BID COPY

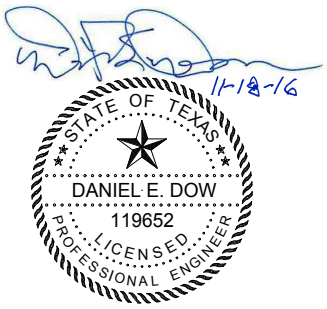
CITY OF ROUND ROCK

Utilities and Environmental Services

Project Manual For:

Forest Creek Lift Station Rehabilitation

November 2016



Lockwood, Andrews & Newnam, Inc.
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00020 NOTICE TO BIDDERS

NOTICE TO BIDDERS

Sealed bids addressed to Eddie Zapata, Senior Project Manager**,** City of Round Rock, Utilities and Environmental Services Department, 2008 Enterprise Drive, Round Rock, TX 78664, for furnishing all labor, material and equipment and performing all work required for the project titled, Forest Creek Lift Station Rehabilitation (project includes installation of a duplex lift station, complete with adjacent valve vault, back-up generator and controls canopy, and including partial demolition and abandonment of existing wet well and gravity sewer sections.), will be received until December 21, 2016, at 10:00 a.m., then publicly opened and read aloud at the same address. Bid envelopes shall state date and time of bid and "**Forest Creek Lift Station Rehabilitation**". Bids must also be accompanied by a "Statement of Bidder's Safety Experience" included in Section 410 of the Project Manual. No bids may be withdrawn after the scheduled opening time. Any bids received after scheduled bid opening time will be returned unopened.

Bids must be submitted on City of Round Rock bid forms and must be accompanied by an acceptable bid security as outlined in the Instructions to Bidders, payable to the City of Round Rock, Texas equal to five percent (5%) of the total bid amount. Plans, Bid Forms, Specifications, and Instructions to Bidders may be obtained from the City of Round Rock website at the following web address: www.roundrocktexas.gov/utilitiescip. **Bidders shall be responsible for printing or obtaining prints of the aforementioned documents as necessary.** For questions please contact the City's Project Manager, Eddie Zapata, (512) 218-6605.

In case of ambiguity, duplication, or obscurity in the bids, the City of Round Rock reserves the right to construe the meaning thereof. The City of Round Rock further reserves the right to reject any or all bids and to waive any informalities and irregularities in the bids received.

The successful bidder will be expected to execute the City of Round Rock's standard contract and to furnish performance and payment bonds, all as described in the bid documents. Contractors and subcontractors shall pay to laborers, workmen, and mechanics the prevailing wage rates as determined by the City of Round Rock.

A MANDATORY Pre-Bid conference will be held at 2008 Enterprise Dr., Round Rock, Texas on December 14, 2016 at 3:00 p.m..

Publish Dates:

Round Rock Leader:
December 1, 2016
December 8, 2016

Pflugerville Pflag:
November 30, 2016
December 7, 2016

00100 INSTRUCTIONS TO BIDDERS

INSTRUCTIONS TO BIDDERS

1. Prior to submitting any bid, bidders are required to read all drawings (plans), specifications, and all other Project Manual and/or Contract Documents carefully; to inform themselves by their independent research, test and investigation of the difficulties to be encountered and judge for themselves of the accessibility of the Work and all attending circumstances affecting the cost of doing the Work and the time required for its completion and obtain all information required to make a bid. **The aforementioned documents may only be obtained from the City's website at the following web address:** www.roundrocktexas.gov/utilitiescip **. Bidders shall be responsible for printing or obtaining prints of the aforementioned documents as necessary.**

2. Should the bidder find discrepancies in, or omissions from the drawings (plans), specifications, or other Project Manual and/or Contract Documents, or should he be in doubt as to their meaning, he should notify at once the City and obtain clarification or addendum prior to submitting any bid. **Any addenda issued will be posted with the documents at the web address mentioned in 1 above no later than two business days prior to the Bid Opening Date. Prior to submitting a bid, the bidder is responsible for determining if any addenda have been issued and for following any instructions required in any addenda issued.**

3. **It shall be the responsibility of the bidder to see that his bid is received at the place and time named in the Notice to Bidders in the Project Manual**. Bids received after the scheduled opening time will be returned unopened.

4. Bids shall be submitted in sealed envelopes plainly marked "Sealed Bid" and showing the name of the project, the job number if applicable, and the opening date and time.

5. **Bidders shall be responsible for submitting a copy of the City's Bid Form, Bid Bond Form, and Statement of Bidder's Safety Experience from the Project Manual documents posted at the web address as described in 1 above.**

6. Bids shall be accompanied by a bid security consisting of a certified cashier's check in an amount not less than five percent (5%) of the total maximum bid price, payable without recourse to the City of Round Rock, or a bid bond in the same amount from a reliable surety company, as a guarantee that the bidder will enter into a contract and execute performance and payment bonds, as stipulated by item 15 below, within ten (10) days after notice of award of contract to him. Bid securities must be submitted in the same sealed envelope with the bid. Bids submitted without a bid security may not be considered at the sole discretion of the City.

7. **If awarded the bid, the bidder must complete a Form 1295 electronically on the Texas Ethics Commission (TEC) Website at https://www.ethics.state.tx.us/whatsnew/elf_info_form1295.htm and submit the signed and notarized Form 1295 within ten (10) business days of notification of the award. Instructions for completing a Form 1295 are attached as Exhibit "A" to the Instructions to Bidders.**

8. No conditional bids will be accepted.

9. A bidder wishing to withdraw his submitted sealed bid prior to the scheduled bid opening time must do so by presenting in person a written request signed by an authorized representative of the bidder to a City employee at the location for which sealed bids are to be addressed. No telephone, facsimile, or email requests will be accepted. The City will expend the time and effort that the City in its sole discretion determines is necessary to investigate the authenticity of a request before complying with a request. The City shall in its sole discretion determine if the City will comply with a request and the City shall not be held liable for not complying with a request. If the City does not comply with a request, the request shall automatically become null and void.

10. A bidder wishing to revise his sealed bid after submittal but before the scheduled bid opening time must first withdraw his bid as provided for in the Instructions to Bidders and then submit a sealed bid in accordance with the Instructions to Bidders. No revisions to a bid will be allowed after the scheduled bid opening time. The bidder shall be responsible for ensuring the amount of the bid security is as specified in the Instructions to Bidders.

11. All bid securities will be returned to the respective bidders within twenty-five (25) days after bids are opened, except those which the City elects to hold until the successful bidder has executed the Agreement. Thereafter, all remaining securities, including security of the successful bidder, will be returned within sixty (60) days.

12. Until the award of the contract, the City reserves the right to reject any and all bids and to waive technicalities; to advertise for new bids; or to do the work otherwise when the best interest of the City will be thereby promoted.

13. In case of ambiguity or lack of clarity in the statement of prices in the bids, the City reserves the right to consider the most favorable analysis thereof, or to reject the bid. Unreasonable and/or unbalanced prices submitted in a bid may result in rejection of such bid or other bids.

14. Award of the contract, if awarded, will be made within sixty (60) days after opening of the bids, and no bidder may withdraw his bid within said sixty (60) day period of time unless a prior award is made. A Notice to Proceed will be issued within sixty (60) days after contract Execution Date as defined in the General Conditions.

15. Within ten (10) days after written notification of award of the contract, the successful bidder must furnish a performance bond and a payment bond in the amount of one hundred

percent (100%) of the total Contract Amount. Said performance bond and payment bond shall be from an approved surety company holding a permit from the State of Texas, indicating it is authorized and admitted to write surety bonds in this state. In the event the bond exceeds $100,000.00, the surety must also (1) hold a certificate of authority from the United States secretary of the treasury to qualify as a surety on obligations permitted or required under federal law; or (2) have obtained reinsurance for any liability in excess of $100,000.00 from a reinsurer that is authorized and admitted as a reinsurer in this state and is the holder of a certificate of authority from the United States secretary of the treasury to qualify as a surety or reinsurer on obligations permitted or required under federal law.

In determining whether the surety or reinsurer holds a valid certificate of authority, the City may rely on the list of companies holding certificates of authority as published in the Federal Register covering the date on which the bond is to be executed.

16. Failure to execute the Agreement within ten (10) days of written notification of award or failure to furnish the performance bond and payment bond as required by item 15 above, shall be just cause for the annulment of the award. In case of annulment of the award, the bid security shall become the property of the City, not as a penalty, but as liquidated damages.

17. No contract shall be binding upon the City until it has been signed by its Mayor after having been duly authorized to do so by the City Council.

18. The Contractor shall not commence Work under the Agreement until he has furnished certification of all insurance required and such has been approved by the City, nor shall the Contractor allow any Subcontractor to commence work on his subcontract until proof of all similar insurance that is required of the subcontractor has been furnished and approved. The Contractor's insurer shall use the certificate of insurance form included in the bid documents or the standard ACORD form.

19. If the bidder's insurance company is authorized, pursuant to its agreement with bidder, to arrange for the replacement of a loss, rather than by making a cash payment directly to the City, the insurance company must furnish or have furnished by bidder, a performance bond in accordance with Section 2253.021(b), Texas Government Code, and a payment bond in accordance with Section 2253.021(c).

20. Any quantities given in any portion of the Bid Documents, including the drawings (plans), are estimates only, and the actual amount of work required may differ somewhat from the estimates. The basis for payment shall be the actual amount of work done and/or material furnished as specified in the General Conditions.

21. Bids shall be submitted on a separated contract basis. No Texas sales tax shall be included in the prices bid for materials consumed or incorporated into the Work. This contract is issued by an organization which is qualified for exemption pursuant to the provisions of Section 151.309(5) of the Texas Tax Code. The City will issue an exemption certificate to the Contractor. The Contractor must then issue a resale certificate to the material supplier

for materials purchased. The Contractor must have a valid sales tax permit in order to issue a resale certificate.

Upon obtaining consumable materials, the Contractor will issue a resale certificate in lieu of payment of sales tax, and the following conditions shall be observed;

1) The Contractor will transfer title of consumable, but not incorporated, materials to the City at the time and point of receipt by the Contractor;
2) The Contractor will be paid for these consumable materials by the City as soon as practicable. Payment will not be made directly but considered subsidiary to the pertinent bid item. The Contractor's monthly estimate will state that the estimate includes consumables that were received during the month covered by the estimate; and
3) The designated representative of the City must be notified as soon as possible of the receipt of these materials so that an inspection can be made by the representative. Where practical, the materials will be labeled as the property of the City.

22. The Contractor, after execution of the contract and pursuant to Internal Revenue Service (IRS) regulations, shall furnish its Taxpayer Identification Number (TIN) to the City. The Contractor shall provide the appropriate information on a W-9 form (which can be provided by the City upon request). This form shall be submitted directly to the City's Accounts Payable Department to ensure security of the information.

23. If the Bid Form includes Add and/or Deduct Alternate bid items and/or otherwise provides for Alternate bids, the City will determine whether to select or not select one or more of the Add and/or Deduct Alternate bid items and/or Alternate bids at the City's sole discretion and for its greatest advantage. If the City selects any Add and/or Deduct Alternate bid items, the total bid amount will be determined by adding the amount of the selected Add Alternate(s) to, and deducting the amount of the selected Deduct Alternate(s) from the Base Bid or the selected Alternate bid.

EXHIBIT "A"
FORM 1295 INSTRUCTIONS

Pursuant to newly enacted Section 2252.90 of the Texas Government Code, as of January 1, 2016, any business entity entering into a contract with a local government that requires approval of the governing body must submit a disclosure of interested parties to the local governmental prior to the execution of the contract. The Texas Ethics Commission (TEC) has adopted a form for the disclosure of interested parties (Form 1295) and has created a website application for business entities to submit the required information.

The City of Round Rock may not enter into a contract that requires the approval of the City Council until the business entity that is a party to the contract files a Form 1295 with the City Clerk. The instructions to complete Form 1295 and file it with the City Clerk are as follows:

1. Upon being notified of a bid award, the award recipient ("business entity") must go to the following website: https://www.ethics.state.tx.us/whatsnew/elf_info_form1295.htm and follow the login directions on the website application to complete a Form 1295. If this is a business entity's first time logging on to the website application, the business entity must create a login Username and Password and then follow the application's instructions to complete a Form 1295.

2. The City does not have a Contract ID Number System. Please insert the project name in this box.

3. Even if a business entity has no interested parties, Form 1295 still must be completed using the website application and filed with the City Clerk.

4. Once confirmation is received that the information has been submitted, the business entity MUST print, sign and notarize the printed out completed Form 1295.

5. **The signed and notarized Form 1295 must be filed with the Clerk of the City of Round Rock within ten (10) business days of the date of notification of the award. The signed and notarized Form 1295 may be scanned and e-mailed to swhite@roundrocktexas.gov OR mailed or hand-delivered to the address below.**

6. Once the City Clerk receives the signed and notarized Form 1295, the City Clerk will submit confirmation of receipt through the TEC website application within thirty (30) days of the filing of Form 1295.

7. This process must be followed for each contract a business entity enters into with the City of Round Rock.

8. A Form 1295 cannot be handwritten. It must be completed electronically through the TEC website application.

9. If you have any questions regarding the filing of Form 1295, please contact:

   Sara White, City Clerk
   221 East Main Street
   Round Rock, Texas 78664
   Phone: (512) 218-5404
   Fax: (512) 218-7097
   E-mail: swhite@roundrocktexas.gov

00200 BID BOND

BID BOND

THE STATE OF TEXAS §
§ KNOW ALL BY THESE PRESENTS:
COUNTY OF WILLIAMSON §

That _____ of the City of _____ County of _____ State of _____ as Principal, and _____ authorized under the laws of the State of Texas to act as surety on bonds for principals, are held and firmly bound unto the **CITY OF ROUND ROCK, TEXAS ("Owner"),** in the penal sum of Five Percent (5%) of the total amount of the Bid of the Principal submitted to the Owner, for the Work described below; for the payment whereof, well and truly to be made, and the said Principal and Surety do herby bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, as follows:

In no case shall the liability of the Surety hereunder exceed the sum of (_____ _____ Dollars ($_____).

THE CONDITIONS OF THIS OBLIGATION ARE SUCH that, whereas, the Principal has submitted the above-referenced Bid to the Owner, for construction of the Work under the "Specifications for Construction of Forest Creek Lift Station Rehabilitation _____ _____", for which Bids are to be opened at the office of Owner on the 21st day of December, 2016.

NOW, THEREFORE, if the Principal is awarded the Contract, and within the time and manner required under the "Instructions to Bidders," after the prescribed forms are presented to her/him for signature, enters into a written Agreement substantially in the form contained in the Bid Documents, in accordance with the Bid, and files the two (2) bonds with the Owner, one to guarantee faithful performance and the other to guarantee payment for labor and materials, then this obligation shall be null and void; otherwise, it shall be and remain in full force and effect.

In the event that suit is brought upon this Bond by the Owner and judgment is recovered, said Surety shall pay all costs incurred by the Owner in such suit, including a reasonable attorney's fee to be fixed by the Court.

IN WITNESS WHEREOF, the said Principal and Surety have signed this instrument on this the _____ day of the month of _____ 20____.

_____	_____
Principal	Surety
_____	_____
Printed Name	Printed Name
By: _____	By: _____
Title: _____	Title: _____
Address: _____	Address: _____
_____	_____

Resident Agent of Surety:

_____

Signature

_____

Printed Name

_____

Street Address

_____

City, State, Zip

00300 BID FORM

BID FORM

PROJECT NAME: Forest Creek Lift Station Rehabilitation

PROJECT LOCATION: Round Rock, Texas

OWNER: City of Round Rock, Texas

DATE: December 21, 2016

Gentlemen:

Pursuant to the foregoing Notice to Bidders and Instructions to Bidders, the undersigned bidder hereby proposes to do all the Work, to furnish all necessary superintendence, labor, machinery, equipment, tools, materials, insurance and miscellaneous items, to complete all the Work on which he bids as provided by the attached Bid Documents, and as shown on the plans for the construction of Forest Creek Lift Station Rehabilitation and binds himself on acceptance of this bid to execute the Agreement and bond for completing said Work within the time stated, for the following prices, to wit:

Any addenda issued will be posted with the Project Manual and/or Contract Documents on the City's website at www.roundrocktexas.gov/utilitiescip by the close of business on December 19, 2016. Prior to submitting a bid, the bidder is responsible for determining if any addenda have been issued and for following any instructions in any addenda issued.

Bidder acknowledges receipt of the following Addenda by listing Addendum "number" and "date".

BASE BID

Bid Item	Approx. Quantity	Unit	Item Description and Written Unit Price	Unit Price	Amount
1	1	LS	Clearing and Grubbing, per section 102 complete in place per Lump Sum for _____ dollars and _____ cents.		
2	4.3	CY	Flexible Base (Surface), per section 210 complete in place per Cubic Yard for _____ dollars and _____ cents.		

BASE BID

Bid Item	Approx. Quantity	Unit	Item Description and Written Unit Price	Unit Price	Amount
3	140	CY	Rock Structural Excavation, per section 111 complete in place per Cubic Yard for _____ dollars and _____ cents.		
4	6.7	CY	Cast-in-Place Concrete, Wet Well Base, per section 410 complete in place per Cubic Yard for _____ dollars and _____ cents.		
5	2	CY	Cast-in-Place Concrete, Wet Well Pad, per section 410 complete in place per Cubic Yard for _____ dollars and _____ cents.		
6	5.4	CY	Cast-in-Place Concrete, Generator Pad, per section 410 complete in place per Cubic Yard for _____ dollars and _____ cents.		
7	2.5	CY	Cast-in-Place Concrete, Electrical Canopy Spread Fittings, per section 410 complete in place per Cubic Yard for _____ dollars and _____ cents.		

BASE BID

Bid Item	Approx. Quantity	Unit	Item Description and Written Unit Price	Unit Price	Amount
8	23	SY	Cast-in-Place Concrete Driveway, per section 433 complete in place per Square Yard for _____ dollars and _____ cents.	_____	_____
9	33	LF	Pipe, 6" Dia., Ductile Iron CL350 (all depths), factory restrained joints, incl. excavation and backfill, per section 510 complete in place per Linear Foot for _____ dollars and _____ cents.	_____	_____
10	52	LF	Pipe, 6" Dia., Ductile Iron CL350, flanged discharge pipe in wet well, per section 510 complete in place per Linear Foot for _____ dollars and _____ cents.	_____	_____
11	5	LF	Pipe, 4" Dia., PVC Sch. 40 (all depths), incl. fittings, P-trap, excavation and backfill, per section 510 complete in place per Linear Foot for _____ dollars and _____ cents.	_____	_____
12	24	LF	Pipe, 8" Dia., PVC SDR-26 (all depths), incl. fittings, excavation and backfill, per section 510 complete in place per Linear Foot for _____ dollars and _____ cents.	_____	_____

BASE BID

Bid Item	Approx. Quantity	Unit	Item Description and Written Unit Price	Unit Price	Amount
13	29	LF	Pipe, 15" Dia., PVC SDR-26 (all depths), incl. fittings, excavation and backfill, per section 510 complete in place per Linear Foot for _____ dollars and _____ cents.		
14	0.15	TON	Ductile Iron Fittings, 4" through 24", per section 510 complete in place per Ton for _____ dollars and _____ cents.		
15	1	EA	Vent Pipe, 4" Dia. Stainless Steel, including accessories, complete in place, per section 02577 complete in place per Each for _____ dollars and _____ cents.		
16	3	EA	New Manhole Construction, 48" Diameter, per section 506 complete in place per Each for _____ dollars and _____ cents.		
17	153	LF	Trench Safety System, including Wet Well (all depths), per section 509 complete in place per Linear Foot for _____ dollars and _____ cents.		

BASE BID

Bid Item	Approx. Quantity	Unit	Item Description and Written Unit Price	Unit Price	Amount
18	2	EA	Valves, Resilient Seated Gate Type, 6" Dia., per section 15139 complete in place per Each for _____ dollars and _____ cents.		
19	2	EA	Valves, Swing Check Type, 6" Dia., per section 15139 complete in place per Each for _____ dollars and _____ cents.		
20	1	EA	Valves, Flag Gate Type, 4: Dia., per section 15139 complete in place per Each for _____ dollars and _____ cents.		
21	360	SY	Native Grassland Seeding and Planting, per section 610/01562 complete in place per Square Yard for _____ dollars and _____ cents.		
22	120	LF	Protective Tree Fencing, Type A Chain Link, per section 610/01562 complete in place per Linear Foot for _____ dollars and _____ cents.		

BASE BID

Bid Item	Approx. Quantity	Unit	Item Description and Written Unit Price	Unit Price	Amount
23	1	EA	Stabilized Construction Entrance (incl. mulch application and removal), per section 641 complete in place per Each for _____ dollars and _____ cents.	_____	_____
24	210	LF	Silt Fence for Erosion Control, per section 641 complete in place per Linear Foot for _____ dollars and _____ cents.	_____	_____
25	1	LS	Total Mobilization Payment (Not to Exceed 5% of Total Base Bid), per section 700 complete in place per Lump Sum for _____ dollars and _____ cents.	_____	_____
26	68	LF	New fencing, Incl. Posts and Accessories for Wrought Iron and Fencecrete Extensions, per section 701 complete in place per Linear Foot for _____ dollars and _____ cents.	_____	_____
27	40	LF	Remove Existing 6' Security Fence, per section 702 complete in place per Linear Foot for _____ dollars and _____ cents.	_____	_____

BASE BID

Bid Item	Approx. Quantity	Unit	Item Description and Written Unit Price	Unit Price	Amount
28	1	LS	Electrical Canopy Framing and Metal Deck, per section 721 complete in place per Lump Sum for _____ dollars and _____ cents.		
29	3	MO	Barricades, Signs, and Traffic Handling, per section 803 complete in place per Month for _____ dollars and _____ cents.		
30	1	LS	Fiberglass Reinforced Polymer (FRP) wet well, Including Excavation and Backfill, per section 02577 complete in place per Lump Sum for _____ dollars and _____ cents.		
31	3	EA	500 gpm Hydromatic S4K Submersible Pump (40 HP), incl. pump, base, guide brackets, rails, hatch with fall protection, and accessories, per section 11319 complete in place per Each for _____ dollars and _____ cents.		
32	1	LS	Lift Stationo Start Up and Testing, per section 01655 complete in place per Lump Sum for _____ dollars and _____ cents.		

BASE BID

Bid Item	Approx. Quantity	Unit	Item Description and Written Unit Price	Unit Price	Amount
33	1	LS	Lift Station Demolition, per section 02530 complete in place per Lump Sum for _____ dollars and _____ cents.	_____	_____
34	1	EA	Precast 72" valve vault with double door hatch, traffic rated, including excavation and backfill, per section 403 complete in place per Each for _____ dollars and _____ cents.	_____	_____
35	1	LS	Odor Control System, complete in place, including concrete slab, pipe and appurtenances, per section 11332 complete in place per Lump Sum for _____ dollars and _____ cents.	_____	_____
36	1	LS	Diversion Pumping, per section 02539 complete in place per Lump Sum for _____ dollars and _____ cents.	_____	_____
37	1	EA	Blue Ribbon Pump Controller, per section 13421 complete in place per Each for _____ dollars and _____ cents.	_____	_____

BASE BID

Bid Item	Approx. Quantity	Unit	Item Description and Written Unit Price	Unit Price	Amount
38	1	EA	Birdcage Submersible Pressure Level, per section 13421 complete in place per Each for _____ dollars and _____ cents.		
39	1	EA	Electrical Service, per section 13400 complete in place per Each for _____ dollars and _____ cents.		
40	1	EA	SCADA/Power Equipment, per section 16050 complete in place per Each for _____ dollars and _____ cents.		
41	1	EA	Generator/ATS, per section 16230 complete in place per Each for _____ dollars and _____ cents.		
42	1	LS	Conduit/Wiring, per section 16050 complete in place per Lump Sum for _____ dollars and _____ cents.		

ADD ALTERNATE BID

Bid Item	Approx. Quantity	Unit	Item Description and Written Unit Price	Unit Price	Amount
A-1	1	LS	Add for Polymer Concrete Wet Well, Complete in Place, in Lieu of Fiberglass Reinforced Wet Well		

complete in place per Lump Sum
for _____ dollars
and _____ cents. _____ $ -

TOTAL ADD ALTERNATE BID: $ -

STATEMENT OF SEPARATE CHARGES:

Materials:	
All Other Charges:	
*** Total:**	$ -

*** Note:** This total must be the same amount as shown above for **"Total Add Alternate Bid"**

BASE BID	
ADD ALTERNATE BID	$ -
TOTAL	$ -

TOTAL BASE BID (Items 1 thru 42) _____

Materials: _____
All Other Charges: _____
*** Total:** _____

*** Note:** This total must be the same amount as shown above for **"Total Base Bid"**

If this bid is accepted, the undersigned agrees to execute the Agreement and provide necessary bonds and insurance certification as per the Instructions to Bidders.

The undersigned certifies that the bid prices contained in the bid have been carefully checked and are submitted as correct and final. The Owner reserves the right to reject any or all bids and may waive any informalities or technicalities.

Respectfully Submitted,

Signature	
Print Name	Address
Title	Telephone
Name of Firm	
Date	Secretary, if Bidder is a Corporation

00410 STATEMENT OF BIDDER'S SAFETY EXPERIENCE

Statement of Bidder's Safety Experience Section 00410

Bidder must submit a signed Statement of Bidder's Safety Experience form with his Bid; failure to do so will constitute an incomplete Bid that may be rejected. In order to make a responsive Bid, Bidder must provide evidence that it meets minimum OSHA construction safety program requirements, has not been fined by OSHA for any willful safety violations in the past three years, and has a lost time injury rate that doesn't exceed the limits established below. All questions must be answered and data given must be clear and comprehensive. If necessary, questions may be answered on separate attached sheets.

Company Name: _____

Address: _____ Phone: _____

Completed by: _____ Date: _____

1. Does the company have a written construction Safety program? ☐Yes ☐No
2. Does the company conduct construction safety inspections? ☐Yes ☐No
3. Does the company have an active construction safety-training program? ☐Yes ☐No
4. Has the company been fined by OSHA for any willful safety violations in the past three years? ☐Yes ☐No
5. Does the company have a lost time injury rate of 7.8 for SIC 15, or 7.6 for SIC 16, or less over the past three years? ☐Yes ☐No

   Attach the company's OSHA 200/300 logs for the past three years.

6. Does the company or affected subcontractors have competent persons in the following Areas?

   A. Scaffolding ☐Yes ☐No ☐N/A
   B. Excavation ☐Yes ☐No ☐N/A
   C. Cranes ☐Yes ☐No ☐N/A
   D. Electrical ☐Yes ☐No ☐N/A
   E. Fall Protection ☐Yes ☐No ☐N/A
   F. Confined Spaces ☐Yes ☐No ☐N/A

I hereby certify that the above information is true and correct.

Signature _____ Title _____

00500 AGREEMENT

City of Round Rock, Texas
Standard Form of Agreement between
Owner and Contractor

AGREEMENT made as of the _____ ( ) day of _____ in the year 20___.

BETWEEN the Owner: City of Round Rock, Texas (hereafter "Owner" or "City")
221 East Main Street
Round Rock, Texas 78664

and the Contractor _____ ("Contractor")

The Project is described as: Forest Creek Lift Station Rehabilitation

The Engineer is: Lockwood, Andrews, & Newnam, Inc.
8911 N. Capital of Texas Highway
Building 2 - Ste. 2300
Austin, TX 78759

For and in consideration of the mutual terms, conditions and covenants of this Agreement and all accompanying documents between Owner and Contractor, the receipt and sufficiency of which are hereby acknowledged, Owner and Contractor agree as follows:

ARTICLE I THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement and Modifications issued after execution of this Agreement; these form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. An enumeration of the Contract Documents, other than Modifications, appears in Article 7.

ARTICLE 2 THE WORK OF THIS CONTRACT

Contractor shall fully execute the Work described in the Contract Documents, except to the extent specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT; DATE OF SUBSTANTIAL COMPLETION; DATE OF FINAL COMPLETION

3.1 The date of commencement of the Work shall be the date of this Agreement unless a different date is stated below or provision is made for the date to be fixed in a Notice to Proceed issued by Owner.

3.2 The Contract Time shall be measured from the date delineated in the Notice to Proceed.

3.3 Contractor shall commence Work within ten (10) calendar days from the date delineated in the Notice to Proceed.

3.4 Contractor shall achieve Substantial Completion of the items of Work listed on Attachment A to this Agreement no later than one hundred twenty (120) calendar days from issuance by Owner of Notice to Proceed, and Contractor shall achieve Substantial Completion of the entire Work no later than one hundred twenty (120) calendar days from issuance by Owner of Notice to Proceed, subject to adjustments of this Contract Time as provided in the Contract Documents.

3.5 If Contractor fails to achieve Substantial Completion of the Work (or any portion thereof) on or before the date(s) specified for Substantial Completion in the Agreement, Contractor shall pay to Owner, as liquidated damages, the sum of one thousand and No/100 Dollars ($ 1,000) for each calendar day that Substantial Completion is delayed after the date(s) specified for Substantial Completion. It is hereby agreed that the liquidated damages to which Owner is entitled hereunder are a reasonable forecast of just compensation for the harm that would be caused by Contractor's failure to achieve Substantial Completion of the Work (or any portion thereof) on or before the date(s) specified for Substantial Completion in the Agreement. It is agreed that the harm that would be caused by such failure, which includes loss of expected use of the Project areas, provision of alternative storage facilities and rescheduling of moving and occupancy dates, is one that is incapable or very difficult of accurate estimation. It is hereby agreed that if Substantial Completion of the Work (or any portion thereof) is not achieved on or before thirty (30) days after the date(s) specified for Substantial Completion in the Agreement, the Owner shall have the option to either collect liquidated damages as set forth herein or to thereafter rely on its remedies under the Contract Documents and at law and in equity, including without limitation, the recovery of actual damages. The date(s) specified for Substantial Completion of the Work (or any portion thereof) in the Agreement shall be subject to adjustment as provided in the Contract Documents.

3.6 Contractor shall achieve Final Completion of the entire Work no later than one hundred fifty (150) calendar days from issuance by Owner of Notice to Proceed.

ARTICLE 4 CONTRACT SUM

4.1 Owner shall pay Contractor the Contract Sum in current funds for Contractor's performance of the Contract. The Contract Sum shall be _____

_____

($_____), subject to additions and deductions as provided in the Contract Documents.

4.2 Does the Contract Sum include alternates which are described in the Bid Form?
No _____. Yes X . If yes, please provide details below:

Add for Polymer Concrete Wet Well,
Complete in Place, in Lieu of Fiberglass
Reinforced Wet Well.

ARTICLE 5 PAYMENTS

5.1 PROGRESS PAYMENTS

5.1.1 Based upon Applications for Payment submitted to Engineer and Owner by Contractor, and Certificates for Payment issued by Engineer and not disputed by Owner and/or Owner's lender, Owner shall make progress payments on account of the Contract Sum to Contractor as provided below, in Article 14 of the City of Round Rock General Conditions, and elsewhere in the Contract Documents.

5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month.

5.1.3 Provided that an Application for Payment is received by Engineer and Owner, and Engineer issues a Certificate of Payment not later than the tenth (10th) day of a month, Owner shall make payment to Contractor not later than the tenth (10th) day of the next month. If an Application for Payment is received by Engineer and Owner after the application date fixed above, payment shall be made by Owner not later than one month after the Engineer issues a Certificate for Payment.

5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form and supported by such data to substantiate its accuracy as Engineer and Owner may require. This schedule, unless objected to by Engineer or Owner, shall be used as a basis for reviewing Contractor's Applications for Payment.

5.1.5 Applications for Payment shall warrant the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

5.1.6 Subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as provided in Article 14 of the City of Round Rock General Conditions.

5.1.7 Except with Owner's prior written approval, Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

5.2 FINAL PAYMENT

5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by Owner to Contractor when:

.1 Contractor has fully performed the Contract except for Contractor's responsibility to correct Work, and to satisfy other requirements, if any, which extend beyond final payment; and

.2 a final Certificate for Payment has been issued by Engineer.

5.2.2 Owner's final payment to Contractor shall be made no later than thirty (30) days after the issuance of Engineer's final Certificate for Payment. In no event shall final payment be required to be made prior to thirty (30) days after all Work on the Contract has been fully performed. Defects in the Work discovered prior to final payment shall be treated as non-conforming Work and shall be corrected by Contractor prior to final payment, and shall not be treated as warranty items.

ARTICLE 6 TERMINATION OR SUSPENSION

6.1 The Contract may be terminated by Owner or Contractor as provided in Article 15 of the City of Round Rock General Conditions.

6.2 The Work may be suspended by Owner as provided in Article 15 of the City of Round Rock General Conditions.

ARTICLE 7 ENUMERATION OF CONTRACT DOCUMENTS

7.1 The Contract Documents, except for Modifications issued after execution of this Agreement, are enumerated as follows:

7.1.1 The Agreement is this executed version of the City of Round Rock, Texas Standard Form of Agreement between Owner and Contractor, as modified.

7.1.2 The General Conditions are the "City of Round Rock Contract Forms 00700," General Conditions, as modified.

7.1.3 The Supplementary, Special, and other Conditions of the Contract are those contained in the Project Manual dated November 2016.

7.1.4 The Specifications are those contained in the Project Manual dated November 2016.

7.1.5 The Drawings, if any, are those contained in the Project Manual dated November 2016.

7.1.6 The Insurance & Construction Bond Forms of the Contract are those contained in the Project Manual dated November 2016.

7.1.7 The Notice to Bidders, Instructions to Bidders, Bid Form, and Addenda, if any, are those contained in the Project Manual dated November 2016.

7.1.8 If this Agreement covers construction involving federal funds, thereby requiring inclusion of mandated contract clauses, such federally required clauses are those contained in the "City of Round Rock Contract Forms 03000," Federally Required Contract Clauses, as modified.

7.1.9 Other documents, if any, forming part of the Contract Documents are as follows:

01000-Attachment A

ARTICLE 8 MISCELLANEOUS PROVISIONS

8.1 Where reference is made in this Agreement to a provision of any document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

8.2 Owner's representative is:

Eddie Zapata
Project Manager
2008 Enterprise Drive
Round Rock, Texas 78664

8.3 Contractor's representative is:

8.4 Neither Owner's nor Contractor's representative shall be changed without ten (10) days' written notice to the other party.

8.5 Waiver of any breach of this Agreement shall not constitute waiver of any subsequent breach.

8.6 Owner agrees to pay Contractor from available funds for satisfactory performance of this Agreement in accordance with the bid or proposal submitted therefor, subject to proper additions and deductions, all as provided in the General Conditions, Supplemental Conditions, and Special Conditions of this Agreement, and Owner agrees to make payments on account thereof as provided therein. Lack of funds shall render this Agreement null and void to the extent funds are not available. This Agreement is a commitment of City of Round Rock's current revenues only.

8.7 Although this Agreement is drawn by Owner, both parties hereto expressly agree and assert that, in the event of any dispute over its meaning or application, this Agreement shall be interpreted reasonably and fairly, and neither more strongly for nor against either party.

8.8 This Agreement shall be enforceable in Round Rock, Texas, and if legal action is necessary by either party with respect to the enforcement of any or all of the terms or conditions herein, exclusive venue for same shall lie in Williamson County, Texas. This Agreement shall be governed by and construed in accordance with the laws and court decisions of the State of Texas.

8.9 Both parties hereby expressly agree that no claims or disputes between the parties arising out of or relating to this Agreement or a breach thereof shall be decided by an arbitration proceeding, including without limitation, any proceeding under the Federal Arbitration Act (9 USC Section 1-14) or any applicable state arbitration statute.

8.10 The parties, by execution of this Agreement, bind themselves, their heirs, successors, assigns, and legal representatives for the full and faithful performance of the terms and provisions hereof.

This Agreement is entered into as of the day and year first written above and is executed in at least three (3) original copies, of which one is to be delivered to Contractor, one to Engineer for use in the administration of the Contract, and the remainder to Owner.

OWNER	**CONTRACTOR**
CITY OF ROUND ROCK, TEXAS	_____
_____	_____
Printed Name: _____	Printed Name: _____
Title _____	Title: _____
Date Signed: _____	Date Signed: _____

ATTEST:

_____
City Clerk

FOR CITY, APPROVED AS TO FORM:

_____
City Attorney

00600 INSURANCE AND CONSTRUCTION BOND FORMS

BONDS AND INSURANCE INSTRUCTIONS

Instruction Sheet

1. Insurance Company must be licensed by State of Texas.

2. Agent signing bonds must be licensed in Texas.

3. Agent signing bonds must have Power of Attorney on behalf of insurance company.

4. If Agent signing bonds has Power of Attorney, but not licensed in Texas, then the bond must be counter-signed by Texas local recording agent.

ALL THE ABOVE INFORMATION CAN BE FOUND AT
Texas Department of Insurance website –www.tdi.state.tx.us

5. Make sure the dollar amount on both Performance and Payment Bonds match the amount of the Agreement & Bid Form Sheet.

6. Both Performance and Payment Bonds should be signed by Authorized Person. If the contractor is a corporation, then it should be signed by the President or the Vice-President. If the contractor is not incorporated, then it may be signed by the Owner. Please state the title of the authorized person.

CERTIFICATE OF LIABILITY INSURANCE
Instruction Sheet

1. **CERTIFICATE OF LIABILITY INSURANCE FORM**
The City of Round Rock's Certificate of Liability Insurance form provided herein or a standard ACORD form.

2. **PRODUCER** and **INSURED** - Please list name, address, phone number and e-mail.

3. **COMPANIES AFFORDING COVERAGE** – TDI number required. The TDI number can be obtained from the Texas Dept of Insurance Website: http://www.tdi.state.tx.us/. – Company Lookup.

   Note: Exception to this rule. In certain instances where there is unusual risks involved, **Surplus Lines Insurance Carriers** can be used. Below are the guidelines:

   a. **Insurance Company does not have to be "licensed in Texas", but they do have to be "*eligible* for a Texas license."**
   Please verify with the Texas Dept of Insurance
   Website: http://www.tdi.state.tx.us/. – Company Lookup

   b. **Policy has to be written by licensed surplus lines Agent.**
   Also verify with the Texas Dept of Insurance
   Website: http://www.tdi.state.tx.us/ - Agent Lookup

4. **TYPES OF INSURANCE COVERAGE –**

   CONSTRUCTION CONTRACT: Please double check the **General Conditions and the Supplemental General Conditions** for the types and amounts of insurance required. The Supplemental General Conditions usually state the following:

   a. **Business Automobile Liability Insurance**
   b. **Workers' Compensation and Employers' Liability Insurance**
   c. **Commercial General Liability Insurance**
   d. **Builders' Risk Insurance** – (Generally required for all "vertical" construction. Check with Project Manager for requirements.)

   FOR ALL OTHER CONTRACTS, PLEASE REFER TO THE INSURANCE SECTION FOR TYPE OF INSURANCE REQUIRED. (For example Engineering Service Contracts usually require "professional liability insurance".)

5. **EFFECTIVE DATE & EXPIRATION DATE**
Please make sure dates are current.

6. City of Round Rock must be listed on the Certificate of Insurance as an additional insured (except Workers Compensation and Builders Risk).

7. Certificate must indicate that the insurance Company must give the City of Round Rock notice of any changes, cancellation , etc. at least thirty (30) days prior to date of change.

8. **Make sure Certificate is signed by an Agent Licensed in the State of Texas, this can also be found on the Texas Department of Insurance website –www.tdi.state.tx.us – Agent Lookup.**

PERFORMANCE BOND

THE STATE OF TEXAS §
§ KNOW ALL BY THESE PRESENTS:
COUNTY OF WILLIAMSON §

That _____ of the City of _____, County of _____ , and State of _____, as Principal, and _____ authorized under the law of the State of Texas to act as surety on bonds for principals, are held and firmly bound unto **THE CITY OF ROUND ROCK, TEXAS, (Owner),** in the penal sum of _____ Dollars ($ _____) for the payment whereof, well and truly to be made the said Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, by these presents:

WHEREAS, the Principal has entered into a certain written Agreement with the Owner dated the _____ day of _____, 20__ to which the Agreement is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein consisting of: Forest Creek Lift Station Rehabilitation _____ _____ (Name of the Project)

NOW, THEREFORE, THE CONDITIONS OF THIS OBLIGATION IS SUCH, that if the said Principal shall faithfully perform said Agreement and shall, in all respects, duly and faithfully observe and perform all and singular the covenants, conditions and agreements in and by said Agreement, agreed and covenanted by the Principal to be observed and performed, including but not limited to, the repair of any and all defects in said work occasioned by and resulting from defects in materials furnished by or workmanship of, the Principal in performing the Work covered by said Agreement and occurring within a period of twelve (12) months from the date of Final Completion and all other covenants and conditions, according to the true intent and meaning of said Agreement and the Plans and Specifications hereto annexed, then this obligation shall be void; otherwise to remain in full force and effect;

PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Chapter 2253, Texas Government code, as amended, and all liabilities on this bond shall be determined in accordance with the provisions of said Chapter 2253 to the same extent as if it were copied at length herein.

PERFORMANCE BOND (continued)

Surety, for value received, stipulates and agrees that no change, extension of time, alteration or addition to the term of the Agreement, or to the Work performed thereunder, or the Plans, Specifications, or drawings 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 Agreement, or to the work to be performed thereunder.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this instrument this _____ day of _____, 20___.

_____	_____
Principal	Surety
_____	_____
Printed Name	Printed Name
By: _____	By: _____
Title: _____	Title: _____
Address: _____	Address: _____
_____	_____

Resident Agent of Surety:

_____
Signature

_____
Printed Name

_____
Street Address

_____
City, State & Zip Code

PAYMENT BOND

THE STATE OF TEXAS §
§ KNOW ALL MEN BY THESE PRESENTS:
COUNTY OF WILLIAMSON §

That _____, of the City of _____, County of _____, and State of _____ as Principal, and _____ authorized under the laws of the State of Texas to act as Surety on Bonds for Principals, are held and firmly bound unto **THE CITY OF ROUND ROCK, (OWNER)**, and all subcontractors, workers, laborers, mechanics and suppliers as their interest may appear, all of whom shall have the right to sue upon this bond, in the penal sum of _____ Dollars ($ _____) for the payment whereof, well and truly be made the said Principal and Surety bind themselves and their heirs, administrators, executors, successors, and assigns, jointly and severally, by these presents:

WHEREAS, the Principal has entered into a certain written Agreement with the Owner, dated the _____ day of _____, 20___, to which Agreement is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein consisting of: Forest Creek Lift Station Rehabilitation

_____

_____(Name of the Project)

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said Principal shall well and truly pay all subcontractors, workers, laborers, mechanics, and suppliers, all monies to them owing by said Principals for subcontracts, work, labor, equipment, supplies and materials done and furnished for the construction of the improvements of said Agreement, then this obligation shall be and become null and void; otherwise to remain in full force and effect.

PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Chapter 2253, Texas Government code, as amended, and all liabilities on this bond shall be determined in accordance with the provisions of said Chapter 2253 to the same extent as if it were copied at length herein.

PAYMENT BOND (continued)

Surety, for value received, stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Agreement, or to the Work performed thereunder, or the plans, specifications or drawings accompanying the same shall in anywise affect it's 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.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this Instrument this _____ day of _____, 20___.

_____	_____
Principal	Surety
_____	_____
Printed Name	Printed Name
By: _____	By: _____
Title: _____	Title: _____
Address: _____	Address: _____
_____	_____

Resident Agent of Surety:

_____
Signature

_____
Printed Name

_____
Street Address

_____

CERTIFICATE OF LIABILITY INSURANCE

Date:_____

PRODUCER:

_____

_____

_____

Phone: E-mail:

INSURED:

_____

_____

_____

Phone: E-mail:

TDI number required. Please refer to the Texas Dept of Insurance website: http://www.tdi.state.tx.us/

	COMPANIES AFFORDING COVERAGE	TDI
A		
B		
C		
D		

THIS IS TO CERTIFY THAT the Insured named above is insured by the Companies listed above with respect to the business operations hereinafter described, for the types of insurance and in accordance with the provisions of the standard policies used by the companies, and further hereinafter described. Exceptions to the policies are noted below.

CO LTR	TYPE OF INSURANCE	POLICY NUMBER	EFFECTIVE DATE	EXPIRATION DATE			LIMITS
	GENERAL LIABILITY				GENERAL AGGREGATE	$	
					PRODUCTS-COMP/OP AGG.	$	
					PERSONAL & ADV. INJURY	$	
					EACH OCCURRENCE	$	
					FIRE DAMAGE (Any one fire)	$	
					MED. EXPENSE (Any one person)	$	
	AUTOMOBILE LIABILITY				COMBINED SINGLE LIMIT	$	
					BODILY INJURY (Per person)	$	
					BODILY INJURY (Per accident)	$	
					PROPERTY DAMAGE	$	
	EXCESS LIABILITY				EACH OCCURRENCE	$	
					AGGREGATE	$	
	WORKERS' COMPENSATION				STATUTORY LIMITS	$	
	AND EMPLOYERS' LIABILITY				EACH ACCIDENT	$	
					DISEASE - POLICY LIMIT	$	
					DISEASE - EACH EMPLOYEE	$	
	PROFESSIONAL LIABILITY						
	BUILDERS' RISK INSURANCE OR INSTALLATION INSURANCE						

DESCRIPTION OF OPERATIONS/LOCATIONS/VEHICLES/SPECIAL ITEMS/EXCEPTIONS

The City of Round Rock is named as additional insured with respect to all policies except 'Workers' Compensation and Employers' Liability' and 'Professional Liability'. Should any of the above described policies be cancelled or changed before the expiration date thereof, the issuing company will mail thirty (30) days written notice to the certificate holder named below.

CERTIFICATE HOLDER: City Manager
City of Round Rock
221 E. Main Street
Round Rock, Texas 78664

SIGNATURE OF AGENT LICENSED IN STATE OF TEXAS

_____

Typed Name: _____

License ID: _____

00700 GENERAL CONDITIONS

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GENERAL CONDITIONS

ARTICLE 1 - DEFINITIONS

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

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

1.2 Agreement - Prescribed form, referenced as Section 00500.

1.3 Alternative Dispute Resolution - The process by which a disputed Claim may be settled if the OWNER and the CONTRACTOR cannot reach an agreement between themselves, as an alternative to litigation.

1.4 Bid - Proposal of bidder on prescribed forms setting forth prices for performing the Work described in the Contract Documents.

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

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

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

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

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

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

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

1.12 Contract Documents – Invitation to Bid, Instructions to Bidders, General Conditions, Supplemental General Conditions, Special Conditions, Technical Specifications, Project Manual, Drawings, Addenda and Change Orders.

1.13 Contract Time - The number of days allowed for completion of the Work as defined by the Contract. When any period is referred to in days, it will be computed to exclude the first and include the last day of such period. A day of twenty-four (24) hours measured from midnight to the next midnight will constitute a day.

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

1.15 Drawings - Those portions of the Contract Documents which are graphic representations of the scope, extent and character of the Work to be furnished and performed by the CONTRACTOR and which have been

approved by the OWNER. Drawings may include plans, elevations, sections, details, schedules and diagrams. Shop Drawings are not Drawings as so defined.

1.16 Engineer/Architect (E/A) - The OWNER's design professional identified as such in the Contract. The titles of "Architect/Engineer," "Architect" and "Engineer" used in the Contract Documents shall be read the same as Engineer/Architect (E/A). Nothing contained in the Contract Documents shall create any contractual or agency relationship between E/A and the CONTRACTOR.

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

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

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

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

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

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

1.23 Legal Holidays

1.23.1 The following are recognized by the OWNER:

Holiday	*Date Observed*
New Year's Day	January 1
Martin Luther King, Jr.'s Birthday	Third Monday in January
President's Day	Third Monday in February
Memorial Day	Last Monday in May
Independence Day	July 4
Labor Day	First Monday in September
Veteran's Day	November 11
Thanksgiving Day	Fourth Thursday in November
Friday after Thanksgiving	Friday after Thanksgiving

Christmas Eve December 24

Christmas Day December 25

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

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

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

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

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

1.26 OWNER – The City of Round Rock, Texas, a municipal corporation, home-rule city and political subdivision organized and existing under the laws of the State of Texas, acting through the City Manager or his/her designee, officers, agents or employees to administer design and construction of the Project.

1.27 Owner's Representative - The designated representative of the OWNER.

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

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

1.30 Project Manual - That portion of the Contract Documents which may include the following: introductory information; bidding requirements, Contract forms and General and Supplemental General Conditions; General Requirements; Specifications; Drawings; Project Safety Manual; and Addenda.

1.31 Proposal – Proposal of Offeror, under Local Government Code §271.113 providing for alternative project delivery methods, on prescribed forms setting forth prices for performing the Work described in the Contract Documents.

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

1.33 Resident Project Representative - The authorized representative of E/A who may be assigned to the site or any part thereof.

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

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

1.36 Substantial Completion - The stage in the progress of the Work when the Work, or designated portions thereof, may still require minor modifications or adjustments but, in the OWNER's opinion, the Work has progressed to the point such that all parts of the Work under consideration are fully operational, as evidenced by a Certificate of Substantial Completion approved by the OWNER.

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

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

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

1.40 Supplemental General Conditions - The part of the Contract Documents which either amends or supplements the General Conditions. All General Conditions which are not so amended or so supplemented shall be considered as remaining in full force and effect.

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

1.42 Time Extension Request - An approved request for time extension on a form acceptable to the OWNER.

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

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

1.45 Working Times – Times of day(s) during which work may be performed. Unless authorized by Owner's Representative, all Work shall be performed between 7:00 a.m. and 6:00 p.m. on weekdays and, if previously authorized as provided for in paragraph 1.44 or paragraph 1.6 herein, as applicable, between 9:00 a.m. and 6:00 p.m. on Saturdays, Sundays or Legal Holidays. When the CONTRACTOR has been authorized to perform Work during hours outside Working Times, such hours shall be considered time worked on Working Day contracts. Notwithstanding the preceding, emergency work may be done without prior permission only as provided in paragraph 6.11.5 herein.

1.46 Written Notice - Written communication between the OWNER and the CONTRACTOR. Written Notice shall be deemed to have been duly served if delivered in person to Owner's Representative or to the CONTRACTOR's duly authorized representative, or if such Written Notice is delivered to or sent by registered or certified mail to the attention of Owner's Representative or to the CONTRACTOR's duly authorized representative at the last business address known to the party giving notice.

ARTICLE 2 - PRELIMINARY MATTERS

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

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

2.2 Copies of Documents:

The OWNER shall furnish to the CONTRACTOR two (2) copies of the Contract Documents unless otherwise specified.

2.3 Commencement of Contract Times; Notice to Proceed:

The Contract Time(s) will begin to run on the day indicated in the Notice to Proceed. Notice to Proceed will be given at any time within sixty (60) Calendar Days after the Execution Date of the Agreement, unless extended by written agreement of the parties.

2.4 Before Starting Construction:

2.4.1 No Work shall be done at the site prior to the preconstruction conference without the OWNER's approval. Before undertaking each part of the Work, the CONTRACTOR shall carefully study and compare the Contract Documents and check and verify pertinent figures shown thereon and all applicable field measurements. The CONTRACTOR shall promptly report in writing to Owner's Representative any conflict, error, ambiguity or discrepancy which the CONTRACTOR may discover and shall obtain a written interpretation or clarification from Owner's Representative before proceeding with any Work affected thereby. The CONTRACTOR shall be liable to the OWNER for failure to report any conflict, error, ambiguity or discrepancy in the Contract Documents of which the CONTRACTOR knew or reasonably should have known.

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

.1 a preliminary progress schedule indicating the times (number of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents, identifying when all Subcontractors will be utilized, and taking into consideration any limitations on Working Hours;

.2 a preliminary schedule of Shop Drawing and sample submittals;

.3 a preliminary schedule of values for all of the Work, subdivided into component parts in sufficient detail to serve as the basis for progress payments during construction. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work;

.4 a letter designating CONTRACTOR's Superintendent;

.5 a letter from the CONTRACTOR and Subcontractor(s) listing any salaried specialists;

.6 if applicable, a letter designating the "Competent Person(s)" on general safety and trench safety measures;

.7 if applicable, a trench safety system plan;

.8 if applicable, a plan illustrating proposed locations of temporary facilities;

.9 if applicable, a traffic control plan;

.10 a completed Non-Use of Asbestos Affidavit (Prior to Construction); and

.11 if applicable, a letter designating the Texas Registered Professional Land Surveyor for layout of the Work.

2.5 Preconstruction Conference:

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

2.6 Initially Acceptable Schedules:

Unless otherwise provided in the Contract Documents, the CONTRACTOR shall obtain approval of Owner's Representative on final versions of the schedules submitted in accordance with paragraph 2.4.2 before the first progress payment will be made to the CONTRACTOR. The progress schedule must provide for an orderly progression of the Work to completion within any specified Milestones and Contract Times. Acceptance of the schedule by Owner's Representative will neither impose on Owner's Representative responsibility for the sequencing, scheduling or progress of the Work nor interfere with or relieve the CONTRACTOR from the CONTRACTOR's full responsibility therefor. The CONTRACTOR's schedule of Shop Drawings and sample submissions must provide an arrangement agreeable to the parties for reviewing and processing the required submittals.

ARTICLE 3 - CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.1 Intent:

3.1.1 The intent of the Contract Documents is to include all information necessary for the proper execution and completion of the Work by the CONTRACTOR. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all. In cases of disagreement, the following order of precedence shall govern (top item receiving priority of interpretation):

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

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

3.2 Reporting and Resolving Discrepancies:

If, during the performance of the Work, the CONTRACTOR discovers any conflict, error, ambiguity or discrepancy within the Contract Documents or between the Contract Documents and any provisions of any such law or regulation applicable to the performance of the Work or of any such standard, specification, manual or code or instructions of any Supplier, the CONTRACTOR shall immediately report it to Owner's Representative in writing, and the CONTRACTOR shall not proceed with the Work affected thereby until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in paragraph 3.3.1 or paragraph 3.3.2. The CONTRACTOR shall be liable to the OWNER for failure to report any such conflict, error, ambiguity or discrepancy of which the CONTRACTOR knew or reasonably should have known.

3.3 Amending and Supplementing Contract Documents:

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

.1 Change Order.

.2 Change Directive.

.3 Time Extension Request.

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

.1 Field Order.

.**2** Review of a Shop Drawing or sample.

.3 Written interpretation or clarification.

3.4 Reuse of Documents Prohibited:

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

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

4.1 Availability of Lands:

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

4.2 Subsurface and Physical Conditions:

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

4.2.2 If conditions are encountered at the site which are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, that differ materially from those normally encountered in the type of work being performed under this Contract, then notice by the observing party shall be given to the other party promptly before conditions are disturbed and in no event later than seven (7) calendar days after first observance of the conditions. Owner's Representative will promptly investigate such conditions with E/A and, if they differ materially and cause an increase or decrease in the CONTRACTOR's cost of, or time required for, performance of any part of the Work, will

recommend an equitable adjustment in the Contract Amount or Contract Time, or both. If Owner's Representative determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the CONTRACTOR shall be notified in writing, stating the reasons. Any disputes arising from Owner's Representative's determination shall be resolved in accordance with Article 16.

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

4.2.4 The CONTRACTOR shall take reasonable precaution to avoid disturbing primitive records and antiquities of archaeological, paleontological or historical significance. No objects of this nature shall be disturbed without written permission of the OWNER and the Texas Department of Antiquities Protection. When such objects are uncovered unexpectedly, the CONTRACTOR shall stop all Work in close proximity and notify Owner's Representative and the Texas Department of Antiquities Protection of their presence and shall not disturb them until written permission and permit to do so is granted. All primitive rights and antiquities uncovered on the OWNER's property shall remain property of the State of Texas, the Texas Department of Antiquities Protection conforming to the Texas Natural Resources Code. If it is determined by the OWNER, in consultation with the Texas Department of Antiquities Protection, that exploration or excavation of primitive records or antiquities on Project site is necessary to avoid loss, the CONTRACTOR shall cooperate in salvage work attendant to preservation. If the Work stoppage or salvage work causes an increase in the CONTRACTOR's cost of, or time required for, performance of the Work, the Contract Amount and/or Contract Time may be equitably adjusted.

4.3 Reference Points:

Unless otherwise specified, the OWNER will furnish all reference points, benchmarks, survey monuments, and control points which, in the OWNER’s opinion, are suitable for laying out the Work. Such benchmarks and reference points will be placed at intervals not to exceed 1,500 feet.

All reference points, benchmarks, survey monuments and control points shall be carefully preserved by the CONTRACTOR by use of flags, laths or other appropriate measures and, in case of destruction or removal by the CONTRACTOR or its employees, such reference points, benchmarks, survey monuments, and control points shall be replaced by a Registered Professional Land Surveyor at the CONTRACTOR's expense. When reference points, benchmarks, survey monuments, or control points are in conflict with the Work, then reestablishment will be the OWNER’s responsibility during or upon completion of the Work.

4.4 Hazardous Materials:

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

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

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

ARTICLE 5 - BONDS AND INSURANCE

5.1 Surety and Insurance Companies:

All bonds and insurance required by the Contract Documents shall be obtained from solvent surety or insurance companies that are duly licensed by the State of Texas and authorized to issue bonds or insurance policies for the limits and coverages required by the Contract Documents. The bonds shall be in a form acceptable to the OWNER and shall be issued by a surety which complies with the requirements of Art. 7.19-1, Texas Insurance Code (1997) and which is otherwise acceptable to the OWNER.

OWNER may require the surety to obtain reinsurance for any portion of the risk that exceeds 10% of the surety's capital and surplus. For bonds exceeding $100,000, the surety must also hold a certificate of authority from the U.S. Secretary of the Treasury or have obtained reinsurance from a reinsurer that is authorized as a reinsurer in Texas and holds a certificate of authority from the U.S. Secretary of the Treasury.

5.2 Workers' Compensation Insurance Coverage:

5.2.1 Definitions:

.1 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 showing statutory workers' compensation insurance coverage for the person's or entity's employees providing services on the Project, for the duration of the Project.

.2 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 OWNER.

.3 Persons providing services on the Project ("subcontractor" herein) - 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, by way of illustration and not of 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.

5.2.2 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.

5.2.3 The OWNER will not execute the Contract prior to the CONTRACTOR providing all required certificates of coverage.

5.2.4 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 OWNER showing that coverage has been extended.

5.2.5 The CONTRACTOR shall obtain from each person providing services on the Project, and provide to the OWNER:

.1 a certificate of coverage, prior to that person beginning Work on the Project, so the OWNER will have on file certificates of coverage showing coverage for all persons providing services on the Project; and

.2 no later than seven (7) 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.

5.2.6 The CONTRACTOR shall retain all required certificates of coverage for the duration of the Project and for one (1) year thereafter.

5.2.7 The CONTRACTOR shall notify the OWNER in writing by certified mail or personal delivery within ten (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.

5.2.8 The CONTRACTOR shall post at its office or 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.

5.2.9 The CONTRACTOR shall contractually require each person with whom it contracts to provide services on a Project to:

.1 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;

.2 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;

.3 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;

.4 obtain from each other person with whom it contracts, and provide to the CONTRACTOR:

a) a certificate of coverage, prior to the other person beginning Work on the Project; and

b) 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;

.5 retain all required certificates of coverage on file for the duration of the Project and for one (1) year thereafter;

.6 notify the OWNER in writing by certified mail or personal delivery within ten (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

.7 contractually require each person with whom it contracts, to perform as required by paragraphs 5.2.9.1 - 5.2.9.7, with the certificates of coverage to be provided to the person for whom they are providing services.

5.2.10 By signing this Contract or providing or causing to be provided a certificate of coverage, the CONTRACTOR is representing to the OWNER 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.

5.2.11 The CONTRACTOR's failure to comply with any of these provisions is a breach of Contract by the CONTRACTOR which entitles the OWNER to declare the Contract void if the CONTRACTOR does not remedy the breach within ten (10) days after receipt of notice of breach from the OWNER.

5.3 Contractor Insurance Requirements:

For specific bond requirements and additional insurance requirements, refer to the Supplemental General Conditions.

5.3.1.1 General Requirements:

.1 CONTRACTOR shall carry insurance in the types and amounts indicated below for the duration of the Contract, which shall include items owned by OWNER in the care, custody and control of CONTRACTOR prior to and during construction and warranty period.

.2 CONTRACTOR must complete and forward the required Certificates of Insurance to OWNER before the Contract is executed as verification of coverage required below. CONTRACTOR shall not commence Work until the required insurance is obtained and until such insurance has been reviewed by OWNER. Approval of insurance by OWNER shall not relieve or decrease the liability of CONTRACTOR hereunder and shall not be construed to be a limitation of liability on the part of CONTRACTOR. CONTRACTOR must also complete and forward the required Certificates of Insurance to OWNER whenever a previously identified policy period has expired as verification of continuing coverage.

.3 CONTRACTOR's insurance coverage is to be written by companies licensed to do business in the State of Texas at the time the policies are issued and shall be written by companies with A.M. Best ratings of B+VII or better, except for hazardous material insurance which shall be written by companies with A.M. Best ratings of A- or better.

.4 All endorsements naming the OWNER as additional insured, waivers, and notices of cancellation endorsements as well as the Certificate of Insurance shall indicate: City of Round Rock, 221 E. Main St., Round Rock, Texas 78664.

.5 The "other" insurance clause shall not apply to the OWNER where the OWNER is an additional insured shown on any policy. It is intended that policies required in the Contract, covering both OWNER and CONTRACTOR, shall be considered primary coverage as applicable.

.6 If insurance policies are not written for amounts specified below, CONTRACTOR shall carry Umbrella or Excess Liability Insurance for any differences in amounts specified. If Excess Liability Insurance is provided, it shall follow the form of the primary coverage.

.7 OWNER shall be entitled, upon request and without expense, to receive certified copies of policies and endorsements thereto and may make any reasonable requests for deletion or revision or modification of particular policy terms, conditions, limitations, or exclusions except where policy provisions are established by law or regulations binding upon either of the parties hereto or the underwriter on any such policies.

.8 OWNER reserves the right to review the insurance requirements set forth during the effective period of this Contract and to make reasonable adjustments to insurance coverage, limits, and exclusions when deemed necessary and prudent by OWNER based upon changes in statutory law,

court decisions, the claims history of the industry or financial condition of the insurance company as well as CONTRACTOR.

.9 CONTRACTOR shall not cause any insurance to be canceled nor permit any insurance to lapse during the term of the Contract or as required in the Contract.

.10 CONTRACTOR shall be responsible for premiums, deductibles and self-insured retentions, if any, stated in policies. All deductibles or self-insured retentions shall be disclosed on the Certificate of Insurance.

.11 CONTRACTOR shall provide OWNER thirty (30) days written notice of erosion of the aggregate limits below occurrence limits for all applicable coverages indicted within the Contract.

.12 If OWNER-owned property is being transported or stored off-site by CONTRACTOR, then the appropriate property policy will be endorsed for transit and storage in an amount sufficient to protect OWNER's property.

.13 The insurance coverages required under this contract are required minimums and are not intended to limit the responsibility or liability of CONTRACTOR.

5.3.1.2 Business Automobile Liability Insurance.

Provide coverage for all owned, non-owned and hired vehicles. The policy shall contain the following endorsements in favor of OWNER:

a) Waiver of Subrogation endorsement TE 2046A;

b) 30 day Notice of Cancellation endorsement TE 0202A; and

c) Additional Insured endorsement TE 9901 B.

Provide coverage in the following types and amounts:

.1 A minimum combined single limit of $500,000 per occurrence for bodily injury and property damage. Alternate acceptable limits are $250,000 bodily injury per person, $500,000 bodily injury per occurrence and at least $100,000 property damage liability each accident.

5.3.1.3 Workers' Compensation and Employers' Liability Insurance:

Coverage shall be consistent with statutory benefits outlined in the Texas Workers' Compensation Act (Section 401). CONTRACTOR shall assure compliance with this Statute by submitting two (2) copies of a standard certificate of coverage (e.g. ACCORD form) to Owner's Representative for every person providing services on the Project as acceptable proof of coverage. The required Certificate of Insurance must be presented as evidence of coverage for CONTRACTOR. Workers' Compensation Insurance coverage written by the Texas Workers Compensation Fund is acceptable to OWNER. CONTRACTOR's policy shall apply to the State of Texas and include these endorsements in favor of OWNER:

a) Waiver of Subrogation, form WC 420304; and

b) 30 day Notice of Cancellation, form WC 420601.

The minimum policy limits for Employers' Liability Insurance coverage shall be as follows:

.1 $100,000 bodily injury per accident, $500,000 bodily injury by disease policy limit and $100,000 bodily injury by disease each employee.

5.3.1.4 Commercial General Liability Insurance.

The Policy shall contain the following provisions:

a) Blanket contractual liability coverage for liability assumed under the Contract and all contracts relative to this Project.

b) Completed Operations/Products Liability for the duration of the warranty period.

c) Explosion, Collapse and Underground (X, C & U) coverage.

d) Independent Contractors coverage.

e) Aggregate limits of insurance per project, endorsement CG 2503.

f) OWNER listed as an additional insured, endorsement CG 2010.

g) 30 day notice of cancellation in favor of OWNER, endorsement CG 0205.

h) Waiver of Transfer of Recovery Against Others in favor of OWNER, endorsement CG 2404.

Provide coverages A&B with minimum limits as follows:

.1 A combined bodily injury and property damage limit of $500,000 per occurrence.

5.3.1.5 Builders' Risk Insurance.

CONTRACTOR shall maintain Builders' Risk Insurance or Installation Insurance on an all risk physical loss form in the Contract Amount. Coverage shall continue until the Work is accepted by OWNER. OWNER shall be a loss payee on the policy. If off site storage is permitted, coverage shall include transit and storage in an amount sufficient to protect property being transported or stored.

5.4 Bonds:

5.4.1 General.

.1 Bonds, when required, shall be executed on forms furnished by or acceptable to OWNER. All bonds signed by an agent must be accompanied by a certified copy of such agent's authority to act.

.2 If the surety on any bond furnished by CONTRACTOR is declared bankrupt or becomes insolvent or its right to do business is terminated in the State of Texas or it ceases to meet the requirements of the preceding paragraph, CONTRACTOR shall within ten (10) days thereafter substitute another bond and surety, both of which must be acceptable to OWNER.

.3 When Performance Bonds and/or Payment Bonds are required, each shall be issued in an amount of one hundred percent (100%) of the Contract Amount as security for the faithful performance and/or payment of all CONTRACTOR's obligations under the Contract Documents. Performance Bonds and Payment Bonds shall be issued by a solvent surety company authorized to do business in the State of Texas, and shall meet any other requirements established by law or by OWNER pursuant to applicable law. Any surety duly authorized to do business in Texas may write Performance and Payment Bonds on a project without reinsurance to the limit of 10 percent of its capital and surplus. Such a surety must reinsure any obligations over 10 percent.

5.4.2 Performance Bond.

.1 If the Contract Amount exceeds $100,000, CONTRACTOR shall furnish OWNER with a Performance Bond in the form set out by OWNER.

.2 If the Contract Amount exceeds $25,000 but is less than or equal to $100,000, CONTRACTOR shall furnish OWNER with a Performance Bond in the form set out by OWNER, unless the original Contract Time is 60 Calendar Days/40 Working Days or less, in which case CONTRACTOR can agree to the following terms and conditions for payment in lieu of providing a Performance Bond: no money will be paid to CONTRACTOR until completion and acceptance of the Work by OWNER; CONTRACTOR shall be entitled to receive 95% of the Contract Amount following Final Completion, and the remaining 5% of the Contract Amount following the one year warranty period.

.3 If the Contract Amount is less than or equal to $25,000, CONTRACTOR will not be required to furnish a Performance Bond; provided that no money will be paid to CONTRACTOR until completion and acceptance of the Work by OWNER under the following terms and conditions: CONTRACTOR shall be entitled to receive 95% of the Contract Amount following Final Completion, and the remaining 5% of the Contract Amount following the one year warranty period.

.4 If a Performance Bond is required to be furnished, it shall extend for the one year warranty period.

5.4.3 Payment Bond.

.1 If the Contract Amount exceeds $25,000, CONTRACTOR shall furnish OWNER with a Payment Bond in the form set out by OWNER.

.2 If the Contract Amount is less than or equal to $25,000, CONTRACTOR will not be required to furnish a Payment Bond; provided that no money will be paid to CONTRACTOR until completion and acceptance of the Work by OWNER under the terms and conditions specified in paragraph 5.4.2.3.

ARTICLE 6 - CONTRACTOR'S RESPONSIBILITIES

6.1 Supervision and Superintendence:

6.1.1 The CONTRACTOR shall supervise, inspect and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Unless otherwise directed by the OWNER in the Contract Documents, the CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences and procedures of construction. The CONTRACTOR shall be responsible to see that the completed Work complies accurately with the Contract Documents.

6.1.2 The CONTRACTOR shall have an English-speaking, competent Superintendent on the Work at all times that work is in progress. Upon request of Owner's Representative, the CONTRACTOR shall present the resume of the proposed Superintendent to Owner's Representative showing evidence of experience and successful superintendence and direction of work of a similar scale and complexity. If, in the opinion of Owner's Representative, the proposed Superintendent does not indicate sufficient experience in line with the Work, he/she will not be allowed to be the designated Superintendent for the Work. The Superintendent shall not be replaced without Written Notice to Owner's Representative. If the CONTRACTOR deems it necessary to replace the Superintendent, the CONTRACTOR shall provide the necessary information for approval, as stated above, on the proposed new Superintendent. A qualified substitute Superintendent may be designated in the event that the designated Superintendent is temporarily away from the Work, but not to exceed a time limit acceptable to Owner's Representative. The CONTRACTOR shall replace the Superintendent upon the OWNER's request in the event the Superintendent is unable to perform to the OWNER's satisfaction. The Superintendent will be the CONTRACTOR's representative on the Work and shall have the authority to act on behalf of the CONTRACTOR. All communications given to the Superintendent shall be as binding as if given to the CONTRACTOR. Either the CONTRACTOR or the

Superintendent shall provide an emergency and home telephone number at which one or the other may be reached if necessary when work is not in progress.

6.2 Labor, Materials and Equipment:

6.2.1 The CONTRACTOR agrees to employ only orderly and competent workers, skillful in performance of the type of Work required under this Contract. The CONTRACTOR, Subcontractors, Sub-subcontractors, and their employees may not use or possess any firearms, alcoholic or other intoxicating beverages, illegal drugs or controlled substances while on the job or on the OWNER's property, nor may such workers be intoxicated, or under the influence of alcohol or drugs, on the job. If the OWNER or Owner's Representative notifies the CONTRACTOR that any worker is incompetent, disorderly or disobedient, has knowingly or repeatedly violated safety regulations, has possessed any firearms, or has possessed or was under the influence of alcohol or drugs on the job, the CONTRACTOR shall immediately remove such worker from performing Contract Work, and may not employ such worker again on Contract Work without the OWNER's prior written consent. The CONTRACTOR shall at all times maintain good discipline and order on or off the site in all matters pertaining to the Project. The CONTRACTOR shall pay workers no less than the wage rates established in Section 00900, and maintain weekly payroll reports as evidence thereof.

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

6.2.3 All materials and equipment shall be of good quality and new (including new products made of recycled materials), except as otherwise provided in the Contract Documents. If required by Owner's Representative, the CONTRACTOR shall furnish satisfactory evidence (reports of required tests, manufacturer's certificates of compliance with material requirements, mill reports, etc.) as to the kind, quantity and quality of materials and equipment. All materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with instructions of the applicable Supplier, except as otherwise provided in the Contract Documents.

6.2.4 Substitutes and "Approved Equal" Items:

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

.1 "Approved Equal": If, in the OWNER's sole discretion, an item of material or an item of equipment proposed by the CONTRACTOR is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by the OWNER as an "approved equal" item, in which case review of the proposed item may, in the OWNER's sole discretion, be accomplished without compliance with some or all of the requirements for evaluation of proposed substitute items. The CONTRACTOR shall provide the OWNER with the documentation required for the OWNER to make its determination.

.2 Substitute Items: If, in the OWNER's sole discretion, an item of material or an item of equipment proposed by the CONTRACTOR does not qualify as an "approved equal" item under paragraph 6.2.4.1.1, then it will be considered a proposed substitute item. The CONTRACTOR shall submit sufficient information to allow the OWNER to determine that the item of material or item of equipment proposed is essentially equivalent to that named and a substitute therefor.

6.2.4.2 Substitute Construction Methods and Procedures: If a specific means, method, technique, sequence or procedure of construction is shown or indicated in and expressly required by the Contract Documents, the CONTRACTOR may with prior approval of the OWNER furnish or utilize a substitute means, method, technique,

sequence, or procedure of construction. The CONTRACTOR shall submit sufficient information to Owner's Representative to allow the OWNER, in the OWNER's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents.

6.2.4.3 OWNER's Evaluation: The OWNER will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to paragraph 6.2.4.1.1 and paragraph 6.2.4.1.2. The OWNER will be the sole judge of acceptability. No "approved equal" or substitute shall be ordered, installed, or utilized until the OWNER's review is complete, which will be evidenced by either a Change Order or completion of the Shop Drawing review procedure. The OWNER may require the CONTRACTOR to furnish at the CONTRACTOR's expense a special performance guarantee or other surety bond with respect to any "approved equal" or substitute. The OWNER shall not be responsible for any delay due to review time for any "approved equal" or substitute.

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

6.2.5 The CONTRACTOR agrees to assign to the OWNER any rights it may have to bring antitrust suits against its Suppliers for overcharges on materials incorporated in the Project growing out of illegal price fixing agreements. The CONTRACTOR further agrees to cooperate with the OWNER should the OWNER wish to prosecute suits against Suppliers for illegal price fixing.

6.3 Progress Schedule:

Unless otherwise directed, the CONTRACTOR shall adhere to the progress schedule established in accordance with paragraph 2.6 as it may be adjusted from time to time as provided below:

.1 The CONTRACTOR shall submit to Owner's Representative for acceptance proposed adjustments in the progress schedule that will not change the Contract Times or Milestones. Such adjustments will conform generally to the progress schedule then in effect.

.2 Proposed adjustments in the progress schedule that will change the Contract Times or Milestones shall be submitted in accordance with the requirements of Article 12. Such adjustments may only be made by a Change Order or Time Extension Request in accordance with Article 12.

6.4 Concerning Subcontractors, Suppliers and Others:

6.4.1 Assignment: The CONTRACTOR agrees to retain direct control of and give direct attention to the fulfillment of this Contract. The CONTRACTOR agrees not to, by Power of Attorney or otherwise, assign said Contract without the prior written consent of the OWNER.

6.4.2 Award of Subcontracts for Portions of the Work: The CONTRACTOR shall not employ any Subcontractor, Supplier or other person or organization, whether initially or as a substitute, against whom the OWNER may have reasonable objection. The CONTRACTOR must provide the OWNER with a list of all Subcontractors, Suppliers, or other persons or organizations it will use in the Work, and such list must be provided prior to the preconstruction conference. Should the OWNER have objections, the OWNER will communicate such objections by Written Notice. If the OWNER requires a change without good cause of any Subcontractor, person or organization previously accepted by OWNER, the Contract Amount may be increased or decreased by the difference in the cost occasioned by any such change, and an appropriate Change Order shall be issued. The CONTRACTOR shall not substitute any Subcontractor, person or organization that has been accepted by the OWNER, unless the substitute has been accepted in writing by the OWNER. No acceptance by the OWNER of any Subcontractor, Supplier or other person or organization shall constitute a waiver of any right of the OWNER to reject defective Work.

6.4.3 The CONTRACTOR shall enter into written agreements with all Subcontractors and Suppliers which specifically bind the Subcontractors or Suppliers to the applicable terms and conditions of the Contract Documents for the benefit of the OWNER and E/A. The OWNER reserves the right to specify that certain requirements shall be adhered to by all Subcontractors and Sub-subcontractors as indicated in other portions of the Contract

Documents and these requirements shall be made a portion of the agreement between the CONTRACTOR and Subcontractor or Supplier.

6.4.4 The CONTRACTOR shall be fully responsible to the OWNER for all acts and omissions of the Subcontractors, Suppliers and other persons and organizations performing or furnishing any of the Work under a direct or indirect contract with the CONTRACTOR just as the CONTRACTOR is responsible for the CONTRACTOR's own acts and omissions. Nothing in the Contract Documents shall create for the benefit of any such Subcontractor, Supplier or other person or organization any contractual relationship between the OWNER and any such Subcontractor, Supplier or other person or organization, nor shall it create any obligation on the part of the OWNER or E/A to pay or to see to the payment of any amounts due any such Subcontractor, Supplier or other person or organization except as may otherwise be required by laws and regulations.

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

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

6.4.7 The CONTRACTOR shall pay each Subcontractor and Supplier their appropriate share of payments made to the CONTRACTOR not later than ten (10) Calendar Days after the CONTRACTOR’s receipt of payment from the OWNER.

6.5 Patent Fees and Royalties:

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

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

6.5.3 The CONTRACTOR shall defend all suits or claims for infringement of any patent or copyright and shall save the OWNER harmless from any loss or liability, direct or indirect, arising with respect to the CONTRACTOR's process in the formulation of its bid or the performance of the Work or otherwise arising in connection therewith. The OWNER reserves the right to provide its own defense to any suit or claim of infringement of any patent or copyright in which event the CONTRACTOR shall indemnify and save harmless the OWNER from all costs and expenses of such defense as well as satisfaction of all judgments entered against the OWNER.

6.5.4 The OWNER shall have the right to stop the Work and/or terminate this Agreement at any time in the event the CONTRACTOR fails to disclose to the OWNER that the CONTRACTOR's work methodology includes the use of any infringing design, device, material or process.

6.6 Permits, Fees:

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

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

.1 Site Development Permit.

.2 Building Permit(s).

.3 Texas Department of Transportation permit for work in State rights-of-way.

.4 Railroad Utility License Agreement.

