacers (insulated type) and casing end seals shall be installed. Do not damage the polyethylene film where these devices are attached to the pipe, over the encasement.

3.03 REPAIRS

Repair any cuts, tears, punctures, or damage to polyethylene with adhesive tape or with short length of polyethylene sheet or cut open tube, wrapped around pipe to cover damaged area, and secured in place.

3.04 BACKFILL

Prevent damage to the polyethylene wrap when placing earthen backfill. Assure backfill material is free from cinders, refuse, boulders, rocks, stones, or other material that could damage the polyethylene. Follow AWWA C600 for backfilling.

3.05 QUALITY ASSURANCE

A. Freedom from Defects: All polyethylene film shall be clean, sound and free from defects.

B. Inspection: All parts of this Section are subject to inspection by the owner or its designated representative.

C. Non-Compliance: The Contractor will correct any deficiencies in materials or installation at his expense, including excavating the pipe subsequent to backfilling and re-installing the polyethylene wrap.

END OF SECTION
APPENDIX C – PROJECT SIGN
Project Sign Detail

Notes:
1. Board: 3/4” Exterior or Marine Grade Plywood or Approved Equal. Painted White.
2. Flower Mound Symbol – Blue.
3. Block Lettering – Black 5” Size
4. New Signs Will be Required for Each Project. Street Project Signs will have T-Footing to allow signage relocation throughout the project (use sandbag stabilization on T-Footings signage). All other signage will be mounted in the ground and stabilized with a minimum of 2’ buried for stabilization (see design detail)
5. Frame of 2” x 4” Stock Painted White
6. Contractor will place this sign at each end of the project limits and properly maintain the sign during the construction phase of the project.
7. Project name, contact phone number, consultant name, contractor name, and Town Council members will be provided for each project by the Town’s project manager.
8. A Project Signage submittal will be required for Town project manager approval prior to installation.