6.7 Laws and Regulations:

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

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

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

6.8 Taxes:

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

6.8.2 The OWNER is an exempt organization as defined by Chapter 11 of the Property Tax Code of Texas and is thereby exempt from payment of Sales Tax under Chapter 151, Limited Use Sales, Excise and Use Tax, Texas Tax Code, and Article 1066 (C), Local Sales and Use Tax Act, Revised Civil Statutes of Texas.

6.9 Use of Premises:

6.9.1 The CONTRACTOR shall confine construction equipment, the storage of materials and equipment and the operations of workers to the site and land and areas identified in and permitted by the Contract Documents and other land and areas permitted by laws and regulations, rights-of-way, permits and easements, and shall not unreasonably encumber the premises with construction equipment or other materials or equipment. The CONTRACTOR shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof or of any adjacent land or areas, resulting from the performance of the Work. Should any claim be made by any such owner or occupant because of the performance of the Work, the CONTRACTOR shall promptly settle with such other party by negotiation or otherwise resolve the claim by dispute resolution proceeding or at law. The CONTRACTOR shall indemnify, defend and hold harmless the OWNER, E/A, E/A's consultants and anyone directly or indirectly employed by any of them from and against all claims, costs, losses and damages (including court costs and reasonable attorneys' fees) arising out of or resulting from any claim or action, legal or equitable, brought by any such owner or occupant against the OWNER, E/A or any other party indemnified hereunder to the extent caused by or based upon performance of the Work or failure to perform the Work.

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

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

6.10 Record Documents:

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

6.11 Safety and Protection:

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

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

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

.3 other property at the site or adjacent thereto, including but not limited to, trees, shrubs, lawns, walks, pavements, roadways, structures, utilities and underground facilities not designated for removal, relocation or replacement in the course of construction.

6.11.2 The CONTRACTOR shall comply with all applicable laws and regulations of any public body having jurisdiction for safety of persons or property or to protect them from damage, injury or loss; and shall erect and maintain all necessary safeguards for such safety and protection. The CONTRACTOR shall notify owners of adjacent property and of underground facilities, and utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation and replacement of their property. All damage, injury or loss to any property referred to in paragraph 6.11.1.2 and paragraph 6.11.1.3 caused, directly or indirectly, in whole or in part, by the CONTRACTOR, Subcontractor, Supplier or any person or organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them may be liable, shall be remedied by the CONTRACTOR (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of the OWNER, or E/A, or E/A's consultant or anyone employed by any of them or anyone whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the faults or negligence of the CONTRACTOR or any Subcontractor, Supplier or other person or organization directly or indirectly employed by any of them). The CONTRACTOR's duties and responsibilities for safety and protection of the Work shall continue until such time as all the Work is completed and Owner's Representative has issued a notice to the OWNER and the CONTRACTOR in accordance with Article 14 that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

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

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

6.11.5 Emergencies:

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

6.11.5.2 Authorized agents of the CONTRACTOR shall respond immediately to call-out at any time of any day or night when circumstances warrant the presence on Project site of the CONTRACTOR or its agent to protect the Work or adjacent property from damage, restriction or limitation or to take such action or measures pertaining to the Work as may be necessary to provide for the safety of the public. Should the CONTRACTOR and/or its agent fail to respond and take action to alleviate such an emergency situation, the OWNER may direct other forces to take action as necessary to remedy the emergency condition, and the OWNER will deduct any cost of such remedial action from the funds due to the CONTRACTOR under this Contract.

6.11.5.3 In the event there is an accident involving injury to any individual on or near the Work, the CONTRACTOR shall notify Owner's Representative within twenty-four (24) hours of the event and shall be responsible for recording the location of the event and the circumstances surrounding the event through photographs, interviewing witnesses, obtaining medical reports and other documentation that describes the event. Copies of such documentation shall be provided to Owner's Representative, for the OWNER's and E/A's records, within forty-eight (48) hours of the event.

6.12 Continuing the Work:

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

6.13 CONTRACTOR's General Warranty and Guarantee:

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

.1 abuse, modification or improper maintenance or operation by persons other than the CONTRACTOR, Subcontractors or Suppliers; or

.2 normal wear and tear under normal usage.

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

.1 observations by Owner's Representative and/or E/A;

.2 recommendation of any progress or final payment by Owner's Representative;

.3 the issuance of a certificate of Substantial Completion or any payment by the OWNER to the CONTRACTOR under the Contract Documents;

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

.5 any acceptance by the OWNER or any failure to do so;

.6 any review of a Shop Drawing or sample submittal;

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

.8 any correction of defective Work by the OWNER.

6.14 Indemnification:

6.14.1 The CONTRACTOR shall defend, indemnify and hold harmless the OWNER, E/A, E/A's consultants and subconsultants and their respective officers, directors, partners, employees, agents and other consultants and any of them from and against all claims, costs, losses and damages (including but not limited to all fees and charges of engineers, architects, attorneys and other professionals and all court or other dispute resolution costs) arising out of or resulting from the performance of the Work, provided that any such claim, cost, loss or damage:

.1 is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, and

.2 is caused in whole or in part by any negligent act or omission of the CONTRACTOR, any Subcontractor, any Supplier, any person or organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them may be liable, regardless of whether or not caused in part by any negligence or omission of a person or entity indemnified hereunder or whether liability is imposed upon such indemnified party by laws and regulations regardless of the negligence of any such person or entity.

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

6.14.3 The obligations of the CONTRACTOR under paragraph 6.14.1 shall not extend to the liability of the OWNER, E/A, E/A's consultants, and their officers, directors, partners, employees or agents caused primarily by negligent preparation of maps, drawings, surveys, designs or specifications upon which is placed the applicable state-authorized design professional seal of the OWNER’s, E/A's or E/A's consultant's officers, directors, partners, employees or agents.

6.14.4 In the event the CONTRACTOR fails to follow the OWNER's directives concerning use of the site, scheduling or course of construction, or engages in other conduct which proximately causes damage to property based on inverse condemnation or otherwise, then and in that event, the CONTRACTOR shall indemnify the OWNER against all costs resulting from such claims.

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

6.15 Survival of Obligations:

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

6.16 Losses from Natural Causes:

Unless otherwise specified, all loss or damage to the CONTRACTOR arising out of the nature of the Work to be done or from action of the elements, floods or from unforeseeable circumstances in prosecution of the Work or from unusual obstructions or difficulties which may be encountered in prosecution of the Work, shall be sustained and borne by the CONTRACTOR at its own cost and expense.

6.17 Notice of Claim:

Should the CONTRACTOR suffer injury or damage to person or property because of any error, omission or act of the OWNER or of any of the OWNER's employees or agents or others for whose acts the OWNER is liable, a Claim will be made to the other party within thirty (30) calendar days of the event giving rise to such injury or damage. The provisions of this paragraph 6.17 shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitations or statute of repose.

6.18 Liquidated Damages:

At set forth in the Agreement, paragraph 1.2, the CONTRACTOR or its Surety shall be liable for Liquidated Damages for the CONTRACTOR’s failure to timely complete the Work or any portion thereof within the Contract Time. See Supplemental Conditions for amount of Liquidated Damages.

ARTICLE 7 - OTHER WORK

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

7.2 The CONTRACTOR shall afford other contractors who are in a contract with the OWNER and each utility owner (and the OWNER, if the OWNER is performing the additional work with the OWNER's employees) proper and safe access to the site and a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work and shall properly connect and coordinate the Work with theirs. Unless otherwise provided in the Contract Documents, the CONTRACTOR shall do all cutting, fitting and patching of the Work that may be required to make its several parts come together properly and integrate with such other work. The CONTRACTOR shall not endanger any work of others by cutting, excavating or otherwise altering their work and will only cut or alter their work with the written consent of Owner's Representative and the other contractors whose work will be affected. The CONTRACTOR shall promptly remedy damage wrongfully caused by the CONTRACTOR to completed or partially completed construction or to property of the OWNER or separate contractors.

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

7.4 The OWNER shall provide for coordination of the activities of the OWNER's own forces and of each separate contractor with the Work of the CONTRACTOR, who shall cooperate with them. The CONTRACTOR shall participate with other separate contractors and Owner's Representative in reviewing their construction schedules when directed to do so. The CONTRACTOR shall make any revisions to the construction schedule

deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the CONTRACTOR, separate contractors and the OWNER until subsequently revised.

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

ARTICLE 8 - OWNER'S RESPONSIBILITIES

8.1 Prior to the start of construction, the OWNER will designate in writing a person or entity to act as Owner's Representative during construction. Except as otherwise provided in these General Conditions, the OWNER shall issue all communications to the CONTRACTOR through Owner's Representative.

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

8.3 The OWNER is not responsible for the acts or omissions of the CONTRACTOR, or of any Subcontractor, any Supplier, or of any other person or organization performing or furnishing any of the Work.

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

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

8.6 Notice of Claim:

Should the OWNER suffer injury or damage to person or property because of any error, omission or act of the CONTRACTOR or of any of the CONTRACTOR's employees or agents or others for whose acts the CONTRACTOR is liable, a Claim will be made to the other party within thirty (30) calendar days of the event giving rise to such injury or damage. The provisions of this paragraph 8.6 shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitations or statute of repose.

ARTICLE 9 - ENGINEER/ARCHITECT'S STATUS DURING CONSTRUCTION

9.1 E/A's Authority and Responsibilities:

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

9.1.2 E/A will not supervise, direct, control or have authority over or be responsible for the CONTRACTOR's means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto. E/A is not responsible for any failure of the CONTRACTOR to comply with laws and regulations applicable to the furnishing or performing the Work. E/A is not responsible for the CONTRACTOR's failure to perform or furnish the Work in accordance with the Contract Documents. Failure or omission of E/A to discover, or

object to or condemn any defective Work or material shall not release the CONTRACTOR from the obligation to properly and fully perform the Contract.

9.1.3 E/A is not responsible for the acts or omissions of the CONTRACTOR, or of any Subcontractor, any Supplier, or of any other person or organization performing or furnishing any of the Work.

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

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

9.2 E/A as Owner's Representative:

9.2.1 E/A may be designated as Owner's Representative under paragraph 8.1.

9.3 Visits to Site:

If the OWNER so directs, E/A will make visits to the site at intervals appropriate to the various stages of construction as is necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of the CONTRACTOR's executed Work. Based on information obtained during such visits and observations, E/A will endeavor for the benefit of the OWNER to determine if the Work is proceeding in accordance with the Contract Documents. E/A will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. E/A's efforts will be directed toward providing for the OWNER a greater degree of confidence that the completed Work will conform to the Contract Documents. On the basis of such visits and on-site observations, E/A will keep the OWNER informed of the progress of the Work and will endeavor to guard the OWNER against defective Work. E/A's visits and on-site observations are subject to all the limitations on E/A's authority and responsibility set forth in paragraph 9.1.

9.4 Project Representative:

If the OWNER and E/A agree, E/A will furnish a Resident Project Representative to assist E/A in providing more continuous observation of the Work. The responsibilities and authority and limitations of any such Resident Project Representative and assistants will be as provided in paragraph 9.1 and in the Supplemental General Conditions. The OWNER may designate another representative or agent to represent the OWNER at the site who is not E/A, E/A's consultant, agent or employee.

9.5 Clarifications and Interpretations:

E/A may determine that written clarifications or interpretations of the requirements of the Contract Documents (in the form of drawings or otherwise) are necessary. Such written clarifications or interpretations will be consistent with the intent of and reasonably inferable from the Contract Documents, will be issued with reasonable promptness by Owner's Representative and will be binding on the OWNER and the CONTRACTOR. If the OWNER or the CONTRACTOR believes that a written clarification or interpretation justifies an adjustment in the Contract Amount or the Contract Times, the OWNER or the CONTRACTOR may make a Claim therefor as provided in Article 11 or Article 12.

9.6 Rejecting Defective Work:

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

ARTICLE 10 - CHANGES IN THE WORK

10.1 Changes:

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

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

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

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

10.1.5 If notice of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Amount or Contract Times) is required by the provisions of any Bond to be given to a surety, the giving of any such notice will be the CONTRACTOR's responsibility, and the amount of each applicable Bond will be adjusted accordingly.

10.2 Change Orders:

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

.1 a change in the Work;

.2 the amount of the adjustment in the Contract Amount, if any; and

.3 the extent of the adjustment in the Contract Time, if any.

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

10.3 Change Directives:

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

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

10.3.3 A Change Directive shall be recorded later by preparation and execution of an appropriate Change Order.

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

10.4 Field Order:

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

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

10.5 No Damages for Delay:

The CONTRACTOR shall receive no compensation for delays or hindrances to the Work. If delay is caused by specific orders given by the OWNER to stop work or by performance of extra Work or by failure of the OWNER to provide information, access to the work, material or necessary instructions for carrying on the Work, then such delay will entitle the CONTRACTOR to an equivalent extension of time, the CONTRACTOR's application for which shall, however, be subject to approval of the OWNER. No such extension of time shall release the CONTRACTOR or surety on its performance bond from all the CONTRACTOR's obligations hereunder which shall remain in full force until discharge of the Contract.

ARTICLE 11 - CHANGE OF CONTRACT AMOUNT

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

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

11.3 The Contract Amount shall only be changed by a Change Order. Any claim for an adjustment in the Contract Amount shall be made by Written Notice delivered by the party making the Claim to the other party promptly (but in no event later than thirty (30) calendar days) after the start of the occurrence or event giving rise to the Claim and stating the general nature of the Claim. Notice of the amount of the Claim with supporting data shall be delivered within thirty (30) calendar days after Written Notice of Claim is delivered by claimant, and shall represent that the adjustment claimed covers all known amounts to which claimant is entitled as a result of said occurrence or event. If the OWNER and the CONTRACTOR cannot otherwise agree, all Claims for adjustment in the Contract Amount shall be determined as set out in Article 16.

11.4 Determination of Value of Work:

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

.1 by application of unit prices contained in the Contract Documents to the quantities of the items involved.

.2 by a mutually agreed lump sum properly itemized and supported by sufficient substantiating data to permit evaluation.

.3 by cost of Work plus the CONTRACTOR's fee for all overhead costs and profit (determined as provided in paragraph 11.5).

11.4.2 Before using the method described in paragraph 11.4.1.3, the OWNER and the CONTRACTOR agree to negotiate a Change Order using the methods identified in paragraph 11.4.1.1 and paragraph 11.4.1.2, as appropriate, to determine the adjustment in the Contract Amount.

11.5 Cost of Work:

If neither of the methods defined in paragraph 11.4.1.1 or paragraph 11.4.1.2 can be agreed upon before a change in the Work is commenced which will result in an adjustment in the Contract Amount, then the change in the Work will be performed by Change Directive and payment will be made as follows:

.1 For all personnel, the CONTRACTOR will receive the rate or wage specified in the prevailing wage rates established in Section 00900 for each hour that said personnel are actually engaged in such Work, to which will be added an amount equal to twenty-five percent (25%) of the sum thereof as compensation for the CONTRACTOR's and any affected Subcontractor's total overhead and profit. No separate charge will be made by the CONTRACTOR for organization or overhead expenses. For the cost of premiums on public liability insurance, workers' compensation insurance, social security and unemployment insurance, an amount equal to fifty-five percent (55%) of the wages paid personnel, excluding the twenty-five (25%) compensation provided above, will be paid to the CONTRACTOR. The actual cost of the CONTRACTOR's bond(s) on the extra Work will be paid based on invoices from surety. No charge for superintendence will be made unless considered necessary and ordered by the OWNER.

.2 The CONTRACTOR will receive the actual cost, including freight charges, of the materials used on such Work, to which costs will be added a sum equal to twenty-five percent (25%) thereof as compensation for the CONTRACTOR's and any affected Subcontractor's total overhead and profit. In case material invoices indicate a discount may be taken, the actual cost will be the invoice price minus the discount.

.3 For machinery, trucks, power tools, or other similar equipment agreed to be necessary by the OWNER and the CONTRACTOR, the OWNER will allow the CONTRACTOR the rate as given in the latest edition of the Associated General Contractors of America "Contractor's Equipment Cost Guide" as published by Dataquest for each hour that said tools or equipment are in use on such work, which rate includes the cost of fuel, lubricants and repairs. No additional compensation will be allowed on the equipment for the CONTRACTOR's overhead and profit.

.4 The compensation, as herein provided for, shall be received by the CONTRACTOR and any affected Subcontractor as payment in full for work done by Change Directive and will include use of small tools, and total overhead expense and profit. The CONTRACTOR and the Owner's Representative shall compare records of work done by Change Directive at the end of each day. Copies of these records will be made upon forms provided for this purpose by the OWNER and signed by both Owner's Representative and the CONTRACTOR, with one (1) copy being retained by the OWNER and one (1) by the CONTRACTOR. Refusal by the CONTRACTOR to sign these records within two (2) working days of presentation does not invalidate the accuracy of the record.

11.6 Unit Price Work:

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

11.6.2 When "plan quantity" is indicated for a bid item, the CONTRACTOR shall be paid the amount specified in the Contract Documents without any measurements.

11.6.3 Each unit price will be deemed to include an amount considered by the CONTRACTOR to be adequate to cover the CONTRACTOR's overhead and profit for each separately identified item.

11.6.4 A Major Item is any individual bid item in the Bid that has a total cost equal to or greater than five percent (5%) of the original Contract Amount or $50,000, whichever is greater, computed on the basis of bid quantities and Contract unit prices.

11.6.5 The OWNER or the CONTRACTOR may make a Claim for an adjustment in the Contract Amount in accordance with Article 11 if:

.1 the actual quantity of any Major Item should become as much as twenty percent (20%) more than or twenty percent (20%) less than in the Bid; or

.2 The CONTRACTOR presents proper documentation contesting the accuracy of "plan quantity," and Owner's Representative verifies quantity and determines original quantity is in error by five percent (5%) or more.

11.6.6 Right to Verify Information: The CONTRACTOR agrees that any designated representative of the OWNER shall have the right to examine the CONTRACTOR's records to verify the accuracy and appropriateness of the pricing data used to price change proposals. Even after a Change Order Proposal has been approved, the CONTRACTOR agrees that if the OWNER later determines the cost and pricing data submitted was inaccurate, incomplete, not current or not in compliance with the terms of this Agreement regarding pricing of change orders, then an appropriate contract price reduction will be made.

11.6.7 Pricing Information Requirements: The CONTRACTOR agrees to provide and require all subcontractors to provide a breakdown of allowable labor and labor burden cost information as outlined herein. This information will be used to evaluate the potential cost of labor and labor burden related to change order work. It is intended that this information represent an accurate estimate of the CONTRACTOR's actual labor and labor burden cost components. This information is not intended to establish fixed billing or change order pricing labor rates. However, at the time change orders are priced the submitted cost data for labor rates may be used to price change order work. The accuracy of any such agreed-upon labor cost components used to price change orders will be subject to later audit. Approved change order amounts may be adjusted later to correct the impact of inaccurate labor cost components if the agreed-upon labor cost components are determined to be inaccurate.

ARTICLE 12 - CHANGE OF CONTRACT TIMES

12.1 Working Day and Calendar Day Contracts:

12.1.1 The Contract Times (or Milestones) shall only be changed by Change Order or Time Extension Request duly executed by both the CONTRACTOR and Owner's Representative. Any claim for an adjustment of the Contract Times (or Milestones) shall be made by Written Notice delivered by the party making the Claim to the other party promptly (but in no event later than thirty (30) calendar days) after the start of the occurrence or event giving rise to the delay and stating the general nature of the delay. Notice of the extent of the delay with supporting data shall be delivered within thirty (30) calendar days after Written Notice of Claim is delivered by claimant, and shall represent that the adjustment claimed is the entire adjustment to which claimant is entitled as a result of said occurrence or event. If the OWNER and the CONTRACTOR cannot otherwise agree, all Claims for adjustment in the Contract Times (or Milestones) shall be determined as set out in Article 16. No Claim for an adjustment in the Contract Times (or Milestones) will be valid if not submitted in accordance with the requirements of this paragraph.

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

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

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

.1 Changes ordered in the work which justify additional time.

.2 Failure of materials or products being at the Project site due to delays in transportation or failures of Suppliers, which are not the result of the CONTRACTOR's, Subcontractor's or Supplier's negligence. The request for an extension of time shall be supported by a recitation of acts demonstrating that such delays were beyond the control of the CONTRACTOR, including but not limited to, the CONTRACTOR's efforts to overcome such delays documented as follows:

a) Copy of purchase order for delayed item(s) indicating date ordered by the CONTRACTOR/Subcontractor and date purchase order received by Supplier.

b) If item(s) require Shop Drawings or other submittal information in accordance with the Contract Documents, provide record of date submittal(s) forwarded to Owner's Representative, date submittal(s) returned to the CONTRACTOR, and date submittal(s) forwarded to Supplier.

c) Copy of document(s) from Supplier, on Supplier's letterhead, indicating date(s) item(s) would be ready for shipment and/or actual shipment date(s).

d) Copies of all correspondence between the CONTRACTOR/ Subcontractor and Supplier indicating the CONTRACTOR/ Subcontractor's efforts to expedite item(s).

e) If item(s) are being purchased by a Subcontractor, provision of meeting notes, correspondence, and the like which reflect the CONTRACTOR's efforts with the Subcontractor to expedite delivery of the item(s).

.3 When acts of the OWNER, E/A, utility owners or other contractors employed by the OWNER delay progress of work through no fault of the CONTRACTOR.

.4 When the CONTRACTOR is delayed by strikes, lockouts, fires, losses from natural causes, or other unavoidable cause or causes beyond the CONTRACTOR's control.

12.2 Calendar Day Contracts:

Under a Calendar Day Contract, the CONTRACTOR may also be granted an extension of time because of unusual inclement weather that is beyond the normal weather expected for the Williamson and Travis Counties, Texas area. Normal weather which prevents the CONTRACTOR from performing Work is expected during a Calendar Day Contract, and is <u>not</u> a justification for an extension of time. The following delineates the number of days per month for which, for purposes of Calendar Day Contracts, expected normal weather will prevent performance of Work:

January.....	7 days
February.....	7 days
March.....	7 days
April.....	7 days
May.....	8 days
June.....	6 days
July.....	6 days
August.....	5 days
September.....	7 days
October.....	7 days

November..... 7 days
December..... 7 days

Days per month exceeding the number shown above may be credited as Rain Days if a Claim is made in accordance with paragraph 12.1.1 and meets the following definition: a "Rain Day" is any day in which a weather event occurs at the site and is sufficient to prevent the CONTRACTOR from performing units of Work critical to maintaining the project schedule.

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

13.1 Notice of Defects:

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

13.2 Access to Work:

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

13.3 Tests and Inspections:

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

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

.**1** for inspections, tests or approvals covered by paragraph 13.3.3 below;

.2 for reinspecting or retesting defective Work; and

.3 as otherwise specifically provided in the Contract Documents.

All testing laboratories shall be those selected by the OWNER.

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

13.4 Uncovering Work:

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

13.4.2 If Owner's Representative considers it necessary or advisable that covered Work be observed, inspected or tested, the CONTRACTOR shall uncover, expose or otherwise make available for observation, inspection or testing 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 pay all claims, costs, losses and damages caused by, arising out of or resulting from such uncovering, exposure, observation, inspection and testing and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and the OWNER shall be entitled to an appropriate decrease in the Contract Amount, and may make a Claim therefor as provided in Article 11. If, however, such Work is not found to be defective, the CONTRACTOR shall be allowed an increase in the Contract Amount or an extension of the Contract Times (or Milestones), or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement and reconstruction; and the CONTRACTOR may make a Claim therefor as provided in Article 11 and Article 12.

13.5 OWNER May Stop the Work:

13.5.1 If the Work is defective, or the CONTRACTOR fails to supply sufficient skilled workers or suitable materials or equipment, or fails to furnish or perform the Work in such a way that the completed Work will conform to the Contract Documents, the OWNER may order the CONTRACTOR to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of the OWNER to stop the Work shall not give rise to any duty on the part of the OWNER to exercise this right for the benefit of the CONTRACTOR or any surety or other party.

13.5.2 If the CONTRACTOR persistently fails to correct defective Work or submit a satisfactory plan to take corrective action, with procedure and time schedule, the OWNER may order the CONTRACTOR to stop the Work, or any portion thereof, until cause for such order has been eliminated, or take any other action permitted by this Contract. A notice to stop the Work, based on defects, shall not stop calendar or working days charged to the Project.

13.6 Correction or Removal of Defective Work:

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

13.7 Warranty period:

13.7.1 If, at any time after the date of Substantial Completion or such longer period of time as may be prescribed by laws or regulations or by the terms of any applicable special guarantee required by the Contract Documents or by any specific provision of the Contract Documents, any Work is found to be defective, the CONTRACTOR shall promptly, without cost to the OWNER and in accordance with the OWNER's written instructions:

(i) correct such defective Work, or, if it has been rejected by the OWNER, remove it from the site and replace it with Work that is not defective, and

(ii) satisfactorily correct or remove and replace any damage to other Work or the work of others resulting therefrom.

If the CONTRACTOR does not promptly comply with the terms of such instructions, or in an emergency where delay would cause serious risk of loss or damage, the OWNER may have the defective Work corrected or the rejected Work removed and replaced, and all claims, costs, losses and damages caused by or resulting from such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by the CONTRACTOR.

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

13.8 OWNER May Correct Defective Work:

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

ARTICLE 14 - PAYMENTS TO CONTRACTOR AND COMPLETION

14.1 Application for Progress Payment:

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

14.1.2 Such applications shall not include requests for payment on account of changes in the Work which have been properly authorized by Change Directives but not yet included in Change Orders.

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

14.1.4 Owner will not pay for materials or equipment not incorporated in the work but delivered and suitably stored at the site or at another location. Payment will be made by Owner only for work completed in accordance with the plans and contract documents.

14.1.5 Where the original Contract Amount is less than $400,000, the OWNER will pay to the CONTRACTOR the total amount of approved Application for Payment, less ten percent (10%) of the amount thereof, which ten percent (10%) will be retained until final payment, less all previous payments and less all sums that may be retained by the OWNER under the terms of this Agreement. Where the original Contract Amount is $400,000 or more, the OWNER will pay to the CONTRACTOR the total amount of approved Application for Payment, less five percent (5%) of the amount thereof, which five percent (5%) will be retained until final payment, less all previous payments and less all sums that may be retained by the OWNER under the terms of this Agreement. In either case, if the Work is near completion and delay occurs due to no fault or neglect of the CONTRACTOR, the OWNER may pay a portion of the retained amount to the CONTRACTOR. The CONTRACTOR, at the OWNER's option, may be relieved of the

obligation to complete the Work and, thereupon, the CONTRACTOR shall receive payment of the balance due under the Contract subject to the conditions stated under paragraph 15.2.

14.1.6 Applications for Payment shall include the following documentation:

.1 updated progress schedule;

.2 monthly subcontractor report; and

.3 any other documentation required under the Supplemental General Conditions.

14.2 CONTRACTOR's Warranty of Title:

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

14.3 Review of Applications for Progress Payment:

14.3.1 Owner's Representative will, within seven (7) calendar days after receipt of each Application for Payment, either indicate a recommendation for payment and forward the Application for processing by the OWNER, or return the Application to the CONTRACTOR indicating Owner's Representative's reasons for refusing to recommend payment. In the latter case, the CONTRACTOR may make the necessary corrections and resubmit the Application.

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

.1 the Work has progressed to the point indicated; and

.2 the quality of the Work is in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, to the results of any subsequent tests called for in the Contract Documents, to a final determination of quantities and classifications for unit price Work, and to any other qualifications stated in the recommendation).

14.3.3 By recommending any such payment, Owner's Representative will not thereby be deemed to have represented that:

.1 exhaustive or continuous on-site inspections have been made to check the quality or the quantity of the Work;

.2 examination has been made to ascertain how or for what purpose the CONTRACTOR has used money previously paid on account of the Contract Amount;

.3 the CONTRACTOR's construction means, methods, techniques, sequences or procedures have been reviewed; or

.4 that there may not be other matters or issues between the parties that might entitle the CONTRACTOR to be paid additionally by the OWNER or entitle the OWNER to withhold payment to the CONTRACTOR.

14.4 Decisions to Withhold Payment:

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

.1 defective Work not remedied;

.2 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Amount;

.3 damage to the OWNER or another contractor;

.4 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay;

.5 failure of the CONTRACTOR to submit a schedule of values in accordance with the Contract Documents;

.6 failure of the CONTRACTOR to submit a submittal schedule in accordance with the Contract Documents;

.7 failure of the CONTRACTOR to submit or update construction schedules in accordance with the Contract Documents;

.8 failure of the CONTRACTOR to maintain a record of changes on drawings and documents;

.9 failure of the CONTRACTOR to maintain weekly payroll reports;

.10 failure of the CONTRACTOR to submit monthly subcontractor reports;

.11 the CONTRACTOR's neglect or unsatisfactory prosecution of the Work, including failure to clean up; or

.12 failure of the CONTRACTOR to comply with any provision of the Contract Documents.

14.4.2 When the above reasons for withholding payment are removed, the CONTRACTOR shall resubmit a statement for the value of Work performed. Payment will be made within thirty (30) calendar days of receipt of approved Application for Payment.

14.5 Delayed Payments:

Should the OWNER fail to make payment to the CONTRACTOR of a sum named in any Application for Payment within thirty (30) calendar days after the day on which the OWNER received the mutually acceptable Application for Payment, then the OWNER will pay to the CONTRACTOR, in addition to the sum shown as due by such Application for Payment, interest thereon at the rate of one percent (1%) per month from date due until fully paid, which shall fully liquidate any injury to the CONTRACTOR growing out of such delay in payment.

14.6 Arrears:

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

14.7 Substantial Completion:

14.7.1 If a Certificate of Occupancy is required by public authorities having jurisdiction over the Work, said certificate shall be issued before the Work or any portion thereof is considered substantially complete. When the CONTRACTOR considers that the Work, or a portion thereof which the OWNER agrees to accept separately, is

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

14.7.2 The OWNER shall have the right to exclude the CONTRACTOR from the Work after the date of Substantial Completion, but the OWNER will allow the CONTRACTOR reasonable access to complete or correct items on the punch list.

14.8 Partial Utilization:

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

14.9 Final Inspection:

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

14.10 Final Application for Payment:

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

.1 Three (3) complete operating and maintenance manuals, each containing maintenance and operating instructions, schedules, guarantees, and other documentation required by the Contract Documents;

.2 Record documents (as provided in paragraph 6.10);

.3 Consent of surety, if any, to final payment. If surety is not provided, complete and legally effective releases or waivers (satisfactory to the OWNER) of all claims arising out of or filed in connection with the Work;

.4 Certificate evidencing that insurance required by the Supplemental General Conditions will remain in force after final payment and through any warranty period;

.5 Non-Use of Asbestos Affidavit (After Construction); and

.6 Any other documentation called for in the Contract Documents.

14.11 Final Payment and Acceptance:

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

14.11.2 As Contract Time is measured to Final Completion, Owner's Representative will issue a letter of final acceptance to the CONTRACTOR which establishes the Final Completion date and initiates any warranty period.

14.11.3 Final payment is considered to have taken place when the CONTRACTOR or any of its representatives negotiates the OWNER's final payment check, whether labeled final or not, for cash or deposits check in any financial institution for its monetary return.

14.12 Waiver of Claims:

The making and acceptance of final payment will constitute:

.1 a waiver of claims by the OWNER against the CONTRACTOR, except claims arising from unsettled claims, from defective Work appearing after final inspection, from failure to comply with the Contract Documents or the terms of any warranty specified therein, or from the CONTRACTOR's continuing obligations under the Contract Documents; and

.2 a waiver of all claims by the CONTRACTOR against the OWNER other than those previously made in writing and still unsettled.

ARTICLE 15 - SUSPENSION OF WORK AND TERMINATION

15.1 OWNER May Suspend Work Without Cause and for Convenience:

At any time and without cause and for convenience, the OWNER may suspend the Work or any portion thereof for a period of not more than ninety (90) calendar days by written agreement or by Written Notice to the CONTRACTOR which will fix the date on which the Work will be resumed. The CONTRACTOR shall resume the Work on the date so fixed. The CONTRACTOR may be allowed an adjustment in the Contract Amount or an extension of the Contract Times, or both, directly attributable to any such suspension if the CONTRACTOR makes an approved Claim therefor as provided in Article 11 and Article 12.

15.2 OWNER May Terminate Without Cause:

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

.1 for completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination;

.2 for all claims incurred in settlement of terminated contracts with Suppliers, Subcontractors, and others. The CONTRACTOR agrees to negotiate in good faith with Subcontractors, Suppliers and others to mitigate the OWNER's cost; and

.3 for anticipated profits on entire Contract not previously paid.

15.3 OWNER May Terminate With Cause:

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

.1 if the CONTRACTOR persistently fails to perform the Work in accordance with the Contract Documents;

.2 if the CONTRACTOR disregards laws or regulations of any public body having jurisdiction;

.3 if the CONTRACTOR disregards the authority of Owner's Representative;

.4 if the CONTRACTOR makes fraudulent statements;

.5 if the CONTRACTOR fails to maintain a work force adequate to accomplish the Work within the Contract Time;

.6 if the CONTRACTOR fails to make adequate progress and endangers successful completion of the Contract; or

.7 if the CONTRACTOR otherwise violates in any substantial way any provisions of the Contract Documents;

The OWNER may, after giving the CONTRACTOR (and the surety, if any) seven (7) calendar days' Written Notice terminate the services of the CONTRACTOR. The OWNER, at its option, may proceed with negotiation with surety for completion of the Work. Alternatively, the OWNER may under these circumstances exclude the CONTRACTOR from the site and take possession of the Work (without liability to the CONTRACTOR for trespass or conversion), incorporate in the Work all materials and equipment stored at the site or for which the OWNER has paid the CONTRACTOR but which are stored elsewhere, and finish the Work as the OWNER may deem expedient. In such case the CONTRACTOR shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Amount exceeds all claims, costs, losses and damages sustained by the OWNER arising out of or resulting from completing the Work, such excess will be paid to the CONTRACTOR. If such claims, costs, losses and damage exceed such unpaid balance, the CONTRACTOR or surety shall pay the difference to the OWNER.

15.3.2 Where the CONTRACTOR's services have been so terminated by the OWNER, the termination will not affect any rights or remedies of the OWNER against the CONTRACTOR and surety then existing or which may thereafter accrue. Any retention or payment of amounts due the CONTRACTOR by the OWNER will not release the CONTRACTOR from liability. In the event the OWNER terminates the Contract with cause, the OWNER may reject any and all bids submitted by the CONTRACTOR for up to three (3) years.

15.4 CONTRACTOR May Stop Work or Terminate:

If through no act or fault of the CONTRACTOR, the Work is suspended for a period of more than ninety (90) calendar days by the OWNER or under an order of court or other public authority, or (except during disputes) Owner's Representative fails to forward for processing any mutually acceptable Application for Payment within thirty (30) calendar days after it is submitted, or (except during disputes) the OWNER fails for sixty (60) calendar days after it is submitted to pay the CONTRACTOR any sum finally determined by the OWNER to be due, then the CONTRACTOR may, upon seven (7) calendar days' Written Notice to the OWNER, and provided the OWNER does not remedy such suspension or failure within that time, terminate the Agreement and recover from the OWNER payment on the same terms as provided in paragraph 15.2. In lieu of terminating the Agreement and without prejudice to any other right or remedy, if (except during disputes) Owner's Representative has failed to forward for processing any mutually acceptable Application for Payment within thirty (30) calendar days after it is submitted, or (except during disputes) the OWNER has failed for sixty (60) calendar days after it is submitted to pay the CONTRACTOR any sum finally determined by the OWNER to be due, the CONTRACTOR may upon seven (7) calendar days' Written Notice to the OWNER stop the Work until payment of all such amounts due the CONTRACTOR, including interest thereon. The provisions of this paragraph 15.4 are not intended to preclude the CONTRACTOR from making a Claim under Article 11 and Article 12 for an increase in Contract Amount or Contract Times or otherwise for expenses or damage directly attributable to the CONTRACTOR's stopping Work as permitted by this paragraph.

ARTICLE 16 - DISPUTE RESOLUTION

16.1 Filing of Claims:

16.1.1 Claims arising from the circumstances identified in paragraphs 3.2, 4.1, 4.2.2, 4.2.4, 6.4.2, 6.11.5.2, 6.17, 7.5, 8.6, 9.5, 10.4.2, 13.8, 15.1, 15.2, 15.3, or 15.4, or other occurrences or events, shall be made by Written Notice delivered by the party making the Claim to the other party within thirty (30) calendar days after the start of the occurrence or event giving rise to the Claim and stating the general nature of the Claim. Notice of the amount of the Claim with supporting data shall be delivered within thirty (30) calendar days after Written Notice of Claim is delivered by claimant and shall represent that the adjustment claimed covers all known amounts to which claimant is entitled.

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

.1 submit additional supporting data requested by the other party;

.2 modify the initial Claim; or

.3 request Alternative Dispute Resolution.

16.2 Alternative Dispute Resolution:

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

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

be waived by written agreement of both parties, in which event the parties may proceed directly to mediation as described below.

16.2.3 Mediation:

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

16.2.3.2 Mediation is a forum in which an impartial person, the mediator, facilitates communication between parties to promote reconciliation, settlement, or understanding among them. The parties hereby agree that mediation, at a minimum, shall provide for 1) conducting an on-site investigation, if appropriate, by the mediator for fact-gathering purposes, 2) a meeting of all parties for the exchange of points of view and 3) separate meetings between the mediator and each party to the dispute for the formulation of resolution alternatives. The parties agree to participate in mediation in good faith for up to thirty (30) calendar days from the date of the first mediation session, unless mutually agreed otherwise. Should the parties fail to reach a resolution of the dispute through mediation, then each party is released to pursue other remedies available to them.

ARTICLE 17 – RIGHT TO AUDIT

17.1 Right to Audit:

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

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

a) The CONTRACTOR's compliance with contract requirements;

b) The CONTRACTOR's compliance with the OWNER'S business ethics policies; and

c) If necessary, the extent of the Work performed by the CONTRACTOR at the time of contract termination.

17.1.2 The CONTRACTOR shall require all payees (examples of payees include subcontractors, insurance agents, material suppliers, etc.) to comply with the provisions of this Article 17 by securing the requirements hereof in a

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

17.1.3 The OWNER's authorized representative or designee shall have reasonable access to the CONTRACTOR's facilities, shall be allowed to interview all current or former employees to discuss matters pertinent to the performance of this Agreement, and shall be provided adequate and appropriate work space in order to conduct audits in compliance with this Article 17.

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

17.1.5 The CONTRACTOR shall take reasonable actions to prevent any actions or conditions which could result in a conflict with the OWNER's best interests. These obligations shall apply to the activities of the CONTRACTOR's employees, agents, subcontractors, etc. in their dealings and relations with the OWNER's current and former employees and their relatives. For example, the CONTRACTOR's employees, agents or subcontractors should not make or provide to be made any employment, gifts, extravagant entertainment, payments, loans or other considerations to the OWNER's representatives, employees or their relatives.

17.1.6 It is also understood and agreed by the CONTRACTOR that any solicitation of gifts or any other item of value by anyone representing the OWNER is to be reported within two (2) business working days to the OWNER at the following telephone number: 512-218-5401. Failure to report any such solicitations or offers shall be deemed a material breach of contract entitling the OWNER to pursue damages resulting from the failure to comply with this provision.

ARTICLE 18 – MISCELLANEOUS

18.1 Venue:

In the event of any suit at law or in equity involving the Contract, venue shall be in Williamson County, Texas and the laws of the state of Texas shall apply to Contract interpretation and enforcement.

18.2 Extent of Agreement:

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

18.3 Cumulative Remedies:

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

18.4 Severability:

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

18.5 Independent Contractor

The Contract shall not be construed as creating an employer/employee relationship, a partnership, or a joint venture. The CONTRACTOR's services shall be those of an independent contractor. The CONTRACTOR agrees and understands that the Contract does not grant any rights or privileges established for employees of the OWNER.

18.6 Prohibition of Gratuities

The OWNER may, by Written Notice to the CONTRACTOR, terminate the Contract without liability if is determined by the OWNER that gratuities were offered or given by the CONTRACTOR or any agent or representative of the CONTRACTOR to any officer or employee of the OWNER with a view toward securing the Contract or securing favorable treatment with respect to the awarding or amending or the making of any determinations with respect to the performing of such Contract. In the event the Contract is terminated by the OWNER pursuant to this provision, the OWNER shall be entitled, in addition to any other rights and remedies, to recover or withhold the amount of the cost incurred by the CONTRACTOR in providing such gratuities.

18.7 Prohibition Against Personal Interest in Contracts

No officer, employee, independent consultant, or elected official of the OWNER who is involved in the development, evaluation, or decision-making process of the performance of any solicitation shall have a financial interest, direct or indirect, in the Contract resulting from that solicitation. Any violation of this provision, with the knowledge, expressed or implied, of the CONTRACTOR shall render the Contract voidable by the OWNER.

End of General Conditions

00800 SUPPLEMENTAL GENERAL CONDITIONS

SUPPLEMENTAL GENERAL CONDITIONS TO AGREEMENT FOR CONSTRUCTION SERVICES

The Supplemental General Conditions contained herein shall amend or supplement the General Conditions, Section 00700.

ARTICLE 1 - DEFINITIONS

1.16 Engineer/Architect (E/A):

Add the following:

Name (Representative): Daniel Dow
Firm: Lockwood, Andrews, & Newnam, Inc.
Address: 8911 N. Capital of Texas Hwy., Bldg. 2, Ste. 2300
City, State, Zip: Austin, Texas, 78759
Telephone: 512-338-4212
Facsimile: _____
Email: DEDow@lan-inc.com

1.27 Owner's Representative:

Add the following:

Name: Eddie Zapata Title: Project Manager
Address: 2008 Enterprise Drive
City, State, Zip: Round Rock, Texas, 78664
Telephone: 512-218-6605
Facsimile: 512-218-5536
Email: ezapata@roundrocktexas.gov

ARTICLE 6 - CONTRACTOR'S RESPONSIBILITIES

6.18 Liquidated Damages

Add the following:

1. CONTRACTOR SHALL PAY LIQUIDATED DAMAGES IN THE AMOUNT OF one thousand AND NO/100 DOLLARS $1,000 PER DAY FOR EACH DAY BEYOND THE DATE ESTABLISHED THEREFOR THAT THE CONTRACTOR FAILS TO ACHIEVE SUBSTANTIAL COMPLETION, AND FOR WHICH OWNER IS UNABLE TO UTILIZE THE IMPROVEMENTS AND FACILITIES DUE TO THE FAILURE OF CONTRACTOR TO HAVE ACHIEVED SUBSTANTIAL COMPLETION IN ACCORDANCE WITH THE CONTRACT.

END OF SUPPLEMENTAL GENERAL CONDITIONS

00900 SPECIAL CONDITIONS

SECTION 01-INFORMATION

01-01 COPIES OF PLANS AND SPECIFICATIONS FURNISHED

The Agreement will be prepared in not less than five (5) counterpart (original signed) sets. The City will furnish to the Contractor two (2) sets of conforming Contract Documents and Specifications unless otherwise specified.

01-02 GOVERNING CODES

All construction as provided for under these Plans and Specifications shall be governed by any existing Resolutions, Codes and Ordinances, and any subsequent amendments or revisions thereto as set forth by the City.

01-03 LOCATION

The location of work shall be as set forth in the Notice to Bidders and as indicated on the Plans.

01-04 USAGE OF WATER

All water used during construction shall be provided by the City and shall be metered. The City shall specify the location from which the Contractor is to procure water. The Contractor shall be responsible for obtaining a bulk water permit from the City and providing all apparatus necessary for procuring, storing, transporting and using water during construction. The Contractor shall strive to use no more water than reasonable to perform the work associated with this Contract and shall avoid waste. The Contractor will be required to pay for all water used if it is found that waste is occurring during construction.

SECTION 02-SPECIAL CONSIDERATIONS

02-01 CROSSING UTILITIES

Prior to commencing the Work associated with this Contract, it shall be the Contractor's responsibility to make arrangements with the Owners of utility companies to uncover their particular utility lines or otherwise confirm their location. Certain utility companies perform such services at their own expense, however, where such is not the case, the Contractor will cause such work to be done at his own expense.

02-02 UTILITY SERVICES FOR CONSTRUCTION

The Contractor will be responsible for providing his own utility services while performing the Work associated with this Contract. Provision of said utility services shall be subsidiary to the various bid items and no additional payment will be made for this item.

02-03 WAGE RATES

Wage Rates (Information From Chapter 2258, Texas Government Code Title 10)

2288.021. Duty of Government Entity to Pay Prevailing Wage Rates

a. The State or any political subdivision of the State shall pay a worker employed by it or on behalf of it:
   (1) not less than the general prevailing rate of per diem wages for work of a similar character in the locality in which the work is performed; and
   (2) not less than the general prevailing rate of per diem wages for legal holiday and overtime work.

b. Subsection (a) does not apply to maintenance work.

c. A worker is employed on a public work for the purposes of this section if a Contractor or Subcontractor in the execution of a contract for the public work with the State, a political subdivision of the State or any officer or public body of the State or a political subdivision of the State, employs the worker.

2258.023. Prevailing Wage Rates to be Paid by Contractor and Subcontractor; Penalty

a. The contractor who is awarded a contract by a public body, or a Subcontractor of the Contractor, shall pay not less than the rates determined under Section 2258.022 to a worker employed by it in the execution of the contract.

b. A Contractor or Subcontractor who violates this section shall pay to the state or a political subdivision of the state on whose behalf the contract is made, $60 for each worker employed for each calendar day or part of the day that the worker is paid less than the wage rates stipulated in the contract. A public body awarding a contract shall specify this penalty in the contract.

c. A contractor or subcontractor does not violate this section if a public body awarding a contract does not determine the prevailing wage rates, and specify the rates in the contract as provided by Section 2258.022.

d. The public body shall use any money collected under this section to offset the costs incurred in the administration of this chapter.

e. A municipality is entitled to collect a penalty under this section only if the municipality has a population of more than 10,000.

2258.051. Duty of Public Body to Hear Complaints and Withhold Payment

A public body awarding a contract, and an agent or officer of the public body, shall:

1. take cognizance of complaints of all violations of this chapter committed in the execution of the contract; and
2. withhold money forfeited or required to be withheld under this Chapter from the payments to the Contractor under the contract, except that the public body may not withhold money from other than the final payment without determination by the public body that there is good cause to believe that the Contractor has violated this chapter.

Applicable wage rates to be used in Williamson and/or Travis County may be obtained from the U.S. Department of Labor website at the following web addresses:

Construction Types: Heavy (Sewer/Water Treating Plant and Sewer/Incidental to Highway)
http://www.wdol.gov/wdol/scafiles/davisbacon/TX33.dvb?v=0

Construction Types: Heavy and Highway
http://www.wdol.gov/wdol/scafiles/davisbacon/TX16.dvb?v=0

Construction Type: Building
http://www.wdol.gov/wdol/scafiles/davisbacon/TX76.dvb?v=1

02-04 LIMIT OF FINANCIAL RESOURCES

The City has a limited amount of financial resources committed to this Project; therefore, it shall be understood by all bidders that the City may be required to change and/or delete any items which it may feel is necessary to accomplish all or part of the scope of work within its limit of financial resources. Contractor shall be entitled to no claim for damages or anticipated profits on any portion of work that may be omitted. At any time during the duration of this contract, the City reserves the right to omit any work from this contract. Unit prices for all items previously approved in this contract shall be used to delete or add work per change order.

02-05 CONSTRUCTION REVIEW

The City shall provide a project representative to review the quality of materials and workmanship.

02-06 LIMITS OF WORK AND PAYMENT

It shall be the obligation of the Contractor to complete all work included in this Contract, so authorized by the City, as described in the contract documents and technical specifications. All items of work not specifically paid for in the bid proposal

shall be included in the unit price bids. Any question arising as to the limits of work shall be left up to the interpretation of the Engineer.

02-07 LAND FOR WORK

Owner provides, as indicated on Drawings, land upon which work is to be done, right-of-way for access to same and such other lands that are designated for the use of the Contractor. Contractor provides, at his expense and without liability of Owner, any additional land and access thereto that may be required for his construction operations, temporary construction facilities, or for storage of materials.

02-08 DEVIATIONS OCCASIONED BY UTILITY STRUCTURES

Whenever existing utilities, not indicated on Plans, present obstructions to grade and alignment of proposed improvements immediately notify engineer, who without delay, will determine if existing utilities are to be relocated, or grade and alignment of proposed improvements changed. Where necessary to move existing utilities and appurtenances as determined by the Engineer, the Engineer and Contractor will make relocation arrangements with the utility owner. The Owner will not be liable for delay costs or damages due to relocations of utilities which hinder progress of the work.

02-09 CONSTRUCTION STAKING

All construction staking required to complete the work associated with this contract shall be provided by the Contractor. The Contractor shall be responsible for determining the layout and extent of staking necessary to construct the improvements to the lines and grades shown in the Plans and such staking shall be satisfactory to the Engineer. The Contractor shall consult with the Engineer and Owners representative in the field for assistance as necessary. Sufficient staking materials and equipment shall be provided by the Contractor including but not limited to: paint, flagging, laths, hubs, blue tops, nails, hammers, measuring chains or tapes, transits and levels. The Contractor shall be responsible for setting and marking control and off-set points for measuring distances and angles, for shooting levels, and for any other items pertaining to construction staking. This item shall not be paid for separately and shall be considered subsidiary to other bid items.

SECTION 03-ACCESS AND TRAFFIC CONTROL

Access shall be provided for the public and emergency vehicles at all possible times. When it becomes necessary to restrict access, the Contractor shall notify the Owner and coordinate with the Owner, all applicable agencies (i.e. Fire Department, E.M.S., Public Works, etc.), residents, and affected parties. If emergency access is required during the work and such access is being hindered by the work, the Contractor will suspend the work if necessary, and otherwise endeavor to assist emergency personnel in accessing a location restricted by the work. Unless otherwise approved by the Engineer, at the end of each day all lanes of traffic shall be opened to the public. The Contractor shall ensure compliance at all times with the accepted Traffic Control Plan for the project and shall be responsible for all maintenance, signing and safety precautions necessary for traffic control. These items shall be included in the bid item Traffic Control.

01000 TECHNICAL SPECIFICATIONS

ITEM 1 GENERAL DESCRIPTION

1.01 SCOPE OF WORK

The Work covered by these Specifications consists of furnishing all labor, equipment, appliances, materials and performing all operations in connection with the inspection and testing, complete in accordance with the Plans, and subject to the terms and conditions of the Contract Documents.

1.02 GOVERNING TECHNICAL SPECIFICATIONS

STREET, WATER, SEWER AND DRAINAGE IMPROVEMENTS

The Round Rock Standard Specification Criteria Manual is hereby referred to and included in this contract as fully and to the same extent as if copied at length herein, and shall be applied to this project unless modified elsewhere as discussed below. The aforementioned Criteria Manual is the "Standard Specifications" section of the City of Round Rock Design and Construction Standards. The Standard Specifications may be accessed from the City of Round Rock website (www.roundrocktexas.gov) at the following web address: www.roundrocktexas.gov/dacs.

Any adjustments, alterations, or additional information regarding Governing Technical Specifications are contained in the Plans (Drawings), Details and Notes described in Section 02000 of the Project Manual or are included in Attachment A at the end of this Technical Specifications Section.

ITEM 2 CONTROL OF WORK

2.01 CLEAN-UP

2.01.1 CONSTRUCTION SITE

During construction the Contractor shall keep the site free and clean from all rubbish and debris and shall clean-up the site promptly when notified to do so by the Engineer.

The Contractor shall, at his own expense, maintain the streets and roads free from dust, mud, excess earth or debris which constitutes a nuisance or danger to the public using the thoroughfare, or the occupants of adjacent properties.

Care shall be taken to prevent spillage on streets and roads over which hauling is done, and any such spillage or debris deposited on streets, due to the Contractor's operations, shall be immediately removed.

2.01.2 BACKWORK

The Contractor shall coordinate his operations in such a manner as to prevent the amount of clean-up and completion of back works from becoming excessive. Should such a condition exist, the Engineer may order all or portions of the work to cease and refuse to allow any work to commence until the back work is done to the Engineer's satisfaction.

2.02 GRADING

The Contractor shall do such grading in and adjacent to the construction area associated with this contract as may be necessary to leave such areas in a neat and satisfactory condition approved by the Engineer.

ITEM 3 EXAMINATION AND REVIEW

3.01 EXAMINATION OF WORK

The work covered under this Contract shall be examined and reviewed by the Engineer, representatives of all governmental entities which have jurisdiction, and the City's authorized representative. The quality of material and the quality of installation of the improvements shall be to the satisfaction of the Engineer. It shall be the Contractor's responsibility for the construction methods and safety precautions in the undertaking of this Contract.

3.02 NOTIFICATION

The Engineer and City must be notified a minimum of 24-hours in advance of beginning construction, testing, or requiring presence of the Engineer, project representative, or City's representative.

3.03 CONSTRUCTION STAKING

The Engineer shall furnish the Contractor reference points and benchmarks that, in the Engineer's opinion, provide sufficient information for the Contractor to perform construction staking.

3.04 PROTECTION OF STAKES, MARKS, ETC.

All engineering and surveyor's stakes, marks, property comers, etc., shall be carefully preserved by the Contractor, and in case of destruction or removal during the course of this project, such stakes, marks, property comers, etc., shall be replaced by the Contractor at the Contractor's sole expense.

ITEM 4 PROTECTION AND PRECAUTION

4.01 WORK IN FREEZING WEATHER

Portions of the work may continue as directed by the Engineer.

4.02 PROTECTION OF TREES, PLANTS AND SHRUBS

The Contractor shall take necessary precautions to preserve all existing trees, plants and shrubs but where it is justifiable and necessary the Contractor may remove trees and plants for construction right-of-way but only with approval of the Engineer.

4.03 TRAFFIC CONTROL MEASURES AND BARRICADES

Traffic control measures and barricades shall be installed in accordance with the **Texas Manual of Uniform Traffic Control Devices** and in other locations deemed necessary by the Engineer, for the protection life and property. Under no circumstances will any existing road be permitted to remain closed over a weekend. No separate pay will be made for this item. Costs for this item shall be subsidiary to other items of work.

4.04 PROPERTY LINES AND MONUMENTS

The Contractor shall be responsible for the protection, reference and resetting of property comer monuments if disturbed.

4.05 DISPOSAL OF SURPLUS MATERIAL

The Contractor shall at his own expense, make arrangement for the disposal of surplus material, such as rock, trees, brush and other unwanted backfill materials.

4.06 CONTRACTOR'S USE OF PREMISES

The Contractor shall, at his own expense, provide additional space as necessary for his operations and storage of materials.

ITEM 5 MATERIALS

5.01 TRADE NAMES

Except as specified otherwise, wherever in the specifications an article or class of material is designated by a trade name or by the name or catalog number of any maker, patentee, manufacturer, or dealer, such designations shall be taken as intending to mean and specify the articles described or another equal thereto in quality, finish, and serviceability for the purpose intended, as may be determined and judged by the Engineer in his sole discretion.

5.02 MATERIALS AND WORKMANSHIP

No material which has been used by the Contractor for any temporary purpose whatever is to be incorporated in the permanent structure without the written consent of the Engineer. Where materials or equipment are specified by a trade or brand name, it is not the intention of the City to discriminate against an equal product of another manufacturer, but rather to set a definite standard of quality for performance, and to

establish an equal basis for the evaluation of bids. Where the words "equivalent", "proper" or "equal to" are used, they shall be understood to mean that the item referred to shall be "proper", the "equivalent" of, or "equal to" some other item, in the opinion or judgment of the Engineer. Unless otherwise specified, all materials shall be the best of their respective kinds and shall be in all cases fully equal to approved samples. Notwithstanding that the words "or equal to" or other such expressions may be used in the specifications in connection with a material, manufactured article or process, the material, article or process specifically designated shall be used, unless a substitute is approved in writing by the Engineer, and the Engineer will have the right to require the use of such specifically designated material, article or process.

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02539	Diversion Pumping	2
02577	Fiberglass Reinforced Plastic (FRP) Wet Well (BASE BID)	6
05310	Steel Roof Decking	2
11319	Submersible Pumps	5
11332	Carbon Odor Control System	4
13219	Polymer Concrete Wet Well (ALTERNATE #1)	5
13400	Instrumentation and Control General Provisions	14
13405	Control System Operation	2
13410	Programmable Logic Controllers (PLC)	6
13413	Control Panels	8
13420	Instrument Commissioning	5
13421	Instruments	2
13422	Instrumentation Accessories	4
15139	Wastewater Valves	8
16050	Electrical General Provisions	5
16060	Grounding	4
16120	Insulated Conductors	6
16130	Raceways	4
16135	Boxes	2
16140	Wiring Devices	3
16210	Electric Service	2
16222	AC Electric Motors – 100HP and Below	7
16230	Packaged Engine Generator Systems	9
16276	Dry Type Transformers – 600V Primary and Below	3

16285 Surge Protective Devices (SPD) – 600V and Below 5
16410 Enclosed Safety Switches 2
16415 Automatic Transfer Switches 3
16425 Motor Starters – 600V and Below 5
16490 Fuses – 600V and Below 2
16510 Lighting Fixtures and Lamps 2

SECTION 00217
BIDDER'S QUALIFICATIONS

Bidder must complete all Attachments to Section 00217 clearly and comprehensively. If necessary, responses may be continued on separately attached sheets.

To be considered a responsive bidder, Bidder must complete and submit Attachments A, B, and C with the Bid. The Bidder agrees that, in addition to determining the apparent low Bid, the Owner will consider the responsibility of the Bidders in awarding a Contract for this Project. If none of the three (3) apparent low Bidders are deemed responsible, the OWNER may notify the next three (3) lowest apparent Bidders, and so on, until a Contract is awarded. Any information in Attachments A through C that indicates the Bidder is not responsible or that might negatively impact a Bidder's ability to complete the Work within the Contract Time and for the Contract Price may result in the Bid being rejected.

The Bidder is responsible for the accuracy and completeness of all of the information provided herein.

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Attachment A
Bidder's Information

(Complete and submit with the Bid)

A. Name of Bidder: _____

B. Bidder's Permanent Address: _____

C. Bidder's Phone No.: _____

D. Number of years in business under current company name: _____

(Note: Bidder must have been in existence for a minimum of one (1) year under its current company name. Changes in company name during the experience period are acceptable, if the continuity of the company can be demonstrated. Attach separate documentation, if applicable.)

If Bidder answers "YES" for any of questions E through H, Bidder must attach separate sheets with a brief description or explanation of the answer and provide pertinent contact information (parties' names, addresses and telephone numbers).

E. Has the Bidder ever defaulted on a contract?
☐ **YES** ☐ **NO**

F. Are there currently any pending judgments, claims, or lawsuits against the Bidder?
☐ **YES** ☐ **NO**

G. Does Bidder currently have any pending claims, judgments or lawsuits against any prior client?
☐ **YES** ☐ **NO**

H. Is the Bidder or its principals involved in any bankruptcy or reorganization proceedings?
☐ **YES** ☐ **NO**

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Attachment B
Experience Requirements (General Contractor)

GENERAL CONTRACTOR EXPERIENCE

List and describe Bidder's construction experience as a general contractor for a minimum of three (3) completed projects of comparable size, scope and complexity to the Work described in the Contract Documents.

Bidder must have completed the projects within the past five (5) years.

Name of Bidder: _____

Name of Project: _____ Location: _____

Role of Bidder: _____

Type of Job: _____

Project Start Date: _____ Estimated Completion Date: _____

Project Contact: _____

Brief Description: _____

_____

Name of Project: _____ Location: _____

Role of Bidder: _____

Type of Job: _____

Project Start Date: _____ Estimated Completion Date: _____

Project Contact: _____

Brief Description: _____

_____

Name of Project: _____ Location: _____

Role of Bidder: _____

Type of Job: _____

Project Start Date: _____ Estimated Completion Date: _____

Project Contact: _____

Brief Description: _____

_____

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Attachment C
Bidder's Authentication

THE STATE OF TEXAS

CITY OF ROUND ROCK

I certify that the responses and information in Attachments A, B, and C are true and correct to the best of my personal knowledge and belief and that I have made no willful misrepresentations in this Section, nor have I withheld any relevant information in my statements and answers to questions. I am aware that the information given 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.

Bidder's full name and entity status:

_____

_____

Signature, Authorized Representative of Bidder

_____

Title

_____ **, 20**

Date

**SECTION 01110 -
SUMMARY OF WORK**

PART 1 - G E N E R A L

1.1 SECTION INCLUDES

A. The work covered under this Contract includes all components associated with construction of Transfer Lift Station. The Contractor shall construct and put into operation, as acceptable to Owner, all portions of the work as shown in the Contract Documents. The work includes, but is not limited to structures, equipment, piping, excavation, grading, and roads, as described herein.

B. Contractor shall furnish all labor, supervision, tools and material, as described in the specifications and as shown on the drawings to perform the required work. Provide all appurtenant equipment, connections and special items necessary to accomplish the purposes shown or specified even if such appurtenances are not specifically specified or shown on the drawings. Install all items provided in accordance with the specifications, the manufacturer's recommendations and the best practices of the trades involved.

C. Contractor shall assume full responsibility for the means, methods, techniques, sequences and procedures of construction and safety precautions and programs incidental thereto, and for the functional operation of equipment and systems specified in this Contract. Provide, connect, test and supervise the installation of the equipment and systems specified. The installation and testing of any device, subsystem or system must be performed under the direct supervision of persons qualified by training and experience to capably perform the work in a satisfactory manner.

1.2 DESCRIPTION OF WORK

A. The following paragraphs describe the major components of the work to be completed under this Contract. This list shall not to be construed as all inclusive and shall not waive the Contractor’s responsibility to provide all necessary components of the project, either stated or implied, in full accordance with the drawings and specifications.

B. Site Clearing, Grubbing and Compacted Fill.

1. Complete the site clearing, grubbing and compacted fill in full accordance with the drawings and specifications.
2. Clear and grub the proposed lift station site and as much of the buffer zone as necessary to transition from the proposed site elevation down to existing natural ground and properly dispose of all cleared and grubbed material. Removed the vegetation and debris (including any demolition debris and root balls from tree removal) from the clearing operation per the Geotechnical Report recommendations.
3. Level the identified major “fill areas” to provide an even base to initiate fill operations. Prior to fill placement, proofroll the site to identify any soft or wet areas and over excavate as appropriate. Utilize the suitable fill as identified in the construction documents and per the Geotechnical Report recommendations. Place the fill in maximum 8-inch lifts in accordance with the Geotechnical Report recommendations, specifically Section 9.1.9. Fill the site to the rough grading elevations.
4. The contract designated Geotechnical consultant must oversee the entire site fill process and the contractor must comply with Geotechnical consultant filling recommendations.

C. Forest Creek Lift Station Rehabilitation.

1. Construct Transfer Lift Station Rehabilitation in full accordance with the drawings and specifications.
2. Purchase and install the lift station pumps, wet well, odor control, all electrical components associated with all powered equipment, lights, receptacles, and any other electrical devices associated with the Forest Creek Lift Station, all piping and fittings required to connect proposed pumps to proposed

discharge header, and from the discharge header to the existing valve vault structure and all instruments and control devices associated with the Forest Creek Lift Station.

D. Other Work.

1. Site work including grading, paving, drainage, fencing, slope protection.
2. Site utilities (electric, potable water, natural gas, communications).
3. All other work and appurtenances required for a complete and operational lift station.

1.3 GEOTECHNICAL CONDITIONS

A recent geotechnical site investigation was completed to provide project design and construction information. Specific site conditions shall not waive the Contractor's responsibility to complete the work stipulated in the drawings and specifications, nor shall it constitute or represent grounds for a claim of changed condition. The geotechnical report shall be made available to the Contractor in conjunction with the technical specification package, and the Contractor shall assume full responsibility for familiarizing himself with the geotechnical conditions and characteristics of the site by all means necessary and available to him, in order to adequately evaluate the cost associated with the completion the work, and shall include all such costs in his bid proposal.

1.4 WORK SEQUENCE

A. Contractor shall submit a detailed phasing plan for review and approval by the Owner and Engineer prior to the start of construction. The phasing plan shall address the Contractor's proposed method and timing of the major construction activities to be undertaken, such that the Owner and Engineer can readily ascertain the Contractor's intended means and methods, execution sequence and plan feasibility. Contractor shall coordinate the proposed phasing plan with the overall construction schedule, prepared in accordance with the requirements of Section 01325, Construction Schedule.

B. Contractor shall submit proposed construction phasing plan no later than 14 calendar days after Contract award. The Notice to Proceed will not be issued, nor will the Pre-Construction Meeting will not be held, prior to phasing plan approval by the Owner and Engineer.

1.5 CONTRACTOR'S USE OF PREMISES

A. Contractor shall be responsible for all areas of the site used by him or his subcontractors in the performance of the work. Contractor shall exert full control over the actions of all employees and other persons with respect to the use and preservation of property and existing facilities, except such controls as may be specifically reserved to the Owner or others. Contractor has the right to exclude from the site all persons who have no purpose related to the work or its inspection, exclusive of the Owner's operations personnel, and may require all persons on the site to observe the same regulations as he requires of his employees.

B. Contractor shall assume full responsibility for the protection and safekeeping of products under this Contract, stored at the site. No claim shall be made against the Owner by reason of any act of an employee or trespassers.

C. Contractor owning or responsible for the stored materials and equipment shall immediately move said materials and equipment should any occasion develop necessitating access to the sites occupied by these stored materials and equipment. No materials or equipment may be placed upon the property of the Owner other than that designated for completion of the work, unless otherwise agreed to by the Owner. Contractor shall relocate any stored products under Contractor's control that interfere with the operations of the Owner or separate contractor. Contractor shall obtain and pay for the use of additional storage or work areas needed for construction.

D. Contractor shall at all times conduct his operations to ensure the least inconvenience to the general public and users of roads leading to the site.

E. Contractor shall select construction equipment to operate with minimum noise and vibration. If, in opinion of Owner's representative, objectionable noise or vibration is produced by equipment, rectify such conditions without extra cost to the Owner. The Sound Power Level (PWL) of any equipment shall not exceed local ordinances.

1.6 CODE REQUIREMENTS AND PERMITS

Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction. The Contractor shall be fully responsible and obligated to maintain procedures for safety of all work, personnel and equipment involved in the project.

1.7 REFERENCE SPECIFICATIONS AND STANDARDS

Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI or AWWA specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date bids are received. Requirements in reference specifications and standards are the minimum for all equipment, material and work. In instances where capacities, size or other features of equipment, devices or materials exceed these minimums, meet listed or shown capacities.

1.8 PRECONSTRUCTION MEETING

A. Prior to the commencement of work at the site, a preconstruction conference will be held at a mutually agreed time and place. The conference shall be attended by:

1. Contractor and his superintendent.
2. Principal subcontractors.
3. Representatives of principal suppliers and manufacturers, as appropriate.
4. Engineer or his representative.
5. Owner or his representatives.
6. Governmental representatives, as appropriate.
7. Others as requested by Contractor, the Owner or Engineer.

B. Unless previously submitted to Engineer, Contractor shall bring to the conference a tentative schedule for each of the following:

1. Construction.
2. Cash flow.
3. Procurement.
4. Schedule of Values for progress payment purposes.
5. Shop drawings and other submittals.

C. The purpose of the conference is to designate responsible personnel and establish a working relationship among those parties. Matters requiring coordination will be discussed and procedures for handling such matters established. The agenda will include:

1. Contractor's tentative schedule and work sequencing plan, including critical items impacting plant operations, such as proposed shut-down periods.
2. Procedures for the transmittal, review and distribution of Contractor's submittals.
3. Processing procedure for monthly payment applications.
4. Procedures for maintaining record documents.
5. Procedures for processing and approval of field decisions and change orders.
6. Use of premises, office and storage areas, security, housekeeping and the City's needs.
7. Major equipment deliveries and priorities.

D. Owner or Engineer will preside at the conference and will arrange for keeping the minutes and distributing the minutes to all persons in attendance.

PART 2 - P R O D U C T S

Not used.

PART 3 - E X E C U T I O N

Not used.

END OF SECTION

**SECTION 01325 -
CONSTRUCTION SCHEDULES**

PART 1 - G E N E R A L

1.1 SECTION INCLUDES

This section includes guidelines for the provision of construction schedules. Prior to the commencement of construction activities, the Contractor shall prepare and submit a proposed construction schedule for the work, with sub-schedules of related activities which are essential to its progress.

1.2 FORM OF SCHEDULES

A. Prepare schedule using Critical Path Method (CPM) in Primavera, Microsoft Project, or other approved scheduling software.

B. Prepare schedules in the form of a horizontal bar chart. Provide separate horizontal bar for each activity or item of work. Include horizontal time scale, based on either a calendar day or working day format, per the specified terms of the contract.

C. Prepare schedule in chronological order, based on the anticipated start date of each activity.

1.3 CONTENT OF SCHEDULES

A. Show complete sequence of construction by activity, including items consistent with the approved schedule of values.

B. Show start and completion dates of each major element of construction.

C. Show projected percentages of completion for each item, as of the first day of each month.

D. Indicate the critical path for completion of the entire project.

E. Show the dates for Contractor's submittals.

F. Show the dates reviewed submittals will be required back from the Engineer.

G. Provide sub-schedules to further define critical portions of prime schedule, if required.

1.4 PROGRESS REVISIONS

A. Indicate progress of each activity to date of submission.

B. Show changes occurring since previous submission of schedule.

1. Major changes in scope.
2. Activities modified since previous submission.
3. Revised projections in progress and completion.
4. Other identifiable changes.

C. Provide accompanying narrative with progress revisions to describe or elaborate on specific components of schedule, if applicable.

1. Problem areas, anticipated delays and the impact on schedule.

2. Corrective action that will be taken by the Contractor to get the project back on schedule. This item is required whenever the progress of the job is behind the original progress schedule.
3. The effect of changes on schedules or on other contractors or sub-contractors.

1.5 SUBMITTALS

A. Submit initial schedules prior to the commencement of construction activities. If required, Contractor shall resubmit schedules within seven (7) days after return of initial review copy.

B. Submit updated progress schedules with each monthly application for payment.

PART 2 - P R O D U C T S

Not used.

PART 3 - E X E C U T I O N

Not used.

END OF SECTION

**SECTION 01330 -
SUBMITTAL PROCEDURES**

PART 1 - G E N E R A L

1.1 SECTION INCLUDES

This section includes the requirements for submittal procedures associated with the completion of the work under this contract.

1.2 SUBMITTAL PROCEDURES

A. Contractor shall transmit all submittals in hard copy and electronic format. Contractor shall first submit electronic copy to the File Transfer Protocol (FTP) site established and maintained by LAN. Once submittal has successfully completed the review process, Contractor shall submit two (2) hard copies of the final submittal to the Owner.

B. Contractor shall be responsible for all costs associated with the provision of required hard copy and electronic submittals, and shall prepare and submit all documents sufficiently in advance of required response time, such that submittal review process does not delay Contractor's construction progress and schedule.

C. The project FTP site is intended to track and expedite the processing of all submittal-related items to the maximum extent possible. In addition, it is the intent that the project FTP site, in conjunction with email notifications, be used by the Contractor to communicate with the Owner, Owner's Program Manager and Engineer throughout the duration of construction, in order to facilitate access to project-related documentation by all parties.

D. FTP Site Software and Hardware Requirements.

1. The Contractor shall purchase any hardware and software that may be required to access the established FTP site via the Internet.
2. The Contractor shall provide an adequate number of users to properly manage the project in accordance with the Project Schedule. The Contractor shall have high-speed Internet access through an Internet service provider of his/her choice.
3. Software requirements shall be as follows:
    a. Microsoft Windows operating system.
    b. An Internet Browser that supports HTML, Tables, Cookies, JavaScript, and Frames, such as Microsoft Internet Explorer.
4. Hardware requirements shall be as follows:
    a. Workstation or laptop of a most-current generation.
    b. A high-speed connection to the Internet.

E. FTP Site Management and Use.

1. Engineer shall act as the administrator for the project FTP site.
2. All costs associated with the Contractor's use of the FTP site, including, but not limited to, computer hardware and Internet service are the responsibility of the Contractor.
3. Each project team member of the Contractor shall have access to the Internet and an Internet e-mail address in order to communicate with various project team members. The Contractor shall provide the names, positions, and e-mail addresses of all project team members designated to receive communications related to the FTP site to the Owner and Engineer at the Pre-Construction Meeting.
4. The Contractor may utilize the project FTP site to communicate with his Sub-contractors. The Contractor shall inform all Sub-contractors of the purpose of the FTP site and how it can assist them in obtaining information for the project.

F. Communication Process.

1. In addition to the provision of hard copy submittals and documentation, all project-related submittals and documentation shall also be transferred through the established project FTP site.
2. Electronic submittal documents shall be uploaded in PDF format by the Contractor, and subsequently downloaded by the Owner and/or Engineer for review.
3. Notification of document postings to the FTP site shall be accomplished via email.
4. All documents requiring formal signatures shall be printed, the hard copies signed, scanned, and subsequently uploaded in PDF format to the FTP site for access by all pertinent parties.
5. Engineer shall enter and maintain the official Submittal Log on the project FTP site.
6. Contractor Daily Reports, Meeting Minutes, Punch Lists, Submittals, and Requests for Information (RFI) shall also be uploaded to the project FTP site in PDF format for downloading, review and comment by all pertinent parties. Support documentation should also be scanned and uploaded to the project FTP site in PDF format for viewing by all team members.

G. The aforementioned project-related communications do not comprise an inclusive list, and are subject to change, supplementation and/or modification in accordance with the direction of the Owner, Owner's Program Manager or Engineer.

1.3 SUBMITTAL REQUIREMENTS

A. Accompany each submittal with a dated transmittal letter which includes:

1. Submittal number. Number submittals using technical specification number, followed by sequence number and submission code (i.e., 00000-001-A), all separated by hyphens.
2. Project title and number.
3. The names of:
    a. Contractor.
    b. Subcontractor.
    c. Supplier.
    d. Manufacturer.
4. Identification of product or material.
5. Relation to adjacent structure or materials.
6. Specification section number and/or drawing number.
7. Applicable standards, such as ASTM number or Federal Specification.

B. All deviations from plans and specifications shall be provided in written format as an attachment to the transmittal form with reasons, supporting data, and other related information demonstrating that item qualifies as an approved substitution for the specified equipment. Identify all proposed product or system limitations that may be detrimental to successful performance of the completed work. Deviations not listed and discovered post-review shall be grounds for rejection of work.

C. Apply signed Contractor's stamp certifying that review, verification of product requirements, field dimensions, adjacent construction work, and coordination of information, as related to the submittal in question, have occurred. Contractor's stamp, dated and initialed or signed, shall be placed on each submittal item. Any submittal items that do not have the Contractor's stamp shall be returned without review.

D. Whenever possible, post related submittals (ex. pump and associated motor and controls component information) simultaneously to expedite Engineer's review.

E. Submittals that are not required, and required submittals which do not conform to the requirements of this Section, shall not be reviewed. Receipt of such submittals shall be acknowledged.

F. Alert all parties via email when submittals are uploaded to the project FTP site for review. Alert all impacted sub-contractors when reviewed submittals are uploaded to project FTP site by Owner's Program Manager or Engineer. Instruct parties to promptly report any inability to comply with provisions.

1.4 REQUIRED SUBMITTALS

A. Contractor shall submit the following items as part of the executed contract:

1. Performance Bond.
2. Payment Bond.
3. Certificate(s) of Insurance.

B. Contractor shall submit the following items within 30 days of Notice to Proceed issuance:

1. List of Subcontractors.
2. Schedule of Values.
3. Construction Schedule(s).
4. Construction Phasing Plan.
5. Submittal Schedule.
6. Storm Water Pollution Prevention Plan.

C. Contractor's initial application for payment shall not be processed until the aforementioned items have been submitted, reviewed and approved by the Owner, Owner's Program Manager and Engineer.

D. During the progress of the work, make the following submittals in a timely manner to prevent any delay in the work.

1. Updated Construction Schedules.
2. Shop Drawings, Product Data and Samples.
3. Mill Certificates.
4. Application for Payment. Submit monthly application for payment no later than the fifth day of each month, for the work completed during the previous month, or as alternatively specified by the Owner.
5. Material and Equipment List.
6. Change Orders. If determined necessary, Contractor shall submit a written change order request to the Owner and Engineer in with sufficient supporting information to facilitate Owner and Engineer assessment of the need proposed change in the work, the contract duration, or the contract amount. If determined acceptable by Owner and Engineer, the proposed change shall be implemented by the issuance of a formal Change Order.
7. Operation and Maintenance manuals.
8. All others as required by these specifications.

1.5 ENGINEER'S DUTIES

A. Review and return submittals within 15 calendar days after receipt.

B. Review for conformance with the design intent and with the Contract Documents.

C. Affix stamp and initials or signature, and indicate approved or requirements for resubmittal. The following review codes shall be utilized by Owner's Program Manager and Engineer:

1. "No Exception" shall be utilized to indicate that the reviewer has no exception to the content of the submittal documentation. Submittals receiving this review code shall be considered acceptable.
2. "Exception as Noted" shall be utilized to indicate that the reviewer has one or more exceptions to the content of the submittal documentation. These exceptions shall be provided in written form for the

Contractor's review. Submittals receiving this review code shall be considered acceptable, pending the Contractor's agreement with the noted exceptions.

3. "Rejected - Resubmit" shall be utilized to indicate that the reviewer has significant exceptions to the content of the submittal documentation, which necessitate its resubmission. These exceptions shall be provided in written form for the Contractor's review and subsequent action. Submittals receiving this review code shall be considered rejected, and must be resubmitted by the Contractor, following their revision, based on the noted basis for rejection.

4. "Acknowledge Receipt" shall be utilized to indicate that the submittal is not required, or is required but does not conform to the requirements of this Section. Submittals receiving this review code shall be considered NOT reviewed.

D. Return submittals to Contractor for distribution or for resubmission.

1.6 RESUBMISSION REQUIREMENTS

A. In instance that initial submittal is rejected by Owner, Owner's Program Manager or Engineer, revise submittal documents as required and resubmit as specified for initial submittal. Indicate on drawings any changes which have been made, including those requested by the Owner, Owner's Program Manager or Engineer.

B. Assign a submittal number that is the same as the original submittal number; however, submission code shall be revised to reflect the appropriate sequential letter suffix, beginning with "B".

C. Engineer shall be responsible for reviewing three (3) submittals related to any one item (original submittal and two resubmittals). The Contractor shall compensate the Engineer for his time for any review of resubmittals beyond this number.

PART 2 - P R O D U C T S

Not Used.

PART 3 - E X E C U T I O N

Not Used.

END OF SECTION

**SECTION 01340 -
SHOP DRAWINGS, PRODUCT DATA AND SAMPLES**

PART 1 - G E N E R A L

1.1 SECTION INCLUDES

This section includes the requirements for the provision of submittals related to shop drawings, product data and samples.

1.2 SHOP DRAWINGS

A. Provide professionally prepared and/or drafted shop drawings for review, as required.

B. Reference project specification or drawing numbers, if necessary, to clarify shop drawing submittal information.

C. Clearly indicate all field dimensions.

D. The use of construction drawing reproductions by Contractor, sub-contractor(s), erector, fabricator, or material supplier, in lieu of shop drawing preparation is permitted; however, it will signify such party's acceptance of all information shown therein as correct, and obligates him to any job expense, real or implied, arising due to any errors that may occur thereon. In addition, all references to the Architect or Engineer, including all professional seals, are to be removed from the drawing prior to its being submitted as a shop drawing.

1.3 PRODUCT DATA

A. Provide manufacturer-supplied product data for review, as required.

B. For manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations and other descriptive data:

1. Clearly mark to identify materials, products or models being submitted for review.
2. Show dimensions and clearances required.
3. Show performance characteristics and capacities.
4. Show wiring diagrams and controls.
5. Provide additional supplemental information if required for clarity.

1.4 SAMPLES

In general, submission of samples shall not be required. If specifically requested by Owner, submit samples of sufficient size and quantity to illustrate clearly functional characteristics of product or materials, including integrally related parts and attachment devices, and full range of available colors.

PART 2 - P R O D U C T S

Products that require shop drawings, product data and samples are indicated in the individual technical specification sections.

PART 3 - E X E C U T I O N

Not used.

END OF SECTION

SECTION 01440 -
CONTRACTOR'S QUALITY CONTROL

PART 1 - G E N E R A L

1.1 SECTION INCLUDES

This section includes the requirements for Contractor's quality control and manufacturer's field services and reports.

1.2 QUALITY CONTROL OF INSTALLATION

A. Monitor quality control of suppliers, manufacturers, products, services, site conditions, and workmanship, in order to produce work of the quality required by the contract documents.

B. Comply fully with all manufacturer recommendations and instructions for installation.

C. Request clarification from Engineer prior to proceeding with any portion of the work for which it is determined that the manufacturers' instructions conflict with the contract documents.

D. Comply with specified standards as minimum requirements for the work, except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship. Obtain up-to-date copies of all applicable standards for reference during the course of construction and/or installation.

E. Ensure that work is performed by persons qualified to produce the specified level of workmanship.

F. Contractor shall identify a person responsible for Quality Control for the project, including for subcontractors, suppliers and manufacturers. Provide contact information for person responsible.

G. Contractor shall submit Quality Control procedures and plan to be followed specific to this project.

1.3 MANUFACTURERS' FIELD SERVICES AND REPORTS

A. When specified in individual section(s) of these specifications, provide technical representative for all material or product suppliers' or manufacturers' to observe site and surface conditions, installation, quality of workmanship, start-up of equipment, operator training, testing, adjusting, and balancing of equipment, as applicable, and to initiate operation, as required. Conform to minimum time requirements for start-up operations and operator training, as defined in Section 01655, Starting of Systems, and Section 01661, Instruction of Operation and Maintenance Personnel.

B. At Owner or Engineer request, submit qualifications of manufacturer's representative in advance of required representative's services for review. If proposed manufacturer's representative is determined to be under-qualified by Owner or Engineer, Contractor shall provide an alternative representative to provide required field services.

C. Manufacturer's representative shall provide written observation report detailing all observations and site decisions or instructions given to applicators or installers, and all other actions or activities completed or witnessed while on site, including those that are supplemental or contrary to manufacturers' written instructions, within one week of field observation to Owner and Engineer for review.

PART 2 - P R O D U C T S

Not used.

PART 3 - E X E C U T I O N

Not used.

END OF SECTION

**SECTION 01455 -
TESTING LABORATORY SERVICES**

PART 1 - G E N E R A L

1.1 SECTION INCLUDES

This section includes the requirements for the testing laboratory services to be performed in conjunction with the work.

1.2 REFERENCES

A. ASTM International (ASTM):

1. C140 -Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
2. C270 - Standard Specification for Mortar for Unit Masonry.
3. C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
4. C1019 - Standard Test Method for Sampling and Testing Grout.
5. C1314 - Standard Test Method for Compressive Strength of Masonry Prisms.

B. International Building Code (IBC) with City of Waco amendments

1.3 TESTING LABORATORY SERVICES

A. This Section describes special tests and inspections of structural assemblies and components to be performed in compliance with IBC with City of Round Rock requirements.

B. These special tests and inspections are in addition to the requirements specified in individual Sections.

C. The Owner will employ 1 or more inspectors who will provide special inspections during construction.

D. The Owner shall directly employ and pay for the services of an independent testing laboratory to perform specified testing. In certain specific cases, the owner may provide an allowance for the contractor to employ testing laboratory services. In those cases the contractor and laboratory will be required to meet the same requirements as an owner employed laboratory.

E. Testing to be performed by the Owner's testing laboratory shall include, but not be limited to the following:

1. Soils compaction control.
2. Backfill and pipe embedment materials.
3. Portland cement concrete paving.
4. Cast-in-place concrete.

F. Plastic skylight assemblies and other unusual materials that are expected to support design live loads.

G. Owner's testing laboratory shall prepare and distribute to Owner and Owner's Inspector written reports documenting all testing and/or inspections conducted one week of occurrence.

H. Functions of Owner's testing laboratory shall not relieve Contractor of his obligation to perform the work according to the contract documents.

I. Owner's testing laboratory shall not be authorized to request a stop work or:

1. Release, revoke, alter, or enlarge on requirements of the contract documents.
2. Approve or accept any portion of the work.
3. Perform any duties of the Contractor.

J. When initial tests indicate noncompliance with the contract documents, all subsequent retesting occasioned by noncompliance shall be performed by the Owner's testing laboratory at the sole expense of the Contractor.

1.4 TESTING LABORATORY QUALIFICATIONS

A. Standard Qualifications.

1. Meet "Recommended Requirements for Independent Laboratory Qualification," latest edition, published by American Council of Independent Laboratories.
2. Meet basic requirements of ASTM E 329, latest edition, "Standards of Recommended Practice for Inspection and Testing Agencies for Concrete and Steel as Used in Construction."
3. Submit copy of testing reports in accordance with Materials Reference Laboratory of National Bureau of Standards, latest edition, with specifics regarding the remedy of any identified deficiencies.

B. Testing Equipment.

1. Calibrate testing equipment at maximum 12-month intervals utilizing devices of accuracy traceable to either the National Bureau of Standards or accepted values of physical constants.
2. Submit copy of certificate of calibration, made by accredited calibration agency.

1.5 CONTRACTOR RESPONSIBILITIES

A. Contractor shall be responsible for all inspections and testing, as required by applicable laws, ordinances, rules and regulations or orders of public authorities.

B. Contractor shall be responsible for meeting the requirements for certification of all products, testing, adjusting and balancing of equipment, and all other tests and standards as required by the individual section(s) of these specifications.

C. Contractor shall work with Owner's testing laboratory to ensure the performance of all specified and required inspections, sampling and testing of materials and methods of construction.

D. Contractor shall provide qualified personnel to support Owner's testing laboratory promptly upon receipt of notice from Owner's Inspector.

E. Contractor shall notify Owner's Inspector and Owner's testing laboratory a minimum of 48 hours in advance of operations requiring testing and/or inspection to facilitate the scheduling of appropriate personnel.

F. Contractor shall cooperate with Owner's testing laboratory personnel and provide access to the work or to manufacturer's operations.

G. Contractor shall provide Owner's testing laboratory with required quantities of representative samples of materials to be tested.

H. Contractor shall furnish all labor and equipment necessary to provide Owner's testing laboratory with access to the work to be tested and /or inspected and all required and/or requested samples and field data.

I. Promptly notify Owner's Inspector of irregularities or deficiencies of work which are observed during performance of services. If Portland cement concrete paving or cast-in-place concrete test do not meet or exceed specified values during the tests, the Engineer shall be notified promptly.

J. Arrange with the testing laboratory for additional samples and tests required for the Contractor's convenience. All such samples and tests shall be paid for at the Contractor’s expense.

PART 2 - P R O D U C T S

Not used.

PART 3 - E X E C U T I O N

3.1 SCHEDULE

A. The Contractor shall allow time necessary for Special Inspections as listed above.

B. Sufficient notice shall be given so that the Special Inspections can be performed. This includes time for off-site Special Inspectors to plan the inspection and travel to site.

3.2 PROCEDURE

A. The Special Inspector will immediately notify the Engineer of any corrections required and follow notification with appropriate documentation.

B. The Contractor shall not proceed until the work is satisfactory to the Engineer.

END OF SECTION

**SECTION 01500 -
TEMPORARY FACILITIES AND CONTROLS**

PART 1 - G E N E R A L

1.1 SECTION INCLUDES

This section includes the requirements for the temporary facilities and controls considered minimum for the project. The Contractor may provide additional facilities and controls which he considers necessary for the proper execution of the work and to meet his responsibilities for protection of persons and property.

1.2 BUILDINGS

A. Storage. Provide watertight storage facilities with floor above ground level as required for materials susceptible to weather damage. Storage of other materials on blocks off the ground is acceptable. Place materials to permit easy access for inspection and identification.

B. Other Buildings. The location or building of structures and the erection of tents or other forms of protection shall be subject to prior approval by the Owner.

1.3 UTILITIES

A. Power. Contractor shall make arrangements with local utility company for the provision of electric power service with ground fault protection, including but not limited to all necessary temporary wiring, panels, use outlets, switches, and lighting, as required to facilitate the prosecution of the work, throughout the duration of construction.

B. Water. Contractor shall be responsible for the provision of potable water, as required to facilitate the prosecution of the work, throughout the duration of construction.

C. Sanitary. Contractor shall provide and maintain sanitary conveniences to satisfy requirements of local, state and federal authorities, ordinances and laws. Contractor shall obtain Owner approval prior to locating any temporary restroom facilities on-site and shall ensure that all such facilities are secluded from public view to the maximum extent possible.

D. Equipment Installation, Start-up, Testing, and Operation. Contractor shall provide all power, water, fuel, lubricants, and any other materials required to facilitate all specified equipment installation, start-up, testing and operation, until formal written acceptance of equipment by Owner.

1.4 ACCESS AND PARKING

A. Contractor on-site laydown and parking areas shall be subject to the approval of the Owner and shall be restricted to designated laydown areas shown on the drawings.

B. Contractor shall provide and maintain all-weather access road to the site, as shown on the drawings, for the entire duration of construction, to ensure that general site access is not impacted.

1.5 SECURITY AND TEMPORARY PROTECTIONS

A. Furnish, install and maintain suitable barriers and protections to prevent public entry, and to protect the work, existing facilities, trees, plants, and adjoining property from construction operations.

B. Provide necessary security measures to protect the work from unauthorized entry, theft and vandalism, including but not limited to, temporary fencing and combination lock.

1.6 STORM WATER POLLUTION PREVENTION

A. Contractor shall prepare, submit, implement, and maintain a Storm Water Pollution Prevention Plan (SWPPP) prior to commencing construction operations, in accordance with the requirements of Part III of the Texas Pollutant Discharge Elimination System (TPDES) Construction General Permit (No. TXR150000), as issued on March 5, 2003.

B. Contractor shall prepare and submit SWPPP for Owner and Engineer review prior to commencement of construction activities. Proposed SWPPP shall employ erosion and sediment control measures including but not limited to reinforced filter fabric fence, stabilized construction entrance/exit, dust prevention methods, and other devices deemed necessary by the Contractor.

C. Contractor shall complete, sign and date TCEQ Form 20022, Notice of Intent (NOI) for Storm Water Discharges Associated with Construction Activity under TPDES No. TXR150000, and shall transmit a signed copy of the NOI, along with required $100.00 (or current) application fee, to the Texas Commission on Environmental Quality (TCEQ) a minimum of two (2) days prior to the commencement of construction activities.

D. Contractor shall post a signed copy of the NOI at the construction site in a location readily available for viewing by the general public, local, state, and federal authorities, prior to commencing construction activities, and shall maintain the notice in that location until final site stabilization. Notice shall include name and telephone number of Contractor's local contact person, brief project description and location of the SWP3.

E. Contractor shall maintain a clean and current copy of the SWP3 and all associated forms and certifications, including but not limited to TPDES Operator's Information Form, Contractor's / Subcontractor's Certification and Construction Inspection Forms, in a readily accessible location at the construction site for use and review by Contractor's personnel identified as having responsibilities under the SWP3, as well as the Owner, Owner's Inspector and/or Engineer.

F. Contractor shall complete, sign and date TCEQ Form 20023 Notice of Termination (NOT) for Storm Water Discharges Associated with Construction Activity under TPDES No. TXR150000, and shall transmit a signed copy of the NOT to the TCEQ within ten (10) days of final stabilization, wherein all silt fences and other temporary erosion controls have been removed, are scheduled to be removed or transferred to a new operator if the new operator has sought permit coverage.

1.7 CONSTRUCTION AIDS

Provide construction aids required by personnel and to facilitate the execution of the work: scaffolds, staging, ladders, stairs, ramps, runways, platforms, railings, hoists, cranes, chutes, and other such facilities and equipment.

1.8 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces prior to enclosing the space.

C. Remove waste materials, debris and rubbish from site weekly and dispose of same off-site in a manner consistent with state and local laws and ordinances.

1.9 REMOVAL OF TEMPORARY FACILITIES AND CONTROLS

Prior to final completion, remove all temporary buildings, sanitary conveniences, signs and other items from the site. Clean and restore entire site to original or better condition, including all roads, parking areas and other areas of impact.

PART 2 - P R O D U C T S

Not used.

PART 3 - E X E C U T I O N

Not used.

END OF SECTION

**SECTION 01562 -
TREE AND PLANT PROTECTION**

PART 1 - G E N E R A L

1.1 SECTION INCLUDES

A. Tree and plant protection and maintenance.

B. Planting new trees and relocating and replanting existing trees.

C. Maintenance of planted or replanted trees.

1.2 CONTRACTOR RESPONSIBILITIES

A. Contractor shall consult with Owner's Inspector to verify Owner's approval of the removal of any tree of eight (8) inches diameter or larger prior to commencing any construction activities that could potentially impact or damage the tree in question.

B. Preserve and protect existing trees and plants designated to remain from damage to foliage, branches, trunk, or roots that could result from construction operations.

C. Prevent following types of damage:

1. Compaction of root zone by foot, vehicular traffic, or material storage.
2. Trunk damage from equipment operations, material storage, or from nailing or bolting.
3. Trunk and branch damage caused by ropes or guy wires.
4. Root poisoning from spilled solvents, gasoline, paint, and other noxious materials.
5. Branch damage due to improper pruning or trimming.
6. Damage from lack of water due to:
    a. Cutting or altering natural water migration patterns near root zones.
    b. Failure to provide adequate watering.
7. Damage from alteration of soil pH factor caused by depositing lime, concrete, plaster, or other base materials near roots.
8. Cutting of roots larger than 1-1/2 inches in diameter.

D. When tree not designated for removal is destroyed or badly damaged as result of construction operations, remove and replace with same size, species, and variety.

PART 2 - P R O D U C T S

2.1 MATERIALS

A. Asphalt Paint. Emulsified asphalt or other adhesive, elastic, antiseptic coating formulated for horticultural use on cut or injured plant tissue, free from kerosene and coal creosote.

B. Burlap. Suitable for use as tree wrapping.

C. Fertilizer. Liquid containing 20 percent nitrogen, 10 percent phosphorus and 5 percent potash.

D. All replacement trees proposed by Contractor, if required, shall be subject to the approval of the Owner.

PART 3 - E X E C U T I O N

3.1 PROTECTION AND MAINTENANCE OF EXISTING TREES AND SHRUBS

A. Trees within project area, except for those trees shown on the drawings or directed by Owner or Owner's Inspector to be removed and relocated, are to remain in place. Protect from damage and maintain trees that are to remain.

B. Perform the following for trees or shrubs designated to remain:

1. Trim trees and shrubs under supervision of professional tree surgeon or horticulturist.
   a. Prune trees according to International Society of Arbor culture specifications.
   b. Prune trees and shrubs requiring pruning for construction operations for balance and to maintain proper form and branching habit.
   c. Cut limbs at branch collar and remove stubs. Do not gouge outer layer of tree structure or trunk.
   d. Prior to construction, prune all trees to remain of new or recent growth to maintain basic branching form of trees. Base extent of pruning upon proximity of pavement to trunk and size of tree blockouts, where applicable, and construction requirements adjacent to tree.
   e. Limit pruning of young branches to the maximum extent possible. Maintain older branches that provide basic form of tree.
   f. Paint exposed, living tissue of cuts over 3/4" in diameter with tree paint.
2. Use extreme care to prevent excessive damage to root systems.
   a. Cut tree roots in construction area smoothly with a trencher before excavating. Do not allow ripping of roots with backhoes or other equipment.
   b. Temporarily cover exposed roots with wet burlap to prevent roots from drying out.
   c. Cover exposed roots with soil as soon as possible.
3. Prevent damage or compaction of root zone (area below drip line) by construction activities.
   a. Do not allow equipment to scar trunks or limbs.
   b. Do not store construction materials, vehicles, or excavated material under drip line of trees.
   c. Do not pour liquid materials under drip line.
4. Water and fertilize remaining trees and shrubs to maintain their health during construction period.
   a. Water landscaping during construction operations at least once every seven days in cold months and once every four days in hot months.
   b. Saturate soils to at least 6 to 8 inches beneath surface.
5. Where applicable, water areas currently being served by private sprinkler systems while systems are temporarily taken out of service to maintain health of existing landscapes.
6. With Owner Inspector's permission, shrubs to remain may be temporarily transplanted and returned to original positions under supervision of professional horticulturist.

3.2 PROTECTION

A. Install steel drive-in fence posts in protective circle, approximately 8 feet on center, not closer than 4 feet to trunk of trees or stems of shrubs.

B. Insert steel drive-in fence posts a minimum of 3 feet into ground, leaving a minimum of 5 feet above ground.

C. Mount fluorescent orange construction fence on fence posts.

D. For trees or shrubs in paved areas, use movable posts consisting of two 1/2-inch minimum diameter concrete-filled steel pipe mounted in rubber automobile tires filled with concrete.

E. Provide timber wrap protection for trees in close proximity to equipment when work is required within construction fencing.

1. Wrap trunk with a layer of burlap.
2. Install vertical 5 to 6 foot long 2 by 4's or 2 by 5's, spaced 3 to 5 inches apart, around circumference of tree trunk.
3. Tie burlap in place with 12 to 9 gauge steel wire.

3.3 RELOCATING AND PLANTING NEW TREES

Contractor shall utilize qualified and experienced persons to plant, move and relocate all trees to the satisfaction of the Owner's Inspector.

3.4 MAINTENANCE OF NEWLY PLANTED TREES AND REPLANTED TREES

A. Minimum warranty period for all newly-planted trees shall be two years. Contractor shall be responsible for maintaining newly planted trees in healthy condition.

B. Contractor shall replace dead trees or trees that, in the opinion of Owner's Inspector, have become unhealthy, unsightly or have lost their natural shape as result of additional growth, improper pruning, maintenance, or weather conditions.

C. When a tree must be replaced, a new warranty period shall commence on date of Owner's acceptance.

D. Contractor shall dispose of all rejected trees.

END OF SECTION

**SECTION 01600 -
MATERIALS AND EQUIPMENT**

PART 1 - G E N E R A L

1.1 SECTION INCLUDES

This section includes the general requirements for materials and equipment, to be utilized by the Contractor during the completion of the work.

1.2 SUBSTITUTIONS AND PRODUCT OPTIONS

A. Contractor's Options.

1. For products specified only by reference standard, Contractor shall select and utilize any product meeting referenced standard.
2. For products specified by naming several products or manufacturers, Contractor shall select and utilize one of the products or manufacturers named.
3. For products specified by naming one or more products or manufacturers, and followed by "or approved substitution" or similar language, Contractor shall select and utilize one of the products of manufacturers named or submit a formal substitution request and supporting documentation, in accordance with the requirements herein, for any product or manufacturer not specifically named.
4. For products specified by naming only one product and manufacturer, Contractor shall select and utilize the product or manufacturer named.

B. Substitutions.

1. Contractor shall request **all** proposed project-related substitutions **in writing**, **in conjunction with his Bid Proposal**.
2. Following contract award, Contractor shall be notified by Engineer, in writing, concerning his proposed substitution(s), and shall be informed of those that shall be considered for project inclusion.
3. **Contractor shall submit formal substitution documentation for all proposed products to be considered** by Engineer for review **within 30 days of Notice to Proceed issuance**.
4. Substitution documentation shall include substitution request form (attached herein) and all shop drawing and product data required to sufficiently demonstrate to the Engineer that proposed substitution is equivalent to the products or manufacturers specified.
5. Engineer, in conjunction with Owner and Owner’s Program Manager, shall be the judge of the acceptability of all proposed substitutions.
6. Contractor shall be notified by Engineer, in writing, regarding acceptance or rejection of all proposed substitutions.

C. Contractor's Representation. A substitution request by the Contractor constitutes a representation that Contractor:

1. Has investigated the proposed product and determined that it is equal to or superior in all respects to that specified.
2. Will provide the same warranties or bonds for the substitution as for the product specified.
3. Will coordinate the installation of an accepted substitution into the work, and make such other changes as may be required to make the work complete in all respects.
4. Waives all claims for additional costs, under his responsibility, which may subsequently become apparent.

1.3 DELIVERY AND HANDLING

A. Arrange deliveries of products in accord with construction schedules; coordinate to avoid conflict with work and conditions at the site.

1. Deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.
2. Immediately on delivery, inspect shipments to assure compliance with requirements of Contract Documents and approved submittals, and that products are properly protected and undamaged.

B. Provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packaging. Owner will not accept delivery for Contractor.

1.4 STORAGE AND PROTECTION

A. Store products in accord with manufacturer's instructions, with seals and labels intact and legible.

1. Store products subject to damage by the elements in weathertight enclosures.
2. Maintain temperature and humidity within the ranges required by manufacturer's instructions.

B. Exterior Storage.

1. Store fabricated products above the ground, on blocking or skids; prevent soiling or staining. Cover products which are subject to deterioration with impervious sheet coverings; provide adequate ventilation to avoid condensation.
2. Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter.

C. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions, and free from damage or deterioration.

D. Store in a manner to avoid overloading conditions on foundations, floors or other surfaces upon which materials are placed.

E. Provide coverings as necessary to protect installed products from damage from traffic and subsequent construction operations. Remove when no longer needed.

PART 2 - P R O D U C T S

2.1 MATERIAL AND EQUIPMENT INCORPORATED INTO THE WORK

A. Unless specifically provided otherwise, all materials and equipment furnished for permanent installation in the work shall conform to applicable specifications and shall be new, unused and undamaged when installed or otherwise incorporated in the work. No material or equipment shall be used by the Contractor for any purpose other than that intended or specified, unless such use is specifically authorized by the Owner in each case.

B. Unless specifically noted otherwise in the individual sections of the technical specifications, for all components, products or equipment specified for project inclusion, installation or implementation, the manufacturer listed first in the list of acceptable manufacturers, represents the equipment around which the Engineer’s design was based. All listed manufacturers are acceptable; however, Contractor shall be fully responsible for the cost associated with all design modifications and impacts, including but not limited to, those associated with the project’s structural, mechanical, electrical, and instrumentation components, resulting from the inclusion, installation or implementation of components, products or equipment by these manufacturers. This obligation shall extend to all accepted components, products or equipment substitutions, if applicable. All design modifications must be prepared, signed

and sealed by an engineer licensed in Texas, and shall be submitted by the Contractor to the Engineer within 45 days or other length of time agreed upon by Owner and Engineer. Written approved by the Engineer is required prior to the Contractor's completion of the work in question.

C. Manufactured and Fabricated Products.

1. Design, fabricate and assemble in accord with the best engineering and shop practices.
2. Manufacture like parts of duplicate units to standard sizes and gauges, to be interchangeable.
3. Two or more items of the same kind shall be identical, by the same manufacturer.
4. Products shall be suitable for service conditions.
5. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.

D. Do not use material or equipment for any purpose other than that for which it is designed or is specified.

E. **Equipment requiring periodic repair and adjustment shall be furnished complete with all special tools, instruments and accessories required for proper maintenance. Equipment requiring special devices for lifting or handling shall be furnished complete with those devices.**

2.2 REUSE OF EXISTING MATERIAL

A. Except as specifically indicated or specified, materials and equipment removed from the existing structure shall not be used in the completed work.

B. For material and equipment specifically indicated or specified to be reused in the work:

1. Use special care in removal, handling, storage and reinstallation, to assure proper function in the completed work.
2. Arrange for transportation, storage and handling of products that require off-site storage, restoration or renovation. Pay all costs for such work.

PART 3 - E X E C U T I O N

3.1 WORK IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS

A. When the Contract Documents require that installation of work shall comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in the installation, including the Inspector. Maintain one set of complete instructions at the job site during installation and until completion.

B. Handle, install, connect, clean, condition and adjust products in strict accord with such instructions and in conformity with specified requirements. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by Contract Documents.

C. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Engineer prior to proceeding with the work.

3.2 EQUIPMENT IDENTIFICATION TAGS

A. When delivered to the construction site, all equipment shall be tagged with its complete identification designation. Equipment designated by distinguishing letters and numbers shall be provided with tags with letters and numbers corresponding to those on the drawings.

B. Tag material may be plastic, fiberglass reinforced plastic, or stainless steel. Plastic or fiberglass reinforced plastic tags shall be a minimum 1/16 inch thick, 2 inches square, and have one grommeted hole for a tag fastener.

Each tag shall have a durable yellow surface color. Permanent lettering shall be produced by engraving through to a black core color. Tags shall be Brady "B-60 Fiber-Shield," Seton "Setonite" or approved substitution. Stainless steel tags shall be a minimum 18 gauge, 2 inches square, and have engraved black-filled letters.

C. Each tag shall be engraved with three rows of 1/4-inch lettering. The top row shall consist of the alphabetical prefix, the second row shall consist of the 4-digit numerical designation and the bottom row shall consist of the alphabetical and/or numerical suffix as required.

D. Tags shall be securely fastened to the equipment with approved meter seals with minimum 4-ply .018 stainless steel smooth wire, stainless steel "S" hooks, or stainless steel jack chain.

3.3 EQUIPMENT FACTORY TESTS

A. The Owner and Engineer reserve the right to witness any and all shop and factory tests. The Contractor shall notify the Owner and Engineer at least 10 days in advance of the time that each shop test will be made.

B. When factory tests are required by the specific equipment specifications, these tests shall include those parameters specified and such additional parameters as are customarily tested for the particular equipment.

C. Submit test procedures, including a description of the test facility, a plan and elevation sketch of the test setup and the piping and instrumentation to be utilized. All submittals and test reports shall be exclusively and entirely in the English language and shall use English units of measure except for the metric unit of milligrams/liter (mg/l).

D. All factory tests shall be conducted in one of the following facilities:

1. A testing facility in the United States that is operated by the equipment manufacturer and is capable of conducting all required tests.
2. A testing facility in the United States that is not operated by the equipment manufacturer, but is capable of conducting all required tests.
3. A testing facility outside the United States that is operated by the equipment manufacturer and is capable of conducting all required tests.

E. If the Owner and Engineer exercise the right to witness factory testing, all costs associated with transportation, food and lodging shall be incurred by the Owner unless specifically required to be included in the contract by the specific equipment specifications.

F. All meters, gauges and other test instruments shall be calibrated within 30 days of the scheduled test and certified calibration data shall be provided.

G. Failure of the equipment to meet the specified operating conditions for any reason shall be considered an incomplete and unacceptable test and the manufacturer shall repair and retest the equipment as required, to the satisfaction of the Owner and Engineer.

H. Certified copies of a report covering each test shall be prepared by the equipment manufacturer and submitted not less than 10 days prior to shipment of the equipment to the Contractor.

END OF SECTION

SUBSTITUTION REQUEST

TO: _____

PROJECT: _____

SPECIFIED ITEM:

_____	_____	_____	_____
Section	Page	Paragraph	Description

The undersigned request consideration of the following:

PROPOSED SUBSTITUTION: _____

_____

Attached data includes product description, specifications, drawings, photographs, performance and test data, samples, etc., adequate for evaluation of the request; applicable portions of the data are clearly identified.

The undersigned states that the function, appearance and quality of the proposed substitution are equivalent or superior to the specified item, and further certifies that:

A. The undersigned will pay for changes to the building design, including engineering and investigation and redesign which may be necessitated by the requested substitution. Changes include: _____
_____.

B. The substitution affects dimensions shown on Drawings thus: _____.

C. Substitution will have the following effect on other trades and on construction schedule: _____
_____
_____.

D. Differences between proposed substitution and specified item include: _____
_____
_____.

E. Differences in manufacturer's guarantees of the proposed and specified items include: _____
_____.

F. Adjustment in the contract sum due to substitution will Add/Delete $_____.

Submitted by:

Signature: _____

Firm _____

Address _____

_____

Date _____

Telephone _____

Attachments: _____

_____

For use by the A/E:

☐ Approved ☐ Approved as noted

☐ Not Approved ☐ Received too late

By _____ Date: _____

Remarks _____

_____

_____

_____

_____

END OF SECTION

**SECTION 01655 -
STARTING OF SYSTEMS**

PART 1 - G E N E R A L

1.1 SECTION INCLUDES

A. This section includes the requirements for the provision of equipment start-up services by the Contractor.

B. Contractor shall start-up, and place into successful operation, all installed equipment according to manufacturer's written instructions and as directed by the manufacturer's field representative.

C. Contractor shall provide all materials, labor, tools, equipment, fuel, electricity, water, filters, chemicals, and other expendables required to facilitate equipment start-up and full plant operation demonstration, in accordance with manufacturer recommendations and as specified herein.

PART 2 - P R O D U C T S

As required by Contractor to facilitate equipment start-up.

PART 3 - E X E C U T I O N

3.1 START-UP PREPARATION PROCEDURES

A. Clean.

1. Clean and remove foreign materials prior to initiating operation.
2. Remove temporary protective coatings.
3. Clean strainers, dirt pockets, orifices, valve seats and headers in fluid system, to assure freedom from foreign materials.
4. Open traps and air vents where used, remove operating elements. Clean thoroughly, replace internal parts, and put back into operation.
5. Remove rust, scale and foreign material from equipment and renew defaced surfaces.

B. Lubricate.

1. Flush and replace greases and lubricants.
2. Provide initial filling of lubricants and all other required operating fluids to proper levels.

C. Align.

1. Check shaft and coupling alignments and reset where needed.
2. Check and set motor, pump and other equipment rotation, safety interlocks, and belt tensions.
3. Check and correct, if necessary, leveling plates, grout, bearing plates, anchor bolts, fasteners, and alignment of piping which may put stress on equipment connected to it.
4. Set and calibrate equipment, including all electrical and control systems.
5. Complete all required adjustments.

D. Drives.

1. Adjust tension in V-belt drives.
2. Adjust variable pitch sheaves and drives for proper equipment speed.

3. Adjust drives for alignment of sheaves and V-belts.

E. Motors.

1. Check each motor for comparison to amperage nameplate value.
2. Correct conditions which produce excessive current flow and exist due to equipment malfunction.

F. Pumps.

1. Check glands and seals for cleanliness and adjustment before running pumps.
2. Inspect shaft sleeves for scoring.
3. Inspect mechanical faces, chambers, and seal rings, and replace if defective.
4. Verify that piping system is free of dirt, debris and scale before circulating liquid through the pump.

G. Valves.

1. Inspect hand and automatic control valves, clean bonnets and stems.
2. Tighten packing glands to assure no leakage, but permit valve stems to operate without galling.
3. Replace packing in valves to retain maximum adjustment after system is judged complete.
4. Replace packing on any valve which continues to leak.
5. Remove and repair bonnets which leak.
6. Coat packing gland threads and valve stems with a surface preparation of "Moly-Cote" or "Mallow-Pro", after cleaning.
7. Verify that control valve seats are free from foreign material, and are properly positioned for intended use.

H. Pipe Joints.

1. Tighten all pipe joints.
2. Replace gaskets which show any sign of leakage after tightening.
3. Inspect all joints for leakage.
4. Promptly remake each joint which appears to be faulty by cleaning threads on both parts and applying sealing compound.

I. Other.

1. Replace defective bearings, and those which run rough or noisy.
2. Check electrical and control compatibility. Check each electrical control and power circuit to assure that operation complies with specifications and requirements to provide desired performance.
3. Inspect fan wheels for clearance and balance.
4. Inspect each pressure gage and thermometer for calibration. Replace items which are defaced, broken or, or which read incorrectly.
5. Repair damaged insulation.
6. Vent gasses trapped in any part of systems. Verify that liquids are drained from all parts of gas or air systems.

3.2 EQUIPMENT START-UP

A. Contractor shall be responsible for start-up of all facilities constructed under this contract. Start-up of the facilities by the Contractor shall include all equipment and/or systems installed as part of the project.

B. Prior to start-up of facilities, the Contractor shall have installed and pre-tested all equipment insofar as possible to check its ability for sustained operation.

C. After the facilities are sufficiently complete to permit start-up, the Contractor shall prepare and submit a proposed start-up schedule for all equipment to be put into service for review by the Owner and Engineer. Proposed schedule shall provide minimum of one week written notice prior to first scheduled start-up date.

D. Following start-up schedule approval, Contractor, with the assistance of Owner's Inspector and qualified manufacturer's representative, shall proceed with start-up operations.

E. An experienced, competent and authorized representative of the manufacturer or supplier of each item of equipment shall be present when the equipment is placed in operation.

F. Manufacturer's field representative shall inspect, check, adjust, and approve the equipment installation prior to Contractor start-up.

G. During start-up, all equipment and/or systems shall be given a running test of normal start and stop, and fully loaded operating conditions.

H. Contractor, in conjunction with manufacturer's field representative, shall correct all defects identified during equipment start-up. Contractor shall continue to operate those components that are incomplete or not operating satisfactorily, and shall repeat start-up procedures, with the assistance of the manufacturer's representative, until satisfactory results are obtained, which are complete and acceptable to the Owner.

I. In general, manufacturer's start-up assistance shall be limited to one 8-hour day, unless otherwise necessitated to sufficiently complete required start-up procedures, such that equipment installation and operation are satisfactory in the opinion of the Owner. Start-up services, regardless of the duration, shall be considered the obligation of the Contractor and equipment manufacturer and shall be provided at no additional cost to the Owner.

J. At the end of the start-up period, the Contractor shall request written acceptance of start-up from the Owner if all equipment is operating within specified limits.

K. Manufacturer's representative for each respective piece of equipment shall submit to the Owner, through the Contractor, a written report certifying that the equipment: (1) has been properly installed and lubricated, in accordance with manufacturer's standard instructions and requirements; (2) is in accurate alignment; (3) is free from any undue stress imposed by connecting piping or anchor bolts; and (4) has been operated under full load conditions and that the equipment operated as intended.

3.3 OPERATION DEMONSTRATION

A. When the start-up period is completed and accepted, the Contractor shall demonstrate the ability of the entire project to operate for 14 consecutive calendar days within a period of 30 days. All process units and equipment shall be operational during the 14-day period.

B. If major equipment or components are not operational, Contractor shall make necessary repairs and the 14-day operational period shall start again.

C. During this demonstration period, Contractor shall provide all labor, spare parts, repairs, fuel, electricity and chemicals required to operate the entire system, unless otherwise specified or agreed to by the Owner.

END OF SECTION

**SECTION 01661 -
INSTRUCTION OF OPERATION
AND MAINTENANCE PERSONNEL**

PART 1 - G E N E R A L

1.1 SECTION INCLUDES

This section includes the requirements for the Contractor's instruction of the Owner's operation and maintenance personnel.

1.2 REQUIREMENTS

A. Equipment manufacturer shall provide the services of a factory-trained maintenance specialist to instruct the Owner's operations and maintenance personnel in the recommended corrective and preventive maintenance procedures for all equipment, as specified in the respective equipment section(s) of these specifications, including electrical equipment.

B. Contractor shall be responsible for coordinating these services at times acceptable to the Owner, with a minimum of 30 days prior notice.

C. Manufacturer shall provide a combination of classroom and field training, as required to sufficiently comply with all training requirements. In general, manufacturer's instruction of operation and maintenance personnel shall be limited to one 8-hour day, unless otherwise necessitated to sufficiently complete required procedures outlined herein.

D. Operation and Maintenance Data must be submitted prior to scheduling Instruction of Operation and Maintenance Personnel.

1.3 SUBMITTALS

A. Submit Contractor's proposed operation and maintenance personnel training schedule.

B. Submit manufacturer's training materials, including specific instruction topics, planned "hands-on" demonstrations, training aids to be utilized.

C. Submit credentials of designated manufacturer's representative. Credentials will include a brief resume and specific details of the instructor's experience with maintenance of and training on the equipment specified.

D. Submit attendance logs (sign in sheets) documenting employees who received instruction subsequent to all completed training sessions.

1.4 INSTRUCTION PLAN

A. Manufacturer's representative instruction session shall include, but not be limited to, the following:

1. Equipment Operation.
   a. Describe equipment's operating (process) function.
   b. Describe equipment's fundamental operating principals and dynamics.
   c. Identify equipment's mechanical, electrical and electronic components and features.
   d. Identify all support equipment associated with the operation of subject equipment (i.e., air intake filters, valve actuators, motors).
   e. Operating instructions for start up, normal operation, regulation and control, normal shutdown, and emergency shutdown.

2. Detailed Component Descriptions.
   a. Identify and describe in detail each component's function.
   b. Where applicable, group related components into subsystems. Describe subsystem functions and their interaction with other subsystems.
   c. Identify and describe in detail equipment safeties and control interlocks.
3. Equipment Preventive Maintenance (PM).
   a. Describe PM inspection procedures to:
      1) Perform an inspection of the equipment in operation.
      2) Spot potential trouble symptoms (anticipate breakdowns).
      3) Forecast maintenance requirements (predictive maintenance).
   b. Define the recommended PM intervals for each component.
   c. Provide lubricant and replacement part recommendations and limitations, along with recommended spare parts.
   d. Describe appropriate cleaning practices and recommended intervals.
4. Equipment Troubleshooting.
   a. Define recommended systematic troubleshooting procedures.
   b. Provide component specific troubleshooting checklists.
   c. Describe applicable equipment testing and diagnostic procedures to facilitate troubleshooting.
5. Equipment Corrective Maintenance.
   a. Describe recommended equipment preparation requirements.
   b. Identify and describe the use of any special tools required for maintenance of the equipment.
   c. Describe component removal/installation and disassembly/assembly procedures.
   d. Perform demonstrations of common corrective maintenance repairs.
   e. Describe recommended measuring instruments and procedures, and provide instruction on interpreting alignment measurements, as appropriate.
   f. Define recommended torquing, mounting, calibration and/or alignment procedures and settings, as appropriate.
   g. Describe recommended procedures to check/test equipment following a corrective repair.

B. The manufacturer's representative shall incorporate training aids as appropriate to assist in the instruction. At a minimum, the training aids shall include text and figure handouts. Other appropriate training aids are:

1. Audiovisual aids such as films, slides, videotapes, overhead transparencies, posters, blueprints, diagrams, and catalogue sheets.
2. Equipment cutaways and samples such as spare parts, damaged equipment, etc.
3. Tools such as repair tools, customized tools, measuring and calibrating instruments.

C. The manufacturer's representative shall utilize descriptive handouts during the instruction. Photocopied handouts shall be good quality reproductions. Handouts should accompany the instruction with frequent reference made to them. Customized handouts developed especially for the instruction are encouraged. Minimum of ten copies of all training materials shall be provided.

D. The manufacturer's representative shall present at least one "hands-on" demonstration of common corrective maintenance repairs. The manufacturer’s representative shall provide the tools and equipment necessary to conduct the demonstration(s).

E. In any "hands-on" training situation where Owner's operation or maintenance personnel participate in disassembly or assembly of equipment components, the manufacturer shall be responsible for such disassembly or assembly and for proper equipment operation subsequent to such activities.

PART 2 - P R O D U C T S

Not used.

PART 3 - E X E C U T I O N

Not used.

END OF SECTION

**SECTION 01770 -
CLOSEOUT PROCEDURES**

PART 1 - G E N E R A L

1.1 SECTION INCLUDES

This section includes the requirements for the Contractor's closeout procedures.

1.2 SUBSTANTIAL COMPLETION AND INSPECTION

A. Contractor shall notify Owner's Inspector when, in the Contractor's opinion, the contract is substantially complete. Substantial completion shall not be requested by the Contractor until all required project start-up and testing procedures have been completed in their entirety.

B. Within ten (10) calendar days of substantial completion notification, Owner's Inspector, in conjunction with the Engineer, shall schedule a substantial completion walk-through, during which the progress and completeness of the work shall be assessed.

C. If Owner's Inspector and Engineer, during the substantial completion walk-through, determine that the project is substantially complete, a written punch list of the outstanding items to be completed as a condition of final project inspection and acceptance shall be completed and issued to the Contractor, along with a certificate of Substantial Completion.

D. If Owner's inspector and Engineer, during the substantial completion walk-through, determine that the project is not substantially complete, a written punch list will not be developed and issued to the Contractor.

E. Contractor shall promptly remedy all deficiencies in the work, in accordance with those items documented on the written punch list.

1.3 FINAL INSPECTION

A. Contractor shall notify Owner's Inspector when, in the Contractor's opinion, the contract has reached final completion. With notification of final completion, Contractor is certifying that the work has been completed in accordance with the contract documents and that all installed and/or constructed equipment and systems have been tested and are operational.

B. Within ten (10) calendar days of final completion notification, Owner's Inspector, in conjunction with the Engineer, shall schedule a final completion walk-through, during which the completeness of the work, including all punch list items, shall be assessed.

C. If Owner's Inspector and Engineer, during the final completion walk-through, determine that the project has reached final completion Owner shall subsequently issue certificates of completion and acceptance and Contractor shall submit all required closeout submittals specified herein, if not already provided, as a condition of final payment.

D. If during the final completion walk-through the Owner's Inspector or Engineer considers any portion of the work to be incomplete or defective, Contractor be notified in writing and shall take immediate steps to remedy the identified deficiencies, following which the Owner's Inspector will re-inspect the work.

1.4 CONTRACTOR'S CLOSEOUT SUBMITTALS

A. Warranty Documents.

1. Contractor shall submit all warranty, bond, service and maintenance contract documentation associated with the work performed.
2. Warranty period for equipment shall, in general, be for two years. Individual section(s) of these specifications shall have precedence over that specified herein, if the stated warranty period exceeds two years.
3. Warranty period shall, in general, commence upon the issuance of a certificate of Final Completion by the Owner. Any variation from these terms must be authorized in writing by the Owner. Only Owner's written acceptance of products and equipment shall authorize the commencement of the warranty period. It shall be the Contractor's responsibility to obtain written verification from Owner of Owner's acceptance of any and all products and/or equipment associated with the project. This request shall not be made prior to Substantial Completion.
4. Provide warranty documentation within 10 calendar days of certificate of Final Completion issuance, or alternate acceptance date, if approved by Owner, and prior to final request for payment.
5. Assemble two (2) original signed copies of all warranties, bonds, and service and maintenance contracts, executed by each of the respective manufacturers, suppliers and subcontractors.
6. Provide complete information for each item, including, but not limited to, the following information:
    a. Product or equipment description, as installed, and including all field changes.
    b. Product or equipment manufacturer and/or supplier and contact information.
    c. Contractor name and contact information.
    d. Name of entity providing warranty, bond or service and maintenance contract and contact information.
    e. Terms of warranty coverage.
    f. Date of warranty commencement and duration of warranty, bond, or service and maintenance contract.
    g. Proper procedure for Owner's personnel to follow during warranty, bond, or service and maintenance contract period.
    h. Instances which might affect validity of warranty or bond.
7. Provide a table of contents, neatly typed, in orderly sequence of all warranty, bond, or service and maintenance contract information provided.
8. Provide submittals in bound in 3-ring binders of commercial quality with cleanable plastic covers.
9. All materials shall be 8-1/2″ x 11″ (larger sheets shall be folded to fit binders) and punched to fit the 3-ring binders.

B. Project Record Documents.

1. Contractor shall maintain the following record documents for the entire duration of the project to assist in his preparation of record drawings that accurately reflect the project as-built conditions.
    a. Drawings.
    b. Project Manual.
    c. Addenda.
    d. Approved Submittals.
    e. Approved Change Orders.
    f. Field Test Records.
    g. Correspondence.
2. All documents shall be made available to Owner's Inspector when requested.
3. Contractor shall keep record drawings current and shall not permanently conceal any work until required information has been recorded.
4. Label each drawing "CONSTRUCTION AS-BUILT" in neat, large, printed letters. Legibly mark drawings to record actual construction, showing:
    a. Depths of various elements of foundation in relation to grade.
    b. Horizontal and vertical location of underground and under slab utilities and appurtenances referenced to permanent surface improvements.
    c. Location of internal utilities and appurtenances referenced to permanent surface improvements.
    d. Manufacturer, trade name, catalog number and supplier of all products and equipment actually installed.

e. Field changes of dimension and detail.
f. Changes made by change order or field order.
g. Details not on original contract drawings.

5. Indicated all changes legibly in a contrasting color.
6. Delete Architect/Engineer seal from all record drawings.
7. Record drawings shall be submitted following the completion of the work, as a condition of final payment.
8. Accompany submittal with a transmittal letter, containing:
   a. Date.
   b. Project title and number.
   c. Contractor's name and address.
   d. Contents of submittal.
   e. Certification that record drawings as submitted are complete and accurate.
   f. Signature of Contractor.

C. Operation and Maintenance Data.

1. Furnish operation and maintenance manuals for all equipment. Operation and maintenance manual must contain all information required for Owner to operate, maintain, and repair equipment. Operation and maintenance manuals must be prepared by the respective equipment manufacturer and furnished to the Owner by the Contractor. This section shall also include electrical equipment.
2. Contractor shall submit two (2) hard copies and electronic version (PDF) of all operations and maintenance manuals for Engineer review, in accordance with the requirements of Section 01330, Submittal Procedures, a minimum of four (4) weeks prior to identified and agreed to equipment start-up date.
3. Contractor shall submit three (3) hard copies and electronic version (PDF) of all final operation and maintenance manuals to Owner as a condition of final payment.
4. Documents shall be submitted in bound 3-ring/D binders with durable plastic covers, and all pages shall be 8-1/2 x 11-inch in size.
5. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.
6. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
7. All operation and maintenance manuals shall include, but not be limited to, the following:
   a. Directory, listing names, addresses, and telephone numbers of Engineer, Contractor, Subcontractors, and major equipment suppliers.
   b. List of equipment included.
   c. Significant design criteria.
   d. Parts list for each component.
   e. Equipment functions, normal operating characteristics, and limiting conditions.
   f. Assembly, installation, alignment, adjustment, and checking instructions.
   g. Operating instructions for start-up, normal operation, regulation and control, normal shutdown, and emergency shutdown.
   h. Lubrication and detailed maintenance instructions. The maintenance instructions are to include detailed drawings giving the location of each maintainable part and lubrication point and detailed instructions on disassembly and reassembly of the equipment.
   i. Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.
   j. Troubleshooting guide.
   k. Complete spare parts list with predicted life of parts subject to wear, lists of spare parts recommended on hand for both initial start-up and for normal operating inventory, and local or nearest source of spare parts availability;
   l. Outline, cross-section, and assembly drawings; engineering product data; wiring diagram.
   m. Test data and performance curves.
   n. Detailed drawings giving the location of each maintainable part.

o. Complete spare parts list with predicted life of parts subject to wear, lists of spare parts recommended on hand for both initial start-up and for normal operating inventory, and local or nearest source of spare parts availability.
p. Certifications from manufacturer that all products and equipment have been correctly installed and are functioning as intended.
q. Photocopies of warranties.

D. Spare Parts and Maintenance Materials.

1. Contractor shall furnish spare parts and maintenance materials as specified in the individual sections of the specifications.
2. Spare parts and materials shall be furnished in manufacturer's unopened cartons, boxes, crates or other protective covering suitable for preventing corrosion or deterioration for the maximum length of storage which may be normally anticipated. All spare parts and materials shall be clearly marked to facilitate ready identification.
3. Parts and materials shall be delivered to the Owner upon final acceptance of the work. Contractor shall then place them in permanent storage rooms or areas approved by the Owner, and in accordance with manufacturer's recommendations. Protect from weather, condensation and humidity.
4. Provide a letter of transmittal including the following:
   a. Date of letter and transfer of parts and materials.
   b. Contract title and number.
   c. Contractor's name and address.
   d. A complete inventory of the parts and material, listing the applicable specification section for each.
   e. A place for the Owner to sign and signify receipt of the parts and materials.
5. Contractor shall be fully responsible for loss or damage to parts and materials until they are transmitted to the Owner.

E. Evidence of Payment and Release of Liens.

1. Provide Contractor's affidavit of payment of debts and claims.
2. Provide Contractor's affidavit of release of liens, with:
   a. Consent of surety to final payment.
   b. Separate releases or waivers of liens for subcontractors and others with lien rights against property of Owner with a list of those parties.

1.5 FINAL ADJUSTMENT OF ACCOUNTS

A. Submit a final statement of accounting which shall reflect all adjustments to the contract sum thus:

1. Original contract sum.
2. Additions and deductions resulting from:
   a. Previous change orders.
   b. Allowances.
   c. Unit prices.
   d. Deductions for uncorrected work.
   e. Deductions for liquidated damages.
   f. Other adjustments.
3. Total contract sum, as adjusted.
4. Previous payments.
5. Sum remaining due.

B. If required Owner shall prepare final change order, reflecting approved adjustments to contract sum which were not previously accounted for in other construction change orders.

1.6 FINAL APPLICATION FOR PAYMENT

Following the final adjustment of accounts, Contractor shall submit final application for payment to Owner.

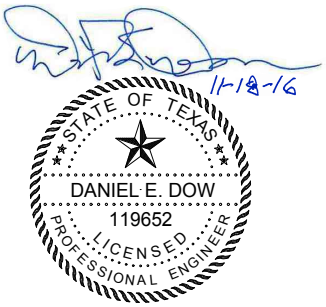
PART 2 - P R O D U C T S

Not used.

PART 3 - E X E C U T I O N

Not used.

END OF SECTION



Lockwood, Andrews & Newnam, Inc.
Texas Registered Engineering Firm F-2614

SECTION 02530

LIFT STATION DEMOLITION

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Each bidder shall visit the site and carefully and thoroughly inspect all existing facilities and take into account, in the preparation of his bid, all conditions affecting the work required by the drawings and specifications.

B. Each bidder shall satisfy himself as to the limits of removal, replacement, and modification of the existing facilities required to complete the Work as indicated on the drawings and as specified, regardless of whether such limits are specifically indicated or specified. Failure to do so will in no way relieve the Contractor of the responsibility for furnishing all labor and materials required.

C. Any delay or extra expense caused by encountering construction or materials other than anticipated or different from those indicated shall not constitute grounds for claims for additional payments or damages.

D. The Contractor shall secure the site and shall provide barricades, signs, lights, etc., to warn of possible dangers on the site as necessary.

E. All existing materials removed shall become the property of the, Contractor, and shall be removed from the premises and disposed of as specified herein.

F. The Contractor shall coordinate with various local, state, and federal agencies as required to secure all necessary permits. The Contractor is responsible for obtaining all necessary permits and licenses so that the completed work complies with all applicable codes, ordinances, regulations, standards, and laws. The cost of such permits and licenses is understood to be a part of the bid price. The Contractor is responsible for performing all work in accordance with all applicable laws regulations, codes, standards, and ordinances. The Contractor shall be responsible for any fines, fees, or other costs charged because of the contractor's violation(s) of any laws, standards, etc.

1.2 PROTECTION.

A. The Contractor shall protect from damage all existing construction, utilities, and equipment that are to remain in service.

B. All piping and appurtenances which are not to be removed must remain in continuous operation during the work. Demolition work shall create minimum interference with the Owner's operations and minimum inconvenience to the Owner.

C. In areas where flame cutting will be used, special attention shall be given to fire protection. All areas shall be dust free before flame cutting will be permitted. Dry chemical fire extinguishers shall be provided in such areas, and workers trained in their use.

D. Contractor shall also take precautions to protect surrounding properties as required.

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

3.1 GENERAL

A. All demolition work shall be carried out in a manner which will prevent injury to workers and damage to existing facilities or construction.

B. Existing materials and equipment removed by contractor shall not be reused in the Work, except where so specified or indicated, and shall become the Contractor's property, unless otherwise specified, and be removed from the job site.

C. All backfilling required by the demolition shall conform to the governing requirements of the earthwork section of the Standard Specifications as provided by the City of Round Rock.

D. Seeding of the areas affected by the demolition work shall be as specified in the construction drawings and specifications.

3.2 PAINT SYSTEM

A. The existing lift station shall be completely demolished and those portions not identified as to remain City property shall be disposed of away from the project site. Demolition methods must conform to current federal and state standards. All requirements pertaining to the preparation and approval of the environment documents, permits, water quality and public involvement issues must be in accordance with the latest state and federal policies and procedures.

3.3 EQUIPMENT

A. The contractor shall remove lift station cover (concrete with hatch), pumps, motors, couplings, controls, panels, and force main valves and deliver to City storage facility as directed by City representative.

3.4 PIPING

A. All portions of Force Main shown to be removed within this project shall be disconnected, dismantled, and removed as required and in such a manner as to minimize distributing or damaging adjacent facilities. Force Main piping shall be delivered and stacked at a City facility as directed by City representative. All other piping shall be abandoned as indicated on the drawings and as specified herein.

B. Contractor shall plug with grout all open ends of pipelines exposed during demolition operations. Contractor shall pump grout into all incoming and outgoing pipe to fill at least 12-inches of the pipe from the structure wall.

3.5 WETWELL DEMOLITION

A. The wet well shall be cut down five (5) feet below grade, filled with flowable fill, and covered with top soil to grade.

3.6 SITEWORK DEMOLITION

A. Site fencing around lift station identified to be removed shall be disposed of in accordance with 3.7 below.
B. Concrete pad shall be disposed of in accordance with 3.7 below.
C. Electrical equipment shall be disposed of in accordance with 3.7 below

3.7 DISPOSAL

A. All removed materials, debris, and rubbish, not belonging to the Owner as outlined above or as identified by Owner representative, resulting from the demolition operations shall be removed from the site and disposed of by, and at the expense of, the Contractor.

3.8 RESTORATION

A. Restorations shall be made as required and as indicated on the drawings to restore existing facilities to an equivalent or better condition. All restoration work shall be subject to acceptance by Owner and Engineer. All materials used for restoration work shall be new.

B. At the completion of the demolition work, the entire site shall be cleaned of all debris and rubbish.

3.9 MEASUREMENT AND PAYMENT METHOD

A. The requirements in this specification shall be paid per lump sum under bid item 02530 “LIFT STATION DEMOLITION”. The cost for equipment and disposal services shall be included in the bid item.

END OF SECTION

**SECTION 02539 -
DIVERSION PUMPING**

PART 1 - G E N E R A L

1.1 SECTION INCLUDES

A. Provide all labor, supervision, tools, plant, equipment, appliances and materials to perform all operations in connection with diversion pumping. The primary purpose of diversion pumping is to provide reliable sewer service to the users of the sanitary sewer at all times. The Contractor shall maintain sewage flow in the construction area in order to prevent backup and/or overflow into adjacent ditches, storm sewers and waterways. The secondary purpose of diversion pumping is to facilitate cleaning, facility repair, television inspection and/or rehabilitation of the sewer line.

B. The Contractor shall be responsible for all required bulkheads/plugs, pumping, equipment, piping, etc., to accomplish the sequence of construction.

1.2 MEASUREMENT AND PAYMENT

A. Payment for bypass pumping is on a lump sum basis.

1.3 SUBMITTALS

A. Provide, in writing, a sequence of construction for review and approval by the Engineer.

B. Shop Drawings/Product Data. At a minimum, provide the following information:

1. Pump sizes, capacity, number of each size and power requirements.
2. Pump curves showing operating range and system head curves.
3. Number of Pumps.
4. Provisions for Operations, including staging areas for pumps, plugging methods and layout plan.
5. Controls.
6. Method of Noise Control for each pump and/or generator.
7. Emergency action plan identifying measures taken in the event of a pump failure or sewer spill.

1.4 COORDINATION

A. If the Owner is operating and/or maintaining diversion pumping in the construction area, the Contractor shall coordinate with the Owner as necessary to accomplish the two purposes stated above. The Contractor shall cease diversion pumping operations when directed by the Engineer.

B. Contractor shall schedule a meeting with the Owner in the field prior to beginning operations.

PART 2 - P R O D U C T S

2.1 GENERAL

A. Diversion pumping equipment shall be designed for the type of work for which it is required.

B. Provide onsite continuous monitoring during all bypass pumping operations using one of the following methods:

1. Personnel on site

2. Portable SCADA equipment

2.2 PUMPING

A. Provide equipment that will convey 100 percent of wet weather peak flow conditions, with head conditions that match the design of the proposed lift station pumps. The flow will be pumped into a force main system as shown on the drawings.

B. Pumps shall meet requirements of City of Round Rock Noise and Sound Level Regulations for a residential district.

2.3 PIPING

A. All piping, joints and accessories shall be designed to withstand at least twice the maximum system pressure, or a minimum of 50 psi, whichever is greater. During diversion pumping, no sewage shall be leaked, dumped or spilled in or onto any area outside the existing sanitary sewer system. When diversion pumping operations are complete, all piping shall be drained into the sanitary sewer prior to disassembly.

PART 3 - E X E C U T I O N

3.1 OVERFLOWS

A. During diversion pumping, do not allow sewage to leak, dump, or spill into or onto areas outside of existing sanitary sewer systems.

B. In the event of an accidental spill or overflow, the Contractor shall immediately stop the overflow, notify the Owner and Engineer, and take the necessary action to clean up and disinfect the spillage to the satisfaction of the Owner. If sewage is spilled onto public or private property, the Contractor shall wash down, clean up and disinfect the spillage to the satisfaction of the Owner. Any and all overflows shall be reported to the Texas Commission on Environmental Quality (TCEQ) and the Environmental Protection Agency (EPA) by the Contractor within 24 hours.

END OF SECTION

SECTION 02577 -
FIBERGLASS REINFORCED POLYESTER (FRP) WET WELL

PART 1 - G E N E R A L

1.1 SECTION INCLUDES

A. This item shall consist of the furnishing and installation of a closed-bottom fiberglass reinforced polyester (FRP) wet well and associated appurtenances for a lift station.

1.2 SUBMITTALS

A. Contractor shall provide all submittals in accordance with the requirements of Section 01330, Submittal Procedures, and Section 01340, Shop Drawings, Product Data and Samples.

B. Submit complete descriptive product data for all equipment to be provided, including but not limited to, fabrication and installation drawings, electrical, instrumentation and controls component requirements and drawings, pertinent design calculations, and any other related information necessary to facilitate Owner and Engineer review.

C. No work shall be performed in connection with the fabrication or manufacture of materials and equipment nor shall any accessory or appurtenance be purchased until the drawings and date thereof have been approved by the Engineer and Owner, except at the Contractor's own risk and responsibility.

D. Shop Drawing/Product Data: At minimum, provide the following information:

1. Demonstrate that the wet well meets the design criteria listed in the specification and as shown in the Plans, including interaction with concrete base slab.

2. Bill of materials of the wet well shall include at a minimum pipe penetration seal, vent, and access cover.

3. Submittal shall include drawings and descriptive information in sufficient detail to show kind, size, material, and arrangement; the external connections, anchorages, access hatch, and supports required; and dimensions needed for installation and correlation with other materials and equipment. Data submitted shall include drawings showing all required wiring and piping layouts. If the cut-sheets contain information not pertaining to the supplied equipment, all extraneous information shall be clearly crossed out and pertinent information highlighted.

E. Operation and Maintenance Manuals. Provide complete operation and maintenance manuals for all equipment, in accordance with the requirements of Section 01770, Closeout Procedures.

1.3 WARRANTY

A. Provide equipment warranty in accordance with the requirements of Section 01770, Closeout Procedures.

B. The Contractor shall bear full responsibility for the proper installation of the wet well.

C. The Contractor and Manufacturer shall guarantee that the structure shall be free from defects in design, materials and workmanship for one year from date of acceptance by the Owner.

1.4 REFERENCES

A. Related Specifications
1. 11319 Submersible Pumps

2. Series 400, “Concrete Structures”
3. Item No. 403, “Concrete for Structures”
4. Item No. 406, “Reinforcing Steel”
5. Item No. 410, “Concrete Structures”
6. Item No. 510, “Pipe”
7. Item No. 720, “Metal for Structures”

B. Applicable Standards and Specifications

1. TCEQ 30 TAC Chapter 217
2. AISI, ANSI, ASTM, OSHA, SSPC
3. ASTM D 3299 Standard Specification for Filament-Wound Glass-Fiber-Reinforced Thermoset Resin Corrision Resistant Tanks
4. ASTM D 3753
5. ASTM C 443 Standard Specification for Glass-Fiber-Reinforced Polyester Manholes and Wetwells

1.5 MANUFACTURER’S SERVICES

A. Manufacturer’s representative shall be on site during installation of polymer wet well to insure manufacturer’s recommendations for handling and installation are followed.

PART 2 - P R O D U C T S

2.1 ACCEPTABLE MANUFACTURERS

A. Provide equipment from one of the following acceptable manufacturers:

1. L.F. Manufacturing, Inc.
2. Or pre-approved equal.

B. If applicable, all equipment substitution requests shall be made in accordance with the requirements of Section 01600, Materials and Equipment.

2.2 PRODUCT DESCRIPTION

A. General

1. Fiberglass reinforced polyester wetwells shall be manufactured from commercial grade polyester resin or vinyl ester resin, with fiberglass reinforcements. The resin system shall be suitable for atmospheres containing hydrogen sulfide and dilute sulfuric acid as well as other gases associated with the wastewater collection systems.

B. Materials

1. Resin: The resins used shall be a commercial grade unsaturated polyester resin.
2. Reinforcing Materials: The reinforcing materials shall be commercial Grade "E" type glass in the form of mat, continuous roving, chopped roving, roving fabric or a combination of the above, having a coupling agent that will provide a suitable bond between the glass reinforcement and the resin.
3. Surfacing Materials: If reinforcing materials are used on the surface exposed to the contained substance, it shall be a commercial grade chemical-resistant glass that will provide a suitable bond with the resin and leave a resin richsurface.
4. Fillers and Additives: Fillers, when used, shall be inert to the environment and wetwell construction. Additives, such as thixotropic agents, catalysts, promoters, etc., may be added as required by the specific

manufacturing process to be used. The resulting reinforced plastic material must meet the requirement of this specification.

C. Fabrication:

1. Exterior Surface: The exterior surface shall be relatively smooth with no sharp projections. Handwork finish is acceptable if enough resin is present to eliminate fiber show. The exterior surface shall be free of blisters larger than 1/2 inch in diameter, delamination and fiber show. For a UV inhibitor the resin on the exterior surface of the manhole shall have gray pigment added for a minimum thickness .125 inches.
2. Interior Surface: The interior surface shall be resin rich with no exposed fibers. The surface shall be free of grazing, delamination, and blisters larger than 1/2 inch in diameter, and wrinkles of 1/8 inch or greater in depth. Surface pits shall be permitted up to 6 square feet if they are less than 3/4 inch in diameter and less than 1/16 inch deep.
3. Fiberglass Reinforced Bottom: The bottom to be fabricated using fiberglass material as stated in section A.2. Material and installation to meet all physical requirements as per section A.4. Bottom to be attached to wetwell pipe with fiberglass layup to comply with A.S.T.M.-D3299 specifications. When reinforcement is necessary for strength, the reinforcement shall be fiberglass channel laminated to wetwell bottom per A.S.T.M.-D3299.
4. Integral Internal Fiberglass Fillet: Fiberglass wetwells and basins may have an internal sloped fillet bottom. The fillet shall be constructed of the same fiberglass material as the wetwell or basin and shall be integral to the wetwell or basin. The fiberglass fillet shall have a 1:1 slope and shall not interfere with pump mounting in the wetwell or basin.
5. Fiberglass Reinforced Top: The fiberglass wetwell top shall be fabricated using fiberglass material as stated in section A.2. Material and installation to meet all physical requirements as per section A.4. Top to be attached to wetwell pipe with fiberglass layup to comply with A.S.T.M.-D3299 specifications. When reinforcement is necessary for strength, the reinforcement shall be fiberglass channel laminated to wetwell bottom per A.S.T.M.-D3299.
6. Installation of Stubouts: Effluent, service, or discharge lines may be factory installed. Approved methods are PVC sewer pipe, Inserta-Tee fittings, or Kor-N-Seal boots. Installation of stubouts to be fiberglass layup to comply with A.S.T.M.-D3299 specifications.
7. Defects Not Permitted:
    a. Exposed fibers: glass fibers not wet out with resin.
    b. Resin runs: runs of resin and sand on the surface.
    c. Dry areas: areas with glass not wet out with resin.
    d. Delamination: separation in the laminate.
    e. Blisters: light colored areas larger than 1/2 inch in diameter.
    f. Crazing: cracks caused by sharp objects.
    g. Pits or Voids: air pockets.
    h. Wrinkles: smooth irregularities in the surface.
    i. Sharp projection: fiber or resin projections necessitating gloves for handling.

D. Physical Requirements:

1. Load Rating: The complete wetwell shall have a minimum dynamic-load rating of 16,000 ft-lbs when tested in accordance with Section A.5. To establish this rating, the complete wetwell shall not leak, crack, or suffer other damage when load tested to 40,000 ft-lbs and shall not deflect vertically downward more than 1/4 inch at the point of load application when loaded to 24,000 lbs.
2. Stiffness: The wetwell cylinder shall have a minimum pipe-stiffness value shown in Table 1 when tested in accordance with ASTM 3753, Section 8.5.
    a. Table 1 – Stiffness Requirements

WW Length – Ft.	Stiffness - psi
10 to 20	2.01
21 to 30	3.02
31 to 40	5.24

3. Physical Properties:

	Hoop Direction	Axial Direction
a. Tensile Strength (psi)	18,000	5,000
b. Tensile Modules (psi)	0.8×10^6	0.7×10^6
c. Flexural Strength (psi)	26,000	4,500
d. Flexural Modulus (psi)		
(no ribs – 48", 60", 72")	1.4×10^6	0.7×10^6
(with ribs – 96", 144")	0.7×10^6	0.7×10^6

4. Tests shall be performed as specified in ASTM-D3753 latest edition, Section 8.

2.3 FUNCTIONAL REQUIREMENTS

A. The wet well access hatch shall be sized large enough for removal of any equipment inside the wet well.

B. All lifting chains, float cables, and power cables, etc. shall be mounted so that they are easily accessible from the lift station hatch without personnel entering wet well.

2.4 TOOLS, SPARE PARTS, ACCESSORIES

A. All hardware, fasteners, and pump mounting bolts used in the wet well shall be 316 series stainless steel.

B. Wet Well Vents shall be constructed of coated ductile iron pipe or schedule 40 stainless steel and be a minimum diameter of 4 inches. Vents shall be sized based upon maximum air change at maximum pumping rate. The end of the vent shall terminate at the odor control equipment, as shown on the plans. Submittal shall include vent piping support. The vent pipe shall penetrate the full thickness of the top slab.

C. Access Hatch

1. Access covers shall be equipped with an aluminum safety grate for fall through protection and controlled confined space entry per current OSHA Standards. The access covers to the wet well shall be sized as identified in the plans and as recommended by the pump manufacturer for safe removal of the pumps. The cover shall be large enough to allow all equipment to be removed easily. The access frame and cover to the wet well shall be constructed of aluminum tread plate with a trough frame and floodtight gasket. The doors shall open to 90° and automatically lock. The lifting handles, hinges, and all fastening hardware shall be stainless steel, Type 316. The covers shall be able to be secured by a padlock using a heavy duty locking staple. Owner will provide padlock at the time of acceptance of the station. Supplier shall deliver access cover to wet well manufacturer for installation in wet well cover. Supplier shall also provide all necessary drawings and dimensions for exact installation.
2. USF Fabrication Model TPD300, or approved equal.

PART 3 - E X E C U T I O N

3.1 DELIVERY AND STORAGE

A. Deliver, handle, store, and protect all equipment in accordance with the requirements of Section 01600, Materials and Equipment.

B. Deliver, handle, store, and protect all equipment in full accordance with manufacturer/supplier recommendations and/or instructions.

3.2 FIELD INSTALLATION AND TESTING

A. Any special lifting device required for off-loading and installation of wet well may be provided by manufacture of wet well and shall not fully penetrate the wet well wall. Installation of the wet well shall be performed in accordance with all applicable standards.

B. Excavation:

1. General: The limit of excavation shall be such to allow for placing and removing forms, installing sheeting, shoring, bracing, etc. The Contractor shall pile excavated material in a manner that will not endanger the work and will avoid obstructing sidewalks, driveways, power poles, etc. Drainage shall be kept clear.

2. Vertical Sides: When necessary to protect existing or proposed structures or other improvements, the Contractor shall maintain vertical sides of the excavation. The limit shall not exceed three feet outside the footing on a vertical plane parallel to the footing except where specifically approved otherwise by the Engineer. The Contractor shall provide and install any sheeting, shoring, and bracing as necessary to provide a safe work area as required to protect workmen, structures, equipment, power poles, etc. The Contractor shall be responsible for the design and adequacy of all sheeting, shoring, and bracing. The sheeting, shoring, and bracing shall be removed as the excavation is backfilled in such a manner as to prevent injurious caving.

3. Sloping Sides: Where sufficient space is available, the Contractor shall be allowed to back slope the sides of the excavation. The back slope shall be such that the excavation shall be safe from caving. The type of material being excavated shall govern the back slope used, but in any case the back slope shall be no steeper than 1 foot horizontal to 1 foot vertical, as permitted by site conditions. In no case shall the excavation extend into the tree protection zone as shown on the plans.

4. Dewatering: The Contractor shall keep the excavation free from water by use of cofferdams, bailing, pumping, well pointing, or any combination as the particular situation may warrant. All dewatering devices shall be installed in such a manner as to provide clearance for construction, removal of forms, and inspection of exterior of form work. It is the intent of these specifications that the foundation be placed on a firm dry bed. The foundation bed shall be kept in a dewatered condition a sufficient period of time to insure the safety of the structure. All dewatering methods and procedures are subject to the approval of the Engineer. The excavation shall be protected from excessive rainfall, drainage and drying. The excavation shall be inspected and approved by the Engineer before work on the structure is started. It is the intent of these specifications that the Contractor provide a relatively smooth, firm foundation bed for footings and slabs that bear directly on the undisturbed earth without additional cost to the Owner, regardless of the soil conditions encountered. The Engineer will be the sole judge as to whether these conditions have been met. The contractor shall pile excavated material in a manner that will not endanger the work.

5. Unauthorized Over Excavation: Excavation for slabs, footings, etc., that bear on earth shall not be carried below the elevation shown on the drawings. In the event the excavation is carried on below the indicated elevation, the Contractor shall bring the slab, footing, etc., to the required grade by filling with concrete having a minimum compressive strength of at least 3,000 psi at 28 days.

6. Handling: Do not drop or impact the wetwell. Wetwells shall be chocked if stored horizontally. If wetwells must be moved by rolling, the ground transversed shall be smooth and free of rocks, debris, etc. FRP wetwells may be lifted by the installation of two lifting lugs as specified by the manufacturer on the outside surface near the top or by a sling or "choker" connection around the center. Use of chains or cables in contact with the wetwell surface is prohibited.

7. Fiberglass Wetwell Top: The fiberglass top may have stubouts installed or may have a raised fiberglass collar around the hatch opening. The fiberglass top shall be designed to withstand the weight of a concrete reinforced slab installed over it.

C. Installation: Install wet well in cast-in-place concrete base as shown in the drawings and as noted in the Specifications.

D. Backfilling: Refer to Specification Item 401, Structural Excavation Backfill, and the Structural Details.

E. Leak Testing:

1. Wet well sections shall be carefully inspected. Units found to have cracks, defects, or any non-reparable damage will not be accepted.
2. All pipe penetrations shall be installed and sealed according to design plans and specifications prior to leak test.
3. All backfilling and compaction shall be completed prior to start of leak test.
4. Contractor shall place and inflate pneumatic plugs in all connecting pipes to isolate wet well. Sealing pressure of plugs shall be according to manufactures recommendations.
5. Wet well shall be filled to the top with water for 24 hours with no drop in water level.
6. If the wet well fails to pass the initial test the contractor shall locate and repair the leak using methods acceptable to current city standards and inspection by the engineer.
7. Upon completion of repairs a second leak test shall be conducted.

3.3 EQUIPMENT PROTECTION AND RESTORATION

A. Painted surfaces shall be protected against impact, abrasion, discoloration, or other damage during shipment. All painted surfaces which are damaged prior to acceptance of the equipment shall be re-painted to the satisfaction of the Inspector and Engineer.

3.4 STORAGE AND HANDLING

A. Deliver, unload, and store products on site in a manner that prevents damage. Refer to related specifications for other storage handling requirements.

END OF SECTION

SECTION 05310

STEEL ROOF DECKING

PART 1 - G E N E R A L

1.1 SUBMITTALS

A. The submittal requirements of this specification may include:

1. Shop drawings indicating material profile, jointing pattern, jointing details, fastening methods, and installation details.

1.2 QUALITY ASSURANCE

A. Installer: Company specializing in sheet metal roof installations with 5 years documented experience.

1.3 STORAGE

A. Protect metal decking stored at jobsite from water, dirt and other harmful matter. Store above ground on platforms, pallets or other supports.

B. Stack precormed and prefinished material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

PART 2 - P R O D U C T S

2.1 MANUFACTURERS

A. Wheeling Corrugating Company, Vulcraft, or Consolidated Systems, Inc.

2.2 METAL DECK

A. Steel roof deck shall be manufactured from steel conforming to ASTM A 611, Grades C, D or E, or from ASTM A 653 Structural Quality, Grade 33 or higher, with a minimum coating of G-90 {Z275}.

B. Minimum physical properties and installation of metal form are noted on the drawings. Deck sections shall be placed so that maximum SDI construction spans are not exceeded. Increase deck thickness if required.

2.3 ACCESSORIES

A. Fabricate welding washers from 14-gauge steel, formed to fit valley of the sheet.

B. Minimum 20-gauge galvanized sheet metal flashing.

C. Additional attachments shall be as scheduled on the drawings.

PART 3 - E X E C U T I O N

3.1 INSTALLATION

A. Steel deck shall be erected and fastened in accordance with the SDI Code of Recommended Standard of Practice and the manufacturer's printed recommendations unless shown otherwise on the drawings.

B. Weld ends of deck to supports using a 12-6-12 pattern (a weld at each side lap and at the third and fourth flutes). Intermediate supports; weld pattern 12-18 staggered (a weld at each side lap and at the third or fourth flute).

C. For spans exceeding 5′-0″ {1500}, fasten side laps together at mid-span using welds or screws.

END OF SECTION

**SECTION 11319 -
SUBMERSIBLE SEWAGE PUMPS**

PART 1 - G E N E R A L

1.1 SECTION INCLUDES

A. This item shall consist of the furnishing all labor, materials, equipment, and incidentals required to provide solids handling submersible centrifugal sewage pumps as specified herein.

1.2 SUBMITTALS

A. Contractor shall provide all submittals in accordance with the requirements of Section 01330, Submittal Procedures, and Section 01340, Shop Drawings, Product Data and Samples.

B. Submit complete descriptive product data for all equipment to be provided, including but not limited to, fabrication and installation drawings, materials of construction, electrical, instrumentation and controls component requirements and drawings, pertinent design calculations, dimensions, and any other related information necessary to facilitate Owner and Engineer review.

C. No work shall be performed in connection with the fabrication or manufacture of materials and equipment nor shall any accessory or appurtenance be purchased until the drawings and date thereof have been approved by the Engineer and Owner, except at the Contractor's own risk and responsibility.

D. Operation and Maintenance Manuals. Provide complete operation and maintenance manuals for all equipment, in accordance with the requirements of Section 01770, Closeout Procedures.

1.3 WARRANTY

A. Provide equipment warranty in accordance with the requirements of Section 01770, Closeout Procedures.

1.4 REFERENCES

A. Applicable Standards and Specifications

1. TCEQ 30 TAC Chapter 217
2. AISI, ANSI, ASTM, OSHA, SSPC
3. ASTM A48
4. ASTM A43

1.5 MANUFACTURER’S SERVICES

A. Manufacturer’s representative shall be on site during installation of polymer wet well to insure manufacturer’s recommendations for handling and installation are followed.

PART 2 - P R O D U C T S

2.1 ACCEPTABLE MANUFACTURERS

A. Provide equipment from one of the following acceptable manufacturers:

1. Hydromatic

2.2 PRODUCT DESCRIPTION

A. Operating Conditions:

1. Each pump shall be rated 40 HP, 460 volts, 3 phase, 60 hertz, and 1,750 RPM. The unit shall produce 500 U.S. GPM at 117.5 feet TDH, with a minimum pump efficiency of 64% and maximum input kW of 34.3 kW. The pump shall be capable of handling a 3" solid. The pump shall be non-overloading throughout the entire range of operation without employing service factor. The pump shall reserve a minimum service factor of 1.20. The performance curve submitted for approval shall state in addition to head and capacity performance, the pump efficiency, solid handling capacity, and reflect motor service factor.
2. Each pump shall also be capable of producing 700 U.S. GPM at 128.8 feet TDH, with a minimum pump efficiency of 69%, by increasing the impeller diameter only.

B. Construction:

1. The pump shall be a centrifugal, solids handling, submersible, wastewater type, model S4K as manufactured by Hydromatic Pump. The pump volute, motor and seal housing shall be high quality gray cast iron, ASTM A-48, Class 30. The pump discharge shall be fitted with a 4" standard ASA 125 lb. flange, faced and drilled. All external mating parts shall be machined and Nitrile O-ring sealed on a beveled edge. Gaskets shall not be acceptable. All fasteners exposed to the pumped liquids shall be 300 series stainless steel.

C. Electrical Power Cord:
1. Electrical power cord shall be SOOW, W, or GGC, water resistant 600V, 90°C, UL and CSA approved and applied dependent on amp draw for size.
2. The pump shall be triple protected with a compression fitting and two epoxy potted areas at the power cord entry to the pump. A separation between the junction box area of the pump and the motor by a stator lead sealing gland or terminal board shall not be acceptable.
3. The power cable entry into the cord cap assembly shall first be made with a compression fitting. Each individual lead shall be stripped down to bare wire at staggered intervals, and each strand shall be individually separated. This area of the cord cap shall then be filled with an epoxy compound potting which will prevent water contamination to gain entry even in the event of wicking or capillary action.
4. The power cord leads shall then be connected to the motor leads with extra heavy connectors having brass inserts with a screwed wire-to-wire connection, rather than a terminal board that allows for possible leaks.
5. The connection box wiring shall be separated from the motor housing wiring by stripping each lead down to bare wire, at staggered intervals, and separating each strand. This area shall be filled with an epoxy compound potting. Fiberglass terminal boards, which are subject to heat fatigue and cracking and which may lead to possible leaks, shall not be acceptable.
6. The cord cap assembly where bolted to the connection box assembly and the connection box assembly where bolted to the motor housing shall each be sealed with a Nitrile O-ring on a beveled edge to assure proper sealing.

D. Motor:
1. The stator, rotor and bearings shall be mounted in a sealed submersible type housing. The stator windings shall have Class F insulation (155°C or 311°F) or Class H insulation (180°C or 356°F) and a dielectric oil-filled motor, NEMA B design. Further protection shall be provided by using on-winding thermal sensors. Because air-filled motors do not dissipate heat as efficiently as oil-filled motors, air-filled designs shall not be acceptable.
2. The pump and motor shall be specifically designed so that they may be operated partially or completely submerged in the liquid being pumped. The pump shall not require cooling water jackets. Dependence upon, or use of, water jackets for supplemental cooling shall not be acceptable.
3. Stators shall be securely held in place with a removable end ring and threaded fasteners so they may be easily removed. No special tools shall be required for pump and motor disassembly.

4. Pump shall be equipped with heat sensors. The heat sensor shall be a low resistance, bi-metal disc that is temperature sensitive. It shall be mounted directly on the stator windings and sized to open at 120°C and automatically reset at 30–35°C differential. The sensors shall be connected in series with motor starter coil so that the starter shall be equipped with 3 leg overload heaters, making all normal overloads protected by the starter.

E. Bearings and Shaft

1. An upper radial bearing and a lower thrust bearing shall be required. These shall be heavy-duty single row ball bearings that are permanently lubricated by the dielectric oil that fills the motor housing. Double row, sealed grease packed bearings shall not be acceptable. Bearings that require lubrication according to a prescribed schedule shall not be acceptable. The upper radial bearing and lower thrust bearing shall have a minimum B-10 life of 50,000 hours.

2. The shaft shall be machined from a solid 400 series stainless steel forging and be a design that is of large diameter with minimum overhang to reduce shaft deflection and prolong bearing life.

F. Seals

1. The pump shall have two mechanical seals, mounted in tandem, with an oil chamber between the seals. Type 21 seals shall be used with the rotating seal faces being carbon and the stationary seal faces to be ceramic. The lower seal shall be replaceable without disassembly of the seal chamber and without the use of special tools. Pump-out vanes shall be present on the backside of the impeller to keep contaminates out of the seal area. Units that require the use of tungsten-carbide seals or foreign manufactured seals shall not be acceptable.

2. The pump shall be equipped with a seal leak detection probe and warning system. This shall be designed to alert maintenance personnel of lower seal failure without having to take the unit out of service for inspection or requiring access for checking seal chamber oil level and consistency.

3. There shall be an electric probe or seal failure sensor installed in the seal chamber between the two tandem mechanical seals. If the lower seal fails, contaminants that enter the seal chamber shall be detected by the sensor, which sends a signal to operate the specified warning device.

4. Units equipped with opposed mechanical seals shall not be acceptable

G. Impeller

1. Impeller shall be of the mono-vane or two-vane, enclosed solids handling design and have pump-out vanes on the front and backside of the impeller to prevent grit and other materials from collecting in the seal area. Impeller shall not require coating. Because most impeller coatings do not remain beyond the very early life of the impeller, efficiency and other performance data submitted shall be based on performance with an uncoated impeller. Attempts to improve efficiency by coating impeller shall not be acceptable.

2. Impellers shall be dynamically balanced. The tolerance values shall be listed below according to the International Standard Organization grade 6.3 for rotors in rigid frames. The tolerance is to be split equally between the two balance planes that are the two impeller shrouds.

RPM	**Tolerance**
3500	.01 in. – oz./lb. of impeller weight
1750	.02 in. – oz./lb. of impeller weight
1150	.026 in. – oz./lb. of impeller weight
870	.03 in. – oz./lb. of impeller weight

3. The impeller shall be threaded shaft or tapered shaft and key driven. A 300 series stainless steel washer and impeller bolt shall be used to secure the impeller to the shaft for both threaded and tapered shafts. Straight end shafts for attachment of the impeller shall not be acceptable

H. Casing

1. The casing shall be of the end suction volute type having sufficient strength and thickness to withstand all stress and strain from service at full operating pressure and load. The casing shall be of the centerline discharge type equipped with an automatic pipe coupling arrangement for ease of installation and piping alignment. The design shall be such that the pumps will be automatically connected to the discharge piping when lowered into position with the guide rails. The casing shall be accurately machined and bored for register fits with the suction and casing covers.
2. A volute case wear ring shall be provided to minimize impeller wear. The wear ring shall be 85-5-5-5 red brass or 80-10-10 bronze, ASTMB-43 and held by 300 series stainless steel fasteners. The wear ring shall be easily replaceable in the field. Wear rings of any other material shall not be acceptable

I. Accessories
1. Contractor shall provide 316 stainless steel guide rails and guide rail brackets, 316 stainless steel lifting chain and shackles, and discharge elbow by Hydromatic. Contractor shall demonstrate that all accessories are compatible with the specified pump and wet well.

2.3 SERVICEABILITY

A. The complete rotating assembly shall be capable of being removed from the volute without disturbing the suction piping, discharge piping, and volute. The motor housing, seal housing with seal plate and impeller still attached to the shaft shall be capable of being lifted out of the volute case from the top as one assembly.

B. All lifting chains, float cables, and power cables, etc. shall be mounted so that they are easily accessible from the lift station hatch without personnel entering wet well.

2.4 TOOLS, SPARE PARTS, ACCESSORIES

A. All hardware, fasteners, and pump mounting bolts used in the wet well shall be 316 series stainless steel.

B. Though the pump may not require feet to support the unit while installed, the pump volute must have feet to support the unit when removed for service. Units that do not have feet upon which the unit can be supported when removed for service shall not be acceptable.

2.5 SPARE PUMP

A. In addition to the two pumps installed complete in place, Contractor shall provide one (1) additional pump, meeting the above requirements, to the City of Round Rock to keep as a spare.

PART 3 - E X E C U T I O N

3.1 DELIVERY AND STORAGE

A. Deliver, handle, store, and protect all equipment in accordance with the requirements of Section 01600, Materials and Equipment.

B. Deliver, handle, store, and protect all equipment in full accordance with manufacturer/supplier recommendations and/or instructions.

3.2 TESTING

A. Commercial testing shall be required and include the following:

1. The pump shall be visually inspected to confirm that it is built in accordance with the specification as to HP, voltage, phase and hertz.

2. The motor seal and housing chambers shall be meggered for infinity to test for moisture content or insulation defects.

3. Pump shall be allowed to run dry to check for proper rotation.

4. Discharge piping shall be attached, the pump submerged in water, and amp readings shall be taken in each leg to check for an imbalanced stator winding. If there is a significant difference in readings, the stator windings shall be checked with a bridge to determine if an unbalanced resistance exists. If so, the stator shall be replaced.

5. The pump shall be removed from the water, meggered again, dried and the motor housing filled with dielectric oil.

3.3 EQUIPMENT PROTECTION AND RESTORATION

A. The pump shall be painted with waterborne hybrid acrylic/alkyd paint. This custom engineered, quick dry paint shall provide superior levels of corrosion and chemical protection.

B. Painted surfaces shall be protected against impact, abrasion, discoloration, or other damage during shipment. All painted surfaces which are damaged prior to acceptance of the equipment shall be re-painted to the satisfaction of the Inspector and Engineer.

3.4 STORAGE AND HANDLING

A. Deliver, unload, and store products on site in a manner that prevents damage. Refer to related specifications for other storage handling requirements.

END OF SECTION

**SECTION 11332 -
CARBON ODOR CONTROL SYSTEM**

PART 1 - G E N E R A L

1.1 SECTION INCLUDES

A. This item shall consist of the furnishing all labor, materials, equipment, and incidentals required to provide odor control unit and accessories as specified herein.

1.2 SUBMITTALS

A. Contractor shall provide all submittals in accordance with the requirements of Section 01330, Submittal Procedures, and Section 01340, Shop Drawings, Product Data and Samples.

B. Submit complete descriptive product data for all equipment to be provided, including but not limited to, fabrication and installation drawings, materials of construction, pertinent design calculations, dimensions, and any other related information necessary to facilitate Owner and Engineer review.

1. General Specification Compliance Document
   a. A copy of this specification with a notation beside each line item confirming compliance or any deviations / exceptions. Any deviations or exceptions should be clearly explained in a separate section of the submittal.
2. Media:
   a. Furnish with 60 days after contract execution, a certificate from the media manufacturer certifying that the proposed media will meet the specifications. Provide a 1-gallon representative carbon sample of each media and specification sheet.
   b. Statement of origin and manufacturers test data noting lot numbers. Submitted lot numbers shall be confirmed with actual material delivered.
   c. Media manufacturer's certificate to include statement of origin and test results.
3. Catalog information, descriptions, specifications layouts, sketches and other information sufficient to clearly and readily demonstrate compliance with all parts of the specifications and drawings.
4. Dimensional and weight information. Include empty weight and operating weight with carbon.

C. Operation and Maintenance Manuals. Provide complete operation and maintenance manuals for all equipment, in accordance with the requirements of Section 01770, Closeout Procedures.

1.3 WARRANTY

A. Provide equipment warranty in accordance with the requirements of Section 01770, Closeout Procedures.

1.4 REFERENCES

A. Applicable Standards and Specifications

1. D2563, Standard Practice for Classifying Visual Defects in Glass Reinforced Plastic Laminate Parts.
2. D2584, Standard Test Method for Ignition Loss of Cured Reinforced Resins.
3. D2854, Standard Test Method for Apparent Density of Activated Carbon.
4. D 2867, Standard Test Methods for Moisture in Activated Carbon.
5. D3299, Standard Specifications for Filament-Wound Glass-Fiber-Reinforced Thermoset Resin Corrosion-Resistant Tanks.
6. D3467, Standard Test Method for Carbon Tetrachloride Activity of Activated Carbon.
7. D3802, Standard Test Method for Ball-Pan Hardness for Activated Carbon.

8. D4097, Standard Specification for contact-molded glass-fiber-reinforced Thermoset Resin Corrosion-Resistant Tanks.
9. D3982, flanges
10. National Bureau of Standards (NBS) PS 15-69, Custom molded reinforced polyester for chemical resistant process equipment

PART 2 - P R O D U C T S

2.1 GENERAL

A. The system supplier shall furnish all of the items required to provide a properly functioning system for the service conditions listed herein, including but not limited to the vessels, media and fan. Basis of design is the Ventadsorb PE packaged carbon adsorber unit.

B. The products shall be the end products of one responsible system supplier in order to achieve standardization of appearance, operation, maintenance, spare parts, and manufacturer's services. Acceptable suppliers of the full packaged system include ECS Environmental Solutions of Belton TX. Alternate suppliers shall be approved 20 days prior to tender. If alternate suppliers are named their products must conform to the specification without exception. This may require customization.

1. A submittal package prepared in accordance with 1.2 shall be submitted to the engineer a minimum 20 days prior to bid tender in order to gain approval as an approved system supplier. Submittal package shall be complete with all components listed noting any deviations or exceptions that will be taken to the base system design.

2.2 SERVICE DESCRIPTION

A. The odor control system shall be designed to remove the odorous constituents from the process air stream under the following operating conditions:

Process Parameter	Value
Duty	Continuous
Inlet Air Temp	0 to 120 degrees F
Inlet Relative Humidity	30% to 90%
Designed system airflow	Up to 200 CFM
Removal Required	H_2S: 99 % removal or a max .05 outlet Odor Units (OU): 90%

B. The vessels shall conform to the following parameters:

Process Parameter	Value
Vessel Type	Single bed
Vessel Material of Construction	High Density PE
Pressure Drop (Max)	Vessel (Inlet to Outlet): 6" w.c.
Carbon volume (Min)	180 lbs
Vessel Inside Diameter	23"

2.3 ADSORBER VESSEL AND DUCTWORK

A. The adsorber vessel shall be manufactured using high density PE. Top shall be reinforced with a ¾" thick PE plate to resist deflection due to the weight of the top mount fan.

B. Adsorber vessel shall have the following connections
1. ½" diameter, 3/16 stainless steel grounding rod
2. ½" FNPT drain
3. 4" plain end inlet with fernco connector.

2.4 MEDIA

A. Media shall be a high capacity single-use 4mm extruded pellet. Type: Carbon shall be a 4mm extruded coconut-based pellet having a minimum H2S capacity of 0.30 g/cc. Wood, peat or lignite based carbon is not acceptable. Carbon shall be Sulfadsorb-HC from ECS Environmental, minotaur from Calgon or Midas from Evoqua.

B. Sufficient activated carbon shall be provided to fill the reactor vessel with the quantity previously specified. The activated carbon shall be suitable for the vapor phase adsorption of sewage treatment odors. No chemical impregnation of the activated carbon is permitted. The activated carbon shall have the following specifications:

1.	Iodine Number	800 mg/g min
2.	Moisture, weight % as packed	5% max
3.	Hardness No.	95 min
4.	Apparent Density, g/ml	0.44 min
5.	H2S Breakthrough Capacity, g H2S removed/cc Carbon[1]	0.30 min
6.	CTC by Weight	60% min

[1] The determination of H2S breakthrough capacity will be made by passing a moist (85% R.H.) air stream containing 1% H2S at a rate of 1,450 cc/min. through a 1 inch diameter by 9 inch deep bed of uniformly packed activated carbon and monitored to 50 ppm breakthrough. Results are expressed in grams H2S removed per cc of carbon. Test shall be performed per ASTM Test method D-6646, without modification or addition.

2.5 FAN

A. The odor control equipment shall be capable of adding a blower in the future, if necessary.

PART 3 - E X E C U T I O N

3.1 DELIVERY AND STORAGE

A. Deliver, handle, store, and protect all equipment in accordance with the requirements of Section 01600, Materials and Equipment.

B. Deliver, handle, store, and protect all equipment in full accordance with manufacturer/supplier recommendations and/or instructions.

3.2 FACTORY TESTING

A. All equipment shall be factory tested for compliance with the requirements specified herein. In addition, a full hydrostatic atmospheric leak test (zero leakage allowed). Hydro test shall be witnessed by an independent inspector.

3.3 FUNCTIONAL TESTING

A. Functional testing shall be conducted after the installation of the carbon vessels and all appurtenances and the equipment has been operated for a sufficient period to make any corrections or adjustments. Each carbon vessel shall be subject to field functional tests under actual operating conditions to determine that operation is satisfactory and in compliance with the Specifications.

B. The Contractor will provide, calibrate, and install all temporary gauges and meters, and install all temporary piping and wiring required for the functional tests.

C. The functional tests shall include the following:

1. Alignment: Test complete assemblies for correct and proper alignment and connection, and quite operation
2. Flow Throughput: Measured by system or temporary instrumentation.
3. Discharge and Inlet Static Pressure: Measured by system instrumentation or temporary measurement devices.
4. Test all system components for proper adjustment and operation in both manual and automatic operating modes.
5. Prior to filling the vessel with carbon the contractor (under direction of the system supplier) shall run a full water regeneration cycle. The system shall prove to be functional, no leaks are allowed.

D. System Start-up

1. Shall be performed by qualified representative of the manufacture.

3.4 MANUFACTURER'S SERVICES

A. Manufacturer's Representative: Present at Site and/or classroom designated by Owner for minimum person-days listed below. Travel.will include a total of 2 trips.

1. One person-days for installation assistance, inspection, functional testing, and completion of Manufacturer's certificate of Proper Installation.

END OF SECTION

SECTION 13219 -
POLYMER CONCRETE WET WELL (ALTERNATE #1)

PART 1 - G E N E R A L

1.1 SECTION INCLUDES

A. This item shall consist of the furnishing and installation of a polymer concrete wet well and associated appurtenances for a lift station.

B. ALTERNATE #1: CONSISTS OF FURNISHING AND INSTALLATION OF A POLYMER CONCRETE WET WELL AND ALL ASSOCIATED APPURTENANCES FOR A LIFT STATION, IN LIEU OF A FIBERGLASS REINFORCED POLYESTER (FRP) WET WELL.

1.2 SUBMITTALS

A. Contractor shall provide all submittals in accordance with the requirements of Section 01330, Submittal Procedures, and Section 01340, Shop Drawings, Product Data and Samples.

B. Submit complete descriptive product data for all equipment to be provided, including but not limited to, fabrication and installation drawings, electrical, instrumentation and controls component requirements and drawings, pertinent design calculations, and any other related information necessary to facilitate Owner and Engineer review.

C. No work shall be performed in connection with the fabrication or manufacture of materials and equipment nor shall any accessory or appurtenance be purchased until the drawings and date thereof have been approved by the Engineer and Owner, except at the Contractor's own risk and responsibility.

D. Shop Drawing/Product Data: At minimum, provide the following information:

1. Calculations signed by a professional engineer registered in Texas demonstrating the wet well meets the design criteria listed in the specification and as shown in the Plans. Wet well shall be designed for buoyant conditions.

2. Bill of materials of the wet well shall include at a minimum pipe penetration seal, epoxy mortar, vent, and access cover.

3. Submittal shall include drawings and descriptive information in sufficient detail to show kind, size, material, and arrangement; the external connections, anchorages, access hatch, and supports required; and dimensions needed for installation and correlation with other materials and equipment. Data submitted shall include drawings showing all required wiring and piping layouts. If the cut-sheets contain information not pertaining to the supplied equipment, all extraneous information shall be clearly crossed out and pertinent information highlighted.

E. Operation and Maintenance Manuals. Provide complete operation and maintenance manuals for all equipment, in accordance with the requirements of Section 01770, Closeout Procedures.

1.3 WARRANTY

A. Provide equipment warranty in accordance with the requirements of Section 01770, Closeout Procedures.

B. The Contractor shall bear full responsibility for the proper installation of the wet well.

C. The Contractor and Manufacturer shall guarantee that the structure shall be free from defects in design, materials and workmanship for one year from date of acceptance by the Owner.

1.4 REFERENCES

A. Related Specifications
1. 11319 Submersible Pumps
2. Series 400, “Concrete Structures”
3. Item No. 403, “Concrete for Structures”
4. Item No. 406, “Reinforcing Steel”
5. Item No. 410, “Concrete Structures”
6. Item No. 510, “Pipe”
7. Item No. 720, “Metal for Structures”

B. Applicable Standards and Specifications

1. TCEQ 30 TAC Chapter 217
2. AISI, ANSI, ASTM, OSHA, SSPC
3. ASTM D 6783 Standard specification for polymer concrete pipe
4. ASTM C 478 Standard Specification for precast reinforced concrete manhole sections
5. ASTM C 443 Standard Specification for joints for concrete pipe and manholes using rubber gaskets
6. ASTM C 923 Standard specification for resilient connectors between reinforced concrete manhole structures, pipes, and laterals
7. ASTM C 33 Standard Specification for concrete aggregates
8. ASTM C 497 Standard test methods for concrete pipe, manhole sections, or tile

1.5 MANUFACTURER’S SERVICES

A. Manufacturer’s representative shall be on site during installation of polymer wet well to insure manufacturer’s recommendations for handling and installation are followed.

PART 2 - P R O D U C T S

2.1 ACCEPTABLE MANUFACTURERS

A. Provide equipment from one of the following acceptable manufacturers:

1. US Composite Pipe, Inc.
2. Or pre-approved equal.

B. If applicable, all equipment substitution requests shall be made in accordance with the requirements of Section 01600, Materials and Equipment.

2.2 PRODUCT DESCRIPTION

A. Solid Cast Polymer Wet Well

1. Wet well shall be constructed of solid cast polymer concrete with steel and or fiberglass reinforcement re-bars per ASTM C 478. Wet well shall be backfilled per design floatation calculations and design drawings.
2. Wet wells shall have a monolithic base slab designed for buopyant conditions. Cold joints shall not be allowed. Wet well components shall have engineered and rated lifting devices that shall not penetrate through the wall. In no case shall the wall thickness be less than 4 inches for a 60-inch diameter or larger wet well and no less than 3 inches for 48-inch diameter wet wells. Wet wells shall be designed with sufficient anchorage and side friction to resist the buoyancy forces. Field case structural concrete floatation collars are acceptable.

B. Materials

1. Materials shall be per ASTM 6783.
2. Polymer concrete shall have a minimum unconfined compressive strength of 9,000 psi when measured according to ASTM C 497.
3. Resin shall be polyester or vinyl ester resin systems designed for use with this particular application. Resin content shall be at least 7 percent by weight.
4. Filler - All aggregate, sand and quarts powder shall meet the requirements of ASTM C 33.
5. Additives – Resin additives, such as curing agents, pigment, dyes, fillers and thixotropic agents, when used, shall not be detrimental to the wet well.
6. Elastomeric Gaskets – Gaskets shall be suitable for the service intended. All gaskets shall beet the requirements of ASTM C 443.

C. Pipe Penetrations: Pipes shall be directly connected to all structures using resilient flexible pipe to manhole connectors per ASTM C 923, or Linkseal connectors where shown on the plans. Cold joint pipe stubs grouted in place shall not be allowed unless shown on the plans.

D. Coatings: Interior and exterior coatings are not required.

E. Hopper Bottom: The wet well shall have a hopper-bottom formed in the field using structural concrete. The minimum slopes shall be at least 1 vertical to 1 horizontal if a polyamide epoxy coating, similar to System 1, is applied to the surface to create a slick surface. If the concrete fill has a slope of 2 vertical to 1 horizontal or greater the fill concrete does not need to be coated, but should only require a smooth rubbed surface.

F. Submersible Pumps: Contractor shall coordinate with Pump Supplier to provide to polymer wet well manufacturer all sizes and dimensions of pumps, rails, and installation hardware. Supplier shall also provide required clearances to insure correct orientation of access cover in relation to pump base, discharge piping, and rails. Pumps shall be mounted in a position so that inflow is directed to the front of the pumps.

G. Joints: Round Joints shall be connected with elastomeric sealing gaskets as a sole means to maintain joint water tightness and both the gasket material and the wet well joint shall meet the requirements of ASTM C 443. Round Wet wells shall utilize a spigot and bell type joint incorporation either a confined o-ring or single step profile joint. Square and rectangular structures shall utilize a ship-lap joint and sealed with a butyl rope sealant per ASTM C 900.

2.3 FUNCTIONAL REQUIREMENTS

A. The wet well access hatch shall be sized large enough for removal of any equipment inside the wet well.

B. All lifting chains, float cables, and power cables, etc. shall be mounted so that they are easily accessible from the lift station hatch without personnel entering wet well.

2.4 TOOLS, SPARE PARTS, ACCESSORIES

A. All hardware, fasteners, and pump mounting bolts used in the wet well shall be 316 series stainless steel.

B. Wet Well Vents shall be constructed of coated ductile iron pipe or schedule 40 stainless steel and be a minimum diameter of 4 inches. Vents shall be sized based upon maximum air change at maximum pumping rate. The end of the vent shall terminate at the odor control equipment, as shown on the plans. Submittal shall include vent piping support. The vent pipe shall penetrate the full thickness of the top slab.

C. Access Hatch

1. Access covers shall be equipped with an aluminum safety grate for fall through protection and controlled confined space entry per current OSHA Standards. The access covers to the wet well shall be

sized as identified in the plans and as recommended by the pump manufacturer for safe removal of the pumps. The cover shall be large enough to allow all equipment to be removed easily. The access frame and cover to the wet well shall be constructed of aluminum tread plate with a trough frame and floodtight gasket. The doors shall open to 90° and automatically lock. The lifting handles, hinges, and all fastening hardware shall be stainless steel, Type 316. The covers shall be able to be secured by a padlock using a heavy duty locking staple. Owner will provide padlock at the time of acceptance of the station. Supplier shall deliver access cover to wet well manufacturer for installation in wet well cover. Supplier shall also provide all necessary drawings and dimensions for exact installation.

2. USF Fabrication Model TPD300, or approved equal.

PART 3 - E X E C U T I O N

3.1 DELIVERY AND STORAGE

A. Deliver, handle, store, and protect all equipment in accordance with the requirements of Section 01600, Materials and Equipment.

B. Deliver, handle, store, and protect all equipment in full accordance with manufacturer/supplier recommendations and/or instructions.

3.2 FIELD INSTALLATION AND TESTING

A. Any special lifting device required for off-loading and installation of wet well may be provided by manufacture of wet well and shall not fully penetrate the wet well wall. Installation of the wet well shall be performed in accordance with all applicable standards.

B. Backfilling: Refer to Specification Item 401, Structural Excavation Backfill, and the Structural Details.

C. Leak Testing:

1. Wet well sections shall be carefully inspected. Units found to have cracks or any non-reparable damage will not be accepted.
2. Epoxy joints (if required) shall have sufficient cure time per manufactures recommendations and shall be inspected for defects.
3. All pipe penetrations shall be installed and sealed according to design plans and specifications prior to leak test.
4. All backfilling and compaction shall be completed prior to start of leak test.
5. Contractor shall place and inflate pneumatic plugs in all connecting pipes to isolate wet well. Sealing pressure of plugs shall be according to manufactures recommendations.
6. Wet well shall be filled to the top with water for 24 hours with no drop in water level.
7. If the wet well fails to pass the initial test the contractor shall locate and repair the leak using methods acceptable to current city standards and inspection by the engineer.
8. Upon completion of repairs a second leak test shall be conducted.

3.3 EQUIPMENT PROTECTION AND RESTORATION

A. Painted surfaces shall be protected against impact, abrasion, discoloration, or other damage during shipment. All painted surfaces which are damaged prior to acceptance of the equipment shall be re-painted to the satisfaction of the Inspector and Engineer.

3.4 STORAGE AND HANDLING

A. Deliver, unload, and store products on site in a manner that prevents damage. Refer to related specifications for other storage handling requirements.

END OF SECTION

SECTION 13400

INSTRUMENTATION AND CONTROL GENERAL PROVISIONS

PART 1 - G E N E R A L

1.1 SUMMARY

A. Provide labor, materials, equipment, and accessories required for a complete and functional instrument and control system as required by the contract documents.

A. This Section specifies the general instrumentation and control requirements for the Forest Creek Lift Station Improvements Project for City of Round Rock, Texas.

B. The requirements outlined in this Section address general hardware, software, and system services necessary to provide the specified control functions. More detailed requirements of specific functions and components are presented in other sections that follow.

C. The following work shall be performed by the System Integrator:

1. Submittal preparation, supply, wire termination and point-to-point check out of Control Panel.

2. Submittal preparation, supply, calibration and check out of Field Instruments.

3. Programmable Logic Controllers (PLCs). The CONTRACTOR shall be responsible for furnishing and installing the PLCs as defined in Specification Section 13410 and as indicated on the drawings. Programing of PLCs provided by the owner. Coordinate PLC and PLC options with owner prior to bid.

4. Provide cabling to instruments.

5. Acceptable System Integrators include the following:

   a. Trac~n~Trol, Georgetown, Texas

   b. Prime Controls, Houston, Texas

   c. Control Panels USA, Austin, Texas

   d. Richardson Logic Controls, Richardson, Texas

6. Provide programming for new lift station points at owner’s existing central station HMI.

7. Radio Telemetry System. The CONTRACTOR shall be responsible for furnishing and installing the radio and other equipment as indicated on the drawings, and ensure connectivity between Lift Station site and City of Round Water Treatment Plant.

1.2 DEFINITIONS

A. Where the word “provide” appears in these Specifications, it shall be construed to mean “furnish and install complete and ready for safe and regular use.”

B. The definitions of terminology used in the Specifications shall be as defined in ISA Standard 51.1 unless otherwise specified.

1. Signal Circuit. Any analog circuit whose principal purpose is the conveyance of information and not the conveyance of energy for the operation of an electrically powered device. Any circuit operating at less than 80 volts AC or DC.
2. Control Circuit. Any digital circuit whose principal purpose is the conveyance of information and not the conveyance of energy for the operation of an electrically powered device. Any circuit operating at 24 volts AC or DC or more,
3. Power Circuit. Any circuit whose principal purpose is the conveyance of energy for the operation of an electrically powered device. Any circuit operating at 12 volts (AC or DC) or more.
4. Two-Wire Transmitter. A transmitter which derives its operating power supply from the signal transmission circuit and, therefore, requires no separate power supply connections. As used in this specification, two-wire transmitter refers to a transmitter which provides a 4 to 20 milliampere current regulation of signal in a series circuit with an external 24-volt direct current driving potential and a maximum external circuit resistance of 600 ohms.
5. Electrical Isolation. Pertaining to an electrical node having no direct current path to another electrical node. As used in this specification, electrical isolation refers to a device with electrical inputs and/or outputs which are galvanically isolated from ground, the device case, the process fluid, and any separate power supply terminals; but such inputs and/or outputs are capable of being externally grounded without affecting the characteristics of the device or providing a path for circulation of ground currents. The terms “galvanic isolation,” “electrical isolation,” “isolation,” or similar terms shall mean electrical isolation whenever used in the Specifications for electrical control and instrumentation equipment. Unless otherwise specified, electrical isolation for analog signal devices shall be in accordance with ANSI/IEEE C39.5.
6. Panel. An instrument support system which may be a flat surface, a partial enclosure, or a complete enclosure for instruments and other devices used in process control systems. Unless otherwise specified or clearly indicated by the context, the term “panel” in these contract documents shall be interpreted as a general term which includes flat panels, enclosures, cabinets and consoles.
7. Data Sheets. Data sheets, as used in this specification, shall comply with the requirements of ISA 20.
8. Field. Locations external to a panel or piece of equipment where a field device is connected.
9. Control Room. An environmentally controlled area intended for housing control equipment, computers, control panels, etc., and intended for those parts of a control system for which operator surveillance is required on a continuing basis.
10. UPS. Uninterruptible Power Supply.
11. HMI. Human-Machine-Interface. The control system hardware and software associated with providing the visual interface between system users and the control system.
12. PLC. Programmable Logic Controller. Field installed unit which monitors and controls devices, located within the plant. The PLCs contain all logic necessary to monitor and control the system process located at the PLC location.
13. SCADA. Supervisory Control and Data Acquisition.
14. RTU. Remote Terminal Unit. Similar to a PLC, except in a more compact form.
15. DCS. Distributed Control System.

1.3 REFERENCE STANDARDS

This subsection references the latest revisions of the following standards. They are a part of Division 13 as specified and modified. In case of conflict between the requirements of this section and those of the listed standards, the requirements of this section shall prevail.

Standard	Title
ANSI/NEMA ICS 6	Enclosures for Industrial Control and Systems
ISA 5.4	Instrument Loop Diagrams

Standard	Title
ISA 20	Specification Forms for Process Measurement and Control Instrumentation, Primary Elements, and Control Valves
ISA 50.00.1	Compatibility of Analog Signals for Electronic Industrial Process Instruments
ISA 51.1	Process Instrumentation Terminology

1.4 WARRANTIES, MAINTENANCE, AND SUPPORT SERVICES

A. Warranty. The manufacturer shall provide an all-inclusive 2-year warranty. The submittal shall provide a contract specific warranty document as detailed in the Specifications.

B. Preventive Maintenance

1. The CONTRACTOR shall provide the services of factory-trained service technicians, for the period from Notice To Proceed to Final Acceptance, for the purpose of performing preventive maintenance. All equipment shall be systematically inspected, cleaned, aligned, adjusted, lubricated, calibrated and otherwise serviced as required to assure proper performance. Equipment manufacturer service recommendations shall be followed where applicable. The preventive maintenance service interval (time-between-service activities) for each piece of equipment shall be that recommended by the equipment manufacturer in accordance with industry practice or six months, whichever is less. The cost to provide preventive maintenance during this period including parts, labor, travel, and subsistence, shall be included in the contract price. Prior to start of in-service use of each part of the Control System, The CONTRACTOR shall provide to the OWNER a schedule for this maintenance service. All preventive maintenance activities shall be documented with service reports which shall identify the equipment being serviced, state the condition of the equipment, describe all work performed, and list materials used. The report shall also include the name of the technician performing the work and his signature. A copy of all service reports shall be delivered to the OWNER on the day the work is performed.

2. At the OWNER's option, OWNER's maintenance personnel may participate in any preventive maintenance procedures.

C. Corrective Maintenance

1. The CONTRACTOR shall provide the services of factory-trained service technicians for the purpose of performing corrective maintenance on all system hardware and software. The period of coverage for each piece of equipment shall begin upon initial equipment purchase or manufacture and shall continue for two years after final acceptance or until expiration of the manufacturer's warranty, whichever period is longer.

2. The CONTRACTOR shall provide a 24-hour, 7-day/week service hotline for telephone notification of system malfunctions. Within 2 hours from notification by the OWNER of defective Control System operation, the CONTRACTOR shall have a qualified service representative establish telephone contact with the OWNER's maintenance personnel to discuss short-term corrective measures. If it is not possible to correct the defective operation as a result of the telephone contact, the CONTRACTOR shall have a qualified service representative at the location of the installed Control System within 24 hours from initial notification. The service representative shall perform all necessary inspections and diagnostic tests to determine the source of the defect and to establish a corrective action plan. The corrective action plan shall be developed such that the defect is corrected as quickly as possible and with the least impact on the operation of the OWNER's facilities. Prior to beginning any repair or replacement procedure, the CONTRACTOR shall review the corrective action plan with the OWNER in order to inform him of the

planned course of action and to allow assessment of any impact that course of action might have on the operation of the OWNER's facilities. At OWNER's option, OWNER maintenance personnel may participate in any corrective maintenance procedures.

3. If possible, the service representative shall effect replacement or repair of the defective component before leaving the site using replacement parts from the spare parts inventory delivered with the system. Otherwise, the corrective action plan shall include a detailed schedule for the planned course of action. Once the defect has been corrected, the corrective action plan shall be updated indicating the source of the defect and specific corrective action taken. A copy of the updated corrective action plan shall be delivered to the OWNER on the day the work is performed. Any spares from the onsite supply of spares used by the CONTRACTOR in correcting the system malfunction shall be replaced within 15 days.

4. If 24-hour response time is not provided, or other corrective maintenance requirements are not met by the CONTRACTOR, the OWNER shall have the right to obtain corrective maintenance from other sources and charge the CONTRACTOR reasonable costs of the alternative maintenance services, including parts, labor, travel, and subsistence.

5. The OWNER, at the OWNER's option, may elect to employ its own maintenance staff to locate and remove a defective component. In this case the OWNER will return the defective component to a repair location as instructed by the CONTRACTOR. The CONTRACTOR shall repair or replace the defective component and return the properly working unit to the OWNER within 15 days.

D. Software Maintenance. After system software or equipment has been placed in service and tested, the Owner may request reasonable additions, modifications and deletions, at no additional cost to the Owner, to control strategies, displays, database, and reports.

1.5 CONTRACTOR'S QUALIFICATIONS

A. Perform all work necessary to select, furnish, configure, customize, debug, install, connect, calibrate, and place into operation all hardware and software specified within this Section and in other Sections.

B. Utilize a "systems integrator," regularly engaged in the design and the installation of instrumentation and control systems and their associated subsystems as they are applied to the municipal water or wastewater industry. For the purposes of this specification section, a "systems integrator" shall be interpreted to mean an organization that complies with all of the following criteria:

1. Employs a registered professional Control Systems Engineer or registered professional Electrical Engineer to supervise or perform the work required by this specification section.
2. Employs personnel on this project who have successfully completed a manufacturer's training course on the configuration and implementation of the specific programmable controllers, computers and software proposed for this project.
3. Has performed work of similar or greater complexity on at least three projects within the last 5 years and has implemented and completed at least one of these three projects with the proposed HMI software.
4. Has been in similar industries performing the type of work specified in this specification section for at least 5 continuous years.

C. Maintain a fully equipped office/production facility with full-time employees capable of fabricating, configuring, programming, installing, calibrating, troubleshooting, and testing the system specified herein. Qualified repair personnel shall be available and capable of reaching the facility within 24 hours.

D. The CONTRACTOR shall perform all work necessary to select, furnish, configure, customize, debug, install, connect, calibrate, and place into operation all hardware and software specified within this section and in other sections as listed in Article 1.02, Related Work.

E. The CONTRACTOR shall be a "systems house," regularly engaged in the design and the installation of computer systems and their associated subsystems as they are applied to the municipal water or wastewater industry. For the purposes of this specification section, a "systems house" shall be interpreted to mean an organization that complies with all of the following criteria:

1. Employs a registered professional Control Systems Engineer or Electrical Engineer to supervise or perform the work required by this specification section.

2. Employs personnel on this project who have successfully completed a manufacturer's training course on the configuration and implementation of the specific programmable controllers, computers and software proposed for this project.

3. Has performed work of similar or greater complexity on at least three (3) projects within the last five (5) years and has implemented and completed at least one of these three projects with the proposed HMI software.

4. Has been in the water/wastewater industry performing the type of work specified in this specification section for the past five (5) continuous years.

F. Actual installation of the system need not be performed by the CONTRACTOR's employees; however, the CONTRACTOR shall provide the on-site technical supervision of the installation.

G. The CONTRACTOR shall furnish equipment which is the product of one manufacturer to the maximum practical extent. Where this is not practical, all equipment of a given type shall be the product of one manufacturer.

H. Pre-approved firms include:

1. Prime Controls.

2. Richardson Logic Control, LLC.

3. Trac~N~Trol

1.6 SUBMITTALS

A. General.

1. Submit to the Owner technical data and drawings for all equipment, materials, software, assemblies, and installations prior to fabrication and installation. In all instances in which submittals are required by the Specifications, do not proceed with the associated work until the submittal has been Successfully Reviewed.
2. Each submittal shall be complete, with all required information provided together at one time, and submitted in a sequence that allows the Owner to have all of the information necessary for checking and approving a particular document at the time of the submittal. Plan and make all submittals as necessary to avoid delays or conflicts in the work.

B. Submittal Categories.

1. Project submittals are divided into the following general categories:
   a. Design Submittals.
   b. System Documentation Submittals.
   c. Testing Submittals.
   d. Training Submittals.
2. The following paragraphs define the specific contents of each of these submittal categories. The requirements outlined for each of these submittals shall apply to all equipment and services specified in the

appropriate section of the Specifications. Additional submittal requirements may be found in other sections of the Specifications.

C. Design Submittals.

1. Hardware Submittal.
   a. Product information shall include, but not be limited to: catalog cuts, data sheets, performance surveys, test reports, equipment lists, material list, diagrams, pictures, and descriptive material. The product information shall cover all items including mechanical devices, mounting components, wiring, terminal strips, connectors, accessories, and spare parts. The submittal information shall show product features, as well as all performance data and specifications.
   b. Prior to commencement of manufacture (or shipment for stock items), submit for review product information for all equipment and material specified in the Specifications, or required to support equipment, or systems specified in the Specifications. Specific requirements for the form and content of product information submittals are included in the individual section that defines the equipment requirements.
2. Connection Diagrams. Submit the following:
   a. Connection diagrams shall show the placement, labeling and wiring of components within panels, cabinets and consoles. Components shall be shown arranged in the physical layout (not necessarily to scale) as it would appear to a person servicing the equipment. Connection diagrams shall include all internal wiring of the panel and connections to external devices. This shall include AC and DC power wiring and multi-conductor cables from PLC I/O modules to the associated termination blocks. Wires shall be shown as a continuous line between their termination points. Each wire label designation shall be shown. The wire label designations on each end of a single wire must be identical. All wire termination point numbers shall be shown. Signal and DC circuit polarities shall be shown. All jumpers, shielding and grounding details shall be shown.
   b. Submit connection diagrams for all new panels, cabinets and consoles.
   c. Furnish drawings on paper, electronically as Adobe PDF files, and in the latest AutoCAD electronic format. Electronic files shall be submitted in CD or DVD format.
3. Panel Fabrication and Layout Drawings. Submit the following:
   a. Panel fabrication drawings shall be drawn to scale and show the physical dimensions, materials, and construction of panels, cabinets, terminal boards, consoles, or other electrical or mechanical equipment enclosures. These drawings shall show the physical arrangement and mounting of all components in or on a panel, terminal board, cabinet, console, or enclosure, as well as the physical dimensions, and the space and mounting requirements of mechanical, electrical, control and instrumentation devices or pieces of equipment. Include ventilation requirements, locations of connections, weight, paint color, material and dry film thickness that are applicable to this design.
   b. Panel fabrication and layout drawings shall include a bill of materials; front, back, and section views; the locations of all components to be mounted in or on the panel, cabinet, console, enclosure or assembly; drawing scale; nameplate engraving schedule; and structural materials and supports. Overall dimensions and minimum clearances shall be shown. Sufficient detail shall be included to demonstrate material choices, outward appearance, construction methods, and seismic force resistance.
   c. Complete shop drawings shall be prepared and submitted for all panels, cabinets, and consoles which are custom fabricated or modified for this project. The Owner shall have the right to make modifications to the interior and exterior layouts of panels as part of the shop drawing review.
   d. Furnish drawings on paper, electronically as Adobe PDF files, and in the latest AutoCAD electronic format.
4. Interface Cables. Submit interface cable pin-out/cable makeup diagrams. This includes all network cables, radio to PLC/RTU cables, computer to PLC cables and printer cables. Submittal shall include copies of the actual hardware documentation. All cables shall either be standard cables from the manufacturer or custom-made. Custom cables must not require the use of gender changers, 9-25 pin converters, null modem adapters, etc., for them to function correctly.
5. Interconnection Diagrams. Submit cable interconnection diagrams. These interconnection diagrams shall include typical wiring diagrams for each type of product. Wires shall be shown as a continuous line

between their termination points. Each wire label designation shall be shown. The wire label designations on each end of a single wire must be identical. All wire termination point numbers shall be shown. Each wire color shall be shown. Signal and DC circuit polarities shall be shown. All jumpers, shielding and grounding details shall be shown.

6. Installation Drawings. Submit panel installation drawings. These panel installation drawings shall show installation arrangements for all provided equipment, mounting and anchoring details, conduit entries into cabinets, and control system electrical power supply distribution conduit and wiring. Data sheets and/or catalog cuts for mounting devices, anchors, wire and other incidental installation materials shall be included.

7. Software. Submit the following software documentation for review:

   a. OEM Software. Submit the product data sheets for OEM software supplied under this contract. OEM software packages include HMI software, RTU/PLC configuration/programming software, reporting software (if not part of the HMI software), and other third-party software provided under this contract.

   b. Application Software. Application software includes the software and programming developed to implement the specific requirements of the Drawings and Specifications.

      1) Submit functional design descriptions of the application software that implements the control strategies described in the Drawings and Specifications. These descriptions shall include field actions/interactions, control interlocks, sequencing, alarms to be generated, and operator interactions with the control strategy.

      2) Submit fully annotated program listings for PLC/RTU programming showing but not limited to the following:

         a) Custom programming provided.
         b) Communication Port configuration.
         c) I/O module configuration.
         d) System architecture.
         e) Field bus layout and configuration.
         f) Database layout and tag naming.

D. Operation and Maintenance (O&M) Manuals.

1. Supply O&M manuals for all the equipment and software provided. O&M manuals shall be developed for personnel at the level of electronic technician. O&M manuals shall describe the detailed preventive and restorative procedures required to keep the equipment in good operating condition. An O&M manual or a set of manuals shall be furnished for all deliverable hardware, including OEM equipment. O&M manuals for OEM equipment shall contain original printed materials, not copies, and may be provided in the manufacturer's original format. Manuals shall be provided in electronic format.

2. Instruction Manual.

   a. The manual shall be written in English and illustrated in detail to the component level, including assemblies, subassemblies, and components. It shall contain a detailed analysis of each major component so that maintenance personnel can effectively service, inspect, maintain, adjust, troubleshoot, and repair the equipment.

   b. Each manual shall include a Table of Contents, arranged in systematic order, and shall be divided into the following sections:

      1) Introduction. The purpose of the manual, special tools and equipment, and safety precautions.

      2) General Information and Specifications. A general description of the equipment item and specifications of its major components.

      3) Listings. Supplier's name, address, and telephone number. Each product shall include name, address, and telephone number of subcontractor, or installer, recommended maintenance contractor, and local source for replacement parts.

      4) Theory of Operation. The relationship of assemblies, subassemblies, components and interchangeability of components, and explanation and analysis of their functions to the smallest board replaceable components.

      5) Software. Listing and explanatory text for any software or firmware.

6) Operation Procedures. The locations and functional descriptions of all controller indicators or CRT displays.

7) Troubleshooting. A list in tabular format of all symptoms, probable causes of malfunction or improper operation, and probable remedies to the smallest board replaceable components.

3. Preventive Maintenance Instructions. These instructions shall include all applicable visual examinations, hardware testing, and diagnostic hardware/software routines. Instructions on how to load and use any test and diagnostic programs and any special or standard test equipment shall be an integral part of these procedures.

4. Corrective Maintenance Instructions.

a. These instructions shall include guides for locating malfunctions down to the card-replacement level. These guides shall include adequate details for quickly and efficiently locating the cause of an equipment malfunction and shall state the probable source(s) of trouble, the symptoms, probable cause, and instructions for remedying the malfunction. These guides shall explain how to use on-line test and diagnostic programs for all devices and any special test equipment, if applicable.

b. The corrective maintenance instructions shall include:

1) Explanations for the repair, adjustment, or replacement of all items, including printed circuit cards. Schematic diagrams of electrical, mechanical, and parts location, illustrations, photographs, and sectional views giving details of mechanical assemblies shall be provided as necessary to repair or replace equipment. Typical signal waveforms, logic levels, bit patterns, etc., shall be included. For mechanical items requiring field repair, information on tolerances, clearances, wear limits, and maximum bolt-down torques shall be supplied. Information on the loading and use of special offline diagnostic programs, tools, and test equipment, as well as any cautions or warnings which must be observed to protect personnel and equipment, shall be included.

2) A list of test equipment and special tools required.

3) A list of all abbreviations and circuit symbols used.

4) Warranties, bonds and maintenance records, including proper procedures in the event of failures and instances which might affect the validity of warranties, bonds, or contracts.

5) A parts catalog enumerating every part to the lowest of card replaceable components. The description shall include component symbol, description, ratings, accuracy, manufacturer's name and address, manufacturer's part number, commercial equivalents, and quantity per assembly or subassembly. The parts catalog shall identify the appropriate locations of the parts and shall group each component by assemblies or subassemblies within each subsystem so that each component can be identified as being part of the next larger assembly.

6) A list of recommended spare parts that includes all parts necessary to maintain and repair control system components. The list shall identify the specific part or model number, description, manufacturer's name and address, commercial equivalents, unit price, lead time for delivery, and recommended quantity. The spare parts list shall indicate which components (by model and serial number) have been provided with the delivered system as part of the spares inventory.

5. Drawings.

a. O&M Manual drawings (with the exception of those provided by third-party manufacturers) shall not be larger than 11 inches by 17 inches and shall be clearly legible when reproduced using conventional office copying machines. Originals shall be provided for all third-party O&M Manual materials. One reproducible of the O&M Manual drawing original must be supplied for each O&M Manual drawing larger than 11 inches by 17 inches, and must satisfy all drawing requirements specified herein. Those preprinted O&M Manual drawings which are not acceptable, or which must be modified or corrected to show the actual as-built design, shall be redrawn as new specially-prepared shop drawings. Acceptable equipment manufacturer's drawings incorporated into equipment operating and maintenance manuals need not be duplicated or removed from the manuals.

b. Furnish drawings on paper, electronically as Adobe PDF files and in the latest AutoCAD electronic format. Electronic files shall be submitted in CD or DVD format.

c. Each O&M Manual shall be bound in 8-1/2-inch by 11-inch, 3-ring side binders with commercial quality hardback, cleanable plastic covers. Maximum of 3-inch binder size. An electrnic copy of the O&M Manual shall be submitted in CD or DVD format.

d. Binder covers shall contain the printed title:

OPERATION AND MAINTENANCE INSTRUCTIONS
[OWNER'S NAME]
[PROJECT NAME]

e. The manuals shall be internally subdivided with permanent page dividers with tab titling clearly printed under reinforced laminated plastic tabs.

f. Each volume shall have a Table of Contents, with each product or system description identified.

6. Software Manuals. Supply original OEM O&M manuals for those standard OEM software packages provided under these Drawings and Specifications. Supply O&M manuals for the application software developed for these contract documents.

E. Record Documents.

1. After successful Site Demonstration Test, submit for review the Record Documents (as-built) for all equipment and software installed by the Contractor. All documents which have changed because of the engineering changes, contract changes, or error or omission shall be updated and the revised documentation provided.

2. Furnish complete as-built sets of:

a. Source tapes, disk pack(s) or other storage media for all custom programs.

b. Loadable and executable object disk pack(s) of the software systems.

c. All previously delivered documents, with as-built updates.

d. OEM standard documentation.

3. These media shall include the operating systems, all programs necessary for the operation as well as maintenance of the system, and all programs supplied by the CPU/microprocessor manufacturers, such as assembler, loaders, editors, compilers and diagnostics.

4. The documentation as outlined in this portion of the document, in conjunction with other documentation specified elsewhere in this document, shall be sufficient to allow the Owner to reconfigure or make additions or deletions to the system without assistance from the Contractor.

F. Testing Documentation Submittals. Submit testing plans to meet the requirements listed in Part 3 - Execution of this Section and the subsequent reports resulting from the testing. The following paragraphs describe the general content of each submittal.

1. System Test Plan. The system plan describes the overall system testing. As a minimum, the plan shall include the general objectives of the test; the delineation of responsibilities of the Owner, Owner's Representative, and Contractor during the test; any initial coordination issues; the location of the testing; a general description of each phase of testing or subsystem test; a description of the expected results; and a description of the procedures for the tracking of the test procedures, as well as any issues and problems that might result from the testing. This plan does not list the specific test procedures.

2. Test Procedures. This test plan is a document that lists the specific tests. Each test should include a description or listing of any setup requirements, the test procedure, and the expected results.

3. Test Reports. The test reports are the documents prepared during the actual testing. These reports shall also include any documentation of any problems and the resolution of those problems.

PART 2 - P R O D U C T S

2.1 INFORMATION ON DRAWINGS

A. Include the following information at a minimum on the Drawings:

1. Loop diagram on flow sheet for each control loop. Diagrams are schematic in nature and intended only as a guide to work to be performed.

2. Approximate location of primary elements, instrument panels and final control elements.

3. Approximate location of instrumentation power junction boxes for instrument electrical power connection.
4. Location of electrical distribution panelboards for instrument electrical power.
5. Location of equipment having alarms and equipment status contacts.
6. Location of equipment being controlled by system.
7. General layout of instrument cabinets.
8. Instrument installation details.

B. The following information is not shown on Drawings but shall be the responsibility of the Contractor to determine, furnish and coordinate with other Divisions, based upon systems specified. Show this information on project Record Drawings.

1. Instrument loop drawings per ANSI/ISA S5.4 minimum, desired and optional items.
2. Location of electrical distribution panelboards supplying power to any device supplied under this contract.
3. Detailed enclosure and instrument panel layouts, fabrication details and wiring diagrams.
4. Detailed system configuration.
5. Raceway and cable routing for instrumentation wiring.

2.2 OPERATING CONDITIONS

A. Ambient Conditions. Provide equipment suitable for project ambient conditions specified. Provide system elements to operate properly in the presence of radio frequency fields produced by portable RF transmitters with output of 5 watts operated 24 inches from instruments; in the presence of plant telephone lines, power lines and electrical equipment; and in the presence of digital data transmission systems.

B. Field Locations. Field equipment may be subjected to ambient temperatures from -5 to 50°C with direct radiation, relative humidity from 0 to 100 percent with condensation.

C. Power Supply. Power supply will be 117 volts AC, single-phase, 60-hertz commercial power. Voltage variations will be at least plus or minus 8 percent. Ensure that analog signal loops incorporate adequate power supply capacity for operations.

2.3 TRANSIENT AND SURGE ISOLATION

Protect all power and communication and transmission/ receiving circuitry from any surge, including spikes up 1,000 volts peak and surges with a rise time of less than one microsecond. Use a combination of current limiting resistors, zener diodes, gas tube surge arresters, and a fusible link which melts and shorts the surge to ground before the device circuitry is affected. Provide protection adequate for personnel safety, which will prevent an erroneous output, change in calibration, or failure of component other than fuse or fusible link.

2.4 SPARE PARTS

When required spare parts are utilized during construction to correct a faulty condition, replace spare part in kind.

2.5 SPECIAL TOOLS

Supply one of each type of special hand tool required to open or operate equipment, to remove or replace replaceable parts, remove or replace cable connectors, or to make required operational or maintenance adjustments. A special hand tool is any tool not readily available from local retail hardware stores.

2.6 TEST EQUIPMENT

Provide a complete list of all tools, test equipment, and commercial software programs necessary for the proper maintenance of the system. This list shall contain the quantity recommended, model number, description, cost, and name and address of supplier.

2.7 MATERIALS AND EQUIPMENT

A. Materials. Material shall be new, free from defects, and of the quality specified. All instruments with the same specification shall be from the same manufacturer.

B. Equipment.

1. Provide equipment of solid-state construction utilizing semiconductors available from two or more sources, unless otherwise specified. Derate components to ensure dependability and long-term stability. Provide printed or etched circuit boards of glass epoxy, hand or wave soldered, of sufficient thickness to prevent warping. Where indicated, printed circuit boards in field-mounted equipment shall be covered with a conformal coating to protect against corrosion. Alignment and adjustments shall be non-critical, stable with temperature changes or aging, and accomplished with premium grade potentiometers or electronically with settings stored in non-volatile memory. Do not insert components of specially selected values into standard electronic assemblies to meet performance requirements. Use parts indicated in instruction manuals, replaceable with standard commercial components of the same description without degrading performance of completed assembly. Use edge connectors and pins with phosphor bronze contacts with gold-plated mating area.
2. Use test equipment and instruments to simulate inputs and read outputs suitable for purpose intended and rated to an accuracy of at least five times greater than the required accuracy of device being calibrated. Test equipment shall have calibration traceable to NIST.
3. Equipment located in hazardous areas shall be suitable for applicable classification by use of either explosion-proof housings or by equipment and barriers being approved as “intrinsically safe” by either UL or FM. Locate barriers in cabinets outside the hazardous area. Use dual barriers in loops in order to prevent grounding loop at the barrier.

PART 3 - E X E C U T I O N

3.1 SPECIAL PROJECT REQUIREMENTS

A. Coordinate with all the sub-systems suppliers and manufacturers, during bidding, construction, testing, installation and start-up phases of the project. The coordination is to assure that the instruments, and sub-systems are in compliance with the Specifications and the central controls, and that the tie-ins and the interface signals are provided as required.

B. The calibration, testing and start-up of all the instruments shall be done by the manufacturer's field technician/engineer in the presence of the Owner. Provide a list of all manufacturers whose technician will perform this work. Provide a certified calibration report stating that each instrument has been installed per manufacturer’s recommendations and per these Specifications.

3.2 SYSTEM DESIGN

A. Provide all the necessary hardware, software and program development to satisfy the instrumentation and control system described in the contract documents.

B. The CONTRACTOR is responsible for the following areas:

1. Acquisition and installation and testing of all the hardware, software, and instrumentation at Forest Creek Lift Station site.

2. Provide the SCADA panel as specified on the drawings.

3. Provide radio network, and install and verify the operation of the wireless network Forest Creek Lift Station site to CORR wastewater treatment plant.

4. Provide startup assistance to CORR during the checkout of the PLC control programs.

5. Provide panel drawings for the SCADA panel.

C. The CORR is responsible for the following areas:

1. PLC programming at the Forest Creek Lift Station site and CORR water treatment plant.

2. HMI modifications at the CORR water treatment plant.

3.3 INSTALLATION AND STARTUP

A. Install the new equipment in accordance with the Drawings and Specifications.

B. Coordinate with the Owner to keep the Owner processes operating during the installation and cutover phases of the project. Any outages required shall be requested in writing with the Owner and approved at least 24 hours prior to the start of the outage.

C. Provide any temporary power and/or controls necessary to keep the Owner's processes operating during the installation of the new equipment.

D. Coordinate any startup testing of new equipment with the Owner prior to the actual testing. Startup testing is defined as any Contractor test to verify to the Contractor's satisfaction that the new equipment has been installed in accordance with the manufacturer's recommendations and the Drawings and Specifications. Testing shall not be a substitute for the formal testing listed under Article 3.4, System Test Requirements of this specification.

3.4 SYSTEM TEST REQUIREMENTS

A. General Requirements.

1. The control system shall undergo a comprehensive system test process to demonstrate that the system performs as an integrated unit to meet the requirements of this specification. As a normal course of system development, conduct all element, subsystem, and system tests necessary to ensure the proper operation of the control system at various stages of system development. This type of testing normally will not be witnessed; however, the Owner and Owner's Representative reserve the right to witness these tests if concerns arise about the progress of system implementation.
2. Three formal, witnessed tests shall be conducted on the control system:
   a. Factory Demonstration Test.
   b. Field I/O Point Checkout.
   c. Field or Site Acceptance Test.
3. The following paragraphs describe the requirements for each of these formal tests.

B. Field I/O Point Checkout.

1. An I/O point-to-point test shall be performed after all equipment is shipped and installed in the field. This is an end-to-end test to verify that the equipment has been installed correctly.
2. The Owner and the Owner's Representative will witness these field tests.

3. The I/O point checkout shall demonstrate the proper operation of all the field points affected by the installation of the equipment provided by this contract.
4. Provide a printed I/O list for all signals to be monitored and controlled under this contract with sign-off space, space for test results and space for notes for each signal.
5. The I/O point checkout shall include, but not be limited to, the following:
   a. Exercise each discrete input. Each state shall be verified at the field unit and the operator workstation.
   b. Exercise each analog input. Each input shall be verified at 0, 25, 50, 75, and 100 percent range of the instrument. Linearity of the signal shall be verified. Each value shall be verified at the field unit and operator workstation.
   c. Exercise each discrete output. Each state shall be initiated from the operator workstation. If necessary, the associated equipment shall be placed into a "safe" state such that the activation of the output will not damage the equipment or cause a safety hazard.
   d. Exercise each analog output. Each output shall be verified at 0, 25, 50, 75, and 100 percent range of the instrument. Linearity of the signal shall be verified. Each value shall be initiated and verified at the operator workstation.
   e. Unless constrained by the operation of the plant or due to safety reasons, all testing, except for the analog input tests, should include the actual equipment and not use simulated signals.

C. Field or Site Acceptance Test.

1. Conduct a site acceptance test to demonstrate the proper implementation, installation and startup of the control system logic and software using the actual devices and plant equipment.
2. Conduct this test in accordance with the approved test plan submitted under Article 1.6 of this specification.
3. This test shall include, but is not limited to, the following:
   a. Demonstrate the communication between the local operator interfaces and field units.
   b. Demonstrate communication between the control room and field control units.
   c. Demonstrate any peer-to-peer communication.
   d. Demonstrate the ability to upload, modify and download control logic to field control units.
   e. Demonstrate that the control logic and programming has been installed and implemented in accordance with the project control strategies and contract documents. This test shall demonstrate this on a subsystem, then system-wide basis.
   f. Demonstrate the plant equipment responds properly to operator commands.
   g. Demonstrate any plant interlocks function properly and in accordance with control strategies and contract documents.
   h. Demonstrate system reporting and proper report formats.
   i. Demonstrate system event and alarming functions in accordance with the approved design and contract documents.
   j. Demonstrate trending of system points both real time and historical.
   k. Demonstrate system redundancy.

3.5 TRAINING

A. Conduct the following training:

1. Operator Training.
   a. The objective of operator training is to provide the Owner's operational personnel with the knowledge necessary to properly use the new equipment to perform their day-to-day duties as plant operators.
   b. Operator training shall utilize the project O&M manuals as a basis for this training.
   c. Submit to the Owner a course outline or syllabus and training material for the topics to be covered in operator training.
   d. Operator training shall occur prior to the system being placed into operation.

e. As a minimum, operator training shall include but is not limited to:
1) Operation of the plant and process equipment from HMI equipment in the main control room and any remote control areas.
2) Operator response to alarms and feedback displays.
3) Trending of system variables.
4) General functioning of the communication network.
5) Alarm (acknowledging and alarm history) and event functions.
6) Reporting functions (configuring, scheduling, and running reports).

2. Maintenance Training.
a. The objective of maintenance training is to provide the Owner's maintenance personnel with the knowledge necessary to properly perform maintenance activities on the system to include preventive and corrective maintenance.
b. Wherever possible, the Owner's maintenance personnel shall be involved in the startup and testing of the system in order for them to get oriented to the system.
c. Maintenance training shall utilize the project O&M manuals as a basis for this training.
d. Submit to the Owner a course outline or syllabus and training material for the topics to be covered in maintenance training.
e. As a minimum, maintenance training shall include but is not limited to:
1) Preventive and maintenance schedule(s) shown in the O&M manuals.
2) General functioning of the communication network and troubleshooting of communication errors.
3) Functioning of field equipment, instruments, and HMI equipment.
4) Use of any diagnostic software provided with the system.
5) Use of any special tools provided with the system.
6) Instrument calibration procedures and schedules.

B. The Contractor has the option of utilizing manufacturer training personnel to meet the requirements of the operator and maintenance training.

END OF SECTION

SECTION 13405

CONTROL SYSTEM OPERATION

PART 1 - G E N E R A L

1.1 SECTION INCLUDES

A. Provide field instrumentation and control system equipment defined in Related Work and connect together to produce a fully operational control system as described in this Section.

B. Connect vendor supplied equipment packages with self-contained control systems to the existing plant monitoring system through outputs from the vendor supplied equipment packages.

C. The operation of the process is illustrated schematically on the drawings

1.2 QUALITY ASSURANCE

A. Requirements included:

1. Acceptable manufacturers for the component parts of the control system are indicated and specified in individual specification sections.

2. All equipment will be of the latest and most modern design and shall perform as guaranteed by the manufacturer or as specified herein, whichever is greater

PART 2 - P R O D U C T S (NOT USED)

PART 3 - E X E C U T I O N

3.1 CONTROL SYSTEM SCOPE

A. The basis of the process control system in this facility shall be industrial quality equipment as defined by the individual specification sections.

B. The PLC shall monitor the lift station through the existing SCADA network system. Local operation will be based upon the Blue Ribbon pump controller furnished with the lift station pump equipment, and meeting the requirements of individual specification sections.

C. All control system design and installation shall consider the protection of personnel and equipment as paramount. Contact (discrete) inputs shall be configured for fail safe operation; i.e., an open contact shall cause an alarm condition in the control system.

3.2 LIFT STATION OPERATION

A. The control sequence shall be for two pumps. Pump activation and deactivation shall be accomplished through the use of a submersible level transmitter and Blue Ribbon Pump Controller. The pump controller levels shall be programmed to provide the following:

1. Low level alarm. Provide interposing relay and provide discrete point alarm to PLC.

2. High level alarm. Stop All Pumps. Provide interposing relay and provide discrete status point to PLC.

3. Start Lag Pump. Provide interposing relay and provide discrete status point to PLC.

4. Start Lag Pump. Provide interposing relay and provide discrete status point to PLC.

Coordinate programming levels with civil drawings and owner.

B. Backup control sequence. Provide 3 alarm float switches. Each level shall be individually adjustable with a minimum differential of not more than 3 inches. The following are suggested pump action levels. Actual levels may be revised by the Engineer or Owner. Refer to the civil drawings for level elevations.

1. High Water Alarm Level. Alarm circuit shall be energized when rising water reaches this level. Level shall activate both pumps through hardwire interlock through pump starters.

2. High Water Alarm Level. Alarm circuit shall be energized when rising water reaches this level. Provide interposing relay and provide discrete point alarm to PLC.

3. Low Water Alarm Level. Alarm circuit shall be energized when falling water reaches this level. Provide interposing relay and provide discrete point alarm to PLC.

C. Alternator. Alternate lead and lag pumps after each start/stop cycle or every 24 hours whichever occurs first.

D. Provide control panel in accordance with Section 13413. The enclosure shall meet the requirements of NEMA 4X Type 304 stainless steel construction.

END OF SECTION

SECTION 13410

PROGRAMMABLE LOGIC CONTROLLERS (PLC)

PART 1 - G E N E R A L

1.1 SUMMARY

A. Provide a complete and operational system of the PLCs, including hardware, software and installation in accordance with the contract documents.

B. Provide the PLC hardware for the locations and requirements identified on the Drawings. This shall include all PLC hardware, software, cables, connectors, PLC/PC network interface cards, termination blocks, fiber-optic cable, PLC data highway cable, PLC Ethernet equipment, and any other hardware and/or software to ensure a fully operational unit.

C. Provide installation services for the PLCs. This service shall include removing the existing hardware if applicable, installing new hardware, panel wiring, I/O points check, and testing.

1.2 SUBMITTALS

A. Product Data.

1. Submit vendor specification information for each scheduled device specified in this Section.
2. Submit vendor specification information for each material and unscheduled device specified in this Section.

B. Provide two complete sets of as-built drawings for each PLC panel. These drawings shall be complete and accurate. If applicable, existing PLC improvement changes or modifications shall be shown on the as-built drawings. Each set of drawings shall be provided in both paper and electronic copy.

1.3 WARRANTY

The manufacturer shall provide an all-inclusive 2-year warranty. The submittal shall provide a contract specific warranty document as detailed in the Specifications.

1.4 TRAINING

The manufacturer shall provide operator training and maintenance training as detailed in the Specifications.

1.5 SPARE PARTS AND TOOLS

The manufacturer shall provide the specified spare parts and/or tools as detailed in Specifications.

PART 2 - P R O D U C T S

2.1 GENERAL REQUIREMENTS

A. All PLCs shall be from one manufacturer. PLC I/O modules shall be selected within one I/O product family.

B. PLC hardware, power supply, CPU and I/O modules, shall fit in the specified panels. In all cases, verify that the PLC supplied will fit and operate properly in the space indicated on the Drawings.

C. PLCs shall be self-contained units capable of collecting data through electrically dry relay contacts, 4 to 20 mA DC analog, high-level AC input signals, and contact making pulsing devices supplied by Owner. The PLCs shall also be capable of providing AC and DC control outputs, both momentary and latching, the contacts of which will be used by Owner for remote control. Provide all interposing relays that may be required to interface with the field AC signals.

D. PLCs shall be fully programmable in a high-level language and shall not require burning or etching of an EPROM for applications programs.

E. PLCs shall have stand-alone calculation and control capability to perform the control logic functions using software and setpoints downloaded from the HMI.

F. Provide a control power supply for the PLC system. The control power unit shall be installed in each PLC panel. The power unit shall be properly sized, installed, wired, checked and tested by the Contractor.

2.2 PLC DESIGN REQUIREMENTS

A. General.

1. Approved PLC manufacturers are as follows:
   a. Modicon (www.modicon.com).
2. PLCs shall be solid-state electronic units of programmable design. PLCs shall have a stand-alone restarting capability; i.e., no reloading of software programs for common logic, communications, and I/O processing at the PLC shall be required to resume operation following a loss of power. Therefore, all PLC basic programs shall be resident in battery backed-up RAM with at least a 5-year battery life.
3. PLCs shall be from one family of the manufacturer's product line with an expected product life of more than 10 years. Products nearing the end of their life cycle are not acceptable. Submit statement from manufacturer as part of the submittal.
4. Solid-state RAM shall be utilized for data buffering, change-of-state information, calculation parameters, and local control algorithms. A power failure indication shall be reported to the HMI after recovery from a power failure so that status initializing may be initiated by the HMI.
5. All electronic components shall be mounted on plug-in printed circuit cards or modular subassemblies. Each printed circuit card and subassembly shall be model and serial numbered to uniquely identify it. Printed circuit cards shall be plug-in with quick-disconnect field terminations.
6. As a minimum, the PLC CPU board shall have LED's for run, CPU fail, and low battery. The I/O modules shall have a power present LED.
7. Equipment shall be sufficiently sturdy to withstand handling during shipment, placement, and start-up without damage or distortion.
8. All switches and breakers and other current interrupting devices shall be non-arcing or hermetically sealed.

B. PLC Common Logic. Logic functions shall be implemented to receive data from and transmit data to the network, perform address decoding and error checks, and transfer data to and from the point input/output logic. In conjunction with the other PLC logic elements, the following functions shall be performed:

1. Respond to commands for retrieving data.
2. Prevent selection of more than one control point in a command sequence.
3. Protect against single component failures causing a malfunction.
4. Inhibit relays from being energized erroneously during the initial power-up period of the PLC.
5. Provide a "power fail bit" which will be set upon commercial power loss or failure of the AC/DC power supply.

6. Protect against a missing or failed logic card causing a malfunction, damage to other logic, or false transmission to the HMI.
7. Protect against over/under voltage conditions from the Owner's power source and/or the Contractor's power subsystem from causing malfunction, damage to logic, or false transmissions to the HMI.
8. Provide a "Change Summary" bit in the returned message to report status point changes on an exception basis (if all status is not returned on each scan).
9. Provide a real-time clock function.
10. Each PLC shall continually monitor its operation and shall shut down in case of failure that would cause faulty solution of logic. A running PLC shall identify communication failures, I/O assembly errors, I/O module errors, and CPU battery failure and shall report such faults to the HMI. Faults shall also be reported to the PLC test set whenever it is connected to a PLC. In addition, a PLC trouble alarm shall activate a discrete output if any diagnostic detects a failure or upon CPU failure.
11. Provide for peer-to-peer communication between PLCs. When connecting to existing PLC systems, new PLCs shall be able to exchange information with existing PLCs using Ethernet/IP protocol. Use of HMI servers to exchange data is not acceptable.
12. Provide empty I/O modules with a door cover for all PLC empty slots.

C. PLC Hardware Requirements.

1. Shall communicate using Ethernet TCP/IP to the wastewater treatment plant SCADA system.
2. Shall communicate using an open standard, such as DeviceNet or Profibus, for the PLC I/O network.
3. No DIP switches shall be used in the PLC system. All I/O addressing shall be done in software and all module configuration details shall be supplied by the PLC controller.
4. Shall be capable of changing RAM battery without loss of program.

D. I/O Modules. The following types of process I/O interface capabilities shall be provided for the PLC:

1. I/O modules shall be capable of being removed or replaced under power while the controller is running so as not to disturb other operating elements of the PLC system.
2. I/O modules shall be software configurable.
3. I/O modules shall have the ability to define the failure mode of output modules. I/O modules shall be configured to turn all outputs off or zero (default state), go to predefined safe station, or hold the last value which the module received just prior to the watch-dog timer expiration. This configuration information shall be set up on a point-by-point or channel-by-channel basis.
4. I/O modules shall have the capability of DeviceNet or Profibus communication by using a communication adaptor.
5. Discrete Input Requirements (DI).
    a. Provide PLC interface with status and alarm contacts. For "dry" contacts, PLCs shall sense the states of these contacts by applying voltage and observing the extent to which current flows. This voltage shall be obtained from a separate, isolated power supply furnished by the Contractor. The voltage applied across the Owner's open contacts shall be [24 VDC] [and] [110 VAC] nominal.
    b. The exact input configuration shall be sized to meet the discrete input needs as specified on the Drawings. The final configuration shall be from the standard product offering of the PLC manufacturer.
    c. The module shall contain at least 16 DI points.
6. Discrete Output Requirements (DO).
    a. The discrete output logic shall process the control commands received from the common logic. Any control scheme, in which a single message with undetected errors can cause a false command, shall be unacceptable.
    b. Discrete output drive circuitry shall be designed such that any single logic component failure in the PLC does not energize a discrete output.
    c. The exact output configuration shall be sized to meet the discrete output needs as specified on the Drawings. The final configuration shall be from the standard product offering of the PLC manufacturer.
    d. The module shall contain at least 16 DO points.

7. Analog Output Requirements (AO)
   a. Provide analog output modules which shall be a 4-20 mA at 24 VDC; suitable for interfacing to an electronic three-mode controller or direct to a variable frequency drive. The analog outputs shall be driven from the isolated 24 VDC power supply supplied by the Contractor in the PLC panel. The module shall have broken wire fault detection.
   b. The exact output configuration shall be sized to meet the analog output needs as specified on the Drawings. The final configuration shall be from the standard product offering of the PLC manufacturer.
8. Analog Input Requirements (AI).
   a. Analog inputs from transducers shall be 4-20 mA DC and all transducer power shall be provided by the dedicated 24 VDC + 10% power supply by the Contractor in the PLC panel, or from an isolated output of the field device. The module shall be bi-polar with broken wire and out-of-range fault detection.
   b. The exact input configuration shall be sized to meet the analog input needs as specified on the Drawings. The final configuration shall be from the standard product offering of the PLC manufacturer.

E. PLC Power Supply. PLC power supplies shall be 110 VAC and shall contain a "Power OK" LED.

F. PLC Communications. PLC communications between the HMI servers and the PLCs shall be Ethernet compliant to IEEE 802.3. Transmission media for links that reside entirely within a building shall be copper Cat-6 cables. For any links that leave the building and are exposed to the external environment, transmission media shall be fiber-optic terminated directly within the PLC panel. Utilize either a communication card by PLC manufacturer or by a third-party manufacturer certified by the PLC manufacturer. Each module shall be configurable with a unique IP network address.

G. Remote I/O. The PLC shall support remote I/O racks connected to the PLC via an open protocol. The remote I/O rack shall utilize the same rack and power supply as the PLC. Provide prefabricated remote I/O drop cables and connectors from the PLC manufacturer.

2.3 PLC SOFTWARE REQUIREMENTS

A. The PLC shall be programmed to provide the overall system functions as described in the Specifications. Specific functions which shall be performed via PLC-level software include, but are not limited to, the following functions described below. Software shall be the latest version of PLC manufacturer's programming package. The following are the general requirements for the PLC programming software package:

1. Windows® based.
2. Be able to monitor and modify the PLC online.
3. Contain an equation editor for complex algorithms.
4. Have quick key support.
5. Be compliant with IEC-61131 Ladder Logic, Function Block, Structured Text, and Sequential Function Chart program formats.
6. Have on-line help menus.

B. Diagnostics and System Programming. The PLC shall be programmed to provide the basic system functions as described in the Specifications. Specific functions which shall be performed via PLC-level software include, but are not limited to, the following functions:

1. PLC network configuration, including IP addressing.
2. CPU module configuration.
3. I/O module configuration.
4. I/O database download as provided by the Owner.

C. Provide two copies of the fully-licensed versions of the PLC programming package.

D. The PLC programming software shall be the full version of package provided by the manufacturer. It shall include all the latest service packs provided for the programming package by the manufacturer with discs, manuals, and certificates in original packaging. The software shall be licensed in the name of the Owner.

E. Make available to the Owner all updates provided by the manufacturer for any provided software during the warranty period.

2.4 PROGRAMMING CABLES

Furnish two programming cables for each type of PLC/RTU to be programmed.

PART 3 - E X E C U T I O N

3.1 TEST REQUIREMENTS

A. Factory Demonstration Test. PLCs shall be integrated with other components of the PLC system and tested as part of the system Factory Demonstration Test specified in the Specifications. In addition to general system test requirements, each PLC shall be subjected to tests described in this Section with a written confirmation of test results.

B. Burn-In Test.

1. Provide certification that PLCs meet ambient temperature requirements and have been tested to screen for infantile failures. If this certification is not provided by the PLC manufacturer, conduct the following test.
2. All PLCs furnished shall be placed in a room having an ambient temperature of 60°C with the PLCs connected to a data channel and to equipment simulating actual field equipment to be monitored or controlled. They shall remain energized at this temperature for a minimum period of 48 hours. During this 48-hour test period, the PLC shall have its various modes of operation exercised periodically. Any equipment failures shall be corrected and shall cause the test to be rerun in its entirety.

C. PLC Functional Test. Each PLC shall successfully pass the following functional tests to be performed in conjunction with the system Factory Demonstration Test:

1. A close-and-open operation on each control point, showing proper sequence of operations
2. Verify proper operation of the digital outputs.
3. A test showing that proper indications are given at an operator workstation when one or more status input points change momentarily.
4. A series of communications tests showing all message protocols and formats to which equipment is designed to respond, and demonstrating that all error-detection or error-correction capabilities function properly, and that equipment does not respond to erroneous commands.
5. Telemeter readings of selected analog points to verify that readings are within specified accuracy when inputs are at 0, 25, 50, 75 and 100 percent of full-scale.
6. A test showing that, as a result of a scan request from the HMI, all requested analog, indication and alarm points are transmitted from the PLC.
7. A test showing that the PLC successfully performs its various modes of operation while the power source for the PLC is varied over its specified range.
8. A test verifying that all common equipment, wiring, files, and power supplies are provided for expansion of the PLC to the ultimate point count specified. This test shall also verify that power supplies are capable of carrying the increased load for this expanded point count.
9. A test to verify proper operation of the stand-alone capabilities of PLCs. This shall include configuration of loops or downloading from the HMI and testing actual control strategy with test signals.

END OF SECTION

SECTION 13413

CONTROL PANELS

PART 1 - G E N E R A L

1.1 SUMMARY

A. Furnish, deliver, and install control panels as shown on the Drawings with power supplies, communications equipment, PLC/RTU equipment, pre-wired termination blocks, incoming power surge suppression, and miscellaneous equipment to provide a fully functional system as shown on the Drawings and specified herein.

B. This Section specifies connection wiring within panel and electrical accessories such as switches, pilot lights, relays, terminal blocks, and fuses, which are included in the panel.

C. All work and products shall conform to the designs shown on the applicable Drawings and shall comply with the provisions of this Section. The control panel shall be factory wired. Panels and cabinet shall include all components indicated in the applicable Drawings, required to provide functions as specified in this Section. Where specific requirements on the Drawings conflict with general design requirements in this Section, requirements shown on the Drawings shall prevail.

1.2 REQUIRED PANELS

Panels shall conform to requirements indicated on the Drawings and specified herein and shall be sized to accommodate initial and future Input/Output (I/O) point counts.

1.3 QUALITY ASSURANCE

All equipment and accessories provided shall be the product of a manufacturer regularly engaged in manufacturing this equipment, whose products have been in satisfactory service for not less than 3 years. Completed panels shall bear the UL label.

1.4 PANEL COMPONENT LAYOUT

Follow component arrangements shown on the Drawings. Make adjustments as necessary to allow each component to be mounted as recommended by the manufacturer, to facilitate easy installation, removal and in-place maintenance of each component, and to allow normal operation of the component by operating and maintenance personnel. Component arrangements shall allow space for routing wiring without kinking or bending around sharp edges, and for free flow of air around and through equipment which requires ventilation for cooling.

1.5 WARRANTY

Provide an all-inclusive 2-year warranty for labor and materials

1.6 TRAINING

The manufacturer shall provide operator training and maintenance training as detailed in the Specifications.

1.7 SPARE PARTS AND TOOLS

Manufacturer shall provide spare parts and/or tools required to perform standard maintenance for up to 5 years after acceptance.

1.8 REFERENCE STANDARDS

A. All materials and workmanship shall conform to the latest published applicable provisions of the following codes and standards:

1. ANSI C37.13 - Low-Voltage AC Power Circuit Breaker (600 Volt Insulation Class).
2. ANSI/IEEE-C-37.90-1 - Standard for Surge Withstand Capabilities (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus.
3. ANSI/IEEE C39.5 - Electrical Isolation for Analog Signal Devices.
4. ANSI/NEMA ICS 1 - General Standards for Industrial Controls and Systems.
5. ANSI/NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
6. ANSI/NEMA ICS 3 - Industrial Systems.
7. ANSI/NEMA ICS 4 - Terminal Blocks for Industrial Control Equipment and Systems.
8. ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
9. ANSI/NEMA 250 - Enclosures for Electrical Equipment (1000 volts maximum).
10. ANSI/NFPA 70 - National Electrical Code (NEC).
11. EIA RS-310-C - Racks, Panels, and Associated Equipment.

B. Unless otherwise specified, electrical equipment and material provided under this contract shall be listed and labeled for the purpose for which it is used by the Underwriters Laboratories, Inc. (UL). This requirement may be waived only if a UL listing is not available for the type of product and approved by the Owner's Representative.

1.9 SUBMITTALS

A. General. Submit for all items supplied. For each panel, submit a certified factory (shop) test report prior to shipment of panels.

B. Product Data. Provide product data sheets for each item utilized.

C. Elementary Control Diagrams. Provide elementary control diagrams, using the ladder diagram format incorporating line number, operation function statement, contact location line number with an underline for a normally closed contact and a description of operation of each device. Label each contact, coil, and indicator with its function, as well as its number. Show terminals for field wiring. Show field wiring as dashed lines.

D. Panel Layout Drawings. Show the general arrangement of equipment within the control panel. The view shall be from the front of the panel with an open door. Include any section views necessary to present a clear picture of equipment mountings and clearances.

E. Connection Diagrams. Provide connection diagrams which show the following:

1. Placement, labeling and wiring of components within panels and cabinets.
2. Components arranged in the physical layout (not necessarily to scale) as it would appear to a person servicing the equipment.
3. Wires as a continuous line between their termination points.
4. The direction of entry to a wire bundle.
5. Wire lists and wireless diagrams are not acceptable.
6. Additions and deletions of devices and wires in existing enclosures.
7. Each wire label designation.
8. Identical wire label designations on each end of a single wire.
9. Wire termination point numbers.

10. Each wire color.
11. Signal and DC circuit polarities.
12. Jumper, shielding and grounding details.
13. Wire pairs.
14. Spare wires and termination points.

F. Test Procedures. Submit factory demonstration procedures as required in the Specifications.

PART 2 - P R O D U C T S

2.1 CONTROL PANELS

A. Physical and Miscellaneous Specifications. The enclosures shall:

1. Be NEMA 4X 304 stainless steel with pad-locking handle.
2. Contain PLC/RTU equipment, surge arresters, circuit breakers, fuses, relays, transformers, terminal strips, nameplates, terminal labels, wire ducts, universal spiral wraps and any necessary parts for a complete system as shown on the Drawings and specified herein.
3. Be wall-mount or free-standing as appropriate for the application.
4. Allow expansion space to accommodate future system needs.

2.2 PANEL FABRICATION

A. Materials. The enclosure shall be made with 12 gauge minimum. Each shall be provided with a full-length interior panel with adjustable mounting on both vertical sides to rails located at the top, bottom, and middle of the enclosure.

B. Acceptable Manufacturers.

1. Hoffman Engineering Company (www.hoffmanonline.com).
2. Rittal (www.rittal.com).
3. Owner Approved substitution.

C. Dimensions. Panels shall be sized by the Contractor to accommodate all initial and future devices.

D. Coating.

1. Metal surfaces of NEMA 12 and NEMA 4 panels and cabinets shall be prepared, primed and finish coated in accordance with requirements of the Specifications and coating manufacturer's recommendations. Scratches or blemishes in panel faces shall be filled prior to finishing. One coat of primer shall be applied at the manufacturer's recommended dry film thickness and allowed to dry prior to applying the first finish coat. Provide a quart of finish paint from batch used for final finish coat.
2. Finish coat shall be aliphatic air-dry polyurethane or epoxy panel enamel. Cabinet interiors shall be Fed. Std. color 27880, white. Exterior color of cabinets shall be Fed. Std. 26306, gray.

E. Face-Mounted Instrument Reinforcement. Face-mounted devices shall be mounted to panel doors using mounting methods recommended by the component manufacturer with mounting kit parts provided by the component manufacturer specifically for the component. If such a mounting method causes the door to deform or allows the component to sag so as not to be perpendicular to the door surface, then design and install appropriate reinforcement to prevent these conditions.

F. Miscellaneous.

1. Face-mounted equipment shall be flush or semi-flush, with flat black escutcheons. Cutouts for future equipment and holes resulting from removal of existing devices shall be blanked off with suitable covers as required to retain the cabinet's NEMA rating. Component identification shall be hot-ink stamped on the panel interior.
2. All miscellaneous hardware and fittings shall be 316 stainless steel. Stainless steel shall meet or exceed the corrosive-resistant properties of 316 stainless steel.

2.3 NAMEPLATES

Machine engraved, three ply laminated phenolic nameplates shall be provided for all panels and cabinets as shown on the Drawings. Nameplates shall be black with white lettering. Nameplates shall be attached to the panel with a minimum of two self-tapping 316 stainless steel sheet metal screws. The height of each character shall be a minimum of 3/16" except as noted.

2.4 WIRING AND ELECTRICAL DEVICES

A. General. Provide electrical devices specified below and associated wiring to provide a fully functional control panel system.

B. Power Distribution.

1. Unless otherwise specified, power for instrumentation equipment shall be obtained from a 120-volt, 60-hertz branch circuit panelboard.
2. Each cabinet shall be equipped with a 120 VAC main power disconnect circuit breaker and power distribution circuit breakers as shown on the Drawings. Circuit breakers shall be sized in accordance with ANSI/NFPA 70 - NEC. Circuit breakers shall be rated at 250VAC with a minimum AIC rating of 10,000 amps. Mount circuit breakers on a standard DIN rail and be channel mounting type.
3. For each power circuit breaker, a neutral return terminal block shall be installed at the bottom of the breaker rail. The neutral return terminal block shall be standard DIN rail mounted and shall be rated the same as the phase bus and accept up to two 12 AWG wires. This terminal block shall conform to requirements specified herein.
4. Each cabinet shall be provided with grounding type receptacle power outlets for 120 VAC power supply connections. Each piece of equipment which is equipped with an AC power cord shall be plugged into a power outlet.

C. Panel Connection Wire and Cable.

1. All cable furnished by the Contractor, including cable with any and all wires terminated at both ends within the same panel or enclosure and cable with any wires terminated at more than one panel or enclosure, shall conform to requirements specified below.
    a. Power and Control Cable. Power and control wiring shall be single-conductor stranded copper NFPA 70, Type MTW. Power wiring from the main circuit breaker to distribution breakers shall be 12 AWG minimum. All other single conductor 120 VAC and 24 VDC power and common return wiring, common ground buses and all common logic bus circuits shall be 16 AWG minimum. Circuits protected by 20-amp circuit breakers shall be 12 AWG minimum. All power wiring shall be rated for 600 volts and 90°C.
    b. Single Conductor Wire. All single conductors used for logic, PLC/RTU input/output and discrete control circuit wiring shall be No. 18 AWG stranded conductor copper, Belden Type 9918 (0.080-inch O.D.), or equal.
    c. Multi-conductor Foil-shield Cable (TP). All multi-conductor cable used for logic, PLC/RTU input/output and discrete control circuit wiring shall be No. 16 AWG stranded copper conductors with polyvinyl/chloride jacket. The cable shall be rated for a minimum of 600 volts and 80°C. The

cable shall have an overall aluminum/polyester foil shield with drain wire, Alpha XTRA-Guard 1, or approved substitution.

d. Analog Signal Cable. Wiring for 4-20 milliampere, 1-5 volt DC signals and other analog signals shall be No. 18 AWG stranded copper twisted-pair shielded cable, 80°C rated, UL listed, 0.25 inches maximum outside diameter, with 100 percent coverage aluminum foil mylar-lines shield and No. 22 AWG (minimum) stranded tinned-copper drain wire, Houston Wire and Cable, Belden, or approved substitution. Multi-pair analog signal cable shall be individually shielded (with drain wire), No. 18 AWG stranded conductor copper with a 100 percent aluminum/polyester foil shield with drain wire and an outer PVC jacket. The cable is designated TSP on the Drawings. The cable shall be rated for 600 volts, 80°C (NEC Article 300-3).

e. Multi-Individual Conductor (TP). Multi-individual conductor cables used for logic, PLC/RTU input/output and discrete control circuit wiring shall be No. 16 AWG stranded copper conductors with polyvinyl/chloride jacket . The cable shall be rated for a minimum of 600 volts and 80°C. The cable shall be Belden or approved substitution.

2. Wire Tagging. All panel connection wiring shall be tagged at terminations with machine-printed slip-on type tags. Show wire/cable tag designations on all wiring diagrams submitted to the Owner. There shall be a tag placed within 2 inches of any wiring termination. The tag shall be fixed to the wire to prevent the tag from sliding more than 2 inches from the terminal as the result of gravity and vibration.

3. Control circuit, logic bus and power circuit wires shall be tagged as follows:

a. Control Circuits. Each individual connection wire shall be tagged at both ends of the wire with a wire number. The tag shall be placed on the wire within 2 inches of the terminal to which the wire is terminated. Assign a unique number for each wire within a panel.

b. Power Circuits. All 120 VAC power wires shall be tagged with the designation “120 VAC-” followed by the circuit breaker number shown on the Drawings, then followed by a letter designating whether the wire carries the line (L), neutral (N), or power ground (PG).

c. Positive 24 VDC power circuit and power bus wires shall be tagged with the designation “+24 VDC-” followed by the circuit breaker number shown on the Drawings, and 24 VDC power returns shall be designated with “24 VDC COMMON”.

4. Wire Colors. Control, logic bus and power conductors in panels shall have the following insulation colors:

Usage	**Color**
Line Power	Black
Neutral	White
Power Ground	Green
+24 VDC Panel Bus	Red
+24 VDC Field Bus	Orange
24 VDC Common	Gray with Red Stripe
Control	Red
Status and Alarm	Blue

5. Signal Circuits. Signal circuit multi-conductor cables shall be tagged at each end with the designation shown on the wiring diagram. Each signal conductor shall be tagged at each end with the designation of the terminal block to which it is connected. Individual conductors in each pair of twisted-pair cable shall have distinctly different colors, such as black and white, black and clear. Shield ground common wires connected between drain wire terminals shall be green and shall be tagged “SG”.

D. Terminal Blocks.

1. Unless otherwise shown or specified, terminal blocks shall be captive screw with pressure plate, DIN EN 50035 rail, 600-volt rating. Terminal blocks for Input/Output shall be prewired type as specified in Section 17300. Terminal blocks shall be the type specified in the following table, or approved substitution:

Description	**Type**	**Application**

Description	Type	Application
Terminal Block or equal	Phoenix UK 5 N	120 VAC, Neutral
Grounding Terminal	Phoenix USLKG 5	Equipment Grounding Block
End Clamps	Phoenix E/NS 35 N	Each Group of Blocks
Terminal Marking	Phoenix ZB 6	All terminal Blocks as required
Terminal Strip Marker	Phoenix KLM-A	Each Group of Blocks
Insertion Strip	Phoenix ESL	As Required

2. Provide Phoenix Contact UK6.3 fused disconnects with light indicators for 24VDC and 120VAC circuits with fuses as shown on the Drawings (www.phoenixcon.com). Provide 20 fuses of each type as spares.

E. Terminal Tags, Covers and Markers. Each terminal strip shall have a unique identifying alphanumeric code designation at one end and a plastic marking strip running the entire length with a unique number for each terminal. Assign terminal strip numbers from the number "1" and continuing in ascending cardinal order. The terminal strip designation shall be the letters "TB" followed by the terminal strip number. The strip and terminal point designations shall be machine printed and l/8 inch high. Terminal blocks carrying 120 VAC power circuits shall be provided with a transparent, hinged cover for personnel protection and accessibility.

F. Wire Routing. Wires shall be routed in slotted plastic wireways with snap covers. Wires carrying 120 VAC shall be separated from other wires and signal cables and shall be routed only in ducts shown on the Drawings to be for 120 VAC. If the power wiring has to cross the signal wiring, the crossing shall be close to a right angle. Ducts shown for 24 VDC shall be used for all other wires and cables. Wires and cable shall be routed along the shortest route between termination points, except routes which would result in routing 120 VDC and other wires and cables in the same duct. For intrinsically safe signal wiring, refer to ANSI/ISA RP12.6, Installation of Intrinsically Safe Instrument Systems in Class I Hazardous Locations. Wires and cables shall have sufficient length to allow slack and to avoid any strain or tension in the wire or cable. Wires and cables shall be placed in the ducts in a straight, neat and organized fashion and shall not be kinked, tangled or twisted together.

G. Wire Terminations.

1. Single wire and cable conductors shall be terminated according to requirements of the terminal device.
2. For captive screw, pressure plate and screw terminals, appropriately sized lugs shall be used. Lugs shall be crimp -on type that form tight connections. All crimping shall be done using a calibrated crimping tool made specifically for the lug type and size being crimped.
3. On shielded cables, the drain wire shall be covered with insulating tubing along its full bare length between the cable jacket and the terminal lug or terminal pressure plate.

H. Single Position Indicating Lights.

1. Single-position indicating lights shall be 24 VDC, NEMA 13, heavy-duty, oil-tight, nominal 1.5 inch diameter. The lens color shall be as designated on Drawings.
2. Single-position indicating lights shall be Micro-switch Type PT, Westinghouse Type PB2, General Electric Type CR104P, or approved substitution.

I. Electro-Mechanical Relays. Control relays shall be UL or CSA approved, and provided with two Form C silver contacts rated at 3 amperes at 28 VDC, and shall be hermetically sealed. Where the Drawings show a requirement for more than two contacts for a single control relay, two relays shall be provided with coils wired in parallel. Coils shall be 24 VDC. Relays shall be mounted on sockets with retainers and shall be wired with drop-out voltage spike suppression diodes in parallel with all coils, with the cathode of the diode connected to the positive side of the coil. Electro-mechanical Control Relays shall be IDEC (www.idec.com) type RY2S-LD with indicator light, Potter and Brumfield (www.tycoelectronics), or approved substitution.

J. Cabinet Lighting. Each panel shall be provided with an internal LED light. Lights shall operate from 120 VAC and shall be wired to power through a door-mounted switch, which shall be activated by opening the panel door, to be located and wired as shown.

K. Circulation Fan. Provide a 120-volt circulation fan with mounting bracket in each panel. Fan shall be 4 inches, capable of 100 cfm.

L. Power Line Surge Protectors. Each panel shall be provided with a 120 VAC, 20-ampere service power line surge protector. The surge protectors shall be heavy-duty, multi-stage, and high speed. Response time shall be 5 nanoseconds maximum and shall allow 340 volts maximum peak surges to pass through. Protector shall be wired to the cabinet ground bar via a dedicated No. 8 AWG solid copper wire. The power line surge protectors shall be EDCO Type HSP-121 (www.edcosurge.com), or approved substitution.

M. PLC/RTU I/O Wiring Requirement. All PLC/RTU I/O logic circuit wiring inside the PLC/RTU panel shall conform to the requirements specified below:

1. Discrete Input Wiring Requirement. Each spare discrete input shall be hardwired to the terminal.
2. Discrete Output Wiring Requirement.
   a. No matter what type of PLC/RTU discrete output will be used in the systems, "dry" contact or semiconductor/transistor type output, every discrete output shall have an interposing relay for an isolation of PLC/RTU I/O board from the field side. The interposing relay shall be rated 24 VDC coil and 2-amp contact for 120 VAC or 24 VDC. If transistor type of discrete output board is selected and used for DC circuit, a drop-out voltage spike suppression protection circuit shall be paralleled in each coil circuit. Provide a fuse per common group.
   b. Each spare PLC/RTU output or output relay shall be hardwired to the terminal block.

N. Analog Input and Output Wiring Requirement. Each analog I/O shall have a voltage surge arrester in circuit to protect analog input from the any electronic surge damage. Phoenix Contact (www.phoenixcon.com) DIN mounted overvoltage arrester PLUGTRAB PT or TERMITRAB series shall be used in each analog circuit, including all spare I/O. Provide a fuse for each analog signal.

O. Panel Ground.

1. Each panel shall be provided with a 1-inch-high by 0.25-inch-thick solid-copper grounding bus bar across the bottom of the panel. The grounding bar shall be mounted on insulated standoffs so that no electrical connection is made between the grounding bar and the cabinet through the mounting. The ground bar shall be drilled and tapped for .25-20 screws at .5-inch intervals along its entire length.
2. An uninsulated solid copper No. 8 AWG ground wire shall be attached between the ground bar and the panel enclosure, and between the ground bar and the mounting panel.

P. Power Supply. Each panel shall be provided with 24 VDC switching type power supplies connected in parallel via current steering diodes. These power supplies shall operate from 120 VDC input power and shall provide direct-current output current of 10 amperes at 24 VDC at 40°C, and shall be adjustable from 24 to 28 VDC by screwdriver-operated adjustment. Input power regulation shall be .2 percent from 105 to 130 VDC. Output load regulation shall be .2 percent maximum from zero to full load. Ripple shall not exceed .5 percent at full load. The power supplies shall have integral output current-limiting and over-voltage protection. The power supplies shall have fully enclosing cases.

Q. Condensation Heater. Provide thermostatically operated condensation space heaters, which are sealed and safe to touch.

R. Wiring Duct. Plastic wiring duct shall be slotted type with dust cover, panduit type E or NE, as required.

PART 3 - E X E C U T I O N

3.1 TEST REQUIREMENTS

Shop test the panels and correct any defects discovered prior to delivery. These tests shall consist of the following:

A. Verify that each wiring connection is made properly by checking electrical continuity, ensuring that connections have less than one ohm resistance end to end, and that no cross continuity exists between separate circuits.

B. Conduct a test of all power circuits and power supply equipment to verify that proper voltages are delivered and all power supply equipment is operating according to the manufacturer's specifications. These tests shall be witnessed by the Owner's representative. Certify the results in writing to the Owner.

C. Functionally test each electrical device to verify correct operation. Test each input/output point. Inputs shall be exercised at the location in the panel the greatest distance in the circuit from the PLC/RTU chassis and verified through to the PLC/RTU processor. Results shall be demonstrated on a programming terminal. Each output shall be exercised from a programming terminal and verified through to the panel location the greatest distance in the circuit from the PLC/RTU chassis. Analog inputs and outputs shall be tested at 0%, 25%, 50%, 75%, and 100% of range. This test shall be witnessed by the Owner's representative and certify the results in writing to the Owner. Test the operator interface unit, including simulated alarm conditions.

D. Test ground fault interrupter (GFI) receptacles and circuit breakers for proper operation by methods sanctioned by the receptacle manufacturer.

3.2 PANEL INSTALLATION

A. Shop Testing. Coordinate panel delivery with the construction of the control room and panel locations to minimize field handling.

END OF SECTION

SECTION 13420

INSTRUMENT COMMISSIONING

PART 1 - G E N E R A L

1.1 SUMMARY

Provide instrument commissioning including but limited to inspection, operational testing, adjustment and calibration of each device, subsystem and system, and placement of each device and system into service.

1.2 SUBMITTALS

A. Test Plan.

1. At least 60 days before commissioning starts, submit a description of the tests to be conducted.
2. Include list of test equipment, test procedures, checklists and test report formats.
3. At the completion of each commissioning phase, deliver all test reports for that phase to Owner's Representative with statement that phase test requirements have been satisfied.
4. Make shop drawing distribution.

B. Responsibility. Review for acceptance by the Owner's Representative of any plan, report or other commissioning activity will not relieve the Contractor of his responsibility to meet the contract requirements.

C. Description. Provide field instrumentation accessories to complete installation of sensors, meters, switches, transmitters and similar devices. Each installation includes:

1. Device.
2. Mounting stand where required.
3. Process leads, connectors, valves, support means and all other devices and material required for a complete installation.

1.3 QUALITY ASSURANCE

A. Referenced Standards.

1. ANSI C37-90a.
2. API RP550.
3. ASTM 153.
4. ASTM B 62.

B. Factory Testing.

1. Subject each device to a complete functional test.
2. Wet-flow calibrate flow meters to within specified accuracy.
3. Submit a certified calibration report for each meter showing results of calibration at a minimum of five points evenly spaced throughout range.
4. Apply a Surge Withstand Capability test wave:
   a. As defined in Section 2 of ANSI C37.90a-1974, to each power supply circuit, battery circuit, signal circuit, output circuit and input circuit.
   b. Application of test wave shall be as described in Section 4 of ANSI C37.90a-1974.

c. Submit a certified copy of test showing the no-load test waveform, details of test wave generator circuit and description of test conducted.

1.4 SUBMITTALS

A. Product Data.

1. Submit vendor specification information along with a corrected copy of applicable specification form for each scheduled device specified in this section.
2. Submit vendor specification information for each material and unscheduled device specified in this Section.

PART 2 - P R O D U C T S

2.1 MATERIALS

A. Devices and systems are specified in other sections of this Specification. Reference to "devices" means all devices included in the contract.

B. Any device that fails to meet contract requirements or published performance specifications of the manufacturer must be repaired or replaced as directed by the Owner's Representative at no cost to Owner.

C. Demonstrate that test equipment is fully operational and properly calibrated.

D. The Owner's Representative reserves the right to disapprove test equipment that is improper or functioning improperly.

PART 3 - E X E C U T I O N

3.1 OBSERVATION

A. The Owner's Representative reserves the right to witness any test, inspection, calibration or start-up activity.

B. Notify the Owner's Representative in writing at least 24 hours in advance of any test. All tests executed without notifying the Owner's Representative are invalid and must be repeated.

C. Perform commissioning of each device, subsystem and system under direct supervision of the individual manufacturer's factory-trained representative.

3.2 REPORTS

A. Prepare report showing test procedures, conditions and results of each test. In the test report, give applicable contract requirements, manufacturer's performance specifications, and permissible tolerances at each test point, actual values of test signals and actual values of test results. Provide report bound in a three ring binder.

B. Check-off List.

1. Maintain a check-off list by loop number indicating tasks remaining to be done to make loop operational.
2. Submit check-off list form at least 60 days before commissioning starts.
3. Submit check-off lists when requested by Owner's Representative.
4. Lists will be requested no more frequently than once a week.

3.3 SCHEDULING GUIDELINES FOR COMMISSIONING PHASES

A. Perform all commissioning in accordance with the instructions on the Contract Drawings, these Specifications, manufacturer's instruction manuals and the direction of the Owner's Representative.

B. Commission field devices, after installation of field instruments and prior to commissioning the instrument or the control panel.

C. After installation of the instrument or control panel and prior to loop commissioning, commission panel-mounted devices and systems.

D. After commissioning field devices and panel-mounted devices, commission loops.

3.4 REQUIREMENTS

A. Transmitters and Receivers.

1. Remove shipping stops before starting with these procedures.
2. Have manufacturer's instruction manuals available.
3. Install miscellaneous components such as charts, illumination, etc., which have been supplied separately but are integral parts of equipment.
4. Test and exercise each instrument to demonstrate correct operation, first individually, then collectively as a functional network.
5. Check calibration of and recalibrate, where necessary, instruments at a minimum of four points over full operational range and prove instruments to be within specified accuracy.
6. Calibrate instruments individually and, where applicable, as loop (i.e., transmitter, controller and valve).
7. Specified accuracy for loop is defined as root-mean-square-summation (RMS) of individual device specified accuracies.
8. Individual device specified accuracy requirements shall be as specified by contract requirements or by published manufacturer accuracy specifications whenever contract accuracy requirements are not specified.
9. Test each loop by applying simulated analog and/or discrete inputs to first elements of loop (i.e., applying simulated analog and/or discrete sensor signals) and measuring outputs from final elements of loop (i.e., controllers, alarms, indicators, etc.).
10. Apply continuously variable analog inputs to verify proper operation and setting of discrete devices (i.e., alarms, etc.).
11. Make provisional settings on controllers, alarms, etc., during loop installation tests.
12. Prepare calibration report on each instrument and loop.

B. Integrators, Ratio Relay, Etc.

1. Check devices in conformance with manufacturer's recommendations.
2. Receiver integrators may be calibrated for proper operation and multiplication factor by feeding maximum input signal for a specified period of time using a stopwatch.
3. Ratio signals may be simulated to check proper ratio settings and output.

C. Flow Meters and Level Transmitters.

1. Perform volumetric draw-down of fill test for all liquid flow meters and level transmitters.
2. Prepare test report for each meter and level transmitter.
3. If test results conflict with calibration report, recalibrate in accordance with subparagraph A above, and repeat volumetric draw-down or fill test.
4. Continue until draw-down test results prove calibration to be correct.

D. Level Switches. Perform draw-down test for each level switch. Set switch in accordance with Specifications or, in absence of switch setting in Specifications, set in accordance with instructions from Owner's Representative.

E. Controllers.

1. Check control action of each controller.
2. Check calibration of gain, integral and rate adjustments where specified, including all modes of operation.
3. For each setting, check output for at least three inputs evenly spaced through input range.
4. Check at least three settings for each adjustment evenly spaced throughout the adjustment range.
5. Run all diagnostic procedures.

F. Interlocks. Ring and check interlocking circuits for conformance to Plans and Specifications.

G. Start-up of Instruments.

1. Test each control loop under start-up and steady-state operating conditions to verify that proper and stable control is achieved using instruments in each instrument panel and control panel.
    a. Test control of final control elements using specified modes of manual and automatic control.
    b. Demonstrate bumpless transition between control station modes.
    c. Use signals from transducers, sensors and transmitters.
    d. Simulated input data signals may be used subject to prior written approval by the Owner's Representative.
2. Set proportional band, reset rate and derivative settings for each control as recommended by manufacturer.
3. Verify transient stability of each control loop by applying control signal disturbances, monitoring amplitude and decay rate of control parameter oscillations and making necessary controller adjustments to eliminate excessive oscillatory amplitudes and decay rates while retaining control sensitivity. Verify proper suppression of "reset wind-up."

H. Component Calibration Sheet.

1. Calibrate and ring out all devices that are to be interfaced with the distributed control system, including devices purchased and installed under other contracts.
2. Each active instrument element (except simple hand switches, lights, etc.) and each I/O module shall have a Component Calibration Sheet. These sheets shall have the following information, spaces for data entry, and a space for signoff by the Contractor.
    a. Project name.
    b. Loop name.
    c. Component tag number or I/O module number.
    d. Component code number.
    e. Manufacturer.
    f. Module number/serial number.
    g. Summary of function requirements.
    h. For indicators and recorders, scale and chart ranges.
    i. For transmitters/converters, input and output ranges.
    j. For computing elements, I/O modules, required and actual inputs or outputs of 0, 10, 50, and 100 percent of span, rising and falling.
    k. Space for comments.
    l. Space for signoff by Contractor.
3. Maintain the Loop Status Reports and Component Calibration Sheets at the job site and make them available to the Owner's Representative at any time.

END OF SECTION

SECTION 13421

INSTRUMENTS

PART 1 - G E N E R A L

1.1 SUMMARY

This Section of instrumentation covers field instruments.

A. Submersible level transmitters.
B. Pressure transmitters.
C. Float switches.

1.2 QUALITY ASSURANCE

A. All instruments shall be of quality as specified.

B. Test. Test the instrument at the factory to assure proper function operation.

1.3 SUBMITTALS

Provide submittals in accordance with the Specifications.

1.4 JOB CONDITIONS

A. Environmental Requirements. The equipment shall operate in ambient temperature 0-130°F, relative humidity 0-100 percent.

B. Project power 120 volts, 60 hertz single-phase. Appropriate isolation shall be provided.

C. Standard Signal.

1. Output Signal. Each instrument, which outputs a signal, shall output the standard 4 to 20 mA signal. The signal shall be constant over a load range of 0 to 600 ohms.
2. Input Signal.
   a. Electronic devices, such as controllers, match function devices, etc., shall have an input impedance of 1 mega-ohm minimum for an input signal of 1 to 5 VDC.
   b. The 1 to 5 VDC signal shall be developed by the standard 4 to 20 mA transmitted signal through a precision 250 ohm, 1-watt resistor.
   c. These requirements allow several receiving units to monitor the same transmitting unit without causing any perturbation of the received signal.
   d. Receiving devices shall not be wired in parallel.

PART 2 - P R O D U C T S

2.1 EQUIPMENT FURNISHED

A. Submersible Level Transmitters.

1. Blue Ribbon Birdcage BC001 or owner approved equal

B. Float Switches.

1. Contegra FS-90.

2. Engineer approved equal.

3. Mercury type float switches are not acceptable

PART 3 - E X E C U T I O N

3.1 INSTALLATION

A. Install control panel and all associated control devices. Coordinate exact locations with Owner's Representative. as shown on the Drawings.

B. Install instruments in various locations in the field and on panels. Coordinate exact locations with Owner's Representative.

C. Coordinate outages and shutdowns with Owner's representative.

D. Starting or stopping of any existing pump, opening any existing breaker, or disconnecting any instrument shall be approved in advance through the Owner's Representative.

E. All installations shall be in accordance with the manufacturer's recommendations and instructions.

F. All necessary mounting accessories shall be provided.

3.2 SCHEDULE

The instruments shall be supplied of the range and type as described in the data sheets.

END OF SECTION

SECTION 13422

INSTRUMENTATION ACCESSORIES

PART 1 - G E N E R A L

1.1 SUMMARY

Provide field instrumentation accessories to complete installation of sensors, meters, switches, transmitters and similar devices. Each installation includes:

A. Device.

B. Mounting stand where required.

C. Process leads, connectors, valves, support means and all other devices and material required for a complete installation.

1.2 QUALITY ASSURANCE

A. Reference Standards.

1. ANSI/IEEE C37-90-1.
2. API RP550.
3. ANSI/ASTM 153.
4. ANSI/ASTM B 62.

B. Factory Testing.

1. Subject each device to a complete functional test.
2. Wet-flow calibrate flow meters to within specified accuracy.
3. Submit a certified calibration report for each meter showing results of calibration at a minimum of five points evenly spaced throughout range.
4. Apply a Surge Withstand Capability test wave:
   a. As defined in ANSI/IEEE C37.90-1, to each power supply circuit, battery circuit, signal circuit, output circuit and input circuit.
   b. Application of test wave shall be as described in Section 4 of ANSI C37.90-1.
   c. Submit a certified copy of test showing the no-load test waveform, details of test wave generator circuit and description of test conducted.

1.3 SUBMITTALS

A. Product Data. Submit vendor specification information along with a corrected copy of applicable specification form for each device specified in this Section.

PART 2 - P R O D U C T S

2.1 UNSCHEDULED DEVICES

A. Hand Valves. Provide process valves at all process taps for isolation of instrumentation equipment except where safety would be compromised by their use.

1. General. Valves must provide straight-through passage and tight shutoff to the rating of the valve.
2. Air Service.
   a. Provide line size ball valve with stainless steel Swagelok body.
   b. Acceptable Manufacturers.
      1) Whitey (www.swagelok.com).
      2) Parker (www.parker.com).
      3) Approved substitution.
3. Water Service with fluid pressure below 200 psig and fluid temperature below 300°F.
   a. Provide 3/4-inch ball valve with stainless steel swage lock body, disc, union bonnet, and TFE impregnated non-asbestos packing.
   b. Acceptable Manufacturer. Crane No. 431 UB (www.cranevalve.com) or approved substitution.

B. Pulsation Damper.

1. Provide pulsation dampers where gauges are subject to pulsations and where indicated.
2. Provide damping by means of self-cleaning pin or piston.
3. Make provisions to vary amount of damping while preventing accidental shutoff.

C. Receiver Gauges.

1. Calibrate scale in process units with tick marks for milliampere input in engineering units.
2. Provide diode to maintain loop continuity in case of meter movement failure.
3. Accuracy shall be as specified for panel meters.

D. Mounting Brackets.

1. 2-5/8-inch channel section.
2. 316 stainless steel.
3. Acceptable Manufacturer. Unistrut (www.unistrut.com) or approved substitution.

E. Nameplate.

1. Provide each device with a nameplate identifying tag number and service as specified on device specification form.
2. Make nameplates of 1/6-inch stainless steel.
3. Machine print each nameplate inscription as shown with letters clearly readable from a distance of 4 feet directly in front of nameplate.
4. Attach nameplates using a minimum of two self-tapping stainless steel sheet metal screws or 6-inch length of stainless steel link chain.
5. Name list must be approved by the Owner's Representative before nameplate engraving.
6. External Power Supply. Provide an internal or external on-off switch for each instrument requiring power from an external power source.

F. Surge Protection.

1. Provide surge protection on all 4-20 mA inputs to all analog devices.

2. The surge protection device shall protect field instrumentation from impulses up to 500V or 10,000A induced by lighting strikes or heavy electrical equipment.
3. The protection device shall be NEMA 4X and installed in accordance with manufacturer's recommendations.

G. Interposing Relay.

1. Provide plug-in hermetically sealed self-clearing control relays with DPDT contact UL-rated 10 amperes at 28 volts DC or 117 volts AC resistive.
2. Provide relays with high-impact dust covers and barrier-protected screw terminal sockets.
3. Acceptable Manufacturers:
   a. Potter and Brumfield (www.tycoelectronics.com). Provide 50 additional spare relays.
   b. RTU interposing relay operation will be provided by the PLC inside the RTU.

PART 3 - E X E C U T I O N

3.1 PREPARATION

A. Coordination. Coordinate equipment delivery with completion of other work to minimize field handling of each device.

B. Verify dimensions in field prior to fabrication.

3.2 INSTALLATION

A. Mount pipe and connect field devices in accordance with contract drawings, specifications, and manufacturer's installation instructions.

B. Avoid tubing, piping and conduit interferences.

C. Locate equipment to be accessible for operation, maintenance and replacement.

D. Examine contract drawings and shop drawings for equipment in order to determine best arrangement for work as a whole.

E. Mount field transmitters 40 inches above floor, work platform, or as sensing line slope requires per manufacturer's guideline. Coordinate tap location and meter location with Owner's Representative prior to beginning work.

F. Where specifications and contract drawings do not delineate precise installation procedures, use API RP550 as a guide to installation procedures. Submit sketch for the Owner's approval prior to installation.

G. Where field devices are shown as yoke-mounted on a floor stand, a wall bracket fabricated from two channel sections 1-5/8 inches mounted to a wall or column is considered equal.

H. Make channel section long enough to mount at least two field devices.

I. Use 316 stainless steel for fabrication.

J. Locate instrument-mounting stands within 5 feet of primary element, unless otherwise indicated. Make stands freely accessible.

K. Locate indicating instruments which must be visible for automatic control adjustment or manual operation to be visible from the adjustment or operating point. If plot or piping arrangement precludes this, make other provisions for indication at the adjustment or operation point.

L. Install instrument mounting stands after all conduit and pipe have been installed, except conduit serving devices on stand.

M. Install instrument process piping and tubing from each primary shutoff valve to appropriate gauge, sensor, meter, analyzer, control panel connections, etc.

N. Clean piping, tubing and components thereof prior to installation. This shall include but is not limited to special cleaning procedures for oxygen service when so required.

O. Adjust pulsation dampers to eliminate rapid fluctuations of gauge or switch but to retain sensitivity to pressure changes.

3.3 SUPPORT OF FIELD MOUNTED INSTRUMENTS

A. Locate field-mounted instruments as shown on drawings or as designated by the Owner's representative.

B. Secure support pipes, stands or brackets of material with sufficient strength to prevent excess vibration or movement.

C. Locate all transmitters, unless otherwise specified on instrument piping drawings, 40 inches above floor, platform, or as sensing line slope requires per manufacturer's guidance, in a location to allow convenient access for readability, calibration and maintenance.

END OF SECTION

SECTION 15139

WASTEWATER VALVES

PART 1 - G E N E R A L

1.1 WORK INCLUDED

This section covers all miscellaneous valves and appurtenances not covered in other sections.

1.2 SUBMITTALS

A. Complete specifications, data and detailed drawings covering the items furnished under this specification shall be submitted for approval. Catalog cuts, showing sufficient detail as determined by the Engineer, will be acceptable in lieu of detailed drawings for valves smaller than 16 inches in size and for other miscellaneous small items for which detailed drawings are not readily available.

B. Operation and Maintenance Instructions. Submit operating and maintenance manuals applicable to each item of equipment furnished.

PART 2 - P R O D U C T S

2.1 BASIC REQUIREMENTS

All valves and accessories shall conform to the requirements shown and scheduled on the plans and as hereinafter specified. Pipe and valve purchase orders shall be coordinated to ensure proper installation of the valves and piping in conformance with the specified requirements.

A. Valve Design.

1. Provide valves designed for repacking or reseating under pressure when fully opened. Perform shell and seat tests and stamp valve to show that tests have been successfully completed.
2. Packing. Use packing suitable for intended service, equipped with gland followers and having pressure and temperature ratings not less than design criteria applicable to components of the system as noted on the Valve Schedule.
3. Seals. For trunion mounted valves use resilient seals suitable for the intended service.
4. Provide valves conforming to the following material specifications:

Material	Specifications
Bronze - 150 psi maximum	ASTM B 62
Bronze - 300 psi maximum	ASTM B 61
Cast Iron	ASTM A 126, Class B
Nodular Cast Iron	ASTM A 339, Grade 60-45-10
Carbon Steel, Cast	ASTM A 216, Grade WCB
Carbon Steel, Forged	ASTM A 105, Grade II
Fabricated Steel	ASTM A 7 or better

B. Valve Operators.

1. Unless otherwise shown or specified, each valve must be equipped with a manual operator and shall be provided with a suitable operating wheel.
2. Worm gear operators shall be designed such that a torque in excess of 160 foot-pounds will not have to be applied to operate the valve at the most adverse condition for which valve is designed. Traveling nut operators shall be designed such that a torque in excess of 100 foot-pounds will not have to be applied to operate the valve at the most adverse condition for which the valve is designed. Limit stops shall be installed on the input shaft of all manual operators in the OPEN and CLOSED positions. The vertical axis of the operating nut shall not move as the valve is opened or closed.
3. Wrench nuts shall be provided on all buried valves, on all valves which are to be operated through floor boxes, where shown on the plans. All wrench nuts shall comply with Section 20 of AWWA C500. Not less than two operating keys shall be furnished for operation of the wrench nut operated valves, one 6-foot length and one 10-foot length.
4. Unless otherwise shown or specified, plug, ball and butterfly valves 6 inches and less in size shall be lever operated.
5. Rotation. The direction of rotation of the wheel, wrench nut and lever to open each valve shall be to the left (counterclockwise). Each valve body or operator shall have cast thereon the word OPEN and an arrow indicating the direction to open.
6. Ends. Unless otherwise specified or shown on the plans, all 3-inch or larger buried valves shall have mechanical joint ends or push-on type joint ends. All other 3-inch or larger valves shall have ends conforming to plan drawing and schedule requirements either flanged or grooved-end coupled. Unless otherwise required by the plans, flanges shall conform to ANSI B16.1, Class 125, flat-faced serrated finish to match flanges on piping.

2.2 GATE VALVES (2-1/2-INCHES AND SMALLER)

A. Gate valves, 2-1/2-inch diameter and smaller, shall have screwed ends and shall be brass, or bronze, or Type 304 stainless steel solid wedge, union bonnet, rising-stem gate valves such as Figures 47 and 48 as manufactured by Jenkins Brothers, or approved equal, products as manufactured by Crane, Fairbank, Kennedy Valve Manufacturing Co., Lukenhiemer, or approved equal.

B. All gate valves, 2-1/2-inch diameter and smaller used in water service, shall be brass body and shall be Jenkins No. 1240, or Hammond 1B-647.

2.3 GATE VALVES (3-INCHES AND LARGER)

A. General Requirements.

1. Gate valves, 3-inch diameter and larger, shall be cast or ductile iron body, resilient seated/wedged or double disc type as specified herein.
2. Unless otherwise specified or show on the Drawings, gate valves shall conform to the requirements of AWWA C500, C509, or C515, as applicable.
3. Unless otherwise specified or shown on the Drawings, gate valves shall be of the non-rising stem design.
4. Gate valves shall use O-ring-type stem seals, except that packing shall be used where geared operators are required.
5. Unless otherwise specified or shown on the Drawings, gate valves shall be rated for the following minimum working water pressures:

Valve Size	Pressure (psig)
3-inch to 12-inch	200
14-inch to 20-inch	150
24-inch and greater	150

6. All gate valve bodies shall be hydrostatically tested to at least twice the rated working water pressure. In addition, valves shall be bi-directionally seat-tested, at the rated working pressure, with seat leakage not to exceed one fluid ounce per inch of valve diameter per hour. There shall be no leakage past the seat for resilient seated gate valves. Provide certificates of testing.
7. Unless otherwise specified, or shown on the Drawings, gate valves shall be flanged with face-to-face dimensions in accordance with ANSI B 16.1 and flanges per ANSI B.16.10. Flange drilling shall be Class 125 or Class 250, as required.
8. All bonnet and packing gland bolts shall be zinc or cadmium electroplated steel; packing gland bolts shall have bronze nuts. All other hardware and fasteners shall be fabricated from Type 304 stainless steel.
9. Gate valves 16-inches and larger, indicated for horizontal stem installation, shall be furnished with rollers, tracks and scrapers.
10. Gate valves shall be marked per AWWA Standards, including name of manufacturer, valve size and working pressure, and year of manufacture.
11. Unless otherwise specified or shown on the Drawings, gate valves 12-inches and smaller shall be capable of being installed in the vertical or horizontal position, sealing in both directions at the rated pressure and shall include direct acting manual handwheel.
12. Unless otherwise specified or shown on the Drawings, gate valves 16-inch and larger shall include bevel gearbox type operator.
13. Gate valve operation shall be counterclockwise to open and clockwise to close. Provide permanent label with arrows showing opening and closing directions.
14. Gate valves shall be UL and FM approved and NSF Standard 61 Certified.
15. Metal and resilient seated gate valves shall be coated internally with a fusion bonded electrostatically applied epoxy per AWWA C550. Exterior surfaces shall be factory primed as specified herein.

B. Valve Applications.

1. Gate valves 3-inches through 12-inches in force main isolation applications shall be resilient seated gate valves as specified herein.

C. Resilient Seated Wedge-Type Gate Valves.

1. Resilient seated wedge-type gate valves shall be in complete compliance with the latest edition of AWWA C515, and the City of Austin Standards, except as specifically modified herein or noted on the Drawings.
2. Valves shall be as manufactured by American Flow Control, M & H, Mueller, U.S. Pipe, or approved equal.
3. The wedge shall be ductile iron, totally encapsulated with an approved synthetic rubber material, bonded and vulcanized in accordance with ASTM B429 Method B.
4. The wedge shall be symmetrical and shall seal equally well with flow in either direction.
5. Bolt materials shall develop the strength requirements of ASTM A307, with square or hexagonal head dimensions conforming to ANSI B.18.2.1.
6. Valve stems shall be manganese bronze and shall be sealed by three O-rings. The top two O-rings shall be replaceable with valve fully open and while subject to full rated working pressure. O-rings set in a cartridge will not be acceptable.
7. Thrust washers shall be located both above and below the thrust collar.

2.4 SWING CHECK VALVES

A. The check valves used shall be swing check valves unless otherwise specified and shall be constructed with a heavy cast iron body and bronze seat ring, non-corrosive shaft for attachment of weight and lever, and complete bronze air cushion chamber. Shaft, counterweight, and cushion assembly shall be field reversible.

B. The valve disc shall absolutely prevent the return of water or gas back through the valve when the inlet pressure decreases below the delivery pressure. The valve shall be tightseating. The seat ring shall be renewable and shall be securely held in place by a threaded joint. The valve disc shall be of cast iron and shall be suspended from a non-corrosive shaft which passes through a stuffing box or O-rings and shall be connected to the weight and lever on the outside of the valve. The shaft shall be keyed into the disc and lever arm. Set screws shall not be acceptable.

C. Swing check valves shall be furnished with ANSI 125 pound flanges. Swing check valves shall be Golden-Anderson 250-D Cushioned.

2.5 INSERT VALVE

A. Ductile Iron Insert Valve shall be a Resilient Wedge Gate Valve designed for use in sewage systems. The design shall allow the valve to be installed into an existing pressurized force main while maintaining constant pressure and service as usual. After flossing the wedge and adequately restraining the valve body the downstream pipe can be completely removed and replaced.

B. The Insert Valve must be installed by companies trained and authorized by the Insert Valve manufacturer. Installer shall provide written documentation validating their certification.

C. Ductile Iron Construction:

1. The ductile iron body, bonnet and wedge provide strength and a pressure rating that meets or exceeds the requirements of AWWA C515. Insert Valve shall be ductile iron construction meeting ASTM A536 Grade 65-45-12.
2. Chemical and modularity tests shall be performed as recommended by the Ductile iron Society, on a per ladle basis. Testing for tensile, yield and elongation shall be done in accordance with ASTM E8.
3. Sizes 12" and smaller must be capable of working on Cast/Grey Iron or Ductile Iron Class A, B, C and D, IPS PVC, C900 and C909 PVC, Steel, AC pipe diameters without changing either top or bottom portion of split valve body.
4. 250 psig maximum working pressure. The pressure rating markings must be cast into the body of the Insert Valve.
5. After the installation of the Insert Valve body on to the existing pipe a pressure test of 1.1 times that of the contents shall sustained for 15 minutes. Once the pressure test is affectively achieved the Insert Valve body must not be moved in accordance with AWWA Standards. If the Insert Valve is moved the pressure test must be completed again. The Insert Valve must not be moved or repositioned once the pressure test is achieved.

D. Resilient Wedge Gate Assembly:

1. The construction of the Resilient Wedge shall comply with AWWA C509 requirements.
2. The ductile iron wedge shall be fully encapsulated with EPDM rubber by a high pressure and high temperature compression or injection mold process. This will assure the ductile gate is fully coated with molded rubber – no exposed iron.
3. The resilient wedge shall seat on the valve body and not the pipe to obtain the optimum seating and flow control results. The resilient wedge shall be totally independent of the carrier pipe.
4. The resilient wedge shall not come into contact with the carrier pipe or depend on the carrier pipe to create a seal. Abrasion results thus shorting the life and quality of the shut down if the wedge contacts the pipe.
5. Pressure equalization on the down or upstream side of the closed wedge shall not be necessary to open the valve.
6. The wedge shall be symmetrical and seal equally well with flow in either direction.
7. The Resilient wedge must ride inside the body channels to maintain wedge alignment throughout its travel to achieve maximum fluid control regardless of high or low flow pressure or velocity.

E. Fusion Bonded Epoxy:

1. The Insert Valve shall be fully epoxy coated on the interior and the exterior. The fusion-bonded coating is applied prior to assembly so that even the bolt holes and body-to-bonnet flange surfaces are fully epoxy coated.
2. Valve shall be coated with a minimum of 10 mils epoxy in compliance with AWWA C550 and certified to ANSI/NSF-61.

F. Gaskets and Triple-O-Ring Stem Seals: Insert Valve shall have triple O-Ring stem seals. Two O-Rings are located above, and one O-Ring located below the thrust collar.

G. Valve Stem and Thrust Washers:

1. The gate valve stem and wedge nut shall be copper alloy in accordance with Section 4.4.5.1 of the AWWA C515 Standard.
2. The NRS stem must have an integral thrust collar in accordance with Section 4.4.5.3 of AWWA C515 Standard. Two-piece stem collars are not acceptable. The wedge nut shall be independent of the wedge and held in place on three sides by the wedge to prevent possible misalignment.
3. Two thrust washers are used. One is located above, and one is located below the stem thrust collar. Two thrust washers ensure easy operation at all times.
4. NRS with AWWA standard turns.
5. Operated by 2" square wrench nut according to ASTM A126 CL.B – open left or open right.

H. Hardware: Bolting materials shall develop the physical strength requirements of ASTM A307 with dimensions conforming to ANSI B18.2.1.

I. Split Restraint Devices:

1. Shall consist of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA C110/A21.10.
2. The devices shall have a working pressure rating of 350 psi for 4-12 inch. Ratings are for water pressure and must include a minimum safety factor of 2 to 1 in all sizes.
3. Chemical and modularity tests shall be performed as recommended by the Ductile iron Society, on a per ladle basis. Three test bars shall be incrementally poured per production shift as per U.L. specifications and ASTM A536. Testing for tensile, yield and elongation shall be done in accordance with ASTM E8.
4. Gland body wedges and wedge actuating components shall be cast from grade 65-45- 12 ductile iron material in accordance with ASTM A536.
5. Mechanical joint restraint shall require conventional tools and installation procedures per AWWA C600, while retaining full mechanical joint deflection during assembly as well as allowing joint deflection after assembly.
6. Proper actuation of the gripping wedges shall be ensured with torque limiting twist off nuts. Set screw pressure point type hardware shall not be used.

J. Valve must be NSF-61 certified.

K. Valve product shall be TEAM InsertValve, or Hydra-Stop Insta-Valve.

2.6 SURFACE PREPARATION AND SHOP COATINGS

A. All exterior surfaces of valves and appurtenances herein specified shall be field painted upon installation in accordance with Section 9928. Accordingly, all valve and appurtenance factory applied coatings and finishes shall be certified to be compatible with the field painting systems specified in Section 9928.

B. All interior surfaces of valves and appurtenances herein specified shall be factory finish coated incompliance with Section 9928 of these Specifications to protect such surfaces from corrosion. If such surfaces are, by design, corrosive resistant (i.e. stainless steel or elastomeric) or the application of coatings will impede the proper performance of the valve and appurtenance, the manufacturer of the valve and appurtenance in question shall submit a statement of exception to this requirement as part of the shop drawing review process. The statement of exception shall provide appropriate rationale as to the reason such coatings are not required and/or desired.

C. The exterior surface of various parts of valves, operators, floor-stands and miscellaneous piping shall be thoroughly cleaned of all scale, dirt, grease or other foreign matter prior to the application of all factory applied coatings.

D. Ferrous surfaces, obviously not to be painted, shall be given a shop coat of grease or other suitable rust-resistant coating. Mounting surfaces shall be especially coated with a rust preventative.

2.7 FACTORY INSPECTION, TESTING AND DEFICIENCY CORRECTION

A. Factory inspection, testing and deficiency correction shall be performed in accordance with the referenced applicable Standards and as herein specified.

PART 3 - E X E C U T I O N

3.1 INSTALLATION

Installation of miscellaneous valves shall be as recommended by manufacturer. Valves shall be positioned as shown on drawings.

3.2 SETTING VALVES AND VALVE BOXES

A. Prior to installing valves, remove foreign matter from within the valves. Inspect the valves in open and closed position to verify that all parts are in satisfactory working condition.

B. Install valves and valve boxes where shown or as located by the Owner. Set valves plumb and as detailed on drawings. Center valve boxes on valves. Locate valves away from roads or streets. Carefully tamp earth around each valve box for a minimum radius of 4 feet, or to undisturbed trench face if less than 4 feet.

3.3 UNDERGROUND VALVE INSTALLATION

A. Each valve which is installed in direct contact with earth backfill shall be provided with a valve box of such type and design that surface loads, impact and shock will not be transmitted through the box to the valve.

B. Valves and valve boxes shall be set plumb. Each valve box shall be placed directly over the valve it serves, with the top of the box brought flush with the finished grade. After being placed in proper position, earth shall be filled in around each valve box and thoroughly tamped for a distance on each side of the box of 4 feet at the top of the pipe and 2 feet measured at the top of the trench.

C. Each valve shall be inspected before installation to ensure that all foreign substances have been removed from within the valve body, and shall be opened and closed to see that all parts are in first-class working condition. Geared valves shall be inspected to see that the gears are properly lubricated.

D. Extension stems for buried valves shall extend to within 6 inches of the surface of the ground. Each extension stem shall be connected to the valve operator with a suitable universal joint type coupling. All connections shall be pinned. Each extension stem shall be provided with spacers which will center the stem in a valve box having an inside diameter of 5-1/2 inches, and shall be equipped with a standard AWWA wrench nut as described in Section 20 of AWWA C500.

3.4 SHOP PAINTING

A. Unfinished interior surfaces of all valves shall be painted or coated for wastewater service in conformity with the standard practice of the manufacturer. All unfinished exterior surfaces of the valves, operators and accessories which are not exposed in manholes, buried or submerged shall be thoroughly cleaned and prime coated with primer compatible with the proposed coating system. Finish coats of paint will be applied after installation of the valves.

B. All exterior surfaces of valves which are exposed in manholes, buried or submerged, and their extension stems and accessories shall be thoroughly cleaned and coated.

C. All polished or machined surfaces of each valve shall be coated with rust-preventative compound, Dearborn Chemical “No-Ox-Id 2W,” Houghton “Rust Veto 344,” or Rust-Oleum “R-9.”

3.5 MEASUREMENT AND PAYMENT

A. Valves: Valves will be paid for at the unit bid price for the size and type valve installed, including valve stem casing and cover, excavation and backfill, setting, adjusting to grade, anchoring in place, and other appurtenances necessary for proper operation.

END OF SECTION

SECTION 16050

ELECTRICAL GENERAL PROVISIONS

PART 1 - G E N E R A L

1.1 SUMMARY

Provide labor, materials, equipment and accessories required for complete and functioning electrical systems as required by the contract documents.

A. Definitions. Where the word "provide" appears in these specifications, it shall be construed to mean "furnish and install complete and ready for safe and regular use."

B. New Work. The work includes, but is not limited to, the following principal systems and equipment:

1. 480/277 volt distribution.
2. 208/120 volt distribution.
3. Transformers.
4. Automatic transfer switches.
5. Motor controls.
6. Electric motors.
7. Lighting fixtures, poles, and lamps.
8. Packaged electric generating system.
9. Uninterruptible power supply.
10. Grounding system.
11. Lightning protection system.
12. Supervisory control and data acquisition (SCADA) system.

C. Demolition.

1. Unless otherwise noted, remove all electrical materials and equipment from areas indicated for demolition.
2. Remove unused conduit to the extent necessary to accommodate new work and where conduit is visible above the floor line. Unused conduit which is concealed, or which does not interfere with the work, may remain in place. Seal abandoned conduit that remain in place behind walls or in floor slabs. Remove wiring from abandoned conduit.
3. Materials and equipment to be removed, except items specifically listed to be relocated or delivered to the Owner, become the property of the Contractor and must be immediately removed from the project site.
4. Electrical services and controls to items being removed must be disconnected and removed as a requirement of this section.
5. Removal of any equipment must not interfere with existing operations.

1.2 QUALITY ASSURANCE

An acceptable Contractor for the work under this Division must have personnel with experience, training and skill to provide a practical working system. The Contractor may be required to furnish acceptable evidence of having installed not less than three systems of size and type comparable to this project. The systems must have served satisfactorily for not less than 3 years. The superintendent must have had experience in installing not less than three such systems.

1.3 REGULATIONS AND PERMITS

A. Regulations. Work, materials and equipment must comply with the latest rules and regulations of the following:

1. National Electrical Code (NEC).
2. National Electrical Safety Code (NESC).
3. Occupational Safety and Health Act (OSHA).
4. Texas Accessibility Standards (TAS).
5. City of Round Rock, Texas.

B. Discrepancies. The drawings and specifications are intended to comply with listed codes, ordinances, regulations and standards. Where discrepancies occur, immediately notify the Architect/Engineer in writing and ask for an interpretation. Should installed materials or workmanship fail to comply, the Contractor is responsible for correcting the improper installation. Additionally, where sizes, capacities, or other such features are required in excess of minimum code or standards requirements, provide those specified or shown.

C. Permits. Obtain certificates of inspection and other permits required as a part of the work.

1.4 CONTRACT DRAWINGS AND SPECIFICATIONS

A. Intent. The intent of the drawings and specifications is to establish the types of systems and functions, but not to set forth each item essential to the functioning of the system. The drawings and specifications are complementary, and work or materials called for in one and not mentioned in the other shall be provided. Electrical drawings are generally diagrammatic and show approximate location and extent of work. Install the work complete, including minor details necessary to perform the function indicated. In case of doubt as to work intended, or if amplification or clarification is needed, request instructions from the Engineer.

B. Discrepancies. Review pertinent drawings and adjust the work to conditions shown. Where discrepancies occur between drawings, specifications, and actual field conditions, immediately notify the Architect/Engineer for his interpretation.

C. Outlet and Equipment Locations. Coordinate the actual locations of electrical outlets and equipment with site features and equipment as indicated on civil and structural drawings. Review with the Engineer any proposed changes in outlet or equipment location. Relocation of outlets before installation, of up to 5 feet from the position indicated, may be directed without additional cost. Remove and relocate outlets placed in an unsuitable location, when so requested by the Engineer.

PART 2 - P R O D U C T S

2.1 PRODUCT REQUIREMENTS

A. Condition. Provide new products of manufacturers regularly engaged in production of such equipment. Provide the manufacturer's latest standard design for the type of product specified. The manufacturer of the equipment/product shall have minimum 5 years experience in producing similar product. When requested by the Architect/Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

B. NEC and UL. Products shall conform to requirements of the National Electrical Code. Where Underwriters' Laboratories have set standards, listed products and issued labels, products used must be listed and labeled by UL.

C. Space Limitations. Equipment selected shall conform to the building features and be coordinated with them. Do not provide equipment which will not suit arrangement and space limitations.

D. Enclosure. Provide NEMA 1 enclosure for indoor installation and NEMA 4X for outdoor enclosure, unless noted otherwise. The enclosure shall be suitable for the environment per NEC, NEMA and ANSI standards.

E. Factory Finish. Equipment must be delivered with a hard surface, factory-applied finish so that no additional field painting is required except for touch-up as required.

F. Interrupting Ratings. The electrical system shall be a fully rated system. Series ratings of overcurrent devices is unacceptable.

G. Furnish documentation from equipment manufacturer for the startup and test procedures for all the equipment installed.

PART 3 - E X E C U T I O N

3.1 PROTECTION OF EQUIPMENT

A. Moisture. During construction, protect switchgear, transformers, motors, control equipment, and other items from insulation moisture absorption and metallic component corrosion by appropriate use of strip heaters, lamps or other suitable means. Apply protection immediately upon receiving the products and maintain continually.

B. Cleanliness. Keep products clean by elevating above ground or floor and by using suitable coverings.

C. Damage. Take such precautions as are necessary to protect apparatus and materials from damage. Failure to protect materials is sufficient cause for rejection of the apparatus or material in question.

D. Finish. Protect factory finish from damage during construction operations and until acceptance of the project. Satisfactorily restore any finishes that become stained or damaged.

3.2 INSTALLATION

A. Cooperation with Other Trades. Cooperation with trades of adjacent, related or affected materials or operations, and with trades performing continuations of this work under subsequent contracts, is considered a part of this work in order to effect timely and accurate placing of work and to bring together, in proper and correct sequence, the work of such trades. Provide other trades, as required, all necessary templates, patterns, setting plans and shop details for the proper installation of the work and for the purpose of coordinating adjacent work. Electrical power connections for mechanical and plumbing equipment are in this Division unless noted otherwise. Verify electrical characteristics of all equipment with wet well contractor before roughing in the electrical connections.

B. Workmanship. Work must be performed by workmen skilled in their trade. The installation must be complete.

C. Sealing of Equipment.

1. Voids between sleeves or core-drilled holes and pipe passing through fire-rated assemblies shall be firestopped to meet the requirements of ASTM E 814. Contractors shall provide proper sizing when providing sleeves or core-drilled holes to accommodate their through-penetrating items.
2. Seal openings into equipment to prevent entrance of animals, birds and insects.

D. Motors.

1. Electrical work includes the electrical connection of all motors, except those which are wired as a part of equipment.

E. Application. Unless otherwise indicated, power will be utilized as follows:

1. 480 volts, three phase: motors 3/4 horsepower and larger.
2. 120 volts, single phase: motors 1/2 horsepower and smaller.
3. 120 volts, single phase: LED lighting.
4. 120 volts, single phase: convenience outlets.
5. 120 volts, single phase: SCADA power supply equipment.
6. 24 volts, single phase: SCADA equipment.

F. Transformers. Use transformers to change the service to the required utilization voltages.

G. Accessories. All offsets, fittings, expansion joints, anchors and accessories that are required for a complete system shall be provided even if not specifically indicated on the drawings or mentioned in the specifications. Offsets, transitions and changes in direction of conduit, cable trays, raceways and busways shall be made to maintain proper headroom. Provide all necessary pullboxes, fittings, etc., required as a result of these transitions and changes in direction.

H. Sleeves, Cutting and Patching. Provide for the timely placing of sleeves for all raceway, exposed cabling and busway passing through walls, partitions, beams, floors and roof while same are under construction. If holes and sleeves are not properly installed and cutting and patching becomes necessary, it shall be done at no expense to the Owner. Secure permission from the Architect/Engineer before cutting or patching a constructed or existing wall. Where floors or walls are fire rated, penetrations shall be completely sealed using UL-listed materials and procedures sufficient to preserve the fire rating as specified in Section 07840. Comply with any special requirements of local authorities.

3.3 EQUIPMENT AND DEVICE MARKING

A. Designations. Identify all equipment, devices, feeders, branch circuits and similar items with the same designations as indicated on the contract documents.

B. Nameplates. Externally mark all electrical equipment with nameplates identifying each and the equipment served. Nameplates shall be black laminated rigid phenolic with white core. Nameplate minimum size shall be 1 inch high by 3 inches long with 3/16-inch-high engraved white letters. Supply blank nameplates for spare units and spaces.

C. Nameplate Fasteners. Fasten nameplates to the front of equipment only by means of stainless steel self-taping screws. Stick-ons or adhesives will not be allowed unless the NEMA enclosure rating is compromised, then only epoxy adhesive shall be used to attach nameplates.

D. Nameplate Information. In general, the following information is to be provided for the types of electrical equipment as listed.

1. Switchboards and Motor Control Centers. On the mains identify the piece of equipment, the source and voltage characteristics (i.e., 480/277V 3PH 4W). For each branch circuit protective device, identify the load served.
2. Transformers, Individual Starters, Contactors, Disconnect Switches, Transfer Switches and similar equipment. Identify the device designation, source and load served.
3. Panelboards. Identify the source, panelboard designation and voltage characteristics.

E. Panelboards. Prepare a neatly typed circuit directory behind clear heat-resistant plastic in a metal frame attached to the inside of the door for each panelboard. Identify circuits by equipment served and by room numbers where room numbers exist. Indicate spares and spaces with light, erasable pencil marking. Adhesive mounted directory pocket is not acceptable.

F. Pull, Junction and Outlet Boxes. With 1/2-inch-high lettering, identify conduits connected to pull, junction and outlet boxes with the complete circuit number of the conductors contained therein. Where multiple circuits are contained in a box, identify the circuit conductors with permanent tags which indicate circuit designation.

G. Power Receptacles.

1. Use nameplate or engrave device plate to identify power receptacles with circuit number, voltage and phases, where:
    a. The nominal voltage between any pair of contacts is greater than 150 volts.
    b. Dedicated receptacles are provided.

3.4 TESTING

A. Test Conditions. Place circuits and equipment into service under normal conditions, collectively and separately, as may be necessary to determine satisfactory operation. Perform specified tests in the presence of the Architect/Engineer. Furnish all instruments, wiring, equipment and personnel required for conducting tests. Demonstrate that the equipment operates in accordance with requirements of the drawings and specifications. Special tests on certain items are specified hereinafter. Where specified that the testing be performed by an independent testing company, an Owner approved NETA certified testing company shall be used.

B. Test Dates. Schedule final acceptance tests sufficiently in advance of the contract date to permit completion of any necessary adjustment or alterations within the number of days allotted for completion of the contract.

C. Retests. Conduct retests as directed by the Architect/Engineer of such time duration as may be necessary to assure proper functioning of adjusted or altered parts or items of equipment. Any resultant delay as a result of such necessary retests does not relieve the Contractor of his responsibility under this contract.

END OF SECTION

SECTION 16060

GROUNDING

PART 1 - G E N E R A L

1.1 SUMMARY

Provide grounding and bonding equipment for electrical systems.

1.2 REFERENCE STANDARDS

Design, test, assemble and install grounding and bonding system in conformance to the latest edition of the following applicable industry standards.

A. ANSI/IEEE Std 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.

B. ANSI/UL 467 - Grounding and Bonding Equipment.

C. IEEE 81 - Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Ground System.

D. IEEE 1100 - Recommended Practice for Powering and Grounding Sensitive Electronic Equipment (IEEE Emerald Book).

E. NFPA 70 - National Electrical Code (NEC).

PART 2 - P R O D U C T S

2.1 GROUND RODS

A. Materials. Provide 3/4-inch by 10-foot long, copper-clad, steel grounding electrodes. Supply a rod to which the copper cladding is permanently and inseparably bonded to a high-strength steel core.

B. Listing. UL 467.

2.2 CONNECTIONS

A. Materials. Unless otherwise noted, for below-grade connections provide exothermic welded type. For above-grade connections provide mechanical bolted-type connections utilizing high conductive copper alloy or bronze lugs or clamps. Where required, provide plated connectors which will not cause electrolytic action between the conductor and the connector.

B. Listing. UL 467.

2.3 WIRING

A. Materials. Provide bare conductors for bonding jumpers. Provide 600-volt insulated conductors having a green-colored insulation for grounding electrode and equipment grounding conductors. Use solid conductors for No. 12 and No. 10 AWG wire; stranded for No. 8 AWG and larger.

B. Listing. UL 83.

2.4 GROUND BUS

Where a field-provided ground bus is required, use round-edge copper bar with 98 percent International Annealed Copper Standard (IACS) conductivity. Size the bus for not less than 25 percent of the cross-sectional area of the related feeder. A minimum size of 1/4 inch {6 mm} by 2 inches {51 mm} is required.

PART 3 - E X E C U T I O N

3.1 SYSTEM GROUND

A. System Neutral. Where a system neutral is used, bond the system neutral to the grounding electrode system in accordance with NEC Article 250. Ground the system neutral only at the point of service and isolate it from ground at all other points in the system.

B. Separately Derived Systems. Ground neutrals of separately derived systems such as generators, transformers, etc., in accordance with NEC 250-30.

C. Size. Size the system grounding electrode conductors to comply with NEC Table 250-66, unless shown larger on the drawings.

D. Depth. Bury grounding electrode conductors below grade to comply with NEC 250-50 and 250-52. Minimum depth 30 inches unless noted otherwise.

E. Testing. Test the completed grounding system. If the resistance of the grounding system is greater than 5 ohms, add ground rods to attain 5 ohms.

3.2 EQUIPMENT GROUND

A. Manholes. Provide a No. 1/0 AWG bare stranded copper ground bus in all manholes. Mount bus 12 inches above floor using one-hole pipe straps 3′-0″ {914 mm} on center. Connect bus to ground rod with a No. 1/0 AWG conductor. Bond all metallic components and electrical grounding conductors to the bus using lugs or clamps.

B. Raceway Systems and Equipment Enclosures.

1. Ground cabinets, junction boxes, outlet boxes, motors, controllers, raceways, fittings, switchgear, transformer enclosures, other electrical equipment and metallic enclosures. Ground equipment and enclosures to the continuous-grounded metallic raceway system in addition to any other specific grounding shown.
2. Provide bonding jumpers and ground wire throughout to ensure electrical continuity of the grounding system.
3. Provide grounding-type insulated bushings for metal conduits 1-1/2 inches and larger terminating in equipment enclosures containing a ground bus and connect the bushing to the ground bus.
4. Provide a green insulated equipment grounding conductor for each feeder and branch circuit.

C. Taps, Splices and Connections. Make grounding (earth) conductor approximately 2 inches longer than the ungrounded (phase) conductors at both ends.

D. Size. When grounding and bonding conductors are not sized on drawings, size the grounding conductors in accordance with NEC Table 250-122. Size bonding jumper so that minimum cross-sectional area is greater than or equal to that of the equivalent grounding conductor as determined from NEC Table 250-122.

3.3 ISOLATED (SINGLE POINT) GROUND

A. Purpose. An isolated single point grounding system is employed for installations utilizing sensitive electronic, data processing or communications equipment. This signal ground bus is not connected in electrical loops, but in a radial configuration between the various electronic equipment locations. The signal ground bus is then connected to the building ground rod array at only one location. This grounding arrangement thus provides only a single path to ground for any circulating ground currents, which will minimize electromagnetic interference with sensitive electronic equipment.

B. Equipment Requiring Isolated Grounding. Equipment typically grounded to the isolated single point grounding system includes communications and coaxial cable shields, telephone termination block earth grounds, radio transmitter chassis grounds, and electronic equipment signal grounds which are isolated from the equipment chassis.

C. Grounding Busbars. Utilize round-edge copper bar with 98 percent IACS conductivity for room isolated ground bus. Grounding busbars should be minimum 0.25 inches thick and 2 inches wide, and should be drilled and tapped as appropriate for the individual equipment ground conductors. The grounding busbars should be mounted on insulated standoffs to ensure isolation from ground potential.

1. Install a local isolated ground bus in each room or area where indicated on the plans. Ground all sensitive electronic equipment in the room or area to the local isolated ground bus.
2. Install a master isolated ground bus for the entire building or plant structure. Connect radial isolated ground leads from each local isolated ground bus to the master isolated ground bus.

D. Grounding Conductors.

1. Conductors from individual equipment and cable shields shall be a minimum No. 6 AWG, type THW stranded copper with green insulation. The conductor from each local isolated ground bus to the master isolated ground bus shall be a minimum of No. 2/0 AWG, type THW stranded copper with green insulation. The conductor from the master isolated ground bus to the facility ground rod array shall be a minimum of No. 2/0 AWG, type THW stranded copper with green insulation. Grounding cable with aluminum conductors is not acceptable.
2. Conductors shall be routed to provide the minimum possible number of cable bends. The radius of any cable bend shall be not less than 8 inches, and the included angle of any bend shall be a minimum of 90 degrees.

E. Grounding Connectors.

1. Connections from individual equipment and cable shields shall use crimp-type connectors of copper or tinned copper construction. Individual equipment connections to local isolated ground buses shall use copper alloy or bronze machine bolts and lock washers.
2. No. 2/0 cable connections from local isolated ground buses to the master ground bus shall utilize an exothermic weld or brazing process. No. 2/0 cable connections from the master ground bus to the facility ground rod array shall utilize an exothermic weld or brazing process.
3. Connectors utilizing aluminum or steel alloys are not acceptable.

END OF SECTION

SECTION 16120

INSULATED CONDUCTORS

PART 1 - G E N E R A L

1.1 SUMMARY

Provide insulated conductors.

1.2 REFERENCE STANDARDS

A. AEIC No. 6 - Specifications for Ethylene-Propylene-Rubber-Insulated Power Cables 5,000 to 35,000 Volts.

B. ANSI/IEEE 386 - Separable Insulated Connectors for Power Distribution Systems Above 600 Volts.

C. ANSI/UL 4 - Armored Cable.

D. ANSI/UL 83 - Thermoplastic-Insulated Wires and Cables.

E. ANSI/UL 1072 - Medium-Voltage Power Cables.

F. ANSI/UL 1277 - Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.

G. IEEE No. 48 - Standard Test Procedures and Requirements for High-Voltage Alternating-Current Cable Terminations.

H. ICEA S-61-402 (NEMA WC 5) - Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

I. ICEA S-68-516 (NEMA WC 8) - Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

1.3 SUBMITTALS

A. Provide product data on the following:

1. 600-volt conductor, splicing and terminating materials.
2. 5 kV insulated conductor, splicing and terminating materials.
3. 15 kV insulated conductor, splicing and terminating materials.

B. Provide cable high voltage factory test reports.

PART 2 - P R O D U C T S

2.1 IDENTIFICATION

Provide new insulated conductors marked according to NEC Article 310.

2.2 600-VOLT INSULATED CONDUCTORS

A. Size. As shown.

B. Construction.

1. Conductor. Soft-drawn, annealed copper. Solid for No. 12 and No. 10 AWG. Stranded for No. 8 AWG and larger.
2. Insulation. Unless otherwise noted on the drawings, use THWN for general wiring.

C. Use. For general wiring use No. 12 minimum. For field-installed control wiring use No. 14 or larger stranded conductors. For tray cable (Type TC) provide a multiconductor cable consisting of insulated conductors as described in the preceding paragraph with an overall outer sheath. Use a nonmetallic sheath that is moisture, sunlight and corrosion resistant and flame retardant, specifically approved for this purpose.

D. Listing.

1. Single Conductor. UL 83.
2. Tray Cable. UL 1277.

2.3 ARMORED CABLE

A. Size. No. 10 AWG minimum.

B. Construction.

1. Conductor. Soft-drawn, annealed copper. Solid for No. 12 and No. 10 AWG. Stranded for No. 8 AWG and larger.
2. Insulation. THHN.

C. Use. For branch circuits only where installed in existing walls.

D. Listing. UL 4, type ACT-HH.

2.4 5000-VOLT INSULATED CONDUCTORS

A. Size. As shown.

B. Single Conductor Construction.

1. Single uncoated annealed copper conductor with Class B stranding.
2. Extruded semi-conducting thermosetting conductor screen firmly bonded to the overlaying insulation.
3. Ethylene-propylene-rubber (EPR) insulation 90 mils thick.
3. Cross-linked-polyethylene (XLP) insulation 90 mils thick.
4. Extruded semi-conducting thermosetting insulation screen.
5. Copper shielding tape 5 mils thick, helically applied with a minimum 25 percent overlap.
6. Polyvinyl chloride jacket with thickness per ICEA.
7. The conductor screen, insulation and insulation screen shall be applied in triple tandem extrusion and simultaneously vulcanized.

C. Multiconductor Construction.

1. Three conductors, each conductor being as specified in the preceding paragraph “B”.
2. For each conductor, provide a phase-identifying means, such as a colored tape.

3. Suitably lay the three insulated conductors and cable together with a grounding conductor, fillers and overall binder tapes. Size grounding conductor area to correspond with NEC Table 250-94, "Grounding Electrode Conductor for AC Systems."
4. Enclose the entire 3-conductor cabled assembly in galvanized steel, interlocked armor.
5. Provide a PVC outer jacket with thickness per ICEA.

D. High Voltage Factory Test.

1. Corona level test with a maximum partial discharge of 5 picocoulombs.
2. AC test: 13 kV for 5 minutes.
3. DC test: 35 kV for 15 minutes.
4. Insulation resistance test: IR constant to be 50,000 megohms per 1000 feet minimum.
5. Use test procedures given in ICEA S-68-516 and AEIC No. 6.
6. Certified test reports with test data and corona level plots are to be submitted for review prior to shipment.

E. Type.

1. Single Conductor. MV-90.
2. Multiconductor. MC-CT.

F. Listing. UL 1072.

G. Manufacturers. Provide Cablec, Okonite or Rome.

2.5 15,000-VOLT INSULATED CONDUCTORS

A. Size. As shown.

B. Single Conductor Construction.

1. Single uncoated annealed copper conductor with Class B stranding.
2. Extruded semi-conducting thermosetting conductor screen firmly bonded to the overlaying insulation.
3. Ethylene-propylene-rubber (EPR) insulation 215 mils thick.
3. Cross-linked-polyethylene (XLP) insulation 215 mils thick.
4. Extruded semi-conducting thermosetting insulation screen.
5. Copper shielding tape 5 mils thick helically applied with a minimum 25 percent overlap.
6. Polyvinyl chloride jacket 80 mils thick.
7. The conductor screen, insulation and insulation screen shall be applied in triple tandem extrusion and simultaneously vulcanized.

C. Multiconductor Construction.

1. Three conductors, each conductor being as specified in the preceding paragraph "B".
2. For each conductor, provide a phase-identifying means, such as a colored tape.
3. Suitably lay the three insulated conductors and cable together with a grounding conductor, fillers and overall binder tapes. Size grounding conductor area to correspond with NEC Table 250-94, "Grounding Electrode Conductor for AC Systems."
4. Enclose the entire 3-conductor cabled assembly in galvanized steel, interlocked armor.
5. Provide a PVC outer jacket with thickness per ICEA.

D. High Voltage Factory Test.

1. Corona level test with a maximum partial discharge of 5 picocoulombs.

2. AC test: 33 kV for 5 minutes.
3. DC test: 80 kV for 15 minutes.
4. Insulation resistance test: IR constant to be 50,000 megohms per 1000 feet minimum.
5. Use test procedures given in ICEA S-68-516 and AEIC No. 6.
6. Certified test reports with test data and corona level plots are to be submitted for review prior to shipment.

E. Type.

1. Single Conductor. MV-90.
2. Multiconductor. MC-CT.

F. Listing. UL 1072.

G. Manufacturers. Provide Cablec, Okonite or Rome.

2.6 HIGH VOLTAGE SPLICES AND TERMINATIONS

A. Splices. Use Elastimold 650LR series, RTE or 3M 5815 series, 600 ampere, 15 kV, modular splicing system suitable for use on 15 kV cables with 133 percent insulation level.

B. Terminations.

1. In live front switchgear, use 3M 5630K series, Class 1, 25 kV, cold-shrink rubber termination kits.
2. In dead-front switchgear, manholes or pull boxes, use Elastimold or RTE 15 kV class, 200-ampere load-break or 600-ampere dead-break, submersible, fully shielded, premolded, elbow connector with tape shield adapter for use on 15 kV cables with 133 percent insulation level.

C. Compatibility. Splicing and terminating materials must be compatible with the cable supplied. Submit proof of the acceptability by the cable manufacturer of any splicing or terminating materials.

PART 3 - E X E C U T I O N

3.1 INSTALLATION

A. Protection. Unless otherwise indicated, mechanically protect conductors for systems by installing in raceways. Do not install the conductors until raceway system is complete and properly cleaned. Use Polywater J cable lubricant when pulling conductors. Do not bend any conductor either permanently or temporarily during installation to radii less than four times the outer diameter of 600-volt insulated conductors, nor less than twelve times the outer diameter of the completed 5 kV or 15 kV cable. Do not exceed manufacturer's recommended values for maximum pulling tension.

B. Splices and Terminations. Use pressure-type lugs or connectors for terminations or splices of all stranded conductors. Use ring-tongue type terminators on all control wiring. Make grounding (earth) conductor approximately 2 inches {50 mm} longer than the ungrounded (phase) conductors at both ends. Refer to Section 16060.

C. Appearance. Neatly and securely bundle or cable all conductors in an enclosure using nylon straps with a locking hub or head on one end and a taper on the other.

3.2 600-VOLT INSULATED CONDUCTORS

A. Size. Install conductor sizes as indicated. Provide No. 10 AWG conductor for the entire circuit length for single-phase, 20-ampere circuits for which the distance from panelboard to the last outlet is more than 100 feet for 120-volt circuits or 200 feet for 277-volt circuits.

B. Home Runs. Except where specifically indicated, provide branch circuit home runs with not more than two different line conductors and a common neutral in a single raceway for 3-wire, single-phase systems, nor more than three different line conductors and a common neutral in a single raceway for 4-wire, 3-phase systems. Use home run circuit numbers as indicated for panelboard connections.

C. Color Code. Use factory-colored insulated conductors for No. 10 and smaller conductors and color code larger insulated conductors with an approved field-applied tape. Use different colors for control wiring. Follow the color scheme below.

Line	240/120	208/120	480/277
A or L1	Black	Black	Brown
B or L2	Red	Red	Orange
C or L3		Blue	Yellow
Neutral	White	White	Gray
Ground	Green	Green	Green
Switch Leg	Pink	Pink	Pink

Where more than one conductor of the same phase or more than one neutral conductor occur at the same outlet or junction box, these conductors shall be identifiable from each other by use of stripes or distinguishing markings.

D. Field Testing. Insulation resistance of all conductors shall be tested. Each conductor shall have its insulation resistance tested after the installation is completed and all splices, taps and connections are made except connection to or into its source and point (or points) of termination. Insulation resistance of conductors which are to operate at 600 volts or less shall be tested by using a Biddle Megger of not less than 1000 volts d-c. Insulation resistance of conductors rated at 600 volts shall be free of shorts and grounds and have a minimum resistance phase-to-phase and phase-to-ground of at least 10 megohms. Conductors that do not exceed insulation resistance values listed above shall be removed at Contractor's expense and replaced and test repeated. The Contractor shall furnish all instruments and personnel required for tests, shall tabulate readings observed, and shall forward copies of the test readings to the Owner in accordance with Section 16050. These test reports shall identify each conductor tested, date and time of test and weather conditions. Each test shall be signed by the party making the test.

3.3 ARMORED CABLE

Install armored cable in accordance with NEC Article 333. Do not install armored cable in thermal insulation. Use fittings specifically designed for armored cable.

3.4 5 KV AND 15 KV INSULATED CONDUCTORS

A. Bonding. At each splice and termination, bond tape shield to grounding conductor.

B. Cable Splices. Provide cable splicing system as specifically indicated. Have splices installed by an experienced cable splicer in strict accordance with the splicing system manufacturer's instructions and cable manufacturer's recommendations. Submit cable splicer's qualifications for Owner's approval.

C. Terminations. Provide terminations as specifically indicated. Have terminations installed by an experienced cable terminator in strict accordance with the termination manufacturer's instructions and the cable manufacturer's recommendations. Submit cable terminator's qualifications for Owner's approval.

D. Fireproofing. Fireproof each individual high voltage insulated conductor for entire length exposed in each manhole or pull box. Use Scotch 77 tape with Scotch 69 glass cloth overlay wrapped in the opposite direction. Provide a minimum 25 percent overlap of each tape layer.

E. Installation. Wrap cables horizontally around manholes a minimum of one time before exiting. Provide galvanized steel cable racks with fiberglass saddles for cable support. Use plastic cable ties to secure cables and splices to racks.

F. Identification. Identify each circuit in manholes and pull boxes with a laminated plastic tag securely fastened to the conductors with stainless steel wire.

G. Tray Cables. Secure all cables installed in tray systems on not greater than 5-foot centers.

H. Field Testing. Field test 5 kV shielded cable at 25 kV d-c and 15 kV shielded cables at 65 kV d-c for 15 minutes in the presence of the Owner's representative. Conduct the test after conductors have been installed and all connections, splices, and terminations have been completed, except connections to transformers and other terminal equipment and before energizing with system voltage. Record dates and times of the tests, weather conditions, relative humidity, and identify each conductor tested. Conduct tests in accordance with ICEA standards. Remove and replace any conductor, splice or termination found to be defective and retest. Have each test signed by the party making the test and by the Owner's representative witnessing it and submit test reports to Owner's representative.

END OF SECTION

SECTION 16130

RACEWAYS

PART 1 - G E N E R A L

1.1 SUMMARY

Provide electrical raceway systems:

A. Conduit.

1. Rigid metal conduit.
2. PVC-coated rigid metal conduit.
3. Rigid nonmetallic conduit.
4. Liquid-tight flexible metal conduit.

B. Wireways.

C. Underground Duct Bank is specified in Section 02581.

1.2 REFERENCE STANDARDS

A. ANSI C80.5 - Rigid Aluminum Conduit.

B. ANSI/UL 360 - Liquid-tight Flexible Steel Conduit.

C. ANSI/UL 467 - Electrical Grounding and Bonding Equipment.

D. ANSI/UL 651 - Schedule 40 and 80 Rigid PVC Conduit.

E. ANSI/UL 870 - Wireways, Auxiliary Gutters and Associated Fittings.

F. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.

1.3 SUBMITTALS

Provide product data on:

A. PVC-coated rigid metal conduit.

PART 2 - P R O D U C T S

2.1 CONDUIT AND FITTINGS

A. Rigid Metal Conduit.

1. Conduit. Either rigid aluminum (alloy 6063-T1) conduit (RAC) or rigid hot-dipped galvanized steel (RGS) conduit with zinc-coated threads and an outer coating of zinc chromate.

2. Fittings. For RAC use threaded aluminum; for RGS use threaded steel or malleable iron either cadmium plated or hot-dipped galvanized.

B. PVC-Coated Rigid Metal Conduit.

1. Conduit. Same as rigid metal conduit plus a factory-applied, 40-mil-thick covering of polyvinyl chloride (PVC) bonded to the metal.
2. Fittings. Same as rigid metal conduit fittings plus a factory-applied, 40-mil-thick covering of PVC bonded to the metal.
3. Manufacturers. Rob-roy, OCAL, or approved substitution.
4. Training. Manufacturer shall provide "hands on" training for the Contractor on proper methods of preparation, installation and touch-up.

C. Rigid Nonmetallic Conduit.

1. Conduit. Schedule 40 polyvinyl chloride (PVC).
2. Fittings. Solvent weld socket type.

D. Liquid-tight Flexible Steel Conduit.

1. Conduit. Spiral-wound, square-locked, hot-dipped galvanized steel strip plus a bonded outer jacket of PVC.
2. Fittings. Compression type, malleable iron, with insulated throat, either cadmium plated or hot-dipped galvanized.

2.2 WIREWAYS

A. Material. Not less than 16-gauge sheet steel.

B. Dimensions. Cross section dimensions not less than 4 inches by 4 inches.

C. Finish. Not less than two coats of enamel over a rust-inhibiting prime coat.

D. Type.

1. Indoors. NEMA 1.
2. Outdoors. NEMA 4X.

PART 3 - E X E C U T I O N

3.1 CONDUIT AND FITTINGS

A. Minimum Trade Size.

1. 3/4 inch above grade.

2. 1 inch below grade.

B. Types According to Use. Use rigid aluminum conduit (RAC) throughout the project except as specified below.

1. PVC RAC where exposed to rain, condensation, moisture, constant high humidity or corrosive atmospheres:

2. PVC–coated RAC or rigid nonmetallic conduit 1 inch and smaller may be embedded in slabs if the slab thickness is a minimum of 5 inches thick. Conduit placement shall not impair the slab's structural integrity.

3. Use PVC–coated RAC or rigid nonmetallic conduit encased in concrete with minimum 3-inch-thick walls, for conductors installed below grade at a minimum depth of 24 inches to top of conduit. All horizontal to vertical transitions shall be made using PVC–coated RAC elbows and PVC–coated RAC conduit stub-ups.

4. Use direct-buried PVC conduit for conductors installed below foundations. All horizontal to vertical transitions shall be made using PVC–coated RAC elbows and PVC–coated RAC conduit stub-ups.

5. Do not allow RAC to make direct contact with concrete or earth. Aluminum conduit, straps, and struts shall not be in direct contact with concrete. Provide a neoprene washer between the two materials. Aluminum conduit which penetrates into concrete shall be factory-coated with 40mil of polyvinylchloride

6. Do not use EMT.

7. Connect all electrical equipment subject to vibration or movement with liquid-tight flexible metal conduit 24 inches minimum length. Provide liquid-tight conduit with proper liquid-tight fittings for exterior locations or in wet areas.

8. Transitions.

   a. Where rigid nonmetallic conduit is used in concrete encasement or under concrete slabs, a conversion to PVC–coated RAC shall be made at least 3 feet before the run exits the encasement or slab cover.

   b. For below-grade to above-grade locations, extend concrete encasement around conduit 3 inches above finished grade and slope top away from conduit with a 6-inch-per-foot slope. This provision does not apply for conduits extending into pad-mounted or floor-mounted equipment.

C. Preparation. Place sleeves in walls and slabs for the free passage of cables or conduits. Set sleeves in place a sufficient time ahead of concrete placement so as not to delay the work. Seal all openings and voids around sleeves through floors and walls. Be sure that plugs or caps are installed before concrete placement begins.

D. Installation Requirements.

1. Metallic conduits must be continuous between enclosures such as outlet, junction and pull boxes, panels, cabinets, motor control centers, etc. The conduit must enter and be secured to enclosures so that each system is electrically continuous throughout. Where knockouts are used, provide double locknuts, one on each side. For RAC, provide nonmetallic insulating bushings for conductor protection. Where conduits 1-1/2 inches and larger terminate in equipment having a ground bus, such as in switchgear, motor control centers and panelboards, provide conduit with an insulated grounding bushing and a suitable grounding conductor terminated at the ground bus.

2. Have rigid nonmetallic conduit adequately solvent welded at joints to form a tight, waterproof connection.

3. Run concealed conduit as directly and with the largest radius bends as possible. Run exposed conduit parallel or at right angles to building or other construction lines in a neat and orderly manner. Conceal conduit in finished areas. Unless otherwise noted, remaining conduit may be exposed.

Provide chrome-plated floor and ceiling plates around conduits exposed to view and passing through walls, floors, partitions, or ceilings in finished areas. Select properly sized plates to fit the conduit when securely locked in place.

E. Installation Methods.

1. Install each entire conduit system complete before pulling in any conductors. Clean the interior of every run of conduit before pulling in conductors to guard against obstructions and conduit omissions.

2. Cut all joints square, then thread and ream smooth.

3. Make bends with standard ells or conduit bent in accordance with the NEC. Make field bends using equipment designed for the particular conduit material and size involved. Bends must be free from dents or flattening. Use no more than the equivalent of four 90-degree bends in any run between terminals and cabinets, or between outlets and junction boxes or pull boxes.

4. Conduit bodies may be used in lieu of conduit ells where ease of installation and appearance warrants their use. Conduit bodies larger than 1 inch may be used only where approved.

5. Securely fasten and support conduit to structure or metal framing using hot-dipped galvanized, malleable iron pipe straps or other approved means. Wires of any type may not be used for securing conduits. Branch circuit raceways which are 1 inch or smaller may be attached to wall studs by use of manufactured clips.

6. Install a pulling string in empty (spare/future)) conduit, except sleeves and nipples. Provide a No. 30 nylon pulling line in conduits in which wiring is not installed under this work. Identify both ends of the line by means of labels or tags reading “Pulling Line - Telephone,” etc.

7. Suitably cap conduit during construction to avoid water, dirt and trash entrance.

8. Use expansion-deflection fittings on conduit crossing structural expansion joints and on exposed conduit runs where necessary. Provide bonding jumpers across fittings in metal raceway systems.

9. With a coupling, terminate concealed conduit for future use at structural surfaces. Install a pipe plug flush with the surface.

3.2 WIREWAYS

Install wireways, where shown, according to NEC Article 376. Field apply a 90 percent zinc paint coating over cuts or scratches before any other finish is applied.

END OF SECTION

SECTION 16135

BOXES

PART 1 - G E N E R A L

1.1 SUMMARY

Provide outlet boxes, floor boxes, junction boxes and pull boxes.

1.2 REFERENCE STANDARDS

A. ANSI/NEMA Publication No. OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers and Box Supports.

B. ANSI/UL 514A - Metallic Outlet Boxes.

C. ANSI/UL 514B - Fittings for Conduit and Outlet Boxes.

D. NFPA 70 - National Electrical Code (NEC).

1.3 SUBMITTALS

Provide product data on floor boxes and fire-rated poke-through units.

PART 2 - P R O D U C T S

2.1 OUTLET BOXES

A. Flush Device Boxes. Provide galvanized steel boxes of sufficient size to accommodate wiring devices to be installed at outlet. Provide an extension ring for the device(s) to be installed. Square or rectangular boxes may be used. Unless otherwise noted, provide minimum 1-1/2-inch deep by 4-inch square minimum size box.

B. Exposed Device Boxes. Provide cast aluminum boxes for surface mounting in areas having exposed rigid metal conduit systems.

C. Switch Boxes. Not permitted.

D. Listing. UL 514.

2.2 JUNCTION, PULL AND SPLICE BOXES

A. Construction. Provide 304 stainless steel boxes conforming to NEC Article 314.

B. Exterior Spaces. Provide NEMA 4X type boxes at least 4 inches deep.

C. Embedded. Provide NEMA 4 cast iron type with flush flanged cover when cast in concrete.

D. Listing. UL 514.

PART 3 - E X E C U T I O N

3.1 OUTLET BOXES

A. Flush Boxes. Unless otherwise indicated, mount all outlet boxes flush within 1/4 inch of the finished wall or ceiling line. Provide galvanized steel extension rings where required to extend the box forward in conformance to NEC requirements. Attach ring with at least two machine screws. Securely fasten outlet boxes. Provide plaster covers for all boxes in plastered walls and ceilings.

B. Mounting Height. Mounting height of a wall-mounted outlet box means the height from finished floor to horizontal center line of the cover plate. Where outlets are indicated adjacent to each other, mount these outlets in a symmetrical pattern with all tops at the same elevation. Where outlets are indicated adjacent, but with different mounting heights, line up outlets to form a symmetrical vertical pattern on the wall. Verify the final location of each outlet with Owner's representative before rough-in. Remove and relocate any outlet box placed in an unsuitable location.

C. Box Openings. Provide only the conduit openings necessary to accommodate the conduits at the individual location.

3.2 JUNCTION AND PULL BOXES

A. Installation. Install boxes as required to facilitate cable installation in raceway systems. Generally, provide boxes in conduit runs of more than 100 feet. Junction box and pullbox locations as shown on drawings are approximate unless dimensioned. Verify location of boxes and outlets prior to rough-in. outlet locations may be modified to accommodate changes in door swings, space changes, or to clear other interferences that arise from job modifications.

B. Conduit entering junction boxes and enclosures located in vaults shall be bottom and side entry. Top entry is not allowed.

C. Covers. Provide boxes so that covers are readily accessible and easily removable after completion of the installation. Include suitable access doors for boxes above inaccessible ceilings. Select a practical size for each box and cover.

END OF SECTION

SECTION 16140

WIRING DEVICES

PART 1 - G E N E R A L

1.1 SUMMARY

Provide wiring devices and device plates.

1.2 REFERENCE STANDARDS

A. Americans with Disabilities Act (ADA).

B. ANSI/IEEE 62.41 - Guide for Surge Voltages in Low-Voltage AC Power Circuits.

C. ANSI/UL 20 - General-Use Snap Switches.

D. ANSI/UL 498 - Attachment Plugs and Receptacles.

E. ANSI/UL 943 - Ground Fault Circuit Interrupters.

F. NEMA WD 1 - General Requirements for Wiring Devices.

G. UL 1449 – Surge Protective Device.

1.3 SUBMITTALS

Provide product data on wiring devices and plates.

PART 2 - P R O D U C T S

2.1 RECEPTACLES

A. Type. Back and side wired receptacles.

B. Rating. Scheduled on drawings.

C. Listing. UL 498 and Federal Specification W-C-596.

D. Manufacturers. The following designations are for brown devices; provide devices in the color specified in Article 2.6.

NEMA Config.	Arrow Hart	Bryant	GE	Hubbell
5-15R	5262	5262	5262-1	5262
6-15R	5662	5662	5662-1	5662
5-20R	5362	5362	5362-1	5362
6-20R	5462	5462	5462-1	5462
14-20R	5759	C	1420	8410

NEMA Config.	Arrow Hart	Bryant	GE	Hubbell
15-20R	5781	C	1520	8420
5-30R	5716N	9530-FR	4138-3	9308
6-30R	5700N	9630-FR	4139-3	9330
14-30R	5744N	9430-FR	4191-3	9430A
15-30R	8430N	8430-FR	1530-3	8430A
5-50R	5711N	9550-FR	4140-3	9360
6-50R	5709N	9650-FR	4141-3	9367
14-50R	5754N	9450-FR	4181-3	9450A
15-50R	8450N	8450-FR	1550	8450A
CLOCK	5708	2828-GS	4225-5	5235
GFCI	GF8300	GFR83FT	GFR8300	GF-8300
TVSS	8300SI	SP83-TIGI	8300-SIG	8300H-IS

PART 3 - E X E C U T I O N

3.1 GENERAL

A. Install wiring devices in accordance with applicable requirements of the NEC, NEMA, ANSI, and the product manufacturer recommendations.

B. Device Coordination. Where items of equipment are provided under other sections of this specification or by the Owner, provide a compatible receptacle for the cap or plug and cord of the equipment.

C. Taps, Splices and Connections. Make grounding (earth) conductor approximately 2 inches {50 mm} longer than the ungrounded (phase) conductors at both ends. Refer to Section 16060.

3.2 LIGHT SWITCHES

A. Location. Set switches in a suitable outlet box centered at the height of 44 inches from the floor, except as otherwise shown on the drawings.

3.3 RECEPTACLES

Mount receptacles vertically with the ground on top in a suitable steel outlet box centered at the height of 18 inches from the floor or grade, except as otherwise shown on the drawings. For horizontally mounted receptacles, ground should be on left. Reasonable changes in receptacle locations may be directed without change in the contract sum.

3.4 DEVICE PLATES DEVICE PLATES

A. Finished Spaces. Use smooth high-impact thermoplastic device plates (“Lexan,” “Noryl” or “Nylon”).

B. Exposed Boxes in Dry Interior Spaces. Make plates of heavy cadmium-plated sheet steel. Edges of plates must be flush with edges of boxes.

C. Hose-down and Exterior Areas. Use weatherproof nonmetallic enclosure. Provide enclosure with gasketed cover for protection of device and meeting the requirements of NEC 410 57b.

D. Acceptable Manufacturer. TayMac No. 71204 or approved substitution.

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END OF SECTION

SECTION 16210

ELECTRICAL SERVICE

PART 1 - G E N E R A L

1.1 SUMMARY

Make arrangements for permanent electrical services. Temporary (construction phase) power is specified in Section 01500.

1.2 REFERENCE STANDARDS

Comply with all service installation standards of the serving utility.

1.3 SOURCE

Electrical service will be provided and will be run via an existing overhead system. The source characteristics are 480/277 volts, 3 phase, 4 wire, 60 hertz.

1.4 COORDINATION

The location of the service entrance must be coordinated with the Oncor Electric Delivery. Provide materials and equipment required to connect the project service to the utility system. Refer to drawings for point of contact information.

PART 2 - P R O D U C T S

Not used.

PART 3 - E X E C U T I O N

3.1 PREPARATION

A. Application for Service. Verify that an application for service has been submitted to the utility. If application for service is not filed with utility, prepare application and coordinate with Owner to submit application for service.

B. Service Outlet Location and Data Statement. Secure a service outlet location and data statement ("statement") from the utility company. Verify that the information on the statement is correct, including type of service, service facility arrangement, and location of service outlet. Notify Owner and Engineer immediately of any and all discrepancies between contract documents and statement, and propose a resolution.

3.2 INSTALLATION

Install the utility services as required by the contract documents. Demonstrate that the electrical system is operational.

3.3 OUTAGES

Schedule power outages to avoid interference with the Owner's activities. Obtain approval from Owner at least 30 days prior to the requested outage. If required by the Owner, provide a schedule showing sequence and duration of all activities during the requested outage.

END OF SECTION

SECTION 16222

AC ELECTRIC MOTORS

PART 1 - G E N E R A L

1.1 SUMMARY

A. Equipment. This section provides general requirements for 1-phase and 3-phase electric motors with NEMA frame machines sized through 100 horsepower. Unless otherwise specified, provide motors meeting the basic requirements for general-purpose alternating current motors, as defined in ANSI/NEMA MG 1-1.05.

B. Unit Responsibility. Motors are furnished under other sections of this specification as a part of the driven equipment. The Contractor is responsible for all coordination between the various components and for the warranty.

1. The motors shall include all necessary appurtenances needed to comply with the enclosure requirements detailed in this specification. This shall include, but not be limited to, filters, filter holders, flanges and fittings.
2. All couplings and base plates shall be supplied by other Divisions unless otherwise indicated.

C. Exceptions. Exceptions to this section are indicated either in the various sections that specify motor-driven equipment or on the drawings.

1.2 REFERENCE STANDARDS

A. ANSI/IEEE 117 - Standard Test Procedure for Evaluation of Systems of Insulating Materials for Random Wound AC Electric Machinery.

B. ANSI/NEMA MG 1 - Motors and Generators.

C. ANSI/NEMA MG 2 - Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors.

D. ANSI/UL 674 - Electric Motors and Generators for Use in Hazardous (Classified) Locations.

E. ANSI/UL 1004 - Electric Motors.

F. NFPA 70 - National Electrical Code (NEC).

1.3 SUBMITTALS

A. Provide the following information for each motor:

1. Manufacturer.
2. Rated full load horsepower.
3. Rated volts.
4. Number of phases.
5. Frequency in hertz.
6. Full load amperes (FLA).
7. Locked rotor amperes (LRA) at rated voltage or NEMA code letter.
8. Nominal speed at full load (rpm).
9. Service factor.

10. NEMA design letter.
11. NEMA machine type (ODP, WP-I, TEFC, etc.).

B. For motors 1 horsepower and larger, include the following additional information:

1. NEMA frame size.
2. NEMA insulation system classification. For motors required to be installed outdoors, include information showing compliance with the intent of paragraph 2.4C.
3. Maximum ambient temperature for which motor is designed.
4. Time rating.
5. Bearing type.
6. Efficiency at full load.

C. For motors 20 horsepower and larger, include the following additional information:

1. No load amperes.
2. Safe stall time.
3. Efficiency at 1/2 and 3/4 load.
4. Power factor at no load, 1/2, 3/4 and full load.
5. Motor manufacturer's recommended maximum power factor correction capacitor (kvar) that can safely be switched with the motor.
6. Expected value of corrected power factor at no load, 1/2, 3/4 and full load.
7. Full load amperes with corrected power factor.
8. Maximum guaranteed slip at full load.

D. For motors with space heaters, include space heater voltage and wattage.

1.4 DELIVERY, STORAGE AND HANDLING

A. Delivery. Upon delivery at the job site, the Contractor shall inspect the motor thoroughly for damage.

B. Handling. The motor shall be lifted in accordance with the manufacturer's instruction. All necessary slings and spreader bars shall be provided by the Contractor. Under no circumstances shall the motor be lifted by using the shaft as an attachment point.

C. Storage. The motor should be installed as soon as possible. If storage is required, the motor shall be stored under cover in a clean, dry location and shall be protected from rapid temperature changes. If storage is anticipated to be longer than 2 months, the following additional steps shall be taken:

1. The motor space heaters shall be energized, as applicable.
2. Motors with sleeve bearings shall have the oil reservoirs filled to the proper level with the specified oil.
3. Motors with anti-friction bearings shall receive an initial change of grease and then be re-greased every 6 months.
4. The motor shaft braces shall be removed and the motor shaft rotated every 2 weeks. The shaft braces shall be replaced prior to relocation to the installation site. Under no circumstances shall the motor be lifted without the braces in place.

1.5 SPARE PARTS AND CONSUMABLES

Provide sufficient quantity of recommended renewable spare parts (gaskets, O-rings, pins, fasteners, etc.) and consumables (oil, grease, etc.) as required to support operation and required maintenance for one year.

PART 2 - P R O D U C T S

2.1 RATING

A. Speed and Size. Speed and approximate horsepower ratings are specified in the driven equipment specification sections or are indicated on the drawings. Furnish motors sufficiently sized for the particular application and with full-load rating not less than required by the driven equipment at specified capacity. Size motors so as not to overload at any point throughout the normal operating range.

B. Voltage.

1. Single phase: 115 volts for 120-volt nominal system voltage.
2. Three phase: 200 volts for 208-volt nominal system voltage.
3. Three phase: 230 volts for 240-volt nominal system voltage.
4. Three phase: 230/460 volts for 240/480-volt nominal system voltage.
5. Three phase: 460 volts for 480-volt nominal system voltage.

C. Frequency. 60 hertz.

D. Service Factor. According to NEMA MG 1-12.47 but not less than 1.15.

E. Acceleration Time. For integral horsepower motors, if the calculated acceleration time of the combined motor and driven load exceeds 3 seconds at 90 percent of rated voltage, request review by the Architect/Engineer. Do not proceed with manufacturing without approval.

F. Safe Stall Time. For integral horsepower motors, if the safe stall time is less than 15 seconds when hot, request review by the Architect/Engineer. Do not proceed with manufacturing without specific approval.

G. Efficiency. Provide energy-efficient motors meeting the requirements of NEMA MG 1-12.55A, Table 12Y and MG 1.41.3. Efficiency to be determined by testing in accordance with NEMA MG 112.53 using IEEE 112A - Method B.

2.2 DESIGN TYPE

A. Motors Smaller than 1/6 Horsepower. Provide single-phase squirrel-cage induction motors with integral thermal protectors.

B. Motors 1/6 through 1/2 Horsepower. Provide single-phase NEMA Design Letter N, squirrel-cage induction motors.

C. Motors Larger than 1/2 Horsepower. Provide 3-phase, NEMA Design Letter B, squirrel-cage induction motors.

2.3 MOTOR INSULATION

A. Class. Use a Class B insulation system meeting the requirements of NEMA MG 1-1.65 and made of nonhygroscopic materials.

B. Temperature Rise. According to NEMA MG 1-12.41 for fractional horsepower motors and NEMA MG 1-12.42 for integral horsepower motors.

C. Outdoor Suitability. Where motors must be suitable for outdoor installation, the insulation must withstand 1 full week (168 hours) of testing in a chamber maintained at 100 percent relative humidity and 40°C ambient temperature. Immediately after the test period, the insulation system must have a minimum resistance of 1.5

megohms. In addition, the inside circumference of the stator and the outside circumference of the rotor and shaft must be coated with the same moisture-resistant insulation.

2.4 LEADS

For motor leads, use not less than ASTM B 173, Class G, stranded copper conductors with insulation the same as or better than specified in the preceding Motor Insulation paragraph. Provide permanent identification numbers on leads according to NEMA MG 1-2.02. Use crimp-on, solderless copper terminals on leads and place heat-shrink insulation sleeves or covers between leads and terminals.

2.5 ENCLOSURE

A. Indoors. Open drip-proof (ODP). Use steel frame for motors smaller than 3/4 horsepower, and cast-iron frame for motors 3/4 horsepower and larger.

B. Outdoors. Use cast-iron frame as follows:

1. Smaller than 100 Horsepower. Totally enclosed, fan cooled (TEFC), with a corrosion-resistant drain plug under each bearing.
2. Horizontal 100 Horsepower and Larger. ODP suitable for outdoor use. For cooling towers supply TEFC motors as described above.
3. Vertical Motors.
    a. Weather-protected Type I (WP-I).
    b. For 300 hp and larger, use WP-II. For all other sizes, use TEFC.

C. Hazardous Areas. Provide cast-iron frame motors suitable for use in the classified area.

2.6 BEARINGS

A. Motors Smaller than 1/6 Horsepower. Motor manufacturer's standard bearing is acceptable.

B. Motors 1/6 Horsepower and Larger.

1. Antifriction. Supply motors with grease-lubricated antifriction ball bearings conservatively rated for long life under the total radial and thrust loads produced by the actual combination of motor-driven equipment. Provide each motor with suitable lubrication fittings and pressure relief devices suitable for in-service lubrication.
2. Oil Lubricated. If the driven equipment section specifies oil-lubricated bearings for motors, include a suitable sight gauge on each bearing with maximum and minimum levels clearly indicated.

2.7 HARDWARE

Use structural bolts, washers, nuts, pins, and similar items manufactured of high-strength steel. Use only hexagon-head bolts and hexagon nuts. Use corrosion-resistant materials or protect hardware from corrosion by either hot-dip galvanizing, chrome plating or cadmium plating.

2.8 NAMEPLATES

A. Main Nameplate. Provide each motor with a stainless steel nameplate meeting the requirements of NEMA MG 1-10.38, and the National Electrical Code, Section 430-7. Energy-efficient motors shall be identified in accordance with MG-1-12.54.2.

B. Heater Nameplate. When space heaters are furnished, include voltage and wattage on a suitable nameplate.

C. Bearings Nameplate. When bearings are oil lubricated, include oil type information on a suitable nameplate. Also, indicate bearing data if nonstandard.

D. Attachment. Attach the nameplates to the motor with stainless steel fastening pins or screws.

2.9 CONDUIT BOX

For each motor not supplied with a cord and plug, provide a conduit box suitably sized for the motor lead terminations, in accordance with the National Electrical Code, Section 430-12. Include a grounding lug for motors 1/6 horsepower and larger. Supply a gasket suitable for the motor enclosure type and application.

2.10 SPACE HEATERS

Provide space heaters on motors located outdoors or when specified in the driven equipment section. Use heaters hermetically sealed in stainless steel or equivalent corrosion-resistant sheaths. Rate heaters 115 volts, 60 hertz. Braze heat-resistant insulated leads to the heater and extend to the conduit box. Size heaters according to the motor frame size as follows:

Frame Number Series	Minimum Watts	Corresponding HP at 1800 SRPM
Less than 280	Not required	
280 - 320	100	25 - 50
360 - 400	150	60 - 125
440	200	150 - 200

2.11 FINISH

Manufacturer's standard shop paints for prime and finish coats are acceptable.

2.12 NOISE

Provide integral horsepower motors with overall sound power levels meeting the requirements of MG 1-12.49.

PART 3 - E X E C U T I O N

3.1 INSTALLATION

Properly install and align motors in the locations shown, except motors which are factory mounted on the driven equipment. Use crimp-on, solderless copper terminals on the branch circuit conductors. Make grounding (earth) conductor approximately 2 inches {50 mm} longer than the ungrounded (phase) conductors at both ends. Refer to Section 16060. For motors 20 horsepower and larger, use 5300 series 3M motor lead splicing kit or approved equal. When the motor and equipment are installed, the nameplate must be in full view.

3.2 LARGER MOTORS

If a motor horsepower rating larger than indicated is offered as a substitute and accepted, provide required changes in size of conductors, conduits, motor controllers, overload relays, fuses, circuit breakers, switches and other related items at no change in the contract price.

3.3 FIELD TESTING

A. General. Provide all necessary instruments, labor and personnel required to perform motor inspection and testing.

B. Inspection. Inspect all motors for damage, moisture absorption, alignment, freedom of rotation, proper lubrication, oil leaks, phase identification and cleanliness, and report any abnormalities to Owner's representative before energizing.

C. Tests. All motors 20 horsepower and larger shall be megger tested, in accordance with IEEE Report No. 43, "Recommended Practices for Testing Insulation Resistance of Rotating Machinery," to determine insulation resistance. In addition, motor full load current and full load voltage shall be measured. Motor Test Report forms included at the end of this section shall be completed and submitted to the Owner's representative.

D. Energizing. After installation has been thoroughly checked and found to be in proper condition, with thermal overloads in motor controllers properly sized and all controls in place, energize the equipment at system voltage for operational testing.

E. Make an initial uncoupled test of the motor. The motor shaft rotation shall be noted and verified that it is turning in the proper direction. The motor bearing temperatures shall be monitored for excessive temperatures or excessive vibration. If any abnormal vibration or noise occurs, the motor shall be immediately stopped. A factory-trained manufacturer's technician shall inspect and test the motor prior to any further energization.

F. Make coupled start-up tests. The starting time shall be measured and verified that it is less than the manufacturer's rated stall time. When the motor reaches full speed, the motor shall be carefully observed to verify that there is not excessive vibration or noise. The bearing temperatures shall be monitored to verify proper cooling. The line currents shall be monitored to verify "balanced" conditions. In addition, the Contractor shall verify that the cooling and lubrication systems are operating properly. For motors with external systems, the temperature, pressure, flow rate, etc., shall be verified as correct.

G. Provide three copies of the field start-up tests.

END OF SECTION

DATE _____

SHEET _____ OF _____

MOTOR TEST REPORT

PROJECT NAME _____

PROJECT NO. _____

MOTOR MANUFACTURER _____

MOTOR DESIGNATION _____, LOCATION _____

HP _____, FLA _____, LRA _____, NOMINAL VOLTAGE _____

INSULATION CLASS _____

SERVED FROM PANEL/MCC _____

MEASURED CONDITIONS

TEMPERATURE: _____°F

RELATIVE HUMIDITY: _____%

CURRENT (AMPS): ∅A _____, ∅B _____, ∅C _____

VOLTAGE (VOLTS): ∅AB _____, ∅BC _____, ∅CA _____

∅AN _____, ∅BN _____, ∅CN _____

INSULATION RESISTANCE:

∅AB _____, ∅BC _____, ∅CA _____

∅A-GND _____, ∅B-GND _____, ∅C-GND _____

STARTING TIME: _____ SECONDS, SAT _____ UNSAT _____

VIBRATION: SAT _____ UNSAT _____

BEARING TEMPERATURE: SAT _____ UNSAT _____

SECTION 16230

ENGINE GENERATOR SYSTEMS

PART 1 - G E N E R A L

1.1 SUMMARY

A. The Contractor shall furnish, install, and test sound-attenuated enclosed standby diesel fuel engine generator units skid mounted on steel structural base with vibration isolators. Complete with base mounted fuel tank. Provide in accordance with the requirements of the Contract Documents.

B. The Contractor shall furnish the engine generator unit complete with unit mounted generator control panel, automatic electric starting and control equipment, exhaust silencer and piping, intake cleaner and piping, oil pumps, integral radiator, lubricating oil and engine jacket water heater, batteries and battery charger(s), instruments and auxiliary equipment necessary to make the unit completely automatic in starting, operating, and stopping in response to power requirements. The complete unit shall be covered by a comprehensive warranty.

1.2 SUBMITTALS

A. Submit the following information in accordance with Section 01330.

1. Engine Data.
    a. Manufacturer and model number.
    b. Rated capacity in horsepower (standby rating).
    c. Type of engine; aspiration and cooling system.
    d. Number of cycles and cylinders; speed in RPM.
    e. Piston displacement.
    f. Type and make of governor.
    g. Starting KVA; maximum voltage dip.
    h. Dimensions and weights.
    i. Air cooling requirements.
2. AC Generator Data.
    a. Manufacturer and model number.
    b. Rated capacity in kw (standby rating) at 0.8 power factor.
    c. Type of generator; construction.
    d. Voltage; phase, frequency, and connections.
    e. Insulation class; temperature rise.
    f. Efficiency and regulation.
    g. Starting KVA; maximum voltage dip.
    h. Dimensions and weights.
    i. Air cooling requirements.

B. The Contractor, in addition to, shall include the following information as part of the submittals:

1. Engine generator set plans and elevations or riser views showing entrance points for each of the interconnections required.

2. Engine generator/exciter control panel.

3. Fuel consumption rate curves at various loads and fuel pumping rates.

4. Ventilation CFM requirements including allowable cooling fan pressure loss.

5. Exhaust system and vibration isolation.

6. Battery charger, battery, and battery rack.

7. Remote radiator.

8. Actual electrical diagrams including schematic diagrams and interconnection wiring diagrams for all equipment to be provided.

9. Legends for all devices on all diagrams.

10. A certified performance rating from the engine manufacturer that the generator set when equipped with all auxiliary equipment as needed or specified shall have a minimum rating as specified herein when installed at the specified altitude.

11. Complete test specification detailing the testing procedure to be used to verify the performance of the equipment provided.

C. The Contractor shall submit eight (8) copies of the Operation and Maintenance manuals with each unit as follows:

1. Furnish eight identical sets of technical manuals when generator unit is delivered. Each set shall consist of one or more volumes, each of which shall be bound in a standard size, 3-ring loose-leaf, vinyl plastic hard cover binder suitable for bookshelf storage. Binder ring size shall not exceed 2.5 inches.

2. Technical manuals shall include operating and maintenance instructions as applicable, for each item of mechanical and electrical equipment, as follows:

a. Complete operating instructions, including location of controls, special tools, or other equipment required, related instrumentation, and other equipment needed for operation.
b. Lubrication schedules.
c. Preventive maintenance procedures and schedules.
d. Parts lists, by generic title and identification number, complete with exploded views of each assembly.
e. Disassembly and reassembly instructions.
f. Name, location, and telephone number of nearest supplier and spare parts warehouse.
g. Recommended troubleshooting and start-up procedures.

D. The Contractor shall submit “As-Built” electrical drawings including interconnection, schematic and wiring diagrams.

1.3 QUALITY ASSURANCE

A. General. The engine-generator unit shall be the product of a single United States manufacturer that has been regularly engaged for a minimum of 15 years in the production, manufacturing and assembly in the United States of the type and size of equipment specified herein. All materials and parts in this unit shall be new and unused, of current manufacture, and of the highest grade, and free from all defects that may affect performance. To qualify as a manufacturer, the engine must be the principal item manufactured and the completed engine generator set shall be supplied by that manufacturer’s authorized dealers only.

B. Unit Responsibility. The engine-generator unit and all appurtenant equipment specified herein, and the drop-over enclosure shall be provided by a single manufacturer/vendor, establishing one source of responsibility for the equipment performance and assuring high standards of quality, coordination, reliability and service.

C. Factory Test. Prior to delivery at the job site, the engine generator unit and appurtenant equipment shall be tested at the manufacturer’s testing facility to verify that the equipment is free of any defects; to verify guaranteed

performance, and to simulate automatic starting of the unit in conjunction with appurtenant equipment as specified herein.

1. The test for the generator shall be in accordance with IEEE Standard 115. The test shall show guaranteed performance of the equipment as required by the following tests, but not be limited to:

   a. Insulation resistance and high pot test.
   b. Field winding polarity test.
   c. Voltage regulation from no load to full load.

D. Shutdown Tests. Bring the engine generator to stable operation and then create the following conditions in turn to cause alarm and shutdown.

1. High engine temperature.
2. Low engine temperature.
3. Low oil pressure.
4. Engine overspeed

E. The testing of the generator unit, complete with all auxiliaries, shall be for a period of 4-hour load test prior to shipment, including repeated automatic starts at least 2 hours at full load. Testing shall include block loading and unloading, using dry load banks at 25 percent, 50 percent, 75 percent and 100 percent of rated of rate 45 KW. The load bank shall be for unity power factor. The engine shall run in each step until temperature has stabilized and voltage and frequency variations at each step shall be measured. Certified test reports shall be furnished to the Engineer prior to shipment of the unit to the job site. Test report shall include temperature of phase winding taken at 5 minute intervals during load run.

F. Warranty. Equipment furnished under this Section shall be guaranteed against defective parts and workmanship under the terms of the manufacturer's and supplier's standard warranty. In no event shall it be for a period of less than one (1) year from date of final acceptance of the system and shall include labor, materials and travel costs for necessary repairs at the job site.

PART 2 - P R O D U C T S

2.1 MANUFACTUERER

Acceptable manufacturers are Generac, Cummins, Caterpillar, Stewart and Stevenson

2.2 ENGINE

A. General

1. Each engine shall be four stroke cycle, water cooled and manufactured in the United States. Block shall be of one piece design and cast of high tensile strength iron in the system manufacturer's own foundry. Multiple blocks shall not be allowed. Counterboring for cylinder liners shall not be permitted. Crankshaft shall be a one piece forging with regrindable wear surfaces hardened through heat treat methods.

2. The engine shall be equipped with lube oil, intake air filters, lube oil cooler, engine driven battery charging alternator, service meter, gear driven water pump and jacket water heater.

B. Engine/Generator Control Panel.

1. The generator control panel shall be a unit mounted and shall have the following features:

   a. Engine controls and monitoring.
   b. Automatic/manual starts stop control.
   c. Engine control switch for off/reset, auto start, manual start, stop

d. Emergency stop pushbutton.
e. Low oil pressure.
f. High coolant temperature.
g. Overcrank.
h. Overspeed.
i. Oil pressure.
j. System DC volt.
k. Inlet air pressure (boost).
l. Engine speed and hours.

2. The engine generator control panel shall be the manufacturer's premium control panel.

3. Starting Motor. A dc electric starting system including two starting motors with positive engagement drive shall be furnished. The motor voltage shall be as recommended by the engine manufacturer.

4. Batteries. One set of lead acid storage batteries set of the heavy-duty special natural gas starting type shall be provided for each engine generator set. Battery voltage shall be 12 or 24 volt and compatible with the starting system. The battery set shall be rated no less than 220 ampere hours. Necessary cables and clamps for battery connection shall be provided.

5. Battery Racks. Battery racks shall be galvanized steel construction, conforming to NEC 480-7 with plastic insulating rails at all points of contact with the battery case. Racks shall contain any spillage or boil-over of electrolyte to prevent a direct path to ground.

6. Battery Charger. One (1) current limiting battery charger shall be furnished to automatically recharge batteries. Charger shall float at 2.17 volts per cell and equalize at 2.33 volts per cell. It shall include overload protection, silicone diode full wave rectifiers, voltage surge suppressor, DC voltmeter and fused ac input. AC input voltage shall be 120 volts, single phase. Amperage output shall be no less than 30 amperes. Charger shall be in NEMA 1 enclosure suitable for wall mounting and shall be UL listed. Charger shall locally indicate loss of AC power, low battery voltage, high DC charge and provide a common output alarm to the engine-generator control panel.

7. Pre-Alarm Sensors. Pre-alarm sensors shall be provided on the engine to provide signals to audible and visual alarm warning units of impeding fault conditions and provide audible alarm on fault shutdown. Sensors shall govern low oil pressure and high water temperature functions. Pre-alarm shall include low water level at radiator.

8. Provide pre-wired general alarm from C dry contacts which change state for all engine/generator pre-alarms, fault shutdown alarms, battery charger alarms and fuel tank alarms.

C. Governor.

1. The engine governor shall be an electronic governor capable of isochronous frequency regulation from no load to full load.

2. Governor shall maintain frequency regulation not to exceed 25% from no load to full load.

D. Cooling system shall be unit mounted radiator cooled, closed circuit cooling rated for an ambient of 110 degrees F.

1. The system shall have ample capacity to permit up to 100 percent of full load operation at an ambient temperature of 100 degrees F at sustained operation.

2. The fan shall be of the pusher type. The radiator shall be provided with protecting stainless steel grille.

3. A 50 percent ethylene glycol coolant shall be provided.

E. Exhaust System. The engines shall be equipped with a dry, insulated, exhaust manifold as specified herein.

1. A single critical type silencer muffler companion flanges, and flexible braided stainless steel exhaust fittings properly sized shall be furnished according to manufacturer's recommendations. Muffler mounting shall be for mounting in horizontal position. Silencer shall be standard steel.

2. Muffler and exhaust piping shall be sized to ensure that exhaust back pressure does not exceed the maximum specified by the engine manufacturer. Muffler shall have drain valve in silencer at the lowest point for condensation drain.

3. The exhaust system and exhaust silencer above flex connector shall be thermally insulated, aluminum jacketed.

F. Engine Jacket Water Heater.

1. Electric heater shall be installed on the engine, complete with thermostat control in the engine cooling water system to maintain at all times, while the engine is not in operation, a jacket water temperature of 100 degrees F to 140 degrees F.

2. The heater shall be 480 volt, three-phase.

3. Vee-type engine shall have one heater on each bank of cylinders.

4. The heater shall be an electric immersion or thermal circulation type.

G. Lubrication System.

1. The engine shall have a positive gear-type lubricating oil pump and a full flow lubricating oil filter system which shall filter all oil before it enters the main bearing galleries and other areas to be lubricated.

2. The crankcase shall have inspection cover plates to permit easy inspection and access to the oil pump and oil pump screen.

3. The oil filter system shall be engine-mounted, spin-on, cartridge type oil filter; oil filter shall not block access to engine inspection ports and essential piping.

H. Engine Base. The engine-generator unit(s) shall be mounted on a wide flange skid-type I-beam base to maintain engine alignment and provided with spring vibration isolators.

I. Fuel System Accessories. The fuel injection system shall be electronic unit injection type. Provide N.C. electrically operated solenoid valve to open when unit is running.

J. Pipe Connection. All pipe connections to the engine shall be made with flexible connectors of not less than 12 inches in length, with flanges or screwed ends, suitable for minimum 150 psig working pressure and 250 degrees F temperature.

K. Pressure and Temperature Electronic Sensors. Engine mounted pressure and temperature electronic sensors shall be direct continuous reading type with adjustable range and differential.

1. Pressure sensors shall be provided for lube oil low alarm and shutdown.

2. Temperature switches shall be provided for jacket water temperature low alarm and high temperature shutdown, and lube oil high temperature alarm and shutdown. Level switch shall be provided to monitor jacket water level.

L. Engine Accessories. The following engine accessories shall be provided.

1. Guards. Guards shall be provided overall exposed moving parts as required by OSHA.

2. Oil Drip Pan. Provide No. 14 gage galvanized steel drip pan 1-inch deep. Drip pan shall be sized to cover the area beneath the engine.

M. Engine Manufacturer.

1. Cummins.

2. Owner Approved Equal.

2.3 AC GENERATOR

A. Rating. Provide generators with ratings and supply voltage as shown on the drawings. The generator shall be standby rated as shown, with 130 degrees C rise over 40 degrees C ambient, 60 hertz at 1800 rpm with field windings braced for solid grounding. The rating shall be for continuous standby operation during interruption of the normal utility power.

B. Design. The generator shall be 3 pole rigidly coupled to the engine, permanently aligned and of drip proof construction. Bearings shall be shielded permanently lubricated ball bearings. The alternator shall be of the brushless revolving field type with permanent magnet exciter and sold state voltage regulator.

C. Materials. The generator shall have cast iron or fabricated steel frame. Windings shall have Class H insulation with Class F temperature rise per NEMA MG1-1.66, for both stator and rotor epoxy and vacuum pressure impregnated (VPI) with material that will not support fungus growth. Temperature rise at standby rated load shall not exceed 130 degrees C over 40 degrees C as per NEMA MG 1-22.40 definition.

D. Voltage Regulation. A unit mounted voltage regulator shall provide no more than .25 percent voltage regulation from no load to full rated load. Voltage adjustment shall be a minimum of ± 5 percent.

1. Voltage regulator shall be digital type, fully encapsulated.

2. Standard features shall include 1-phase RMS sensing, paralleling, adjustable underfrequency protection under/over voltage protection, rotating diode monitor, loss of sensing protection, loss of excitation protection, and over-excitation protection.

3. The voltage regulation system shall be insensitive to induced waveshape distortion from SCR or thyristor circuits such as those used in battery charging (ups) and motor speed control equipment loads or variable frequency drives (VFD).

4. Generator set shall be capable of safe stable operation with SCR loads of up to 30 percent of the units KVA rating without exceeding the temperature rise limits of the generator insulation system.

5. The digital voltage regulator shall have the following displays:

a. Frequency.
b. Voltage.
c. Current.
d. Diagnostic status.
e. Operating hours.

E. Space Heater. Generator shall have a 120 volt, 60 hertz, single phase space heater to keep alternator dry. Heater shall automatically energize when generator unit is off and be thermostatically controlled to maintain a uniform temperature.

F. Terminal Box. All wiring points for remote interconnection between the generator unit and control panel shall be through a single junction box mounted on the generator set with numbered terminal strips for field wiring. Junction box shall have provision for bottom conduit entry.

G. Accessories. The generator shall have the following additional devices mounted on the unit: Lighting and surge protection consisting of one storm trapper high energy low voltage distribution class surge arrestor per phase shall be Cooper Power Systems ASZH480E101, or equal.

H. Provide 150 amp main circuit breaker.

2.4 FUEL SYSTEM

A. Diesel Fuel

B. Engine-driven, self-priming fuel injection pump suitable for injecting fuel from the day tank to the engine.

1. Day (belly) tank with float switch mounted in skid base of unit and having a minimum capacity for operating unit at full load for 24 hours.

2. Full flow replaceable element fuel filter.

3. Flexible fuel connection lines between day tank and engine.

4. Check valve in fuel line at day tank to prevent fuel line from emptying back into tank.

5. Tank shall be tank-in-tank construction. Interstitial space shall have a fuel sensor to detect a leak in the inner tank. The alarm shall be on the remote alarm panel.

C. Field Connections. Flanges for all field connection shall be flush with the surface of the acoustical enclosure. No field connections are to be made inside the enclosure. All mechanical flex connectors between the enclosure and field piping are to be provided by the manufacturer.

2.5 SOUND ATTENUATED ENCLOSURE

A. Provide a drop-over sound attenuated enclosure. Enclosure shall be constructed of painted steel. The enclosure shall be sized to adequately house the genset and all accessories. Walls and roof shall be constructed of 14 gauge painted steel. All hardware shall be standard steel. Roof shall prevent the entrance of water by inherent design.

B. Provide four (4) lifting eves to set the enclosure in place. Provide two (2) coats primer and two (2) coats enamel paint of customer color choice. Provide two (2) entrance doors on each side. Doors shall be strategically located to provide easy access and service ability. One door shall be located directly on front of the generated mounted circuit breaker. Doors shall be locking type with three point latches, standard steel hardware and emergency exit pushbars.

C. Provide fixed open steel intake louvers and a gravity open steel discharge louver. Intake louvers shall include birdscreen. Louvers shall be adequately sized to insure that the generator cooling system operates within its allowable maximum static pressure restriction.

D. Provide a complete pre-fabricated exhaust system for mounting the silencer on the exterior of the enclosure, including steel flex connector silencer, elbow rain cap, rain shield and silencer mounting brackets. Roof shall be adequately braced to support the weight of the silencer and two men during installation.

E. Contractor to wire out jacket water heater, generator space heater and 24 VDC to battery charger after enclosure is installed on the pad.

F. Provide internal industrial LED lighting, weatherproof light switches and weatherproof convenience receptacles

PART 3 - E X E C U T I O N

3.1 INSTALLATION

A. The engine/generator unit, including all accessories, shall be installed in accordance with the manufacturer's published recommendations. Start-up shall be provided by the manufacturer's authorized field representative.

B. The complete engine/generator unit shall be anchored in place on a concrete pad with leveling channels.

C. It is the intent of these Specifications that the unit supplier shall furnish and install associated equipment and accessories, and furnish all the labor to make the system complete and operational.

3.2 FIELD TEST

A. Field test shall be conducted by the manufacturer's authorized representative after installation to assure compliance with all operating requirements of the specifications.

B. Tests shall include, but not be limited to, a full rated power load test for a period of 4 hours using a reactive dry bank load cell to simulate the actual design loads as shown on the drawings.

C. All field tests shall be witnessed by the Engineer and Owner; test results all documented and submitted to the Engineer.

3.3 STARTUP AND OPERATIONS INSTRUCTION

A. Upon completion of the installation and field tests, startup shall be performed in accordance with manufacturer's published procedures.

B. Step-by-step detailed instructions of the operation of the unit(s) shall be furnished by the equipment supplier. The instructions shall include, but not be limited to, the following procedures:

1. Start up of the unit.
2. Normal shutdown of the unit.
3. Emergency shutdown of the unit.

C. The manufacturer's representative shall conduct a total of two four hour training sessions for the start-up and operations and maintenance of the engine generator unit, and appurtenant equipment.

END OF SECTION

SECTION 16276

DRY-TYPE TRANSFORMERS - 600 VOLT AND BELOW PRIMARY AND RATED 500 kVA AND SMALLER

PART 1 - G E N E R A L

1.1 SUMMARY

Provide dry-type transformers with 600 volt and below primary and rated 500 kVA and smaller.

1.2 REFERENCE STANDARDS

Design, test, assemble and install in conformance to the latest edition of the following applicable industry standards.

A. ANSI/UL 506 - Specialty Transformers.

B. IEEE C57.94 - Recommended Practice for Installation, Application, Operation and Maintenance of Dry-Type General-Purpose Distribution and Power Transformers.

C. ANSI/NEMA ST 20 - Dry-Type Transformers for General Applications.

D. NFPA 70 - National Electrical Code (NEC).

1.3 SUBMITTALS

Provide product data on each transformer. Product data shall include the following minimum information.

A. Manufacturer.

B. Rated kVA, number of phases and frequency.

C. Primary voltage and connections.

D. Secondary voltage and connections.

E. Number and percent taps.

F. Outline dimensions.

G. Total weight of unit.

PART 2 - P R O D U C T S

2.1 MANUFACTURERS

Acme Electric, General Electric, Square D, Eaton, Siemens, or Sola.

2.2 RATINGS

Required kVA, voltages, phases and winding configurations are indicated on the drawings. Transformers must be rated for 60 hertz operation, self-cooled NEMA Class AA, and shall be listed under UL 506.

2.3 COILS

A. Windings. Use aluminum or copper wire (bar stock) for coil windings. Aluminum foil windings are not acceptable.

B. Taps. Furnish transformers with full load rated taps in the primary winding as follows:

kVA Rating	Taps
3-15 kVA, single phase; 9-15 kVA, three phase	Two 5 percent taps below rated voltage
25-100 kVA, single phase; 30-300 kVA, three phase	Six 2-1/2 percent taps, four below and two above rated voltage
167-250 kVA, single phase; 500 kVA, three phase	Four 2-1/2 percent taps, two below and two above rated voltage

2.4 INSULATION

Provide a 220°C insulation system which is the manufacturer's standard for a maximum 150°C rise over a 40°C ambient.

2.5 SOUND REQUIREMENTS

Average sound levels must not exceed the following values as measured in accordance with NEMA ST 20-4.12.

kVA	dB
0-9	40
10-50	45
51-150	50
151-300	55
301-500	60

2.6 CONSTRUCTION

A. Enclosure. Unless otherwise specified or indicated, install transformers in metal enclosures designed to provide air cooling and to prevent accidental contact with live conductors.

A. Enclosure. Install transformers with resin-encapsulated coils in totally-enclosed, non-ventilated metal enclosures designed to prevent accidental contact with live conductors.

B. Wiring Compartment. Locate the wiring compartment below the core and coil. Have the compartment cooled by air circulation or insulated from the core and coil with a suitable thermal barrier.

C. Grounding.

1. Ground the core of the transformer to the enclosure with a flexible grounding conductor sized according to NEC requirements.

2. Ground the transformer neutral in accordance with NEC 250-20(d), 250-21 and 250-30.

D. Mounting Brackets. Furnish mounting brackets, as required, for wall or structure mounting of transformers rated 45 kVA and less.

PART 3 - E X E C U T I O N

3.1 TAP SETTING

Select the appropriate tap setting on transformer so that the actual secondary voltage is ± 1/2 of a tap span at full load. Record the transformer serial number, kVA rating, selected tap setting and secondary voltage readings. Submit copies of the record to the Architect/Engineer.

3.2 CABLE CONNECTIONS

Make transformer cable connections with compression-type lugs suitable for termination of 75°C rated conductors. Position lugs so that field connections and wiring will not be exposed to temperature above 75°C.

3.3 MOUNTING

A. Floor. Construct concrete pad for floor-mounted transformers in accordance with Section 16050, Electrical General Provisions. Maintain a minimum of 6 inches {153 mm} free air space between enclosure and walls.

B. Wall. Securely anchor wall mounting brackets to wall to provide adequate support.

C. Suspended. Suspend transformers from structure by means of trapeze hangers constructed of galvanized all-thread rods and metal framing channels. Make double-nut connections between rods and channels. Locate to provide adequate ventilation and accessibility.

D. Vibration Isolation. Mount transformers on vibration isolating pads suitable for isolating the transformer noise from the building structure.

1. For floor transformer installations, use one pad-type Korfund Elasto-Grip waffle, or accepted substitution, at each corner of the transformer, sized for load of 50 lbs./sq.in. {3.52 Kg/sq.cm}.
2. For wall or ceiling hung transformer installations, use spring-type Korfund Series P, or accepted substitution. Provide sound pads at each corner of the transformer, sized for 1/2-inch {13 mm} deflection.
3. Verify removal of coil shipping anchor bolts before transformer is energized.

E. Ventilation. Provide adequate clearance around transformer for ventilation of core, coil and internal components; minimum 1′-0″ all sides unless noted otherwise.

END OF SECTION

SECTION 16285

SURGE PROTECTION DEVICES (SPD)

PART 1 - G E N E R A L

1.1 SUMMARY

A. This section includes the requirements for the provision of Surge Protective Devices (SPD) equipment having electrical characteristics, ratings and modifications as shown on the contract drawings and specified herein.

1.2 CODES AND REFERENCE

A. Qualification Data: Products shall be tested and listed by a Third Party testing lab or U.S. Department of Labor/OSHA approved NRTL

Agency Approval/Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the testing indicated, that is a Nationally Recognized Testing Laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7.

1. All SPDs shall be tested and listed to ANSI/UL 1449-2006 (UL 1449 3rd Edition) & Complimentary Listed to UL 1283 by a Nationally Recognized Testing Laboratory (NRTL) (i.e. CSA, UL, etc)

B. Applicable Documents:

1. ANSI/IEEE Std C62.41.1™-2002, IEEE Guide on the Surge Environment in Low- Voltage (1000 V and Less) AC Power Circuits

2. ANSI/IEEE Std C62.41.2™-2002,IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

3. ANSI/IEEE Std C62.45™ -2002, IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits

4. ANSI C84.1, American National Standard for Electric Power Systems and Equipment – Voltage Ratings (60 Hertz)

5. IEEE Standard 1100-2005, IEEE Recommended Practice for Power and Grounding Electronic Equipment - Clause 8.6.1

6. National Fire Protection Association (NFPA) 70 (N.E.C.) –2002 – Article 285

7. ANSI/UL 1449-2006 Surge Protective Devices

8. IEEE Std C62.72™-2007 – IEEE Guide for the Application of Surge-Protective Devices for Low-Voltage (1000 V or less) AC Power Circuits

1.3 GLOSSARY AND ACRONYMS

A. SPD: Surge Protective Device(s), both singular and plural.

B. NEC/CEC: National Electric Code / Canadian Electric Code

C. Sinewave Tracking: Voltage independent, dedicated circuitry intended to mitigate the effects of switching or ringing surges that is specifically designed so that it can survive the surge environment. The performance of sinewave tracking circuitry is defined by the level to which it mitigates Ring Wave transients and can be demonstrated in the test results of IEEE C62.41.2-2002, Category A Ring Wave (2kV).

D. Voltage Protection Rating (VPR) A rating selected from a list of preferred values as detailed in ANSI/UL 1449-2006 and assigned to each mode of protection. The value of VPR is determined as the nearest highest value taken from a list of preferred values as detailed in ANSI/UL 1449-2006 to the measured limiting voltage determined during the transient voltage surge suppression test using the combination wave generator at a setting of 6 kV, 3 kA.

E. Maximum Continuous Operating Voltage (MCOV) – The maximum designated root mean-square (rms) value of the power frequency voltage that may be continuously applied to the mode of protection of an SPD.

F. Nominal Discharge Current (In) – Peak value of the current, selected by the manufacturer from a list of values specified in ANSI/UL 1449-2006, through the SPD having a current waveshape of 8/20 where the SPD remains functional after 15 surges using the test procedure described in ANSI/UL 1449-2006.

G. Type 1 SPD – Permanently connected SPDs intended for installation between the secondary of the service transformer and the line side of the service equipment overcurrent device, as well as the load side, including watt-hour meter socket enclosures and intended to be installed without an external overcurrent protective device.

H. Type 2 SPD – Permanently connected SPDs intended for installation on the load side of the service equipment overcurrent device; including SPDs located at the branch panel.

I. Type 4 SPD – Recognized Component SPDs, including discrete components as well as component assemblies, which bear specific conditions of acceptability.

J. Modes Of Protection: Electrical paths where the SPD offers defense against transient overvoltages. e.g. Each Line to Neutral (L-N), Line to Ground (L-G), Line to Line (L-L) and Neutral to Ground (N-G).

K. Per Phase Ratings: „Per-Phase“ ratings for a three-phase Wye-connected SPD are determined by multiplying the kA per mode times the number of discrete modes of protection (directly connected suppression components), minus the value for the Neutral to Ground mode, divided by the number of phases.

Per-Phase = (((kA per mode) X (# of modes))-(N-G mode kA)) / (# of phases)

1.4 SUBMITTALS FOR REVIEW

A. Submit the following information for review/approval in accordance with Section 01330:

1. Descriptive bulletins.

2. Product sheets.

3. Verification that the SPD device complies with the required UL 1449 and UL 1283 suppression voltage ratings (SVR).

4. Actual let-through voltage test data for both the ANSI/IEEE C62.41 Category C3 (combination wave) and B3 (ringwave) tested in accordance with ANSI/IEEE C62.45.

5. UL 1449 Listing/Clamp Voltages. Manufacturer shall provide data showing UL 1449 product listing. Manufacturer shall also submit certified documentation of applicable Location Category Testing in full compliance with NEMA LS 1, paragraphs 2.2.10 and 3.10.

6. Single Pulse Surge Current Capacity Testing. Certified documentation of the unit’s NEMA LS 1 Single Pulse Surge Current Capacity Testing shall be included in the submittal.

7. Minimum Repetitive Surge Current Capacity Testing. Certified documentation of the unit’s ANSI/IEEE C62.41 and ANSI/IEEE C62.45 Minimum Repetitive Surge Current Capacity Testing shall be included in the submittal.

8. Electrical/mechanical drawings showing unit dimensions, weights, installation instruction details, and wiring configuration.

9. Test report from a recognized independent testing laboratory verifying the suppressor components can survive published surge current rating on a per mode and per phase basis using the IEEE C62.41, 8 x 20 microsecond current wave.

B. Submit the following information for record purposes at closeout:

1. O&M Manual. The manufacturer shall furnish with the submittal and with each unit delivered an equipment manual that details the installation, operation, recommended renewal parts list, and maintenance instructions for the specified unit.

2. Drawings. Electrical and mechanical drawings shall be provided by the manufacturer with the submittal and with each unit delivered that show unit dimensions, weights, mounting provisions,

connection details and layout diagram of the unit. Include as-built information. Provide drawings with equipment manual.

C. QUALITY ASSURANCE

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a NRTL testing agency, and marked for intended location and application.

E. Manufacturer's Qualifications: Manufacturer must have at least 10 years experience in the engineering, design and manufacture of permanently connected SPDs. Manufacturer operates a Quality System Certified manufacturing facility as ISO 9001:2000 Compliant

F. Certificate of Declaration that product is CE Low Voltage Directive Compliant

1.5 COORDINATION

A. Coordinate location of field installed SPDs to allow adequate clearances for maintenance.

B. SPDs shall be rated for the class and category of service necessary for the application per the ANSI/IEEE Std C62.41.2TM-2002 and IEEE Std C62.72TM-2007 (Categories C, B, A)

1.6 FUSING

A. Provide as a minimum, over-current, over temperature protection in the form of component-level thermal fusing to ensure safe failure and mitigate thermal runaway. This component-level fusing shall be an integral part of the MOV itself, and not silver wire (or other) independently laid across each MOV.

B. Provide integral short circuit current fusing with each device. The fusing will be independent of the "component-level" fusing and specifically for over-current protection and shall be constructed utilizing surge rated, cartridge fuses and not rated „silver-fuse-wire" (or other).

C. The use of any mechanical or electro-mechanical thermal/over-current protection (i.e. moving parts and/or springs and shutters), in combination with or for the protection of the suppression elements are expressly prohibited and will be rejected.

D. The fusing mechanisms employed must effectively coordinate their performance in conjunction with the high current abnormal over-voltage testing under ANSI/UL 1449-2006 (a.k.a. UL 1449 3rd Edition).

1.7 WARRANTY

A. The manufacturer shall provide unlimited free replacement of the entire SPD (not just modules, components or sub-assemblies) for all inoperable SPDs during the warranty period. Acceptable manufacturers listed below that do not meet the warranty as standard shall submit a letter extending the warranty with the product submittal

1. Warranty Period: Minimum warranty shall be Twenty-Five (25) years from date of installation.

2. Maintenance Restrictions: No SPD shall be supplied which requires scheduled preventative-maintenance or replaceable parts (other than replaceable LEDs or batteries for diagnostic circuits). Units requiring functional testing, special test equipment, or special training to monitor SPD status are not acceptable. SPDs shall require no routine maintenance. SPDs are considered non-repairable items and shall be fully replaced upon failure.

PART 2 - P R O D U C T S

2.1 ACCEPTABLE MANUFACTURER

A. Allen Bradley.

B. General Electric.

C. Square D.

D. Eaton.

2.2 SURGE PROTECTIVE DEVICES - GENERAL

A. Surge Protective Devices (SPD) equipment shall meet all ratings and features specified herein.

B. Electrical Requirements.

1. Unit Operating Voltage. Refer to drawings for operating voltage and unit configuration.

2. Maximum Continuous Operating Voltage (MCOV). The MCOV shall be greater than 115% of the nominal system operating voltage.

3. Operating Frequency. Range shall be 47 to 63 hertz.

4. Protection Modes. For a wye configured system, the device shall have directly connected suppression elements between line-neutral (L N), line-ground (L G), and neutral-ground (N G). For a delta configured system, the device shall have suppression elements between line to line (L L) and line to ground (L G).

5. UL 1449 2nd Edition SVR. The maximum UL 1449 2nd Edition suppression voltage ratings (SVR) for the device shall not exceed the following:

Models	240/120
L-N, L-G, N-G	400V
L-L, L-G	800V

6. ANSI/IEEE Cat C3 Let-Through Voltage. The let-through voltage based on IEEE C62.41 and C62.45 recommended procedures for Category C3 surges (20 kV, 10 kA) shall be less than:

Models	240/120
L-N	533V

7. ANSI/IEEE Cat. B3 Let-Through Voltage. Let-through voltage based on IEEE C62.41 and C62.45 recommended procedures for the ANSI/IEEE Cat. B3/C1 ringwave (6 kV, 5000 amps) shall be less than:

Models	240/120
L-N	437V

8. Surge Current Capacity. Total surge current per phase (based on an 8x20 microsecond waveform) that the device is capable of surviving shall not be less than value listed below for each piece of equipment.

SPD Exposure	Surge Current Capacity per Phase
Medium	200 KA

9. Withstand. Each unit must be capable of surviving the following without failure degradation (>10%):

a. Motor Control Centers and Distribution Panelboards. 20,000 ANSI/IEEE C62.41 Category C3 (20 kV, 10 kA).

b. Branch Circuit Panelboards. 5,000 ANSI/IEEE C62.41 Cat. C3 (20 kV, 10 kA).

10. Let-through voltage results shall be measured at the service entrance lugs.

C. SPD Design.

1. High Performance Suppression System. Include an engineered solid-state high performance suppression system metal oxide varistors. The suppression system shall not incorporate components which may degrade performance or long-term reliability of the suppression system. Suppression system shall reduce transient levels and provide protection for sensitive electronics susceptible to catastrophic or long-term damage.

2. Electrical Noise Filter. Include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be greater than or equal to 44 dB at 100 kHz using the MIL STD 220A insertion loss test method. The unit shall be complementary listed to UL 1283.

3. Internal Connections. No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be hardwired with connections utilizing low impedance copper conductors and compression fittings.

4. Remote Status Monitor. The SPD device shall include form C dry contacts (one NO and one NC) for remote annunciation of unit status. The remote alarm shall change state upon detection of a fault condition.

5. Thermal Protection. Each suppression MOV shall be provided with thermal detection circuit to protect from overheating due to thermal runaway.

6. Diagnostics. Provide unit with following diagnostic features:

   a. Audible alarm with silence, reset and test feature.

   b. Indicator lights per phase.

   c. System fault indicator (service indicator).

   d. Surge counter.

7. Disconnecting Means. Provide circuit breaker or disconnect for servicing of SPD unit.

D. FACTORY TESTING

E. Each unit shall be thoroughly factory tested before shipment. Testing of each unit shall include but shall not be limited to UL manufacturing and production-line tests, quality assurance checks, MCOV and clamping voltage verification tests. All tests shall be in accordance with the latest version of NEMA and UL standards.

PART 3 - E X E C U T I O N

3.1 INSTALLATION

A. Install SPDs in strict accordance with manufacturer’s instructions and the NEC.

B. All SPD’s shall be integrally installed inside the motor control panel at the fabricator’s factory.

END OF SECTION

SECTION 16410

ENCLOSED SAFETY SWITCHES

PART 1 - G E N E R A L

1.1 SUMMARY

Provide enclosed safety switches.

1.2 REFERENCE STANDARDS

A. ANSI/UL 98 - Enclosed and Dead-Front Switches.

B. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches.

1.3 SUBMITTALS

Provide product data on each type and rating of switch.

PART 2 - P R O D U C T S

2.1 MANUFACTURERS

Cutler-Hammer, General Electric Company, Hubbell, Klockner-Moeller, Square D Company, Siemens, Appleton, Crouse-Hinds, or O-Z/Gedney.

2.2 CHARACTERISTICS

A. Voltage. Provide switches with a voltage rating of 250 volts d-c, 240 volts or 600 volts a-c, as required for the installed system voltage.

B. Type. Provide switches conforming to NEMA KS 1 standard for Type HD (heavy duty).

C. Contacts. Provide switches with quick-make, quick-break contacts.

D. Poles. Unless otherwise shown, provide 3-pole, visible blade switches.

2.3 CONSTRUCTION

A. Enclosure. Provide NEMA 1 switch enclosures for indoor dry locations and NEMA 4X for outdoor locations unless otherwise shown.

B. Operating Handle. Provide a handle suitable for padlocking in the OFF position with as many as three padlocks of 5/16-inch diameter shank. Use a defeatable, front accessible, coin-proof door interlock to prevent opening the door when the switch is in the ON position and to prevent turning the switch ON when the door is open.

C. Terminal Shield. Provide incoming line terminals with an insulated shield so that no live parts are exposed when the door is open.

D. Neutral. Provide each switch with an isolated, fully rated neutral block. Make provisions for bonding the block to the enclosure.

E. Ground. Provide each switch with a ground lug.

F. Fuse Holders. Where fusible switches are shown, provide switches with rejection-type fuse holders which are suitable for use with fuses specified under Section 16490, Fuses - 600 Volt and Below.

G. Nameplates. Provide metal nameplates, front cover mounted, that indicates the switch type, catalog number and horsepower rating (with both standard and time delay fuses).

2.4 LISTING

UL 98 - Safety Standard for Enclosed Switches.

PART 3 - E X E C U T I O N

3.1 INSTALLATION

Install switches where indicated on drawings. In general, mount so that operating handle is approximately 44 inches above finished grade. Where grouped, align tops of switches.

END OF SECTION

SECTION 16415

AUTOMATIC TRANSFER SWITCHES

PART 1 - G E N E R A L

1.1 SUMMARY

This section includes the requirements for the provision and installation of service entrance rated automatic transfer switches.

1.2 REFERENCE STANDARDS

A. ANSI/UL 1008 - Automatic Transfer Switches.

B. NEMA ICS 2 447 - A C Automatic Transfer Panels.

1.3 SUBMITTALS

A. Requirements. Refer to Section 16050.

B. Information. Include the following information in submittal:

1. Rated current, voltage and frequency.
2. Number of poles.
3. Symmetrical rms amperes withstand current at 0.2 power factor and at rated voltage.
4. Physical dimensions.
5. NEMA enclosure type – NEMA 4X Type 304 stainless steel.
6. Itemized list of accessories.
7. Schematic diagram (show wiring and only those components which are part of switch).
8. Show all factory wiring on wiring diagram and clearly indicate all wiring and connections to remote devices which are to be made in the field. (Show only that wiring which pertains to switch and remote devices.)

PART 2 - P R O D U C T S

2.1 TYPE

A. Provide a service entrance rated automatic transfer switch which is electrically operated and mechanically held in each direction, and which is true double-throw with no intermediate position.

2.2 RATING

A. Ratings shall be as shown on the drawings with solid neutral.

2.3 OPERATION

A. General. The operating transfer time in either direction shall not exceed 10 cycles. Provide all accessories required to accomplish functions as follows.

B. Sensors.

1. Provide solid-state sensors to monitor all phases of the normal power source from line to line. The pickup voltage shall be adjustable from 85 percent to 100 percent of nominal, and the dropout voltage shall be adjustable from 75 percent to 98 percent of pickup value. Set sensors so that transfer to emergency will be initiated upon reduction of normal voltage to 80 percent of nominal and retransfer to normal will occur when normal voltage is restored to 90 percent of nominal.

2. Provide solid-state sensors to monitor all phases of the emergency power source from line to line. The pickup voltage shall be adjustable from 85 percent to 100 percent of nominal and factory set at 90 percent.

3. Provide solid-state sensors to monitor the frequency of the emergency power source. Set sensor pickup frequency at 90 percent of normal.

C. Time Delays.

1. Provide a time delay to override momentary normal source outages to delay all transfer switch and engine starting signals. The time delay shall be adjustable from 0.5 to 6 seconds and factory set at 3 second.

2. Provide retransfer to the normal source through a local contact actuated by a momentary pushbutton and remotely through Owner furnished contact. Either contact will initiate retransfer to normal source.

3. Provide a time delay on transfer to emergency. The time delay shall be adjustable from 0 to 5 minutes and factory set at 1 second.

D. Contacts.

1. Provide a contact that closes when normal source fails, rated 10 amperes, 32 volts d-c.

2. Provide a contact that opens when normal source fails, rated 10 amperes each, 32 volts d-c.

3. Provide an auxiliary contact that is closed when the transfer switch is connected to the normal source, rated 10 amperes, 480 volts a-c.

4. Provide an auxiliary contact that is closed when the transfer switch is connected to the emergency source, rated 10 amperes, 480 volts a-c.

E. Pilot Lights.

1. Use 10-watt, 230-volt, LED lamps operated at 115 volts.

2. Provide a green signal light to indicate when transfer switch is connected to the normal source.

3. Provide a red signal light to indicate when transfer switch is connected to the emergency source.

F. Test Switch. Provide a 2-position, momentary contact, spring return to normal test switch with nameplate ("NORMAL-TEST") to simulate normal source failure.

G. Open Transition: Provide open transition during transfer from emergency back to utility. Required for project with variable frequency drive equipment.

2.4 MAIN CONTACT PROTECTION

A. Protect main contacts by providing arc barriers on each contact.

2.5 ACCESSIBILITY

A. Provide a switch on which all parts may be inspected or replaced from the front of the switch without major disassembly, disconnection of power conductors, or removal of the switch from the enclosure.

2.6 PRODUCT DATA

A. Permanently attach wiring diagrams and maintenance instructions on the inside of enclosure door in a mounting designed to hold the data

2.7 LISTING

A. UL 1008 - Automatic Transfer Switches.

2.8 MANUFACTURER

A. Acceptable manufacturers.

1. ASCO
2. Owner Approved equal

PART 3 - E X E C U T I O N

3.1 INSTALLATION

Install the transfer switches as shown on the drawings. Install in accordance with manufacturer's instructions.

3.2 PAINTING

Repair any marred surfaces to factory finish.

3.3 TESTING

Test the switch with the packaged electric generator set in operating condition. Demonstrate to the Engineer that the automatic transfer switch performs all required functions.

END OF SECTION

SECTION 16425

MOTOR STARTERS - 600 VOLT AND BELOW

PART 1 - G E N E R A L

1.1 SUMMARY

Provide individual motor starters rated 600 volts and below.

1.2 QUALITY ASSURANCE

A. Reference Standards.

1. ANSI C19 - Industrial Control Apparatus.
2. NEMA ICS - Industrial Controls and Systems.
3. NFPA 70 - National Electrical Code (NEC).
4. UL 508 - Industrial Control Equipment.

B. Qualifications. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of 5 years. When requested, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.3 SUBMITTALS

Provide product data, including the following:

A. Ratings including:

1. Voltage.
2. Horsepower and/or continuous current.

B. Dimensioned outline drawings.

C. Conduit entry/exit locations.

D. Cable terminal sizes.

E. Wiring diagrams.

1.4 SPARES

Provide the greater of 10 percent or three spare fuses for each size and type fuse used in the installed equipment.

PART 2 - P R O D U C T S

2.1 MANUFACTURERS

Allen-Bradley, ABB, General Electric, Square D, Eaton, or Siemens.

2.2 MAGNETIC MOTOR STARTER

A. Type. Provide magnetic, full-voltage, nonreversing, across-the-line motor starters unless otherwise indicated. Where reversing starters are shown, provide factory assembled and wired unit with interlocked forward and reverse contactors. Include electrical interlock [and integral time delay transition] between FORWARD and REVERSE rotation. Starters shall be electrically and mechanically interlocked to prohibit both starters from being energized simultaneously.

B. Overload Relay - Solid State. Provide solid-state overload (SSOL) relay unless otherwise noted. The solid-state overload relay shall sense true-rms motor current in each phase leg and provide protection against motor overload, phase loss and phase imbalance. The relay shall include ground fault protection with start and run delays to prevent nuisance tripping during starting. The relay shall provide user-selectable overload characteristics that closely model the motor thermal overload characteristics. The relay shall provide user-selectable trip class of 10, 20 or 30. The settings, performance and operation of the solid-state overload relay shall not be affected by changes in relay ambient temperature.

C. Contactor. Size contactors according to NEMA standards or as shown. Provide main pole in each phase leg, the number and type of auxiliary contacts to perform the required functions, and two spare auxiliary contacts, one normally open and one normally closed. Use double break contacts of silver-cadmium oxide or similar material to minimize sticking or welding. Provide contactor coils suitable for continuous operation at 120 volts, 60 hertz.

D. Control Power Transformer.

1. Voltage. Provide in each enclosure a single-phase control power transformer with a 480-volt primary and a 120-volt secondary.
2. Fuses. Fuse both primary lines of the transformer and connect to Line 1 and Line 2. Fuse the secondary line leaving transformer terminal X1. Ground the line leaving terminal X2. Use rejection-type fuse clips and RK-1 type current limiting fuses on the primaries. Coordinate primary fuses with secondary fuse to clear a faulted transformer but not blow on magnetizing inrush current.
3. Size. Provide manufacturer's standard size transformer unless noted otherwise on the drawings.

D. Control Power.

1. Voltage. Provide control power circuit for each motor starter, or as indicated on drawings. Provide 120-volt AC circuit unless noted otherwise.
2. Fuses. Fuse each tap to line voltage for each separate control circuit, as indicated on the drawings. Taps or connection to neutral shall not be fused. Size fuses for the control circuit burden, so that fuses clear faulted components but do not open (blow) during normal circuit operation.

E. Enclosure. Provide a NEMA 1 enclosure unless otherwise indicated on drawings.

2.3 COMBINATION CIRCUIT BREAKER-STARTER

A. Type. Provide combination circuit breaker and magnetic motor starter as indicated on the drawings.

B. Motor Circuit Protector. Provide motor circuit protector (MCP) type circuit breaker with adjustable, instantaneous-only trip which is quick-make and quick-break on both manual and automatic operation. Provide a trip-free breaker which is trip indicating. Incorporate instantaneous characteristic by adjustable magnetic trip. Provide inverse time characteristic by separate thermal overload relay to trip motor starter. For 2-pole and 3-pole breakers, provide the common-trip type so that fault on one pole will trip all poles simultaneously.

B. Thermal-Magnetic Circuit Breaker. Where indicated on drawings, provide circuit breaker which is quick-make and quick-break on both manual and automatic operation. Provide a trip-free breaker which is trip indicating. Incorporate inverse time characteristic by bimetallic overload elements and instantaneous characteristic by magnetic

trip. For 2-pole and 3-pole breakers, provide the common-trip type so that an overload or fault on one pole will trip all poles simultaneously.

C. Operators. Provide switch operators mounted through the panel door and permitting operation of the switch with the door closed. Operators shall be capable of being padlocked in the OPEN or OFF position with as many as three padlocks of 5/16-inch diameter shank. Use a defeatable, front-accessible, coin-proof, mechanical, door interlock to prevent opening the door when the operator is in the CLOSED or ON position, and to prevent placing the operator in the CLOSED or ON position when the door is open.

D. Starter. Provide magnetic motor starter as specified in paragraph 2.2.

E. Enclosure. Provide a NEMA 4X enclosure unless otherwise indicated on drawings.

F. Control Devices. Provide control devices as specified in Article 2.4.

2.3 COMBINATION SWITCH-STARTER

A. Type. Provide combination disconnect switch and magnetic motor starter as indicated on the drawings.

B. Switch. Heavy-duty, quick-make and quick-break. Provide fused or unfused type as indicated on the drawings. Make provisions for padlocking in the open position.

C. Operators. Provide switch operators mounted through the panel door and permitting operation of the switch with the door closed. Operators shall be capable of being padlocked in the OPEN or OFF position with as many as three padlocks of 5/16-inch diameter shank. Use a defeatable, front-accessible, coin-proof, mechanical, door interlock to prevent opening the door when the operator is in the CLOSED or ON position, and to prevent placing the operator in the CLOSED or ON position when the door is open.

D. Fuse Clips. Provide rejection-type fuse clips.

E. Starter. Provide magnetic motor starter as specified in paragraph 2.2.

F. Enclosure. Provide a NEMA 4X enclosure unless otherwise indicated on drawings.

G. Control Devices. Provide control devices as specified in Article 2.4.

H. Fuses. Provide fuses conforming to Section 16490, Fuses - 600 Volt and below. Supply one spare set of fuses for each different type and size fuse installed.

2.4 CONTROL DEVICES

Provide the following control devices for each starter unless otherwise indicated on the drawings. Devices shall be mounted on front of enclosure.

A. Selector Switches. Heavy-duty, oil-tight, maintained contact, 3-position, with marked nameplate [HAND-OFF-AUTOMATIC], unless otherwise indicated.

B. Pushbuttons. Heavy-duty, oil-tight, momentary contact with marked nameplate [START-STOP], unless otherwise indicated.

C. Indicating Lights. Pilot light assemblies shall be heavy-duty, oil-tight, push-to-test, transformer-type, long-life, high-density light-emitting diode (LED) type. Incandescent or neon lamps are not acceptable. Provide red (running) and green (stopped) LED lamps with clear or matching color lenses. On two-speed starters, provide amber (low speed), red (high speed) and green (stopped) lenses.

C. Indicating Lights. Pilot light assemblies shall be heavy-duty, oil-tight transformer type with rated life of 20,000 hours. Neon lamps are not acceptable. Provide red (running) and green (stopped) lenses. On two-speed starters, provide amber (low speed), red (high speed) and green (stopped) lenses.

D. Elapsed Time Meter (ETM). Provide panel- or door-mounted, non-resettable, solid-state digital hour meter with LCD display, non-volatile memory, and internal lithium backup battery to display total running hours to the nearest tenth of an hour. Range: 99,999.9 hours. Digits: minimum 3/8-inch height. Case/enclosure: NEMA 4X, standard 2-inch diameter, unless noted otherwise.

2.5 MANUAL MOTOR STARTERS

Provide line voltage manual motor starters for single-phase motors as indicated on the drawings. Include bimetallic thermal overload protection in each ungrounded phase leg. Provide the toggle-operated starter in a NEMA 1 enclosure unless otherwise indicated.

2.6 FACTORY TESTING

A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of UL and NEMA standards.

1. All printed circuit boards shall be functionally tested via fault finder bench equipment prior to unit installation.
2. All main and auxiliary control functions shall be functionally tested following final assembly.
3. All final assemblies shall be load tested. Coordinate with submersible motor manufacturer for motor load test values.

B. Provide certified copies of manufacturer factory test reports.

PART 3 - E X E C U T I O N

3.1 INSTALLATION

Install units where indicated on the drawings. In general, mount combination units so that operating handle is approximately 44 inches above finished floor. On non-combination units, mount so that control device is approximately 44 inches above finished floor. Where grouped, align tops of units. Provide housekeeping pads for freestanding and floor-mounted units, as specified in Section 16050.

3.2 OVERLOAD SETTINGS

Set overload relays at maximum values permitted by NEC 430-32, based on actual installed motor nameplate full load amperes. Coordinate overload settings with NEC 460-9 requirements where power factor correction capacitors are provided.

3.3 FIELD QUALITY CONTROL

A. Provide the services of a qualified factory-trained manufacturer's representative to assist in installation and start-up of the equipment specified under this section. The manufacturer's representative shall provide technical direction and assistance in general assembly of the equipment, connections and adjustments, and testing of the assembly and components contained herein.

B. The following minimum work shall be performed under the technical direction of the manufacturer's service representative.

1. Inspection and final adjustments.

2. Operational and functional checks of controllers/starters and spare parts.

C. Provide copies of the manufacturer's field start-up report to the Architect/Engineer.

END OF SECTION

SECTION 16490

FUSES - 600 VOLT AND BELOW

PART 1 - G E N E R A L

1.1 SUMMARY

Provide low-voltage fuses rated 600 volts and below, 6000 amperes and below.

1.2 REFERENCE STANDARDS

A. ANSI/NEMA FU 1 - Low Voltage Cartridge Fuses.

B. ANSI/UL 198C - High-Interrupting-Capacity Fuses, Current-Limiting Type.

C. ANSI/UL 198D - Class K Fuses.

D. ANSI/UL 198E - Class R Fuses.

1.3 SUBMITTALS

Provide product data on fuses.

1.4 ATTIC STOCK

As spares, provide the greater amount of either three fuses or 10 percent of each size and type installed. Deliver the spare fuses to the Owner at the time of final acceptance of the project. Neatly encase the spare fuses in suitable containers or cabinets.

PART 2 - P R O D U C T S

2.1 MANUFACTURERS

Low voltage fuses shall be products of a single manufacturer. Acceptable manufacturers are Bussman, Gould (Shawmut) and Littelfuse.

2.2 VOLTAGE

Provide fuses with a voltage rating suitable for the nominal voltage of the system in which they are to be applied.

2.3 TYPES

A. Time Delay Fuses. Unless otherwise indicated, provide UL Class RK-5 time delay, current limiting fuses having 200,000 rms symmetrical amperes interrupting rating. Use on all 600-ampere or smaller circuits supplying individual motors and transformers, and where otherwise indicated.

B. Non-Time Delay Fuses. Fuses indicated by “K-1” on the drawings are UL Class RK-1 non-time delay having 200,000 rms symmetrical amperes interrupting rating. Use on all 600-ampere or smaller circuits supplying branch circuit panelboards, resistance heating and where otherwise indicated.

C. Class L Fuses. Fuses rated 601-6000 amperes are UL Class L with 200,000 rms symmetrical amperes interrupting rating.

PART 3 - E X E C U T I O N

3.1 INSTALLATION

A. Instructions. Follow the manufacturer's installation instructions.

B. Fuse Clips. Check fasteners on fuse clips for tightness when installing fuses.

C. Labels. Install fuses so label is in an upright, readable position. Fuses without labels are not acceptable.

END OF SECTION

SECTION 16510

LIGHTING FIXTURES

PART 1 - G E N E R A L

1.1 SUMMARY

Provide lighting fixtures, complete with lamps and other accessories.

1.2 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code (NEC).

1.3 SUBMITTALS

Provide product data on each lighting fixture, type of lamp and poles.

1.3 SUBMITTALS

Provide product data on each lighting fixture, type of lamp and poles.

PART 2 - P R O D U C T S

2.1 LUMINAIRES

A. Weatherproof fixtures must have neoprene gaskets on fixture trim and door assemblies. Fixture must be UL listed for wet locations.

B. Luminaire voltage indicated on the Plans is for reference. Contractor must verify actual voltage required based on the branch circuit.

C. Housing must be prefinished TGIC powder coat, 2.5 mils.

D. Reflector optical systems must be high reflectance prefinished sheet or fabricated construction with no hydroforming, and no spinning.

2.2 LAMPS

A. LED: LEDS must be high-flux/high-power type with rotor life of 50,000 hours minimum producing minimum of 70% of initial intensity at 50,000 hours of life. LEDs must be tested in accordance with IESNA LM-80 testing procedures. LEDs must have color of 3500-4000k with minimum CRI of 75. LED module must be of replaceable design.

2.3 DRIVERS

A. Drivers for LED Lamps. Electronic drivers must be suitable for use with 120V, 208V and 240V (nominal) single and three-phase service. Driver module must be readily accessible and replaceable for maintenance and have fins or other provisions to adequately radiate excess heat. Driver must be UL listed.

2.4 LIGHTING POLES

A. Poles shall have a minimum wind rating 110 mph with a 1.3 gust factor.

B. Unless otherwise noted, poles must be round straight aluminum, thickness not less than 12 gauge with a 2.5 mil powder coat finish.

2.5 MANUFACTURER

A. Luminaire and pole. Refer to drawings.

PART 3 - E X E C U T I O N

3.1 COORDINATION

A. Install lighting fixtures in accordance with manufacturer's written instructions, NEC and NECA. Before placing order, verify the lighting fixtures are compatible with specified ceiling systems as indicated on the drawings. Regardless of the catalog number prefixes and suffixes shown, furnish fixtures with the proper trim, frame, support, hangers, ballasts, voltage rating, and other miscellaneous appurtenances to properly coordinate with building conditions. If a fixture type designation is omitted, furnish fixture of the same type as shown for rooms of similar usage. Confirm with Engineer.

3.2 INSTALLATION

A. Fixtures must be completely wired and lamps installed. Lighting fixtures must be operating properly at final completion.

B. Provide hangers and support members for fixtures as required for proper installation. Provide appurtenances which include stud supports, stems, mounting brackets, frames and plaster rings.

C. Support fixtures from the building structure or from furring channels. Furring channels must be a minimum size of 1-1/2 inches. Fixtures in suspended ceilings shall be supported in accordance with NEC 410-16.

D. Flexible metal conduit from junction box to lighting fixture shall not touch the ceiling as finally installed.

E. Provide foundations for all fixtures requiring such. Poles shall be set plumb.

END OF SECTION

02000 PLANS, DETAILS AND NOTES

If applicable, insert reference(s) to project plans; details; and notes

1. Construction Plans
2. Geotechnical Report

CITY OF ROUND ROCK

FOREST CREEK LIFT STATION REHABILITATION

NOVEMBER 2016
ISSUED FOR BID

SHEET INDEX

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20. E-501 ELECTRICAL DETAILS
21. E-502 ELECTRICAL DETAILS
22. E-503 ELECTRICAL DETAILS
23. E-601 ELECTRICAL ONE-LINE DIAGRAM
24. E-602 ELECTRICAL SCHEDULES
25. E-603 ELECTRICAL CONTROL SCHEMATIC

PROJECT INFORMATION

PROJECT LOCATION

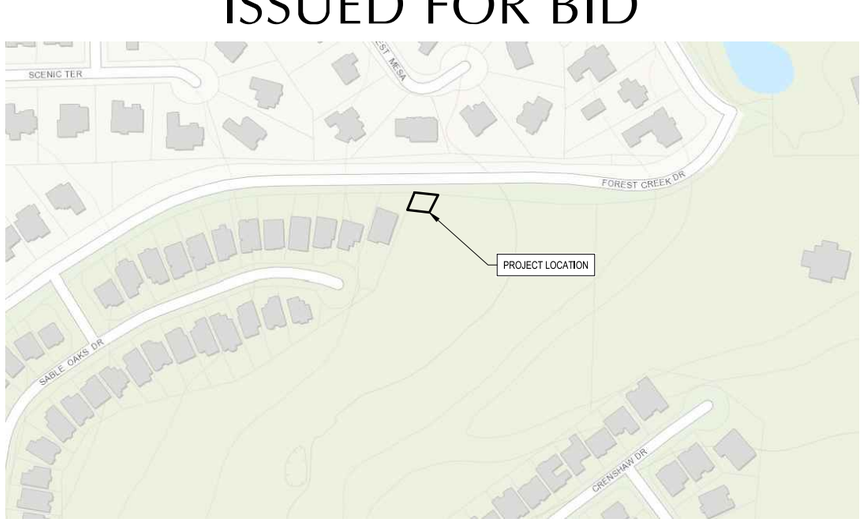
3839 FOREST CREEK BLVD.
ROUND ROCK, TEXAS

OWNER

CITY OF ROUND ROCK
UTILITIES AND ENVIRONMENTAL SERVICES
2008 ENTERPRISE DRIVE
ROUND ROCK, TEXAS 78664

CONTACT

EDDIE ZAPATA
CITY OF ROUND ROCK
UTILITIES AND ENVIRONMENTAL SERVICES
2008 ENTERPRISE DRIVE
ROUND ROCK, TEXAS 78664
(512) 218-6605



VICINITY MAP
SCALE: NTS

Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY
TBPE REGISTRATION #F-2614
8911 N. CAPITAL OF TEXAS HWY
BUILDING 2, SUITE 2300
AUSTIN, TEXAS 78759
(512) 338-4212

ALL RESPONSIBILITY FOR THE ADEQUACY OF THESE PLANS REMAINS WITH THE ENGINEER WHO PREPARED THEM. IN ACCEPTING THESE PLANS THE CITY OF ROUND ROCK MUST RELY UPON THE ADEQUACY OF THE WORK OF THE DESIGN ENGINEER.

SUBMITTED FOR APPROVAL BY:

11-18-16

DANIEL E. DOW, P.E.
ENGINEER OF RECORD
DATE

ACCEPTED FOR CONSTRUCTION BY:

11-21-16

CITY OF ROUND ROCK, TEXAS
UTILITIES AND ENVIRONMENTAL SERVICES DEPARTMENT
DATE

STATE OF TEXAS
GASPAR D. GARCIA
104970
LICENSED
PROFESSIONAL ENGINEER
11/18/2016
Lockwood, Andrews & Newnam, Inc.
Texas Registered Engineering Firm F-2614

STATE OF TEXAS
JENNIFER N. SAVAGE
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STATE OF TEXAS
DANIEL E. DOW
119652
LICENSED
PROFESSIONAL ENGINEER
11-18-16
Lockwood, Andrews & Newnam, Inc.
Texas Registered Engineering Firm F-2614

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GENERAL NOTES:

1. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE CITY OF ROUND ROCK STANDARD SPECIFICATIONS MANUAL.
2. ANY EXISTING UTILITIES, PAVEMENT, CURBS, SIDEWALKS, STRUCTURES, TREES, ETC., NOT PLANNED FOR DESTRUCTION OR REMOVAL THAT ARE DAMAGED OR REMOVED SHALL BE REPAIRED OR REPLACED AT HIS EXPENSE.
3. THE CONTRACTOR SHALL VERIFY ALL DEPTHS AND LOCATIONS OF EXISTING UTILITIES PRIOR TO ANY CONSTRUCTION. ANY DISCREPANCIES WITH THE CONSTRUCTION PLANS FOUND IN THE FIELD SHALL BE BROUGHT IMMEDIATELY TO THE ATTENTION OF THE ENGINEER WHO SHALL BE RESPONSIBLE FOR REVISING THE PLANS AS APPROPRIATE.
4. MANHOLE FRAMES, COVERS, VALVES, CLEANOUTS, ETC. SHALL BE RAISED TO FINISHED GRADE PRIOR TO FINAL PAVING CONSTRUCTION.
5. THE CONTRACTOR SHALL GIVE THE CITY OF ROUND ROCK 48 HOURS NOTICE BEFORE BEGINNING EACH PHASE OF CONSTRUCTION. TELEPHONE 512-844-2682.
6. ALL AREAS DISTURBED OR EXPOSED DURING CONSTRUCTION SHALL BE REVEGETATED IN ACCORDANCE WITH THE PLANS AND SPECIFICATIONS. REVEGETATION OF ALL DISTURBED OR EXPOSED AREAS SHALL CONSIST OF SODDING OR SEEDING, AT THE CONTRACTOR'S OPTION. HOWEVER, THE TYPE OF REVEGETATION MUST EQUAL OR EXCEED THE TYPE OF VEGETATION PRESENT BEFORE CONSTRUCTION.
7. PRIOR TO ANY CONSTRUCTION, THE ENGINEER SHALL CONVENE A PRECONSTRUCTION CONFERENCE BETWEEN THE CITY OF ROUND ROCK, HIMSELF, THE CONTRACTOR, OTHER UTILITY COMPANIES, ANY AFFECTED PARTIES AND ANY OTHER ENTITY THE CITY OR ENGINEER MAY REQUIRE.
8. THE CONTRACTOR AND THE ENGINEER SHALL KEEP ACCURATE RECORDS OF ALL CONSTRUCTION THAT DEVIATES FROM THE PLANS. THE ENGINEER SHALL FURNISH THE CITY OF ROUND ROCK ACCURATE "AS-BUILT" DRAWINGS FOLLOWING COMPLETION OF ALL CONSTRUCTION. THESE "ASBUILT"DRAWINGS SHALL MEET WITH THE SATISFACTION OF THE ENGINEERING AND DEVELOPMENT SERVICES DEPARTMENT PRIOR TO FINAL ACCEPTANCE.
9. THE ROUND ROCK CITY COUNCIL SHALL NOT BE PETITIONED FOR ACCEPTANCE UNTIL ALL NECESSARY EASEMENT DOCUMENTS HAVE BEEN SIGNED AND RECORDED.
10. WHEN CONSTRUCTION IS BEING CARRIED OUT WITHIN EASEMENTS, THE CONTRACTOR SHALL CONFINE HIS WORK TO WITHIN THE PERMANENT AND ANY TEMPORARY EASEMENTS. PRIOR TO FINAL ACCEPTANCE, THE CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVING ALL TRASH AND DEBRIS WITHIN THE PERMANENT AND TEMPORARY EASEMENTS. CLEAN-UP SHALL BE TO THE SATISFACTION OF THE CITY ENGINEER.
11. PRIOR TO ANY CONSTRUCTION, THE CONTRACTOR SHALL APPLY FOR AND SECURE ALL PROPER PERMITS FROM THE APPROPRIATE AUTHORITIES.
12. AVAILABLE BENCHMARKS (CITY OF ROUND ROCK DATUM) THAT MAY BE UTILIZED FOR THE CONSTRUCTION OF THIS PROJECT ARE DESCRIBED AS FOLLOWS:

TRENCH SAFETY NOTES:

1. IN ACCORDANCE WITH THE LAWS OF THE STATE OF TEXAS AND THE U. S. OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION REGULATIONS, ALL TRENCHES OVER 5 FEET IN DEPTH IN EITHER HARD AND COMPACT OR SOFT AND UNSTABLE SOIL SHALL BE SLOPED, SHORED, SHEETED, BRACED OR OTHERWISE SUPPORTED. FURTHERMORE, ALL TRENCHES LESS THAN 5 FEET IN DEPTH SHALL ALSO BE EFFECTIVELY PROTECTED WHEN HAZARDOUS GROUND MOVEMENT MAY BE EXPECTED. TRENCH SAFETY SYSTEMS TO BE UTILIZED FOR THIS PROJECT WILL BE DESIGNED/ PROVIDED BY THE CONTRACTOR.
2. IN ACCORDANCE WITH THE U. S. OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION REGULATIONS, WHEN PERSONS ARE IN TRENCHES 4-FEET DEEP OR MORE, ADEQUATE MEANS OF EXIT, SUCH AS A LADDER OR STEPS, MUST BE PROVIDED AND LOCATED SO AS TO REQUIRE NO MORE THAN 25 FEET OF LATERAL TRAVEL.
3. IF TRENCH SAFETY SYSTEM DETAILS WERE NOT PROVIDED IN THE PLANS BECAUSE TRENCHES WERE ANTICIPATED TO BE LESS THAN 5 FEET IN DEPTH AND DURING CONSTRUCTION IT IS FOUND THAT TRENCHES ARE IN FACT 5 FEET OR MORE IN DEPTH OR TRENCHES LESS THAN 5 FEET IN DEPTH ARE IN AN AREA WHERE HAZARDOUS GROUND MOVEMENT IS EXPECTED, ALL CONSTRUCTION SHALL CEASE, THE TRENCHED AREA SHALL BE BARRICADED AND THE ENGINEER NOTIFIED IMMEDIATELY. CONSTRUCTION SHALL NOT RESUME UNTIL APPROPRIATE TRENCH SAFETY SYSTEM DETAILS, AS DESIGNED BY A PROFESSIONAL ENGINEER, ARE RETAINED AND COPIES SUBMITTED TO THE CITY OF ROUND ROCK.

WATER AND WASTEWATER NOTES:

1. PIPE MATERIAL FOR WATER MAINS SHALL BE PVC (AWWA C-900, MIN. CLASS 200), OR DUCTILE IRON (AWWA C-100, MIN. CLASS 200). WATER SERVICES (2" OR LESS) SHALL BE POLYETHYLENE TUBING (BLACK, 200 PSI, DR 9).
2. PIPE MATERIAL FOR PRESSURE WASTEWATER MAINS SHALL BE PVC (AWWA C-900, MIN. CLASS 150), OR DUCTILE IRON (AWWA C-100, MIN. CLASS 200). PIPE MATERIAL FOR GRAVITY WASTEWATER MAINS SHALL BE PVC (ASTM D2241 OR D3034, MAX. DR-26), DUCTILE IRON (AWWA C-100, MIN. CLASS 200).
3. UNLESS OTHERWISE ACCEPTED BY THE CITY ENGINEER, DEPTH OF COVER FOR ALL LINES OUT OF THE PAVEMENT SHALL BE 42" MIN., AND DEPTH OF COVER FOR ALL LINES UNDER PAVEMENT SHALL BE A MIN. OF 30" BELOW SUBGRADE.
4. ALL FIRE HYDRANT LEADS SHALL BE DUCTILE IRON PIPE (AWWA C-100, MIN. CLASS 200).
5. ALL IRON PIPE AND FITTINGS SHALL BE WRAPPED WITH MINIMUM 8-MIL POLYETHYLENE AND SEALED WITH DUCT TAPE OR EQUAL ACCEPTED BY THE CITY ENGINEER.
6. THE CONTRACTOR SHALL CONTACT THE CITY INSPECTOR AT 512-844-2682 TO COORDINATE UTILITY TIE-INS AND NOTIFY HIM AT LEAST 48 HOURS PRIOR TO CONNECTING TO EXISTING LINES.
7. ALL MANHOLES SHALL BE CONCRETE WITH CAST IRON RING AND COVER. ALL MANHOLES LOCATED OUTSIDE OF THE PAVEMENT SHALL HAVE BOLTED COVERS. TAPPING OF FIBERGLASS MANHOLES SHALL NOT BE ALLOWED.
8. THE CONTRACTOR MUST OBTAIN A BULK WATER PERMIT OR PURCHASE AND INSTALL A WATER METER FOR ALL WATER USED DURING CONSTRUCTION. A COPY OF THIS PERMIT MUST BE CARRIED AT ALL TIMES BY ALL WHO USE WATER.
9. LINE FLUSHING OR ANY ACTIVITY USING A LARGE QUANTITY OF WATER MUST BE SCHEDULED WITH THE WATER & WASTEWATER SUPERINTENDENT, TELEPHONE 512-218-5555.
10. THE CONTRACTOR, AT HIS EXPENSE, SHALL PERFORM STERILIZATION OF ALL POTABLE WATER LINES CONSTRUCTED AND SHALL PROVIDE ALL EQUIPMENT (INCLUDING TEST GAUGES), SUPPLIES (INCLUDING CONCENTRATED CHLORINE DISINFECTING MATERIAL), AND NECESSARY LABOR REQUIRED FOR THE STERILIZATION PROCEDURE. THE STERILIZATION PROCEDURE SHALL BE MONITORED BY CITY OF ROUND ROCK PERSONNEL. WATER SAMPLES WILL BE COLLECTED BY THE CITY OF ROUND ROCK TO VERIFY EACH TREATED LINE HAS ATTAINED AN INITIAL CHLORINE CONCENTRATION OF 50 PPM. WHERE MEANS OF FLUSHING IS NECESSARY, THE CONTRACTOR, AT HIS EXPENSE, SHALL PROVIDE FLUSHING DEVICES AND REMOVE SAID DEVICES PRIOR TO FINAL ACCEPTANCE BY THE CITY OF ROUND ROCK.

WATER AND WASTEWATER NOTES (CONTINUED):

11. SAMPLING TAPS SHALL BE BROUGHT UP TO 3 FEET ABOVE GRADE AND SHALL BE EASILY ACCESSIBLE FOR CITY PERSONNEL. AT THE CONTRACTOR'S REQUEST, AND IN HIS PRESENCE, SAMPLES FOR BACTERIOLOGICAL TESTING WILL BE COLLECTED BY THE CITY OF ROUND ROCK NOT LESS THAN 24 HOURS AFTER THE TREATED LINE HAS BEEN FLUSHED OF THE CONCENTRATED CHLORINE SOLUTION AND CHARGED WITH WATER APPROVED BY THE CITY. THE CONTRACTOR SHALL SUPPLY A CHECK OR MONEY ORDER, PAYABLE TO THE CITY OF ROUND ROCK, TO COVER THE FEE CHARGED FOR TESTING EACH WATER SAMPLE. CITY OF ROUND ROCK FEE AMOUNTS MAY BE OBTAINED BY CALLING THE ENGINEERING AND DEVELOPMENT SERVICES DEPARTMENT AT 218-5555.
12. THE CONTRACTOR, AT HIS EXPENSE, SHALL PERFORM QUALITY TESTING FOR ALL WASTEWATER PIPE INSTALLED AND PRESSURE PIPE HYDROSTATIC TESTING OF ALL WATER LINES CONSTRUCTED AND SHALL PROVIDE ALL EQUIPMENT (INCLUDING PUMPS AND GAUGES), SUPPLIES AND LABOR NECESSARY TO PERFORM THE TESTS. QUALITY AND PRESSURE TESTING SHALL BE MONITORED BY CITY OF ROUND ROCK PERSONNEL.
13. THE CONTRACTOR SHALL COORDINATE TESTING WITH THE CITY OF INSPECTOR AND PROVIDE NO LESS THAN 24 HOURS NOTICE PRIOR TO PERFORMING STERILIZATION, QUALITY TESTING OR PRESSURE TESTING.
14. THE CONTRACTOR SHALL NOT OPEN OR CLOSE ANY EXISTING SYSTEM VALVES UNLESS AUTHORIZED BY THE CITY OF ROUND ROCK.
15. ALL VALVE BOXES AND COVERS SHALL BE CAST IRON.
16. ALL WATER SERVICE, WASTEWATER SERVICE AND VALVE LOCATIONS SHALL BE APPROPRIATELY MARKED AS FOLLOWS:

    WATER SERVICE "W" ON TOP OF CURB
    WASTEWATER SERVICE "S" ON TOP OF CURB
    VALVE "V" ON FACE OF CURB

    TOOLS FOR MARKING THE CURB SHALL BE PROVIDED BY THE CONTRACTOR. OTHER APPROPRIATE MEANS OF MARKING SERVICE AND VALVE LOCATIONS SHALL BE PROVIDED IN AREAS WITHOUT CURBS. SUCH MEANS OF MARKING SHALL BE AS SPECIFIED BY THE ENGINEER AND ACCEPTED BY THE CITY OF ROUND ROCK.
17. CONTACT CITY OF ROUND ROCK UTILITIES AND ENVIRONMENTAL SERVICES DEPARTMENT AT 512-218-5555 FOR ASSISTANCE IN OBTAINING EXISTING WATER AND WASTEWATER LOCATIONS.
18. THE CITY OF ROUND ROCK FIRE DEPARTMENT SHALL BE NOTIFIED 48 HOURS PRIOR TO TESTING OF ANY BUILDING SPRINKLER PIPING IN ORDER THAT THE FIRE DEPARTMENT MAY MONITOR SUCH TESTING.
19. SAND, AS DESCRIBED IN SPECIFICATION ITEM 510 PIPE, SHALL NOT BE USED AS BEDDING FOR WATER AND WASTEWATER LINES. ACCEPTABLE BEDDING MATERIALS ARE PIPE BEDDING STONE, PEA GRAVEL AND IN LIEU OF SAND, A NATURALLY OCCURRING OR MANUFACTURED STONE MATERIAL CONFORMING TO ASTM C33 FOR STONE QUALITY AND MEETING THE FOLLOWING GRADATION SPECIFICATION:

SIEVE SIZE	PERCENT RETAINED BY WEIGHT
1/2"	0
3/8"	0-2
#4	40-85
#10	95-100

20. THE CONTRACTOR IS HEREBY NOTIFIED THAT CONNECTING TO, SHUTTING DOWN, OR TERMINATING EXISTING UTILITY LINES MAY HAVE TO OCCUR AT OFF-PEAK HOURS. SUCH HOURS ARE USUALLY OUTSIDE NORMAL WORKING HOURS AND POSSIBLY BETWEEN 12 A.M. AND 6 A.M.
21. ALL WASTEWATER CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY (TCEQ) REGULATIONS, 30 TAC CHAPTER 213, 217, AND 317, AS APPLICABLE. WHENEVER TCEQ AND CITY OF ROUND ROCK SPECIFICATIONS CONFLICT, THE MORE STRINGENT SHALL APPLY.

TRAFFIC MARKING NOTES:

1. ANY METHODS, STREET MARKINGS AND SIGNAGE NECESSARY FOR WARNING MOTORISTS, WARNING PEDESTRIANS OR DIVERTING TRAFFIC DURING CONSTRUCTION SHALL CONFORM TO THE TEXAS MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS, LATEST EDITION.
2. ALL PAVEMENT MARKINGS, MARKERS, PAINT, TRAFFIC BUTTONS, TRAFFIC CONTROLS AND SIGNS SHALL BE INSTALLED IN ACCORDANCE WITH THE TEXAS DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR CONSTRUCTION OF HIGHWAYS, STREETS AND BRIDGES AND, THE TEXAS MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS, LATEST EDITIONS.

EROSION AND SEDIMENTATION CONTROL NOTES:

1. EROSION CONTROL MEASURES, SITE WORK AND RESTORATION WORK SHALL BE IN ACCORDANCE WITH THE CITY OF ROUND ROCK EROSION AND SEDIMENTATION CONTROL ORDINANCE.
2. ALL SLOPES SHALL BE SODDED OR SEEDED WITH APPROVED GRASS, GRASS MIXTURES OR GROUND COVER SUITABLE TO THE AREA AND SEASON IN WHICH THEY ARE APPLIED.
3. SILT FENCES, ROCK BERMS, SEDIMENTATION BASINS AND SIMILARLY RECOGNIZED TECHNIQUES AND MATERIALS SHALL BE EMPLOYED DURING CONSTRUCTION TO PREVENT POINT SOURCE SEDIMENTATION LOADING OF DOWNSTREAM FACILITIES. SUCH INSTALLATION SHALL BE REGULARLY INSPECTED BY THE CITY OF ROUND ROCK FOR EFFECTIVENESS. ADDITIONAL MEASURES MAY BE REQUIRED IF, IN THE OPINION OF THE CITY ENGINEER, THEY ARE WARRANTED.
4. ALL TEMPORARY EROSION CONTROL MEASURES SHALL NOT BE REMOVED UNTIL FINAL INSPECTION AND APPROVAL OF THE PROJECT BY THE ENGINEER. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO MAINTAIN ALL TEMPORARY EROSION CONTROL STRUCTURES AND TO REMOVE EACH STRUCTURE AS APPROVED BY THE ENGINEER.
5. ALL MUD, DIRT, ROCKS, DEBRIS, ETC., SPILLED, TRACKED OR OTHERWISE DEPOSITED ON EXISTING PAVED STREETS, DRIVES AND AREAS USED BY THE PUBLIC SHALL BE CLEANED UP IMMEDIATELY.

Forest Creek Lift Station Rehabilitation
Round Rock, TX

ROUND ROCK TEXAS

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A LEO A DALY COMPANY
8911 N. Capital of Texas Hwy
Building 2, Suite 2300
Austin, TX 78759
Tel 512-338-4212
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KEY PLAN

REVISIONS

NO.	DESCRIPTION	DATE

FILE LOG

ACTIVITY	BY
Manager	RDO
Design	WCC
Draw	JDV
Check	RDO

STAMP

11-18-16

STATE OF TEXAS
DANIEL E. DOW
119652
LICENSED
PROFESSIONAL ENGINEER

Lockwood, Andrews & Newnam, Inc.
Texas Registered Engineering Firm F-2614

Project No. 160-10727-001
Date: November 2016

GENERAL NOTES

G-003

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Texas Commission on Environmental Quality
Lift Stations and Force Mains
General Construction Notes

1. This lift station and/or force main must be designed and constructed in accordance with the Texas Commission on Environmental Quality's (TCEQ) Edwards Aquifer Rules 30 Texas Administrative Code (TAC) §213.5(c) the Design Criteria for Domestic Wastewater Systems 30 TAC Chapter 217, and the City of Round Rock Standard Specifications.

2. Any modification to the activities described in the referenced Lift Station/Force Main System application following the date of approval may require the submittal of a Lift Station/Force Main System application to modify this approval, including the payment of appropriate fees and all information necessary for its review and approval.

3. Prior to commencing any regulated activity, the applicant or his agent must notify the Austin Regional Office, in writing, of the date on which the regulated activity will begin.

4. Upon completion of the wet well excavation, a geologist, supplied by the City, must certify that the excavation has been inspected for the presence of sensitive features and the certification must be submitted to the appropriate regional office. Further activities may not proceed until the executive director has reviewed and approved the methods proposed to protect any sensitive feature and the Edwards Aquifer from potentially adverse impacts to water quality from the lift station. Construction may continue if the geologist certifies that no sensitive feature or features are present.

5. If any sensitive features are discovered during the wastewater line trenching activities, all regulated activities near the sensitive feature must be suspended immediately. The applicant must immediately notify the appropriate regional office of the Texas Commission on Environmental Quality of the feature discovery. A geologist's assessment of the location and extent of the feature discovered must be reported to that regional office in writing within two working days. The applicant must submit a plan for ensuring the structural integrity of the sewer line or for modifying the proposed collection system alignment around the feature.The regulated activities near the sensitive feature may not proceed until the executive director has reviewed and approved the methods proposed to protect the sensitive feature and the Edwards Aquifer from any potentially adverse impacts to water quality while maintaining the structural integrity of the line.

6. Lift stations shall be designed to withstand and operate during a 100-year flood event and shall be accessible during a 25-year flood. All lift stations shall be intruder-resistant with a controlled access.

7. Dry well sump pumps:
   (a) A dry well must use dual sump pumps, each with a minimum capacity of 1,000 gallons per hour and capable of handling the volume of liquid generated during peak operations.
   (b) A pump must have a submersible motor and watertight wiring.
   (c) A dry well floor must slope toward a sump sized for proper drainage.
   (d) The minimum sump depth is 6.0 inches and must prevent standing water on a dry well floor under normal operation.
   (e) A sump pump must operate automatically by use of a float switch or other level-detecting device.
   (f) A sump pump must use separate pipes capable of discharging more than the maximum liquid level of an associated wet well.
   (g) A sump pump outlet pipe must be at least 1.5 inches in diameter and have at least two check valves in series.

8. Pump Controls.
   (a) A lift station pump must operate automatically, based on the water level in a wet well.
   (b) The location of a wet well level mechanism must ensure that the mechanism is unaffected by currents, rags, grease, or other floating materials.
   (c) A level mechanism must be accessible without entering the wet well.
   (d) Wet well controls with a bubbler system require dual air supply and dual controls.
   (e) Motor control centers must be mounted at least 4.0 inches above grade to prevent water intrusion and corrosion from standing water in the enclosure.
   (f) Electrical equipment and electrical connections in a wet well or a dry well must meet National Fire Prevention Association70 National Electric Code explosion prevention requirements, unless continuous ventilation is provided.

9. Wet wells.
   (a) A wet well must be enclosed by watertight and gas tight walls.
   (b) A penetration through a wall of a wet well must be gas tight.
   (c) A wet well must not contain equipment requiring regular or routine inspection or maintenance, unless inspection and maintenance can be done without staff entering the wet well.
   (d) A gravity pipe discharging to a wet well must be located so that the invert elevation is above the liquid level of a pump's "on" setting.
   (e) Gate valves and check valves are prohibited in a wet well.
   (f) Gate valves and check valves may be located in a valve vault next to a wet well or in a dry well.
   (g) Pump cycle time, based on peak flow, must equal or exceed those in the following table:

Pump Horsepower	Minimum Cycle Times (minutes)
< 50	6
50-100	10
> 100	15

   (h) An evaluation of minimum wet well volume requires the following formula:

$$V = \frac{TxQ}{4x7.48}$$

   Where:
   V = Active volume (cubic feet)
   Q = Pump capacity (gallons per minute)
   T = Cycle time (minutes)
   7.48 = Conversion factor (gallons/cubic foot)

10. Wet Well Slopes.
   (a) A wet well floor must have a smooth finish and minimum slope of 10% to a pump intake.
   (b) A wet well design must prevent deposition of solids under normal operating conditions.
   (c) A lift station with greater than 5.0 million gallons per day firm pumping capacity must have anti-vortex baffling.

11. Dry well access.
   (a) An underground dry well must be accessible.
   (b) A stairway in a dry well must use non-slip steps and conform to Occupational Safety and Health Administration regulations with respect to rise and run.
   (c) A ladder in a dry well must made of non-conductive material and rated for the load necessary for staff and equipment to descend and ascend.

12. Ventilation shall be provided for lift stations, including both wet and dry wells.

13. Hoisting Equipment. A lift station must have permanent hoisting equipment or be accessible to portable hoisting equipment for removal of pumps, motors, valves, pipes, and other similar equipment.

14. A floor drain from a valve vault to a wet well must prevent gas from entering a valve vault by including flap valves, "P" traps, submerged outlets, or a combination of these devices.

15. Pumps.
   (a) General Requirements. A raw wastewater pump, with the exception of a grinder pump, must:
      (1) be designed to prevent clogging;
      (2) be capable of passing a sphere of 2.5 inches in diameter or greater; and
      (3) have greater than 3.0 inch diameter suction and discharge openings.
   (b) Submersible and Non-submersible Pumps.
      (1) A non-submersible pump must have inspection and cleanout plates on both the suction and discharge sides of each pumping unit that facilitate locating and removing blockage-causing materials, unless the pump design accommodates easy removal of the rotation elements.
      (2) A pump support must prevent movement and vibration during operation.
      (3) A submersible pump must use a rail-type pump support system with manufacturer-approved mechanisms designed to allow personnel to remove and replace any single pump without entering or dewatering the wet well.
      (4) Submersible pump rails and lifting chains must be constructed of a material that performs to at least the standard of Series 300 stainless steel.
   (c) Lift Station Pumping Capacity. The firm pumping capacity of a lift station must handle the expected peak flow.
   (d) Pump Head Calculations.
      (1) An owner shall select a pump based upon analysis of the system head and pump capacity curves that determine the pumping capacities alone and with other pumps as the total dynamic-head increases due to additional flows pumped through a force main.
      (2) The pipe head loss calculations, using the Hydraulic Institute Standards, pertaining to head losses through pipes, valves, and fittings, must be included in the report.
      (3) The selected friction coefficient (Hazen-Williams "C" value) used in friction head loss calculations must be based on the pipe material selected.
      (4) For a lift station with more than two pumps, a force main in excess of one-half mile, or firm pumping capacity of 100 gallons per minute or greater, system curves must be provided for both the normal and peak operating conditions at C values for proposed and existing pipe.
   (e) Flow Control.
      (1) A lift station or a transfer pumping station located at or discharging directly to a wastewater treatment system must have a peak pump capacity equal to or less than the peak design flow, unless equalization is provided.
      (2) A wastewater treatment system with a peak flow that is greater than 300,000 gallon per day must use three or more pumps, unless duplex, automatically controlled, variable capacity pumps are provided.
   (f) Self-Priming Pumps.
      (1) A self-priming pump must be capable of priming without reliance upon a separate priming system, an internal flap valve, or any external means for priming.
      (2) A self-priming pump must use a suction pipe velocity at least 3.0 feet per second but not more than 7.0 feet per second, and must incorporate its own suction pipe.
      (3) A self-priming pump must vent air back into the wet well during priming.
   (g) Vacuum-Priming Pumps.
      (1) A vacuum-primed pump must be capable of priming by using a separate positive priming system with a dedicated vacuum pump for each main wastewater pump.
      (2) A vacuum-priming pump must use a suction pipe velocity at least 3.0 feet per second but less than 7.0 feet per second and must have its own suction pipe.
   (h) Vertical Positioning of Pumps. A raw wastewater pump must have positive static suction head during normal on-off cycling, except a submersible pump with "no suction" pipes, a vacuum-primed pump, or a self-priming unit capable of satisfactory operation under any negative suction head anticipated for the lift station.
   (i) Individual Grinder Pumps. A grinder pump serving only one residential or commercial structure that is privately owned,maintained, and operated is not subject to the rules of this chapter.
   (j) Pump for Low-Flow Lift Station. A pump used for a lift station with a peak flow of less than 120 gallons per minute must be submersible and include a grinder.

16. Piping
   (a) Horizontal Pump Suctions.
      (1) Each pump must have a separate suction pipe that uses an eccentric reducer.
      (2) Pipes in a wet well must have a turndown type flared intake.
   (b) Valves.
      (1) The discharge side of each pump followed by a full-closing isolation valve must also have a check valve.
         (A) A check valve must be a swing type valve with an external lever.
         (B) A valve must include a position indicator to show its open and closed positions, unless a full-closing valve is a rising-stem gate valve.
      (2) A grinder pump installation may use a rubber-ball check valve or a swing-type check valve.
      (3) A butterfly valve, tilting-disc check valve, or any other valve using a tilting-disc in a flow pipe is prohibited.
   (c) Pipes.
      (1) A lift station pipe must have flanged or flexible connections to allow for removal of pumps and valves without interruption of the lift station operations.
      (2) Wall penetrations must allow for pipe flexure while excluding exfiltration or infiltration.
      (3) Pipe suction velocities must be at least 3.0 feet per second but not more than 7.0 feet per second .

17. Emergency Provisions for Lift Stations.
   (a) A collection system lift station must be equipped with a tested quick-connect mechanism or a transfer switch properly sized to connect to a portable generator, if not equipped with an onsite generator.
   (b) Lift stations must include an audiovisual alarm system and the system must transmit all alarm conditions through use of an auto-dialer system, Supervisory Control and Data Acquisition system, or telemetering system connected to a continuously monitored location.
   (c) An alarm system must self-activate for a power outage, pump failure, or a high wet well water level.
   (d) A lift station constructed to pump raw wastewater must have service reliability based on:
      (1) Retention Capacity.
         (A) The retention capacity in a lift station's wet well and incoming gravity pipes must prevent discharges of untreated wastewater at the lift station or any point upstream for a period of time equal to the longest electrical outage recorded during the past 24 months, but not less than 20 minutes.
         (B) For calculation purposes, the outage period begins when a lift station pump finished its last normal cycle, excluding a standby pump.
      (2) On-Site Generators. A lift station may be provided emergency power by on-site, automatic electrical generators sized to operate the lift station at its firm pumping capacity or at the average daily flow, if the peak flow can be stored in the collection system.
      (3) Portable Generators and Pumps.
         (A) A lift station may use portable generators and pumps to guarantee service if the report includes:
            (i) the storage location of each generator and pump;
            (ii) the amount of time that will be needed to transport each generator or pump to a lift station;
            (iii) the number of lift stations for which each generator or pump is dedicated as a backup; and
            (iv) the type of routine maintenance and upkeep planned for each portable generator and pump to ensure that they will be operational when needed.
         (B) An operator that is knowledgeable in operation of the portable generators and pumps shall be on call 24 hours per day every day.
         (C) The size of a portable generator must handle the firm pumping capacity of the lift station.
   (e) Spill Containment Structures.
      (1) The use of a spill containment structure as a sole means of providing service reliability is prohibited.
      (2) A lift station may use a spill containment structure in addition to one of the service reliability options detailed in this in subsection (a) of this section.
      (3) The report must include a detailed management plan for cleaning and maintaining each spill containment structure.
      (4) A spill containment structure must have a locked gate and be surrounded an intruder resistant fence that is 6.0 feet high chain link, masonry, or board fence with at least three strands of barbed wire or 8.0 feet high chain link, masonry, or board fence with at least one strand of barbed wire.
   (f) A lift station must be fully accessible during a 25-year 24-hour rainfall event.
   (g) Lift station system controls must prevent over-pumping upon resumption of normal power after a power failure. Backup or standby units must be electrically interlocked to prevent operation at the same time that other lift stations pumps are operating only on the resumption of normal power after a power failure.

THESE LIFT STATION AND FORCE MAINS CONSTRUCTION NOTES MUST BE INCLUDED ON THE CONSTRUCTION PLANS PROVIDED TO THE CONTRACTOR AND ALL SUBCONTRACTORS.

CONSTRUCTION SEQUENCE NOTES:

1. ANY DEVIATION IN THE SEQUENCE SHALL BE APPROVED BY THE OWNER OR ENGINEER PRIOR TO THE START BY CONTRACTOR IN STRICT ACCORDANCE WITH THE WORK SPECIFIED IN THE PROJECT SPECIFICATIONS.
2. CONTRACTOR SHALL GIVE NOTICE TO THE OWNER AND ENGINEER PRIOR TO COMMENCEMENT OF WORK. CONTRACTOR SHALL ASSURE OWNER/ENGINEER THAT ALL CONSTRUCTION PERMITS THAT CAN ONLY BE ISSUED TO CONTRACTOR WILL BE OBTAINED AT THE CONTRACTOR'S EXPENSE.
3. CONTRACTOR SHALL NOT INTERRUPT LIFT STATION OPERATIONS AND/OR INTERFERE WITH THE TRANSMISSION OF WASTEWATER THROUGHOUT THE CITY OF ROUND ROCK SANITARY SEWER COLLECTION SYSTEM. IF CONTRACTOR REQUIRES A SHUT DOWN OF ANY EQUIPMENT, UTILITY, PIPE, OR PUMP DIRECTLY RELATED TO THE TRANSMISSION OF WASTEWATER, THE PROPOSED WORK SHALL BE SUBMITTED IN WRITING TWO WEEKS PRIOR TO WORK FOR ENGINEER/OWNER APPROVAL. OWNER SHALL DIRECT CONTRACTOR AS TO THE MAXIMUM ALLOWABLE TIME PERIOD FOR EQUIPMENT SHUT DOWN. THIS SHALL BE CONSIDERED AS PART OF THE CONTRACTOR'S CONSTRUCTION SCHEDULE. CONTRACTOR SHALL COMPLY WITH ALL TCEQ REGULATIONS FOR PUBLIC DRINKING WATER STANDARDS TAC CHAPTER 290.
4. A SUGGESTED SEQUENCE IS AS FOLLOWS:
   a. INSTALL TEMPORARY TRAFFIC CONTROL.
   b. PREPARE CONTRACTOR STAGING AREA WITH OWNER APPROVAL. ANY TREE TRIMMING REQUIRED MUST BE APPROVED BY THE CITY AND PERFORMED BY AN ARBORIST APPROVED BY THE CITY.
   c. INSTALL EROSION/SEDIMENTATION CONTROL AND TREE PROTECTION FENCING.
   d. CONSTRUCT WET WELL, VALVE VAULT, PIPING, AND MANHOLES WHILE MAINTAINING UNINTERRUPTED SERVICE AT THE EXISTING LIFT STATION.
   e. CONSTRUCT PROPOSED LIFT STATION ELECTRICAL SYSTEM AND CONTROLS. COORDINATE START-UP WITH OWNER SELECTED SUBCONTRACTOR.
   f. CONSTRUCT, TEST AND APPROVE PROPOSED FORCE MAIN WHILE MAINTAINING OPERATION OF THE EXISTING LIFT STATION AND FORCE MAIN.
   g. TEST AND PREPARE FOR SERVICE NEW LIFT STATION, ASSOCIATED PIPING AND FORCE MAIN. PLACEMENT OF OPERATION SHALL REQUIRE APPROVAL BY OWNER/ENGINEER.
   h. SET UP DIVERSION PUMPING SYSTEM.
   i. CONNECT PROPOSED 6-INCH FORCE MAIN TO EXISTING GATE VALVE IN VALVE VAULT. MAINTAIN CONNECTION FROM EXISTING WET WELL WHILE STARTUP COMMENCES.
   j. ONCE NEW LIFT STATION AND FORCE MAIN IS ACCEPTED, DIVERT WASTEWATER FLOW AT P-MH-15 AND P-MH-8 TO NEW MANHOLE P-MH-18 AND PROPOSED LIFT STATION AND START UP PROPOSED LIFT STATION.
   k. ABANDON OR REMOVE EXISTING PIPE AND APPURTENANCES AS SHOWN ON THE DRAWINGS.
   l. DEMOLISH EXISTING WET WELL AND REMOVE FROM SERVICE. ONCE DEMOLITION OF THE EXISTING STATION COMMENCES THE CONTRACTOR IS RESPONSIBLE FOR THE MAINTENANCE AND OPERATIONS OF THE NEW LIFT STATION UNTIL WRITTEN FINAL ACCEPTANCE FROM THE OWNER/ENGINEER. THIS SHALL INCLUDE BUT NOT LIMITED TO FUEL, ELECTRICITY, EQUIPMENT REPAIRS, AND ROUTINE MAINTENANCE.
   m. CONSTRUCT ADDITIONAL SITE IMPROVEMENTS AS SHOWN ON THE DRAWINGS.
   n. REMOVE TEMPORARY EROSION/SEDIMENTATION CONTROLS, TREE PROTECTION FENCING AND TRAFFIC CONTROLS.

Forest Creek Lift Station Rehabilitation
Round Rock, TX

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KEY PLAN

REVISIONS

NO.	DESCRIPTION	DATE

FILE LOG

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1-18-16

STATE OF TEXAS
DANIEL E. DOW
119652
LICENSED
PROFESSIONAL ENGINEER

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Project No. 160-10727-001
Date: November 2016

TCEQ GENERAL NOTES

G-004

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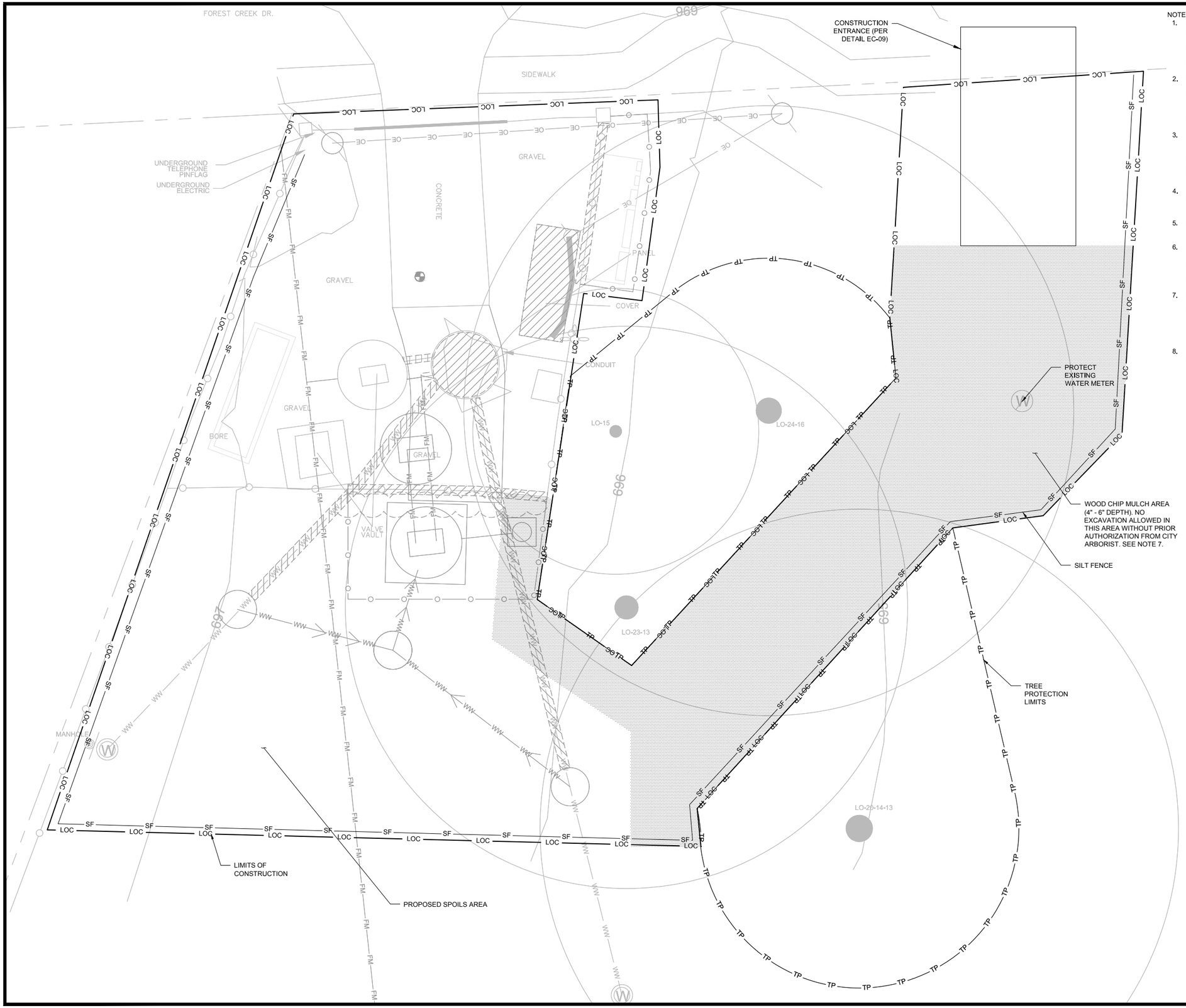

NOTES:

1. CONTRACTOR SHALL FIELD VERIFY LOCATIONS OF EXISTING GRAVITY LINES AND FORCE MAINS PRIOR TO CONSTRUCTION. LOCATIONS SHOWN ON THE DRAWINGS ARE APPROXIMATE . IF CONDITIONS VARY FROM THE DRAWINGS, CONTRACTOR SHALL INFORM THE OWNER AND ENGINEER IMMEDIATELY.
2. NO EXCAVATION SHALL TAKE PLACE WITHIN THE TREE PROTECTION AREA. THIS AREA MAY ONLY BE USED FOR ACCESS TO THE CONSTRUCTION SITE. ANY TREE TRIMMING DESIRED BY THE CONTRACTOR MUST BE APPROVED BY THE CITY OF ROUND ROCK PRIOR TO ANY RELATED WORK ACTIVITIES.
3. TREE PROTECTION FENCE SHALL BE REQUIRED WITHIN THE TREE PROTECTION ZONE ALONG THE LIMITS OF CONSTRUCTION LINE. TREE PROTECTION FENCE WITHIN LIMITS OF CONSTRUCTION SHALL BE DELINEATED BY THE CONTRACTOR PRIOR TO CONSTRUCTION.
4. ALL DISTURBED AREAS OUTSIDE OF FENCED-IN LIFT STATION SITE SHALL BE SEEDED FOLLOWING CONSTRUCTION.
5. CONCRETE WASH OUT AREA REQUIRED - COORDINATE WITH INSPECTOR FOR LOCATION.
6. ANY TREE TRIMMING REQUIRED MUST BE APPROVED BY THE CITY IN ADVANCE AND PERFORMED BY AN ARBORIST APPROVED BY THE CITY OF ROUND ROCK AT THE EXPENSE OF THE CONTRACTOR.
7. UTILIZE CITY OF ROUND ROCK MULCH. COORDINATE WITH CITY FOR PICK UP. CONTRACTOR IS RESPONSIBLE FOR COSTS AND LABOR ASSOCIATED WITH MULCH DELIVERY, APPLICATION, AND REMOVAL. INCLUDE COSTS IN PAY ITEM 22 - STABILIZED CONSTRUCTION ENTRANCE.
8. CONTRACTOR SHALL SUBMIT DEWATERING PLAN PRIOR TO CONSTRUCTION IF DEWATERING IS REQUIRED.

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0 5 10
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Date: November 2016

PROPOSED EROSION CONTROL PLAN

C-101

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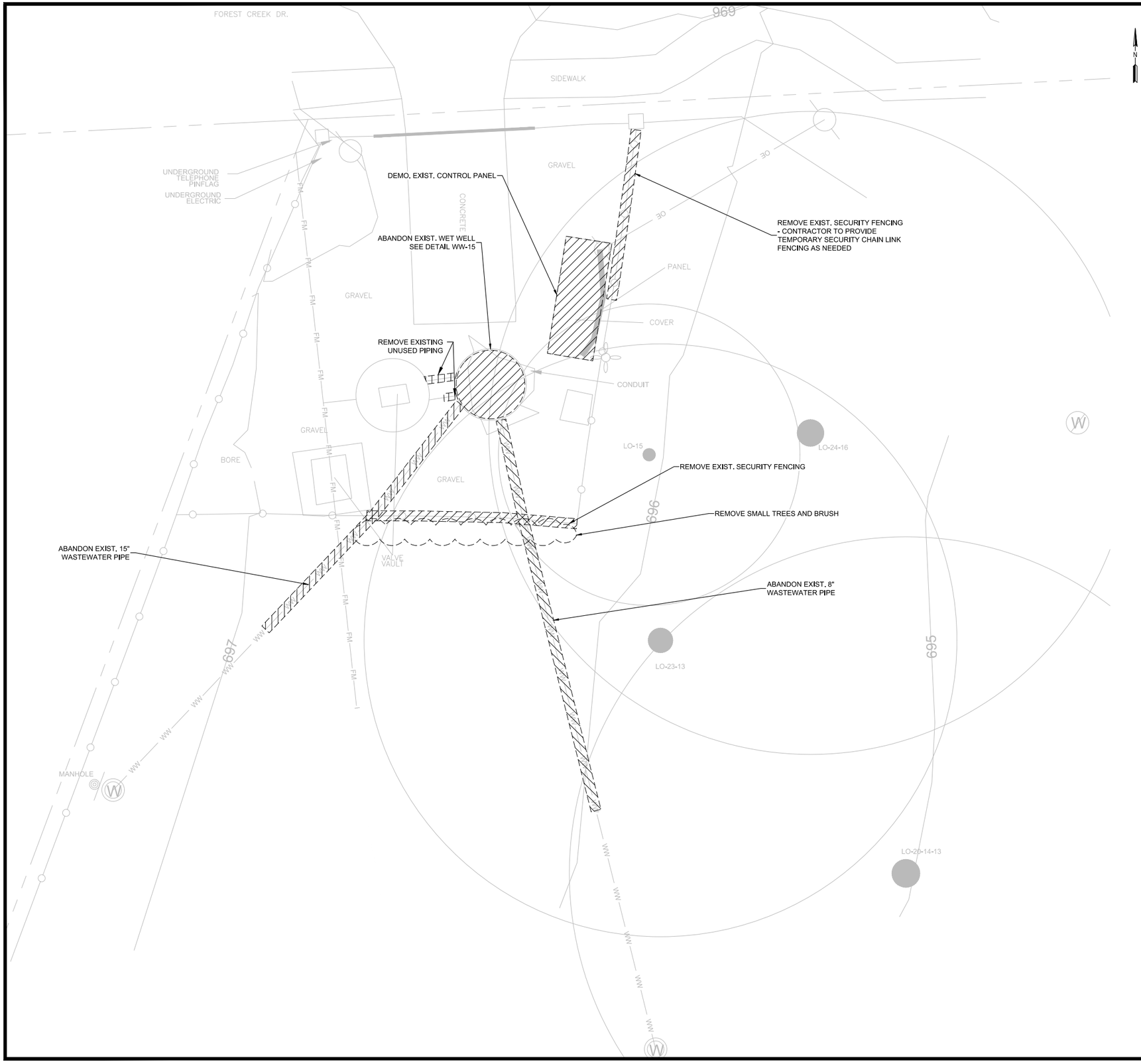

NOTES:

1. ABANDONED PIPE TO BE FILLED WITH FLOWABLE FILL PER SPECIFICATION 402.
2. CONTRACTOR TO PROVIDE TEMPORARY FENCING AS REQUIRED TO SECURE SITE. CONTRACTOR TO COVER ALL EXCAVATIONS DURING NON-WORKING HOURS,.

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Project No. 160-10727-001
Date: November 2016

DEMOLITION PLAN

C-102

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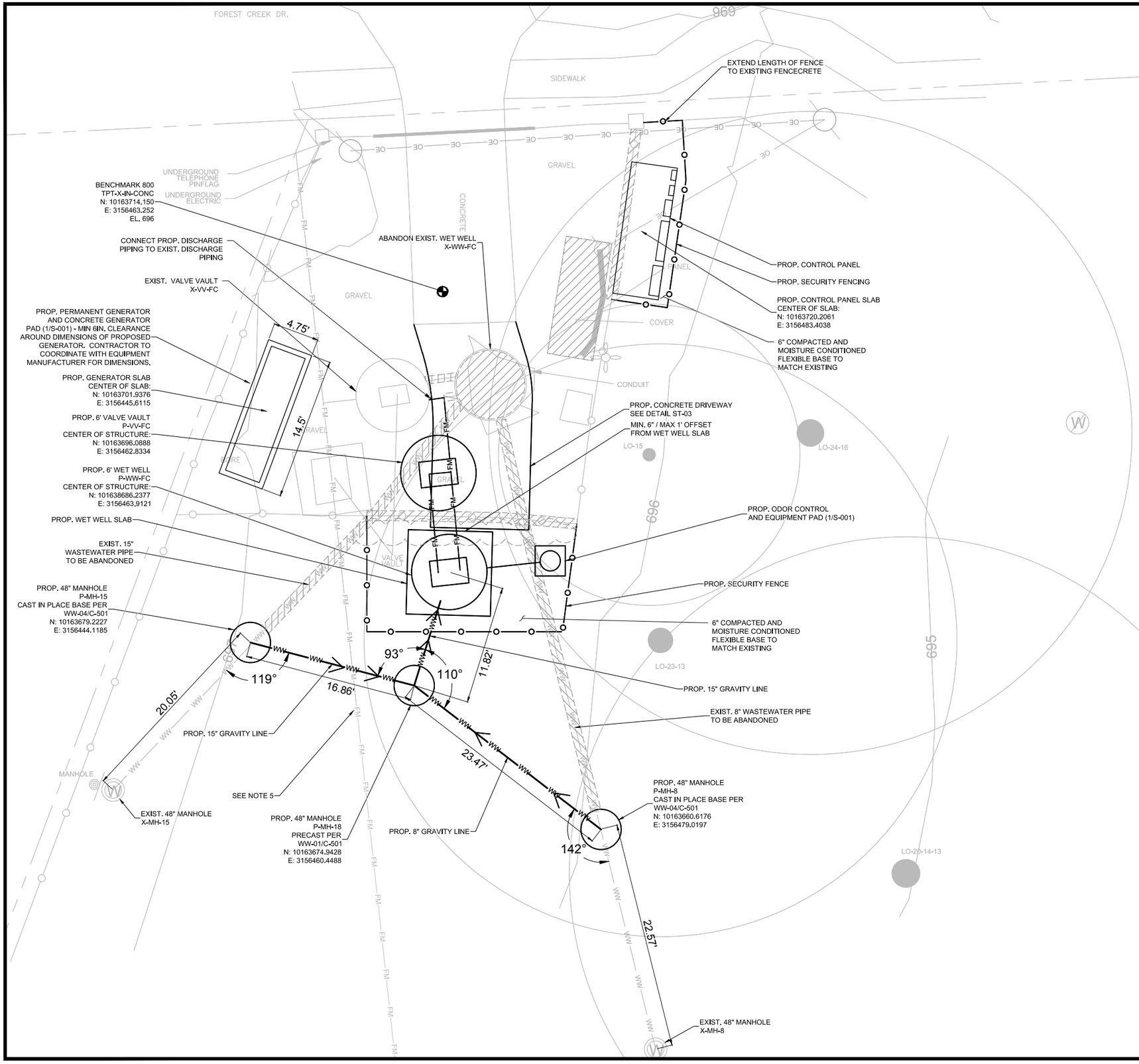

NOTES:

1. CONTRACTOR SHALL FIELD VERIFY LOCATIONS OF EXISTING GRAVITY LINES AND FORCE MAINS PRIOR TO CONSTRUCTION. LOCATIONS SHOWN ON THE DRAWINGS ARE APPROXIMATE . IF CONDITIONS VARY FROM THE DRAWINGS, CONTRACTOR SHALL INFORM THE OWNER AND ENGINEER IMMEDIATELY.
2. CONTRACTOR SHALL TAKE CARE TO PROTECT EXISTING SITE FEATURES DURING CONSTRUCTION. ANY SITE ELEMENTS DAMAGED DURING CONSTRUCTION SHALL BE REPAIRED OR REPLACED TO THE SATISFACTION OF THE OWNER AT NO ADDITIONAL COST.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING A SECURE SITE DURING CONSTRUCTION INCLUDING TEMPORARY FENCING AS NECESSARY AND PROTECTING THE TRENCH AT THE END OF EACH WORKDAY.
4. SEE SHEET C-105 FOR PROPOSED WET WELL, VALVE VAULT, AND CONNECTION DETAIL.
5. EXISTING 10" FORCE MAIN IS SHOWN IN APPROXIMATE LOCATION BASED ON LEVEL D SUE. CONTRACTOR SHALL VERIFY LOCATION OF FORCE MAIN PRIOR TO CONSTRUCTION AND INFORM THE OWNER AND ENGINEER IF THE LOCATION VARIES FROM WHAT IS SHOWN ON THE PLANS. PROTECT IN PLACE DURING CONSTRUCTION.
6. BENCHMARK 801 LOCATED DIRECTLY ACROSS FOREST CREEK DR. FROM ENTRANCE GATE.
7. NEW MANHOLES TO BE COATED WITH CONSHIELD OR APPROVED SUBSTITUTION.

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0 5 10
SCALE: 1"=5'

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PROPOSED SITE PLAN

C-103

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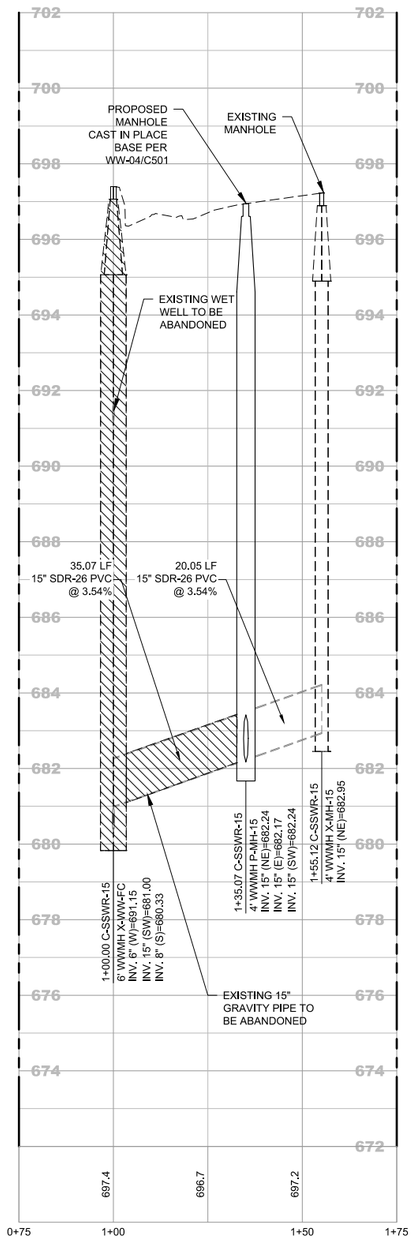
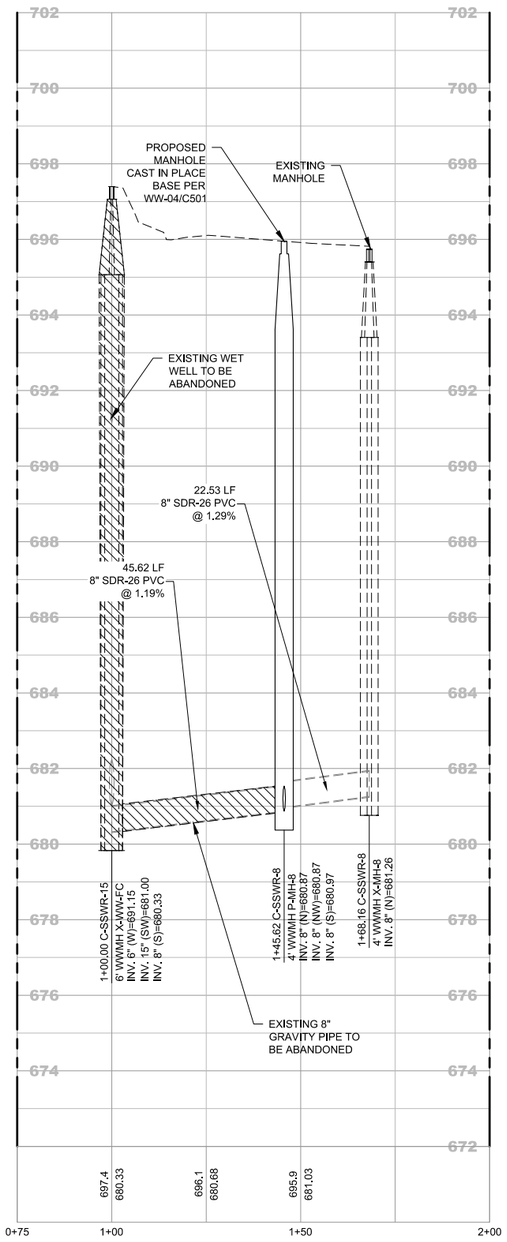
EXISTING 15" WW LINE



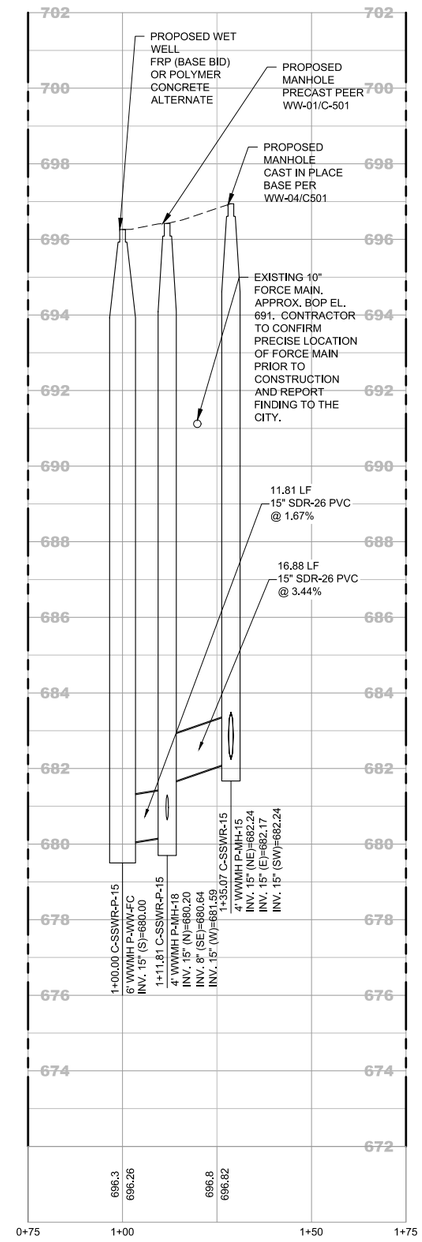
C-SSWR-15

EXISTING 8" WW LINE



C-SSWR-8

PROPOSED 15" WW LINE



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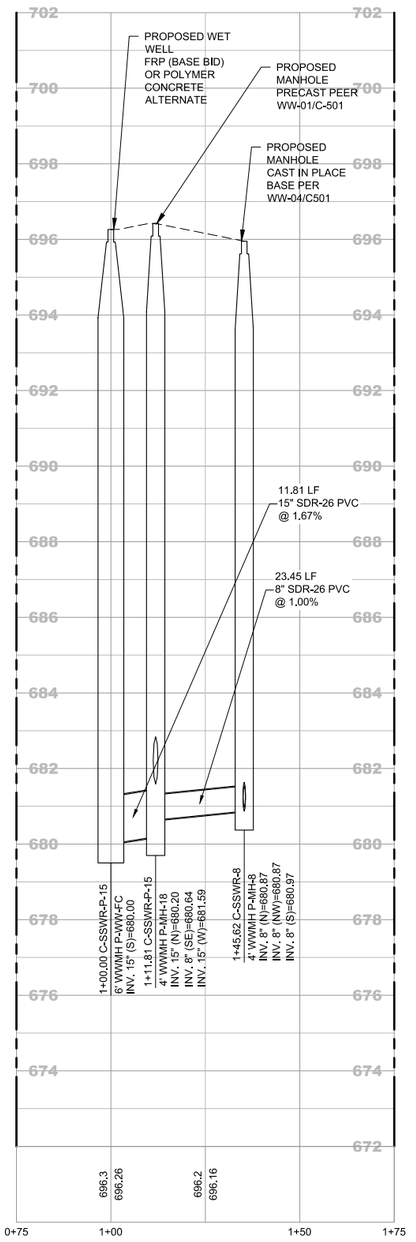
PROPOSED 8" WW LINE



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0 20 40

SCALE: HORIZ. 1"=20'
VERT. 1"=2'

Project No. 160-10727-001
Date: November 2016

PROPOSED WASTEWATER PROFILES

C-104

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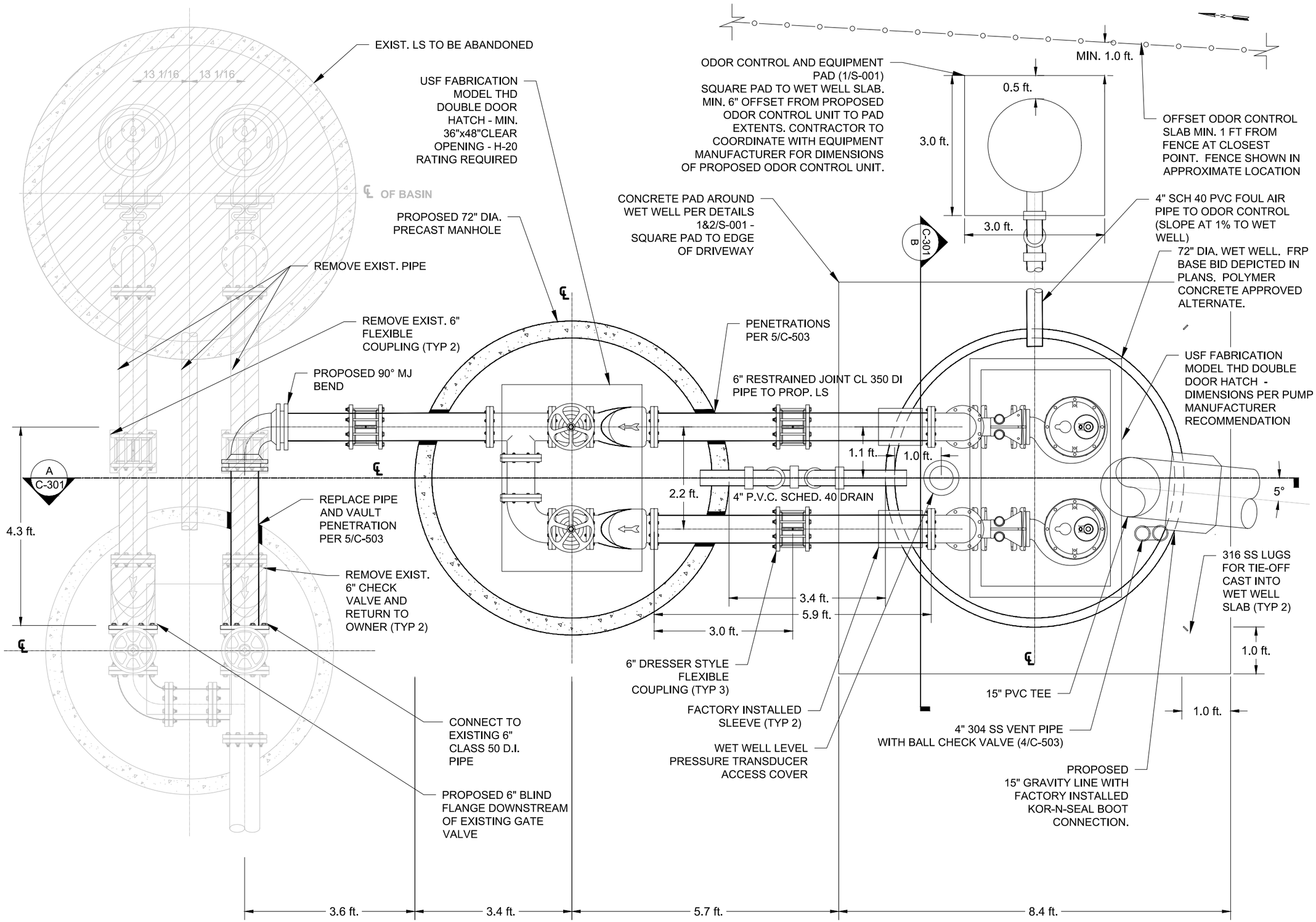

PLAN VIEW

SCALE: 1" = 1'

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SCALE: 1"=1'

Project No. 160-10727-001
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LIFT STATION PLAN DETAIL

C-105

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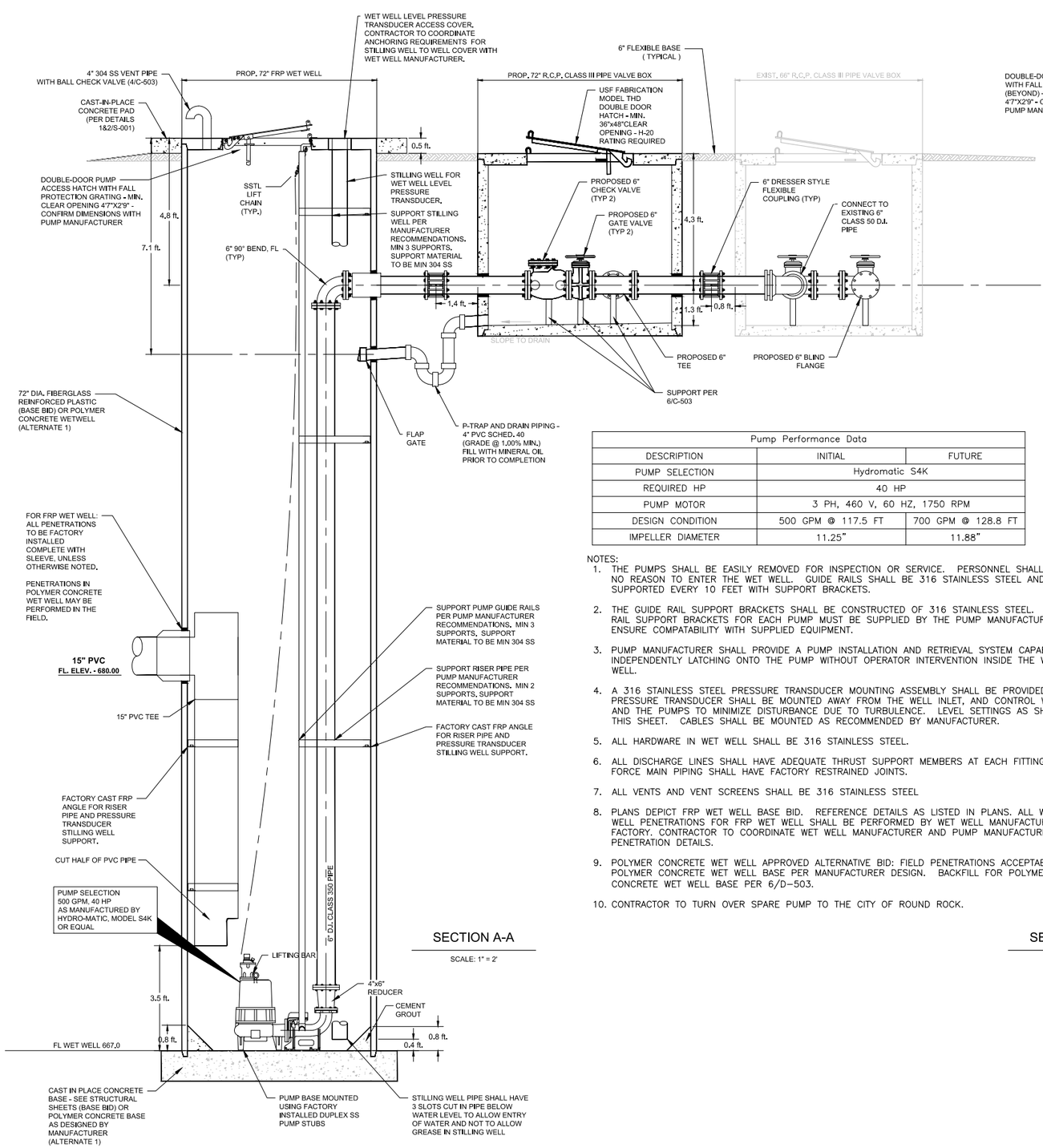


SECTION A-A

SCALE: 1" = 2'

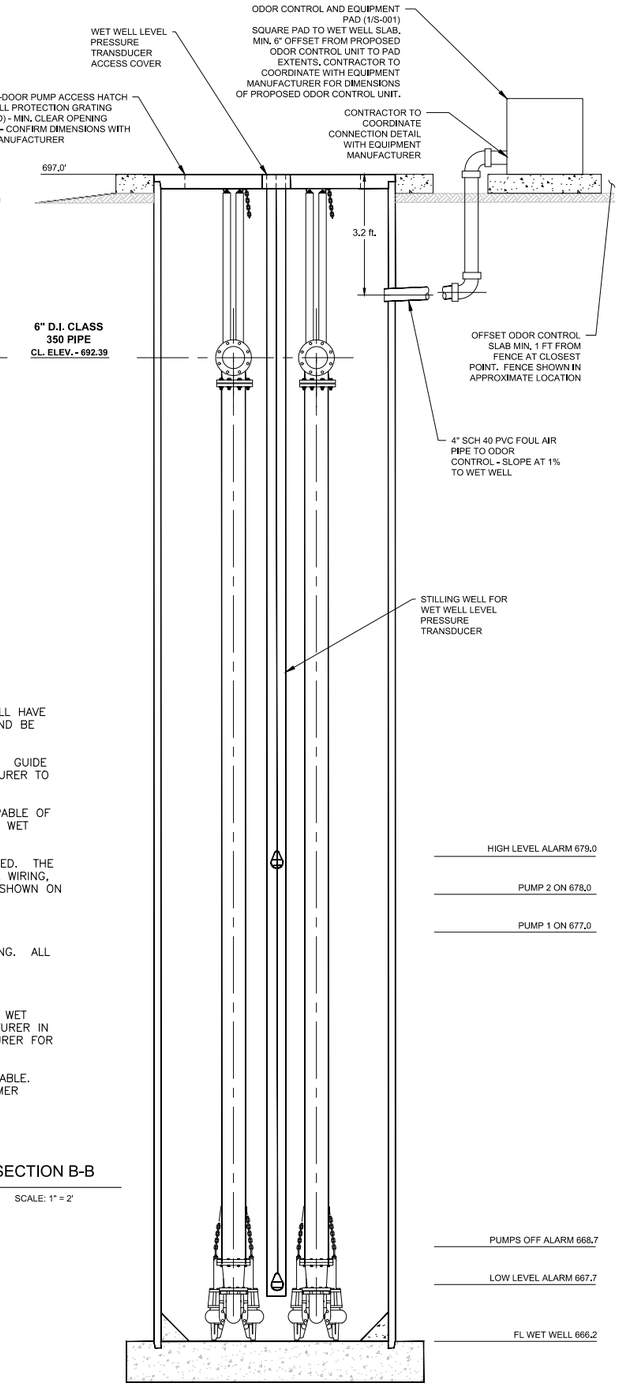
Pump Performance Data		
DESCRIPTION	INITIAL	FUTURE
PUMP SELECTION	Hydromatic S4K	
REQUIRED HP	40 HP	
PUMP MOTOR	3 PH, 460 V, 60 HZ, 1750 RPM	
DESIGN CONDITION	500 GPM @ 117.5 FT	700 GPM @ 128.8 FT
IMPELLER DIAMETER	11.25"	11.88"

NOTES:

1. THE PUMPS SHALL BE EASILY REMOVED FOR INSPECTION OR SERVICE. PERSONNEL SHALL HAVE NO REASON TO ENTER THE WET WELL. GUIDE RAILS SHALL BE 316 STAINLESS STEEL AND BE SUPPORTED EVERY 10 FEET WITH SUPPORT BRACKETS.
2. THE GUIDE RAIL SUPPORT BRACKETS SHALL BE CONSTRUCTED OF 316 STAINLESS STEEL. GUIDE RAIL SUPPORT BRACKETS FOR EACH PUMP MUST BE SUPPLIED BY THE PUMP MANUFACTURER TO ENSURE COMPATABILITY WITH SUPPLIED EQUIPMENT.
3. PUMP MANUFACTURER SHALL PROVIDE A PUMP INSTALLATION AND RETRIEVAL SYSTEM CAPABLE OF INDEPENDENTLY LATCHING ONTO THE PUMP WITHOUT OPERATOR INTERVENTION INSIDE THE WET WELL.
4. A 316 STAINLESS STEEL PRESSURE TRANSDUCER MOUNTING ASSEMBLY SHALL BE PROVIDED. THE PRESSURE TRANSDUCER SHALL BE MOUNTED AWAY FROM THE WELL INLET, AND CONTROL WIRING, AND THE PUMPS TO MINIMIZE DISTURBANCE DUE TO TURBULENCE. LEVEL SETTINGS AS SHOWN ON THIS SHEET. CABLES SHALL BE MOUNTED AS RECOMMENDED BY MANUFACTURER.
5. ALL HARDWARE IN WET WELL SHALL BE 316 STAINLESS STEEL.
6. ALL DISCHARGE LINES SHALL HAVE ADEQUATE THRUST SUPPORT MEMBERS AT EACH FITTING. ALL FORCE MAIN PIPING SHALL HAVE FACTORY RESTRAINED JOINTS.
7. ALL VENTS AND VENT SCREENS SHALL BE 316 STAINLESS STEEL
8. PLANS DEPICT FRP WET WELL BASE BID. REFERENCE DETAILS AS LISTED IN PLANS. ALL WET WELL PENETRATIONS FOR FRP WET WELL SHALL BE PERFORMED BY WET WELL MANUFACTURER IN FACTORY. CONTRACTOR TO COORDINATE WET WELL MANUFACTURER AND PUMP MANUFACTURER FOR PENETRATION DETAILS.
9. POLYMER CONCRETE WET WELL APPROVED ALTERNATIVE BID: FIELD PENETRATIONS ACCEPTABLE. POLYMER CONCRETE WET WELL BASE PER MANUFACTURER DESIGN. BACKFILL FOR POLYMER CONCRETE WET WELL BASE PER 6/D-503.
10. CONTRACTOR TO TURN OVER SPARE PUMP TO THE CITY OF ROUND ROCK.

SECTION B-B

SCALE: 1" = 2'



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LIFT STATION SECTION DETAIL

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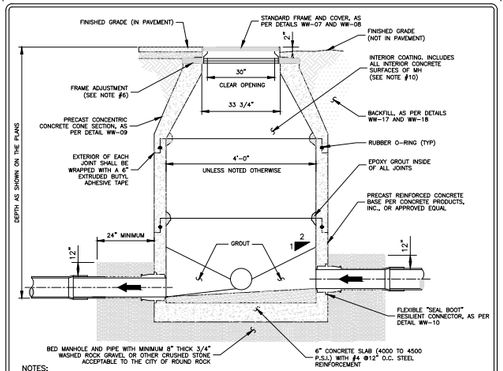
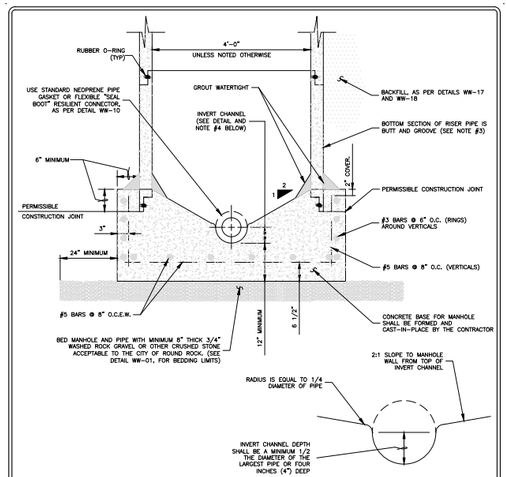


NOTES:

1. IF DROP IS SIX INCHES (6") TO TWO FEET (2'-0"), CONSTRUCTION OF DROP SHALL PROVIDE AN OVERSIZED INVERT TO EXTEND UNDER THE DROP CONNECTION.
2. SEE CONSTRUCTION PLANS FOR MANHOLE SIZE, LOCATION, CONFIGURATION, TYPE OF TOP SECTION, VENTING REQUIREMENTS, PIPE SIZES AND TYPES.
3. MANHOLES SHALL BE PRECAST ASTM C478 BELL AND SPIGOT WITH "O" RING JOINTS.
4. MANHOLES TO BE DESIGNED TO RESIST LATERAL AND VERTICAL SOIL FORCES RESULTING FROM MANHOLE DEPTH. ADDITIONALLY, MANHOLES LOCATED IN PAVEMENT TO BE DESIGNED FOR H20 TRAFFIC LOADING.
5. ALL MANHOLE COVERS SHALL BE BOLTED AND GASKETED, WHEN MANHOLES ARE LOCATED OUTSIDE OF PAVEMENT.
6. FRAME ADJUSTMENT HEIGHT SHALL CONSIST OF FIVE INCHES (5") MINIMUM TO EIGHTEEN INCHES (18") MAXIMUM. GRADE RINGS SHALL BE GROUTED WITH A NON-SHRINK GROUT INSIDE AND OUTSIDE. HDPE GRADE RINGS, AS MANUFACTURED BY LARTECH, INCORPORATED, OR EQUAL, MAY NOT BE USED.
7. FOR MANHOLES TO BE VENTED, SEE DETAILS WW-05 AND WW-06.
8. A FLOW CHANNEL SHALL BE CONSTRUCTED INSIDE MANHOLE TO DIRECT INFLUENT INTO THE FLOW STREAM. ALL P.V.C. PIPE SHALL BE REMOVED FROM INVERT.
9. BASE SECTION SHALL BE DESIGNED FOR H20 LOADING, PLUS EARTH LOAD AT 130 PCF.
10. ENTIRE INTERIOR CONCRETE SURFACES OF WASTEWATER MANHOLES TO BE COATED WITH RAVEN 405, SPRAYWALL, OR APPROVED EQUAL, (WITH A UNIFORM THICKNESS OF 124 MILS AND A MINIMUM THICKNESS OF 100 MILS, APPLIED AFTER MANHOLE HAS PASSED THE VACUUM TEST). FOR REHABILITATING MANHOLES 1/2" MIN. THICKNESS CALCIUM ALUMINATE CEMENTITIOUS COATING AND OTHER INTERIOR SURFACES MAY BE COATED IF RECOMMENDED BY COATING MANUFACTURER. (IN LIEU OF INTERIOR COATINGS NEW PRECAST MANHOLES CONTAINING CONSHIELD WILL BE ACCEPTED PROVIDING THE MANUFACTURER STENCILS "CONSHIELD" ON THE INSIDE AND OUTSIDE OF ALL MANHOLE SECTIONS.)

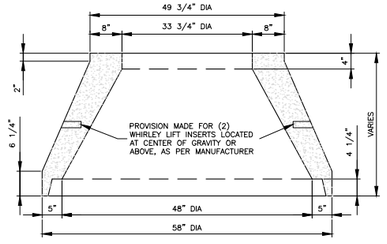
RECORD SIGNED COPY ON FILE AT PUBLIC WORKS	CITY OF ROUND ROCK	DRAWING NO:
APPROVED 12-04-13 DATE	PRECAST CONCRETE WASTEWATER MANHOLE DETAIL	WW-01
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR THE APPROPRIATE USE OF THIS DETAIL (NOT TO SCALE)		ROUND ROCK, TEXAS FUTURE RAIL TRANSIT



NOTES:

1. CAST-IN-PLACE BASE SHALL BE 4000 TO 4500 P.S.I. CONCRETE, 28 DAY STRENGTH.
2. STEEL SHALL BE GRADE 60.
3. MANHOLE RISER PIPE FURNISHED IN LENGTHS OF ONE (1), TWO (2), THREE (3), FOUR (4) OR SIX (6) FEET AND SHALL BE IN ACCORDANCE WITH ASTM C478.
4. INVERT CHANNEL SHALL BE PROVIDED THAT AS MUCH AS POSSIBLE, FORMS A SMOOTH CONTINUATION OF INLET AND OUTLET PIPES.
5. BASE SHALL BE PROPERLY FORMED IN THE FIELD WITH WOOD OR OTHER APPROVED FORMS.
6. VERTICAL BARS MAY BE EXTENSIONS OF BOTTOM STEEL OR SEPARATE FROM, BUT TIED TO BOTTOM STEEL.

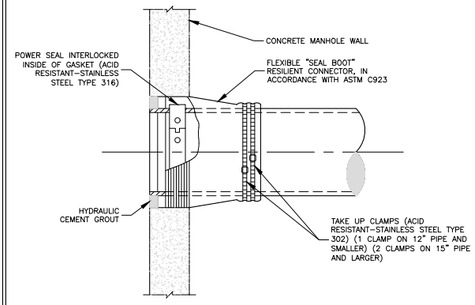
RECORD SIGNED COPY ON FILE AT PUBLIC WORKS	CITY OF ROUND ROCK	DRAWING NO:
APPROVED 04-01-10 DATE	CAST-IN-PLACE BASE FOR CONCRETE WASTEWATER MANHOLE DETAIL	WW-04
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR THE APPROPRIATE USE OF THIS DETAIL (NOT TO SCALE)		ROUND ROCK, TEXAS FUTURE RAIL TRANSIT



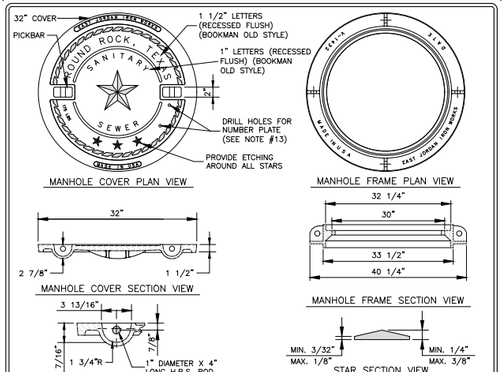
NOTE:

CONCENTRIC CONCRETE CONE SECTION SHALL BE MANUFACTURED USING 4000 TO 4500 P.S.I. CONCRETE, 28 DAY STRENGTH AND IN ACCORDANCE WITH ASTM C478, AS MANUFACTURED BY CONCRETE PRODUCTS, INCORPORATED, OR APPROVED EQUAL.

RECORD SIGNED COPY ON FILE AT PUBLIC WORKS	CITY OF ROUND ROCK	DRAWING NO:
APPROVED 04-01-10 DATE	PRECAST 48" CONCENTRIC CONCRETE CONE SECTION DETAIL	WW-09
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR THE APPROPRIATE USE OF THIS DETAIL (NOT TO SCALE)		ROUND ROCK, TEXAS FUTURE RAIL TRANSIT



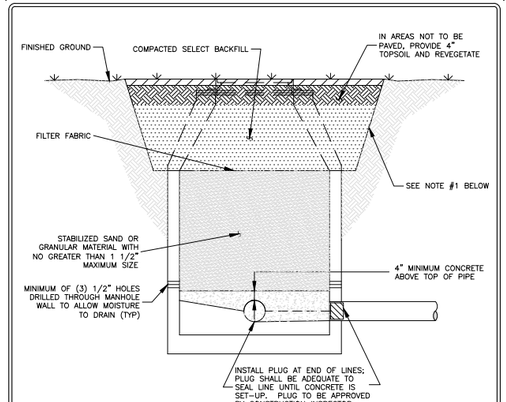
RECORD SIGNED COPY ON FILE AT PUBLIC WORKS	CITY OF ROUND ROCK	DRAWING NO:
APPROVED 04-01-10 DATE	FLEXIBLE "SEAL BOOT" RESILIENT CONNECTOR DETAIL	WW-10
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR THE APPROPRIATE USE OF THIS DETAIL (NOT TO SCALE)		ROUND ROCK, TEXAS FUTURE RAIL TRANSIT



NOTES:

1. COVER AND FRAME SHALL COMPLY WITH STANDARD SPECIFICATIONS FOR DRAINAGE, SEWER, UTILITY AND RELATED CASTINGS: AASHTO DESIGNATION M306-04.
2. MANHOLE COVER SHALL BE MODEL NUMBER: V-1432-3 (PRODUCT NUMBER: 41432059), AS MANUFACTURED BY EAST JORDAN IRON WORKS, INCORPORATED, OR APPROVED EQUAL.
3. MANHOLE FRAME SHALL BE MODEL NUMBER: V-1432 (PRODUCT NUMBER: 41432010), AS MANUFACTURED BY EAST JORDAN IRON WORKS, INCORPORATED, OR APPROVED EQUAL.
4. MANHOLE COVER AND FRAME ASSEMBLY, IF ORDERED AS A SET, SHALL BE MODEL NUMBER: V-1432 (PRODUCT NUMBER: 41432089), AS MANUFACTURED BY EAST JORDAN IRON WORKS, INCORPORATED, OR APPROVED EQUAL.
5. ALL CORNERS AND EDGES SHALL HAVE A 1/16" MINIMUM AND 1/8" MAXIMUM RADIUS.
6. MANHOLE COVERS SHALL BE CAST WITH TWO 1" DIAMETER STEEL PICKBARS.
7. MANHOLE COVER WEIGHT SHALL BE 175 LBS. FOR DUCTILE IRON. WEIGHT SHALL BE CAST ON BOTH TOP AND BOTTOM OF COVER.
8. MANUFACTURER SHALL CERTIFY THAT EACH MANHOLE COVER MEETS HS-20 LOADING.
9. FILLETS SHALL BE 1/4" RADIUS UNLESS OTHERWISE SPECIFIED.
10. MANUFACTURER SHALL REMOVE EXCESS IRON AND MACHINE FINISH SEATING SURFACES TO NOTED DIMENSIONS.
11. COVER SHALL BE DIPPED IN A WATER-BASED ASPHALTIC COATING, PRIOR TO SHIPMENT FROM FOUNDRY.
12. MANUFACTURER SHALL DRILL 2-3/16"X1/2" DEEP HOLES FOR A MANHOLE NUMBER PLATE TO BE PROVIDED BY THE CITY OF ROUND ROCK. THE TOP HOLE SHALL BE DRILLED 1" O.C. FROM THE BOTTOM OF THE PICKBAR AND THE BOTTOM HOLE SHALL BE DRILLED 4" O.C. FROM THE TOP HOLE.

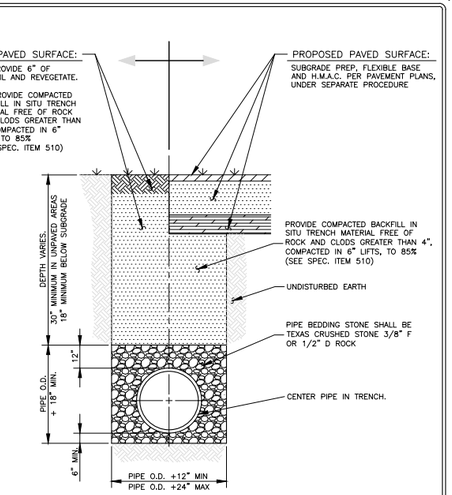
RECORD SIGNED COPY ON FILE AT PUBLIC WORKS	CITY OF ROUND ROCK	DRAWING NO:
APPROVED 04-01-10 DATE	NON-BOLTED WASTEWATER MANHOLE COVER AND FRAME DETAIL	WW-08
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR THE APPROPRIATE USE OF THIS DETAIL (NOT TO SCALE)		ROUND ROCK, TEXAS FUTURE RAIL TRANSIT



NOTES:

1. REMOVE ENTIRE CONE SECTION AND DEMOLISH STRUCTURE TWO FEET (2'-0") MINIMUM BELOW GROUND LEVEL.
2. IF LINE WHICH IS TO ABANDONED IN PLACE, EXTENDS UNDER EXISTING OR PROPOSED STRUCTURE, THEN THE ENTIRE LINE TO THE NEXT MANHOLE SHALL BE GROUTED OR SLURRY FILLED.
3. IF LINE IS NOT LOCATED UNDER A STRUCTURE, ABANDON EXISTING LINE IN PLACE BY PLUGGING BOTH ENDS OF LINE AND GROUTING AROUND PLUGS.
4. THE CONTRACTOR IS TO RECORD AND CERTIFY QUANTITIES OF GROUT OR SLURRY PUMPED. QUANTITIES MUST BE A MINIMUM OF 90% OF CALCULATED EXISTING VOID CAPACITY.

RECORD SIGNED COPY ON FILE AT PUBLIC WORKS	CITY OF ROUND ROCK	DRAWING NO:
APPROVED 04-01-10 DATE	WASTEWATER MANHOLE ABANDONMENT DETAIL	WW-15
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR THE APPROPRIATE USE OF THIS DETAIL (NOT TO SCALE)		ROUND ROCK, TEXAS FUTURE RAIL TRANSIT



NOTE:

ALL TRENCHING AND TRENCH SAFETY SHALL COMPLY WITH APPLICABLE FEDERAL, STATE AND LOCAL REGULATIONS.

RECORD SIGNED COPY ON FILE AT PUBLIC WORKS	CITY OF ROUND ROCK	DRAWING NO:
APPROVED 04-01-10 DATE	WASTEWATER LINE BEDDING AND SURFACE REPAIR DETAIL (NON-PAVED & PROPOSED PAVED SURFACE)	WW-18
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR THE APPROPRIATE USE OF THIS DETAIL (NOT TO SCALE)		ROUND ROCK, TEXAS FUTURE RAIL TRANSIT

1. ALL TREES NOT LOCATED WITHIN THE LIMITS OF CONSTRUCTION AND OUTSIDE OF DISTURBED AREAS SHALL BE PRESERVED. THE CONTRACTOR IS RESPONSIBLE FOR PROTECTING ALL TREES TO BE PRESERVED FROM HIS ACTIVITIES.
2. ALL TREES SHOWN TO BE RETAINED WITHIN THE LIMITS OF CONSTRUCTION ON THE PLANS, SHALL BE PROTECTED DURING CONSTRUCTION WITH FENCING. SEE: TREE PROTECTION TREE WELLS (EC-02), TREE PROTECTION TREE LOCATION (EC-03) AND TREE PROTECTION FENCE-CHAIN LINK (EC-04).
3. TREE PROTECTION FENCES SHALL BE ERECTED ACCORDING TO CITY STANDARDS FOR TREE PROTECTION, INCLUDING TYPES OF FENCING AND SIGNAGE.
4. TREE PROTECTION FENCES SHALL BE INSTALLED PRIOR TO THE COMMENCEMENT OF ANY SITE PREPARATION WORK (CLEARING, GRUBBING, OR GRADING) AND SHALL BE MAINTAINED THROUGHOUT ALL PHASES OF THE CONSTRUCTION PROJECT.
5. EROSION AND SEDIMENTATION CONTROL BARRIERS SHALL BE INSTALLED OR MAINTAINED IN A MANNER WHICH DOES NOT RESULT IN SOIL BUILD-UP WITHIN TREE DRIPLINES.
6. FENCES SHALL COMPLETELY SURROUND THE TREE OR CLUSTERS OF TREES, LOCATED AT THE OUTERMOST LIMITS OF THE TREE BRANCHES (DRIPLINE) OR CRITICAL ROOT ZONE (CRZ), WHICHEVER IS GREATER; AND SHALL BE MAINTAINED THROUGHOUT THE CONSTRUCTION PROJECT IN ORDER TO PREVENT THE FOLLOWING:
   6A. SOIL COMPACTION IN CRZ AREA RESULTING FROM VEHICULAR TRAFFIC OR STORAGE OF EQUIPMENT OR MATERIAL.
   6B. CRZ DISTURBANCES DUE TO GRADE CHANGES OR TRENCHING NOT REVIEWED AND AUTHORIZED BY THE FORESTRY MANAGER.
   6C. WOUNDS TO EXPOSED ROOTS, TRUNK, OR LIMBS BY MECHANICAL EQUIPMENT
   6D. OTHER ACTIVITIES DETRIMENTAL TO TREES SUCH AS CHEMICAL STORAGE, CONCRETE TRUCK CLEANING, AND FIRES.
7. EXCEPTIONS TO INSTALLING TREE FENCES AT THE TREE DRIPLINES OR CRZ, WHICHEVER IS GREATER, MAY BE PERMITTED IN THE FOLLOWING CASES:
   7A. WHERE THERE IS TO BE AN APPROVED GRADE CHANGE, IMPERMEABLE PAVING SURFACE, OR TREE WELL;
   7B. WHERE PERMEABLE PAVING IS TO BE INSTALLED, ERECT THE FENCE AT THE OUTER LIMITS OF THE PERMEABLE PAVING AREA.
   7C. WHERE TREES ARE CLOSE TO PROPOSED BUILDINGS, ERECT THE FENCE NO CLOSER THAN 6 FEET TO THE BUILDING.
   7D. WHERE THERE ARE SEVERE SPACE CONSTRAINTS DUE TO TRACT SIZE, OR OTHER SPECIAL REQUIREMENTS, CONTACT THE FORESTRY MANAGER TO DISCUSS ALTERNATIVES.
8. WHERE ANY OF THE ABOVE EXCEPTIONS RESULT IN A FENCE THAT IS CLOSER THAN 5 FEET TO A TREE TRUNK, THE TRUNK SHALL BE PROTECTED BY STRAPPED-ON PLANKING TO A HEIGHT OF 8 FEET (OR TO THE LIMITS OF LOWER BRANCHING) IN ADDITION TO THE REDUCED FENCING PROVIDED.
9. WHERE ANY OF THE ABOVE EXCEPTIONS RESULT IN AREAS OF UNPROTECTED ROOT ZONES UNDER THE DRIPLINE OR CRZ, WHICHEVER IS GREATER, THOSE AREAS SHOULD BE COVERED WITH 4 INCHES OF ORGANIC MULCH TO MINIMIZE SOIL COMPACTION.
10. ALL GRADING WITHIN CRZ AREAS SHALL BE DONE BY HAND OR WITH SMALL EQUIPMENT TO MINIMIZE ROOT DAMAGE. PRIOR TO GRADING, RELOCATE PROTECTIVE FENCING TO 2 FEET BEHIND THE GRADE CHANGE AREA.
11. ANY ROOTS EXPOSED BY CONSTRUCTION ACTIVITY SHALL BE PRUNED FLUSH WITH THE SOIL AND BACKFILLED WITH GOOD QUALITY TOP SOIL WITHIN TWO DAYS. IF EXPOSED ROOT AREAS CANNOT BE BACKFILLED WITHIN 2 DAYS, AN ORGANIC MATERIAL WHICH REDUCES SOIL TEMPERATURE AND MINIMIZES WATER LOSS DUE TO EVAPORATION SHALL BE PLACED TO COVER THE ROOTS UNTIL BACKFILL CAN OCCUR.
12. PRIOR TO EXCAVATION OR GRADE CUTTING WITHIN TREE DRIPLINES, A CLEAN CUT SHALL BE MADE WITH A ROCK SAW OR SIMILAR EQUIPMENT, IN A LOCATION AND TO A DEPTH APPROVED BY THE FORESTRY MANAGER, TO MINIMIZE DAMAGE TO REMAINING ROOTS.
13. TREES MOST HEAVILY IMPACTED BY CONSTRUCTION ACTIVITIES WILL BE WATERED DEEPLY ONCE A WEEK DURING PERIODS OF HOT, DRY WEATHER. TREE CROWNS ARE TO BE SPRAYED WITH WATER PERIODICALLY TO REDUCE DUST ACCUMULATION ON LEAVES.
14. WHEN INSTALLING CONCRETE ADJACENT TO THE ROOT ZONE OF A TREE, A PLASTIC VAPOR BARRIER SHALL BE PLACED BEHIND THE CONCRETE TO PROHIBIT LEACHING OF LIME INTO THE CRZ.
15. ANY TRENCHING REQUIRED FOR THE INSTALLATION OF LANDSCAPE IRRIGATION SHALL BE PLACED AS FAR FROM EXISTING TREE TRUNKS AS POSSIBLE.
16. NO LANDSCAPE TOPSOIL DRESSING GREATER THAN FOUR (4) INCHES SHALL BE PERMITTED WITHIN THE DRIPLINE OR CRZ OF TREES, WHICHEVER IS GREATER. NO TOPSOIL IS PERMITTED ON ROOT FLARES OF ANY TREE.
17. PRUNING TO PROVIDE CLEARANCE FOR STRUCTURES, VEHICULAR TRAFFIC, AND CONSTRUCTION EQUIPMENT SHALL TAKE PLACE BEFORE CONSTRUCTION BEGINS. ALL PRUNING MUST BE DONE ACCORDING TO CITY STANDARDS AND AS OUTLINED IN LITERATURE PROVIDED BY THE INTERNATIONAL SOCIETY OF ARBORICULTURE (ISA PRUNING TECHNIQUES).
18. ALL OAK TREE CUTS, INTENTIONAL OR UNINTENTIONAL SHALL BE SEALED WITH AN APPROVED PRUNING SEALER IMMEDIATELY (WITHIN 10 MINUTES). TREE PAINT MUST BE KEPT ON SITE AT ALL TIMES.
19. THE FORESTRY MANAGER HAS THE AUTHORITY TO REQUIRE ADDITIONAL TREE PROTECTION BEFORE OR DURING CONSTRUCTION.
20. TREES APPROVED FOR REMOVAL SHALL BE REMOVED IN A MANNER WHICH DOES NOT IMPACT TREES TO BE PRESERVED. REFER TO THE CITY OF ROUND ROUND ROCK TREE TECHNICAL MANUAL FOR APPROPRIATE REMOVAL METHODS.
21. PRIOR TO CONSTRUCTION, ALL LOWER TREE LIMBS OVER ROADWAYS MUST BE PRUNED TO A HEIGHT OF 14 FEET USING THE TECHNIQUES DESCRIBED IN THE CITY OF ROUND ROCK TREE TECHNICAL MANUAL.
22. DEVIATIONS FROM THE ABOVE REQUIREMENTS AND NEGLIGENT DAMAGE TO TREES MAY BE CONSIDERED AS ORDINANCE VIOLATIONS.

FOR QUESTIONS CONCERNING THIS DETAIL, PLEASE CONTACT THE FORESTRY MANAGER.

RECORD SIGNED COPY ON FILE AT PUBLIC WORKS	CITY OF ROUND ROCK	DRAWING NO:
APPROVED 03-25-11 DATE	TREE PROTECTION NOTES	EC-01
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR THE APPROPRIATE USE OF THIS DETAIL (NOT TO SCALE)		ROUND ROCK, TEXAS FUTURE RAIL TRANSIT

Forest Creek Lift Station Rehabilitation Round Rock, TX

ROUND ROCK TEXAS

Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY
8911 N. Capital of Texas Hwy
Building 2, Suite 2300
Austin, TX 78759
Tel 512-338-4212
www.lan-inc.com

KEY PLAN

REVISIONS

NO.	DESCRIPTION	DATE

FILE LOG

ACTIVITY	BY
Manager	RDO
Design	WCC
Draw	JDV
Check	DED

STAMP

STATE OF TEXAS
DANIEL E. DOW
119652
LICENSED PROFESSIONAL ENGINEER
1-18-16

Lockwood, Andrews & Newnam, Inc.
Texas Registered Engineering Firm F-2614

Project No. 160-10727-001
Date: November 2016

CIVIL DETAILS

C-501

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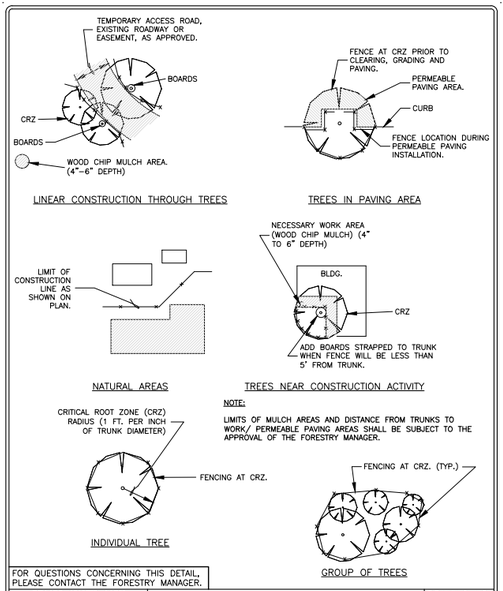
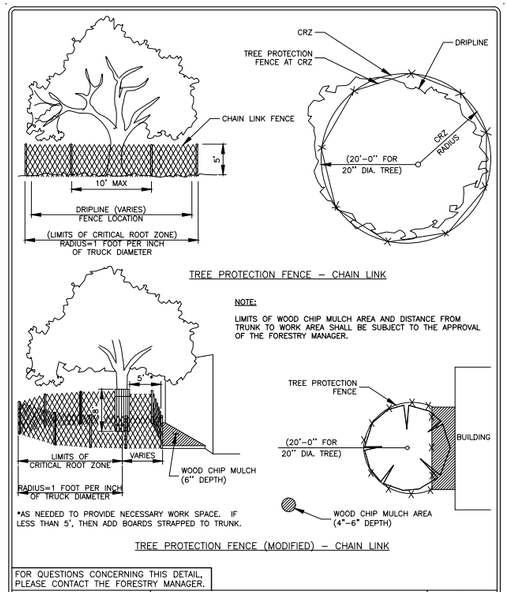


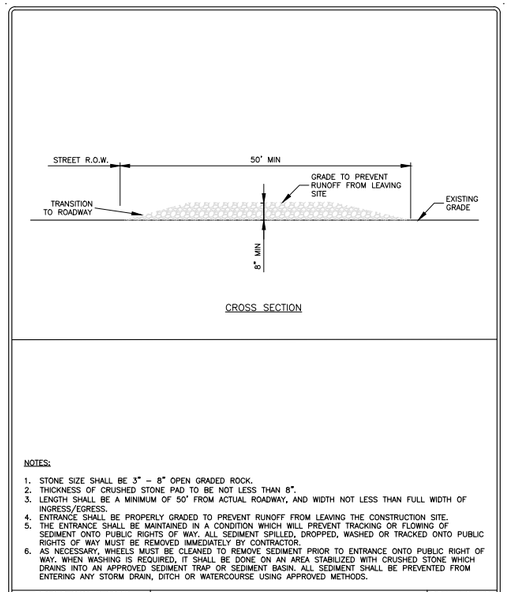
FOR QUESTIONS CONCERNING THIS DETAIL, PLEASE CONTACT THE FORESTRY MANAGER.

RECORD SIGNED COPY ON FILE AT PUBLIC WORKS	CITY OF ROUND ROCK	DRAWING NO: EC-03
APPROVED 03-25-11 DATE	TREE PROTECTION FENCE LOCATIONS	
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR THE APPROPRIATE USE OF THIS DETAIL. (NOT TO SCALE)		

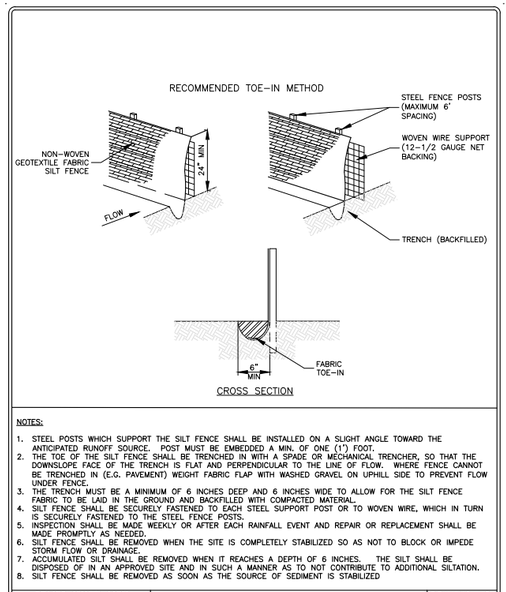


FOR QUESTIONS CONCERNING THIS DETAIL, PLEASE CONTACT THE FORESTRY MANAGER.

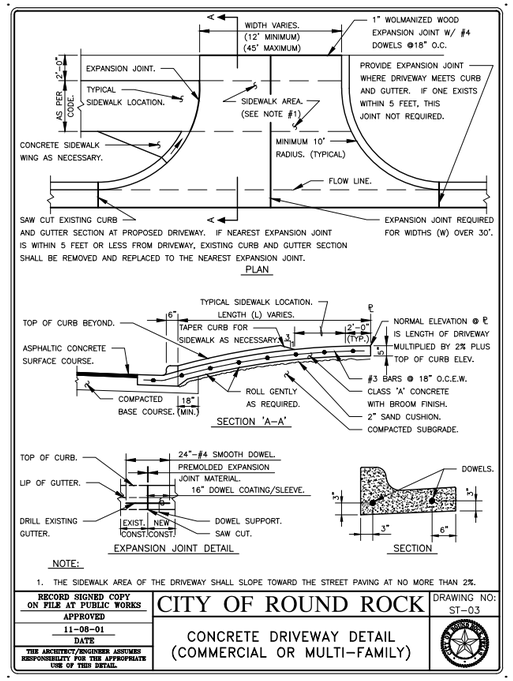
RECORD SIGNED COPY ON FILE AT PUBLIC WORKS	CITY OF ROUND ROCK	DRAWING NO: EC-04
APPROVED 03-25-11 DATE	TREE PROTECTION FENCE CHAIN LINK	
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR THE APPROPRIATE USE OF THIS DETAIL. (NOT TO SCALE)		



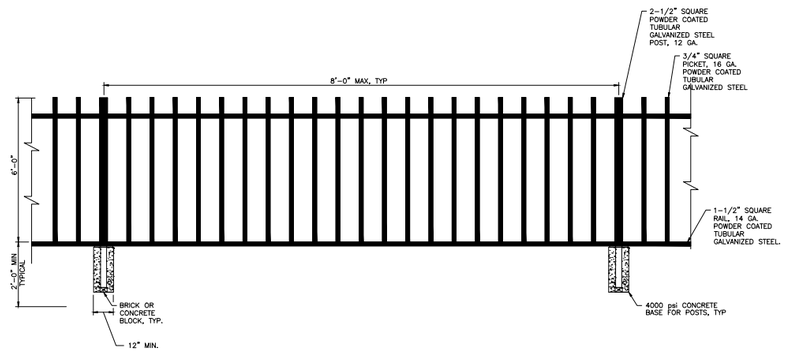
RECORD SIGNED COPY ON FILE AT PUBLIC WORKS	CITY OF ROUND ROCK	DRAWING NO: EC-09
APPROVED 03-25-11 DATE	STABILIZED CONSTRUCTION ENTRANCE DETAIL	
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR THE APPROPRIATE USE OF THIS DETAIL. (NOT TO SCALE)		



RECORD SIGNED COPY ON FILE AT PUBLIC WORKS	CITY OF ROUND ROCK	DRAWING NO: EC-10
APPROVED 03-25-11 DATE	SILT FENCE DETAIL	
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR THE APPROPRIATE USE OF THIS DETAIL. (NOT TO SCALE)		



RECORD SIGNED COPY ON FILE AT PUBLIC WORKS	CITY OF ROUND ROCK	DRAWING NO: ST-03
APPROVED 11-08-01 DATE	CONCRETE DRIVEWAY DETAIL (COMMERCIAL OR MULTI-FAMILY)	
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR THE APPROPRIATE USE OF THIS DETAIL.		



1 SAFETY FENCING DETAIL

SCALE: N.T.S.

Forest Creek Lift Station Rehabilitation
Round Rock, TX

ROUND ROCK TEXAS

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CIVIL DETAILS

C-502

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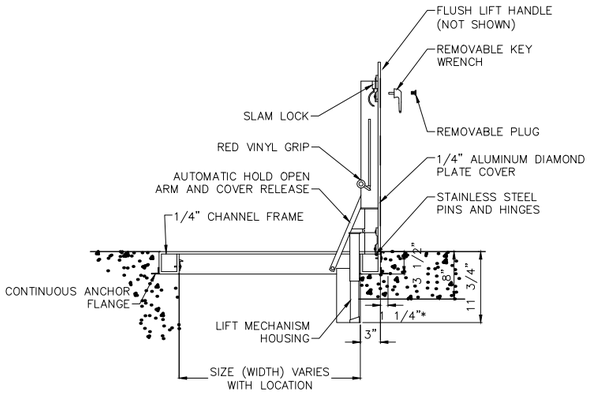
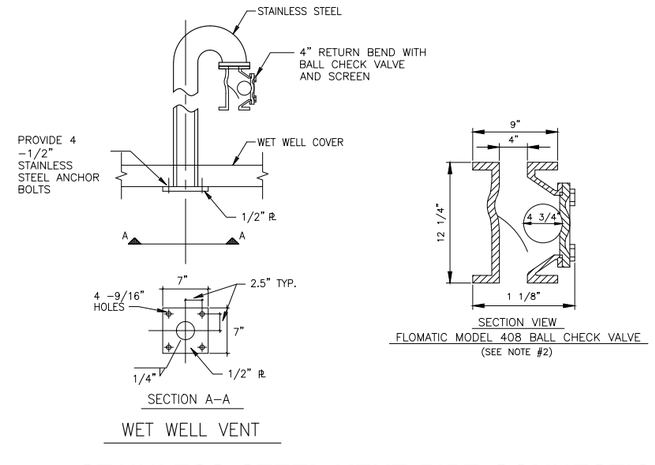


NOTES:

1. REFER TO PLANS AND SPECIFICATIONS FOR HATCH DIMENSIONS AND STYLE
2. CONTRACTOR SHALL VERIFY DIMENSIONS WITH HATCH MANUFACTURER. HATCH OPENING DIMENSIONS SHOWN ON LIFT STATION PIPING PLAN AND SECTION.
3. HATCH MUST HAVE ALL STAINLESS STEEL HARDWARE.
4. SAFETY GRATING SHALL BE PROVIDED FOR ALL HATCHES PER THE MANUFACTURER'S RECOMMENDATION.
5. HATCH LID SHALL BE SPRING LOADED.
6. HATCHES PROVIDED FOR WET WELLS SHALL BE COMPLETE WITH FALL PROTECTION GRATING

3 ALUMINUM HATCH DETAIL

NOT TO SCALE



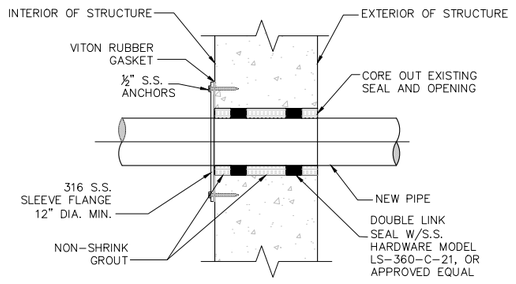
WET WELL VENT

4 STAINLESS STEEL VENT PIPE CONNECTION

NOT TO SCALE

NOTES:

1. CONTRACTOR IS TO COORDINATE VENT PIPE ANCHORING DESIGN WITH WET WELL MANUFACTURER. ANCHORING DESIGN WILL DIFFER FOR FRP VS POLYMER CONCRETE ALTERNATIVES
2. MINIMUM ELEVATION AT THE VENT OPENING SHALL BE 1 FOOT (1'-0") ABOVE THE ULTIMATE 100 YEAR FLOOD PLAIN ELEVATION. IF ELEVATION OF VENT OPENING IS LESS THAN 1 FOOT (1'-0") ABOVE THE ULTIMATE 100 YEAR FLOOD PLAIN ELEVATION, A FLOMATIC MODEL 408, PART #2145 BALL CHECK VALVE, OR APPROVED EQUAL, WITH FLOATING TYPE BALL, SHALL BE INSTALLED AT DOWN TURNED OPENING OF VENT. A 16 MESH 304 STAINLESS STEEL INSECT SCREEN SHALL BE PLACED IN THE OPENING.

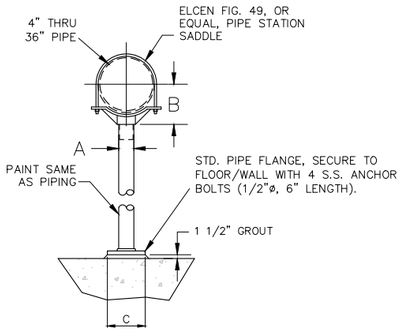


5 WALL PENETRATION EXISTING STRUCTURE

NOT TO SCALE

NOTES: DETAIL APPLICABLE FOR PENETRATION TO EXISTING AND PROPOSED VALVE VAULTS AND POLYMER CONCRETE WET WELL ALTERNATIVE BID AS NOTED ON PLANS. NOT APPLICABLE FOR FRP WET WELL BASE BID.

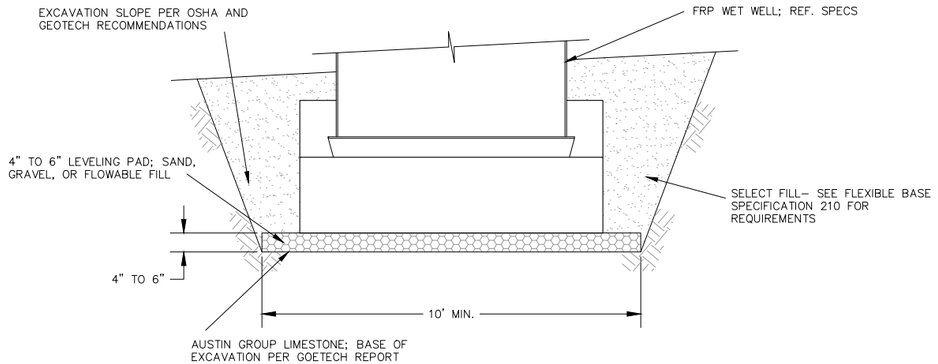
PIPE SIZE	DIMENSIONS (IN.) A	B	C
4"	3	4 3/16	9
5"	3	4 13/16	9
6"	3	5 7/16	9
8"	3	6 15/16	9
10"	3	8 7/16	9
12"	3	9 15/16	9
14"	4	8 1/8	11
16"	4	9 1/8	11
18"	4	10 3/8	11
20"	6	11 3/8	13 1/2
24"	6	13 3/4	13 1/2
30"	6	16 3/4	13 1/2"
36"	8	24 1/2	16



NOTE: SAME DETAIL APPLIES FOR HORIZONTAL BRACING. SUPPORT PIPE SHALL BE STAINLESS STEEL.

6 STAINLESS STEEL PIPE SUPPORT DETAIL

NOT TO SCALE



6 WET WELL BACKFILL DETAIL FOR POLYMER CONCRETE WET WELL ALTERNATE BID

NOT TO SCALE

Forest Creek Lift Station Rehabilitation Round Rock, TX

ROUND ROCK TEXAS

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KEY PLAN

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NO.	DESCRIPTION	DATE

FILE LOG

ACTIVITY	BY
Manager	RDO
Design	WCC
Draw	JDV
Check	DED

STAMP

1-18-16

STATE OF TEXAS
DANIELE DOW
119652
LICENSED PROFESSIONAL ENGINEER

Lockwood, Andrews & Newnam, Inc.
Texas Registered Engineering Firm F-2614

Project No. 160-10727-001
Date: November 2016

CIVIL DETAILS

C-503

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GENERAL NOTES

1. GOVERNING CODES AND STANDARDS

   A INTERNATIONAL BUILDING CODE (IBC), INTERNATIONAL CODE COUNCIL, INC., 2012 EDITION.

   B AMERICAN CONCRETE INSTITUTE (ACI) - BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE, ACI 318-11.

   C AMERICAN CONCRETE INSTITUTE (ACI) - CODE REQUIREMENTS FOR ENVIRONMENTAL ENGINEERING CONCRETE STRUCTURES, ACI 350-06.

   D AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC) - SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS, WITH COMMENTARY, 14TH EDITION.

2. DESIGN LOADS

   A. DEAD LOADS INCLUDE THE WEIGHT OF THE STRUCTURAL COMPONENTS, AS WELL AS THE WEIGHT OF THE MECHANICAL AND ELECTRICAL EQUIPMENT. ANY CHANGES IN TYPE, SIZE, OR LOCATION OF MECHANICAL AND ELECTRICAL EQUIPMENT FROM THAT INDICATED ON THE DRAWINGS SHALL BE REPORTED TO THE ENGINEER PRIOR TO INSTALLATION FOR VERIFICATION OF THE ADEQUACY OF SUPPORTING MEMBERS.

3. STRUCTURAL MEMBERS HAVE BEEN SIZED AND SPACED TO ACCOMMODATE THE EQUIPMENT SPECIFIED. ANY SUBSTITUTIONS CAUSING CHANGES IN THE STRUCTURE SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO COORDINATE.

4. REFER TO THE CIVIL DRAWINGS FOR FLOOR ELEVATIONS, SLOPES, LOCATION OF DEPRESSED FLOOR AREAS, FLOOR FINISHES, WALKS, CURBS, TOPPING SLABS, ETC. ALL SLAB RECESSES SHALL BE PROVIDED BY THE CONTRACTOR WHETHER SHOWN ON THE STRUCTURAL DRAWINGS OR NOT.

5. REPRODUCTION NOTE:

   THE USE OF REPRODUCTIONS OF THESE CONTRACT DRAWINGS BY ANY CONTRACTOR, SUBCONTRACTOR, ERECTOR, OR MATERIAL SUPPLIER IN LIEU OF THE PREPARATION OF SHOP DRAWINGS SIGNIFIES HIS ACCEPTANCE OF ALL INFORMATION SHOWN HEREIN AS CORRECT, AND OBLIGATES HIMSELF TO ANY JOB EXPENSE, REAL OR IMPLIED, ARISING DUE TO ANY ERRORS THAT MAY OCCUR HEREIN. IN ADDITION, ALL REFERENCES TO LOCKWOOD, ANDREWS AND NEWNAM, INC., INCLUDING ALL PROFESSIONAL SEALS ARE TO BE REMOVED IF THESE CONTRACT DRAWINGS ARE TO BE USED AS SHOP DRAWINGS.

6. REFER TO THE SPECIFICATIONS FOR DETAILED REQUIREMENTS NOT FULLY ADDRESSED IN THESE NOTES.

STRUCTURAL EXCAVATION, BACKFILL, AND COMPACTION NOTES

1. BEFORE THE START OF EARTHWORK OPERATIONS, ADEQUATELY PROTECT EXISTING STRUCTURES, UTILITIES, AND OTHER PERMANENT OBJECTS FROM DAMAGE. THE CONTRACTOR IS RESPONSIBLE FOR THE REPAIR OR REPLACEMENT OF ALL DAMAGED ELEMENTS, AT NO ADDITIONAL COST TO OWNER.

2. EXCAVATION WORK SHALL BE NEAT AND FREE OF DEBRIS AND LOOSE MATERIAL.

3. EXCAVATIONS SHALL NOT BE MADE DURING INCLEMENT WEATHER. WATER ACCUMULATION IN EXCAVATIONS EXCEEDING 1 INCH SHALL BE PUMPED OUT BEFORE THE CONCRETE IS PLACED.

4. REFER TO THE GEOTECHNICAL REPORT FOR ADDITIONAL INFORMATION.

5. ALL SURFICIAL VEGETATION AND OTHER ORGANIC MATERIAL SHALL BE REMOVED BENEATH PROPOSED FOUNDATION AND BUILDING AREAS PRIOR TO CONSTRUCTION. THE EXPOSED SURFACE SHALL BE PROOF-ROLLED WITH ANY SOFT OR WEAK AREAS REMOVED AND REPLACED WITH COMPACTED SELECT FILL.

6. SELECT FILL MATERIAL SHALL BE CRUSHED LIMESTONE. FLEXIBLE BASE SHALL BE USED AS SELECT FILL - SEE CITY OF ROUND ROCK STANDARD SPECIFICATION 210.

7. EXISTING SOIL SHALL BE EXCAVATED A MINIMUM OF 2 FEET OR AS INDICATED ON THE DRAWINGS. EXPOSED SOIL SHALL BE SCARIFIED TO A DEPTH OF 6 INCHES AND RECOMPACTED TO AT LEAST 95% OF ASTM D1557 MAXIMUM DRY DENSITY NEAR OPTIMUM MOISTURE CONTENT.

8. PLACE SELECT FILL IN UNIFORM LAYERS WITH A MAXIMUM COMPACTED THICKNESS OF SIX INCHES PER LIFT, DRIED OR MOISTENED AS REQUIRED TO OBTAIN OPTIMUM MOISTURE CONTENT, AND COMPACT EACH LAYER AS SPECIFIED ABOVE.

FOUNDATION NOTES

1. EXCAVATION FOR FOOTINGS SHALL BE NEAT. PLACE CONCRETE IMMEDIATELY AFTER EXCAVATION AND INSPECTION. WATER ACCUMULATION IN FOOTING EXCEEDING 1 INCH SHALL BE PUMPED OUT.

2. DESIGN BEARING SOIL PRESSURES ARE AS FOLLOWS:
   1500 P.S.F. AT 2 FEET BELOW GRADE FOR GRADE BEAMS
   8000 P.S.F. AT 32 FEET BELOW GRADE FOR THE WET WELL

3. A 4 INCH SAND, GRAVEL, OR FLOWABLE FILL LAYER MAY BE PLACED UNDER ALL SLABS ON GRADE FOR LEVELING PURPOSES.

4. REFER TO GEOTECHNICAL REPORT NUMBER 04.30151036 PREPARED BY FUGRO CONSULTANTS, INC. 8613 CROSS PARK DR., AUSTIN, TX 78754 ON AUGUST 1, 2016, FOR FURTHER REQUIREMENTS.

CONCRETE NOTES

1. CONCRETE CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE AMERICAN CONCRETE INSTITUTE BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE, ACI 318.

2. ALL CONCRETE SHALL BE NORMAL WEIGHT CONCRETE WITH A MINIMUM COMPRESSIVE STRENGTH OF 4000 PSI AT 28 DAYS.

3. NORMAL WEIGHT CONCRETE SHALL WEIGH NOT MORE THAN 150 PCF.

4. DETAILING, FABRICATION AND ERECTION OF REINFORCING BARS SHALL COMPLY WITH ACI "MANUAL OF STANDARD PRACTICE FOR DETAILING REINFORCED CONCRETE STRUCTURES" (ACI 315).

5. DEFORMED STEEL REINFORCING BARS SHALL CONFORM TO ASTM A 615 WITH SUPPLEMENTARY REQUIREMENTS S1, GRADE 60. WELDED WIRE FABRIC SHALL CONFORM TO ASTM A 185.

6. PROVIDE ONE NO. 5 X 4'-0" BAR AT ALL RE-ENTRANT CORNERS, PLACED ON THE DIAGONAL WITH 1 INCH CLEARANCE FROM CORNER AND TOP OF SLAB. (THIS INCLUDES ANY RECTILINEAR HOLES MADE DUE TO STANDARD CONSTRUCTION PRACTICES.)

7. PROVIDE A 3/4-INCH CHAMFER AT ALL EXPOSED EDGES OF CONCRETE UNLESS DETAILED OTHERWISE.

8. REINFORCING BARS FOR SLABS ON GRADE SHALL BE SUPPORTED AT 4'-0" MAXIMUM CENTERS EACH WAY BY BAR CHAIRS WITH SHEET METAL BASES. DEPTH OF CHAIRS SHALL PROVIDE FOR 1½ INCH TOP COVER UNLESS NOTED OTHERWISE.

9. LAP CONTINUOUS UNSCHEDULED REINFORCING BARS 30 BAR DIAMETERS UNLESS NOTED OTHERWISE.

10. MINIMUM REINFORCING STEEL COVERAGE SHALL BE AS FOLLOWS:

TOP	2"
SIDES	2"
BOTTOM	3"

11. THE LOCATION OF CONSTRUCTION JOINTS SHALL BE APPROVED BY THE STRUCTURAL ENGINEER. CONSTRUCTION JOINTS SHALL BE MADE IN THE CENTER OF SPANS WITH VERTICAL BULKHEADS UNLESS NOTED OTHERWISE. THERE SHALL BE NO HORIZONTAL CONSTRUCTION JOINTS IN CONCRETE POURS.

STRUCTURAL STEEL NOTES

1. STRUCTURAL STEEL HSS MEMBERS SHALL CONFORM TO ASTM A500 GRADE B.

2. ALL OTHER STRUCTURAL STEEL SHALL CONFORM TO ASTM A36.

3. ALL STRUCTURAL STEEL SHALL BE HOT-DIP-GALVANIZED.

4. ALL STRUCTURAL STEEL SHALL BE DOMESTIC STEEL. FOREIGN STEEL WILL NOT BE ACCEPTED.

5. DETAIL, FABRICATION AND ERECTION OF STRUCTURAL STEEL SHALL COMPLY WITH THE AISC "SPECIFICATION FOR THE DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL FOR BUILDINGS", AISC "CODE OF STANDARD OF STANDARD PRACTICE", AND ALL UPDATING PUBLICATIONS.

6. UNLESS SHOWN OTHERWISE ON THE DRAWINGS, CONNECTIONS SHALL BE SHOP WELDED AND FIELD BOLTED.

7. ALL CONNECTION BOLTS SHALL CONFORM TO ASTM A325 REQUIREMENTS.

8. WELDING SHALL CONFORM TO THE AMERICAN WELDING SOCIETY SPECIFICATION. ELECTRODES SHALL CONFORM TO AWS A5.5, E70XX.

9. ALL MISCELLANEOUS WELDS (FIELD OR SHOP) SHALL BE MINIMUM SIZE FILLET ALL AROUND IN ACCORDANCE WITH AISC. WELDING OF CONTINUOUS MEMBERS SHALL BE A MINIMUM OF 2 INCHES OF 3/16-INCH FILLET STITCH WELDS AT 12 INCHES O.C., STAGGERED EACH SIDE, UNLESS OTHERWISE NOTED. COLUMN BASE PLATES, CAP PLATES AND STIFFENER PLATES SHALL BE WELDED ALL AROUND.

10. SPLICING OF STRUCTURAL STEEL MEMBERS IS PROHIBITED WITHOUT PRIOR APPROVAL OF THE STRUCTURAL ENGINEER AS TO LOCATION AND TYPE OF SPLICE. ANY MEMBER HAVING A SPLICE NOT SHOWN AND DETAILED ON THE SHOP DRAWINGS WILL BE REJECTED.

11. ANCHOR BOLTS SHALL COMPLY WITH ASTM FI554, GR. 36 AND SHALL BE SET USING RIGID TEMPLATES.

12. BURNING OF HOLES IN STRUCTURAL STEEL IS PROHIBITED. ANY MEMBER WITH BURNED HOLES SHALL BE REPLACED.

13. FIELD REPAIR OF GALVANIZING SHALL BE DONE WITH "ZRC COLD GALVANIZING COMPOUND," MANUFACTURED BY ZRC CHEMICAL PRODUCTS COMPANY, QUINCY, MASSACHUSETTS, OR APPROVED SUBSTITUTION.

14. PROVIDE DIELECTRIC ISOLATION KITS AT ALL CONNECTIONS BETWEEN DISSIMILAR METALS.

STEEL DECK NOTES:

1. ALL METAL DECKING SHALL BE GALVANIZED PER THE SPECIFICATIONS.

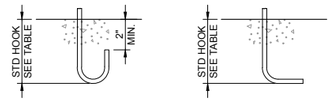
   A. STEEL ROOF DECK (TYPE 1.5B) SHALL BE 1.5 INCH, 22 GAUGE METAL DECK (Fy = 35 KSI MIN.) HAVING THE FOLLOWING MINIMUM SECTION PROPERTIES:

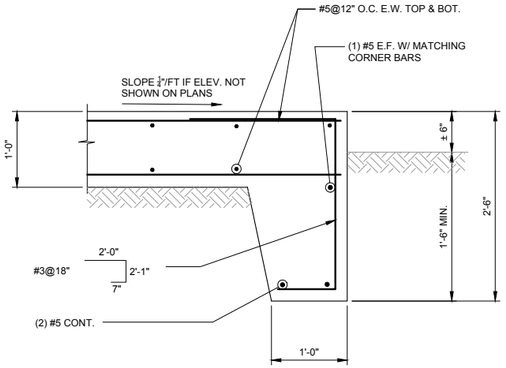
      Ip = 0.155 IN^4/FT
      In = 0.183 IN^4/FT
      Sp = 0.186 IN^4/FT
      Sn = 0.192 IN^4/FT
      p = FOR POSITIVE BENDING
      n = FOR NEGATIVE BENDING

2. SEE SPECIFICATION 05310 FOR STEEL DECK FASTENER ATTACHMENT PATTERN.

REINFORCING LAP SPLICE & EMBEDMENT SCHEDULE					
BAR SIZE	MIN LAP LENGTH (IN)		MIN EMBEDMENT LENGTH (IN)		
	TOP BARS	OTHER BARS	TOP BARS	OTHER BARS	STD HOOK
3	24	18	18	14	7
4	32	24	25	19	9
5	40	31	31	24	12
6	48	37	37	28	14
7	70	54	54	42	17
8	80	62	62	47	19
9	90	70	70	54	21
10	102	78	78	60	24
11	113	87	87	67	27

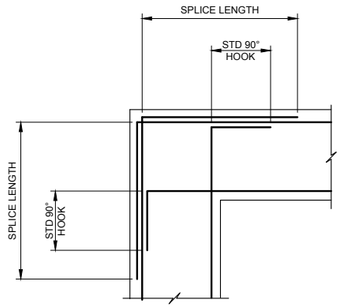
1. LAP SPLICES AND EMBEDMENT LENGTHS NOT SHOWN ON THE DRAWINGS SHALL CONFORM TO THE TABLE AT LEFT.
2. TOP BARS ARE HORIZONTAL BARS WITH MORE THAN 12 INCHES DEPTH OF CONCRETE CAST BELOW THE REINFORCING BAR.
3. EMBEDMENT LENGTH OF STANDARD HOOKS





1 TYPICAL EXTERIOR PAD

SCALE: NONE



NOTE: SPLICE LENGTH- SEE REINFORCING LAP SPLICE AND EMBEDMENT TABLES UNLESS NOTED OTHERWISE ON DRAWINGS.

2 TYPICAL CORNER REINFORCING

SCALE: NONE

Forest Creek Lift Station Rehabilitation
Round Rock, TX

ROUND ROCK TEXAS

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KEY PLAN

REVISIONS

NO.	DESCRIPTION	DATE

FILE LOG

ACTIVITY	BY
Manager	RDO
Design	JNS
Draw	TMP
Check	PRJ

STAMP

STATE OF TEXAS
JENNIFER N. SAVAGE
111686
LICENSED
PROFESSIONAL ENGINEER
11/10/16

Lockwood, Andrews & Newnam, Inc.
Texas Registered Engineering Firm F-2614

Project No. 160-10727-001
Date: November 2016

STRUCTURAL GENERAL NOTES AND TYPICAL DETAILS

S-001

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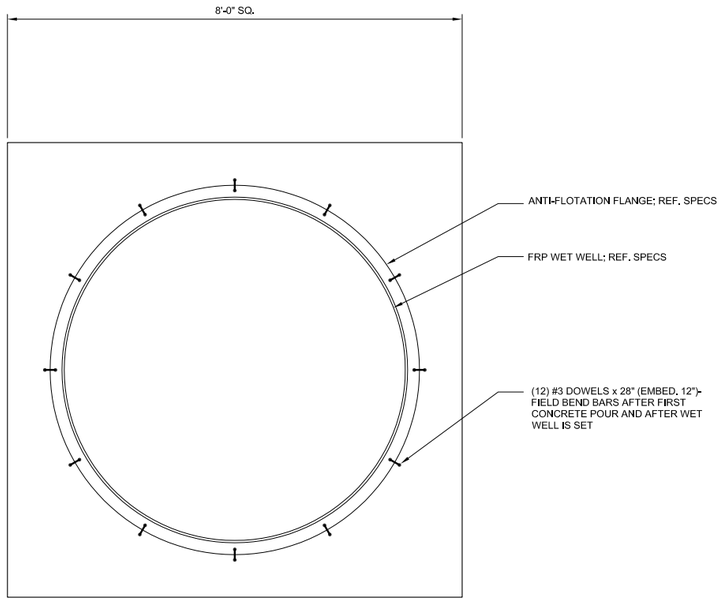
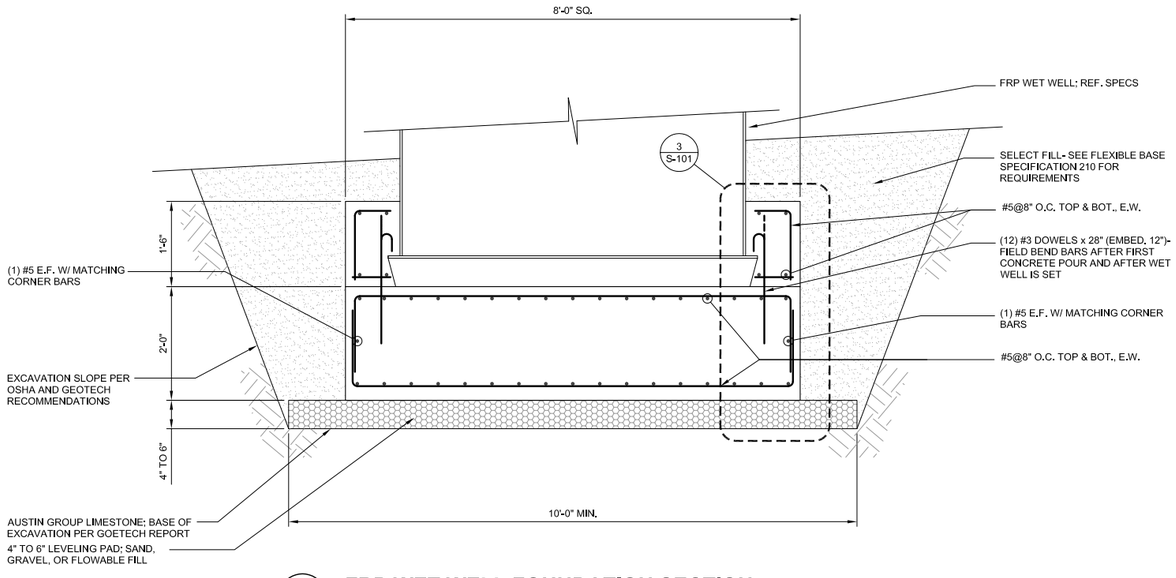


1 FRP WET WELL FOUNDATION PLAN

SCALE: 3/4"=1'-0"



1 FRP WET WELL FOUNDATION SECTION

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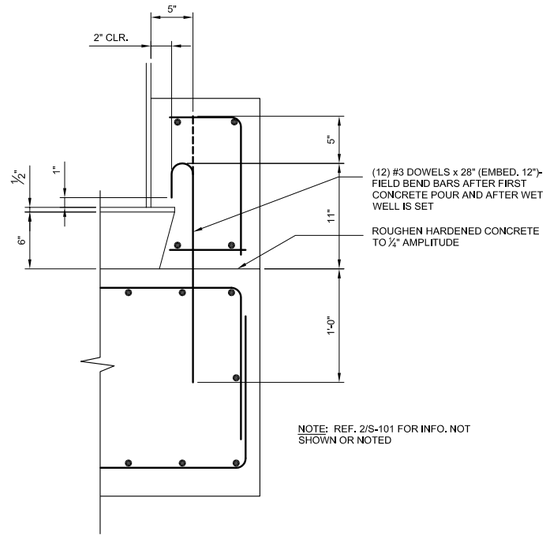

3 ENLARGED DETAIL

SCALE: 1 1/2"=1'-0"

(FRP WET WELL - BASE BID)

Forest Creek Lift Station Rehabilitation
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ROUND ROCK TEXAS

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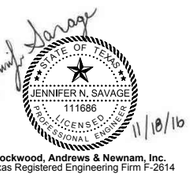

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Texas Registered Engineering Firm F-2614

Project No. 160-10727-001
Date: November 2016

FRP WET WELL FOUNDATION PLAN AND DETAILS

S-101

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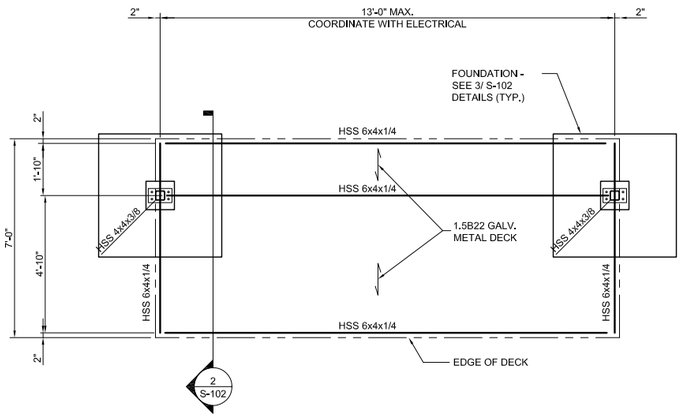
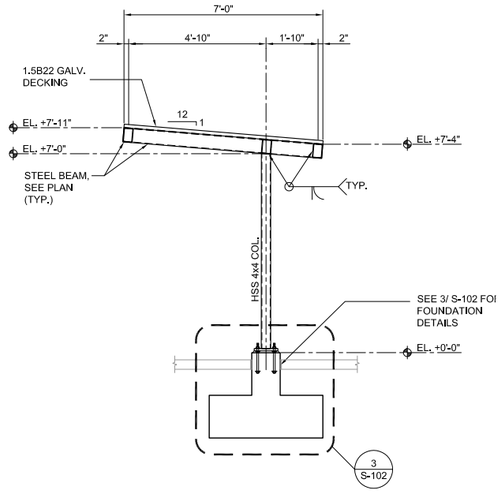


1 ELECTRICAL CANOPY FOUNDATION AND FRAMING PLAN

SCALE: 3/8"=1'-0"



2 ELECTRICL CANOPY SECTION

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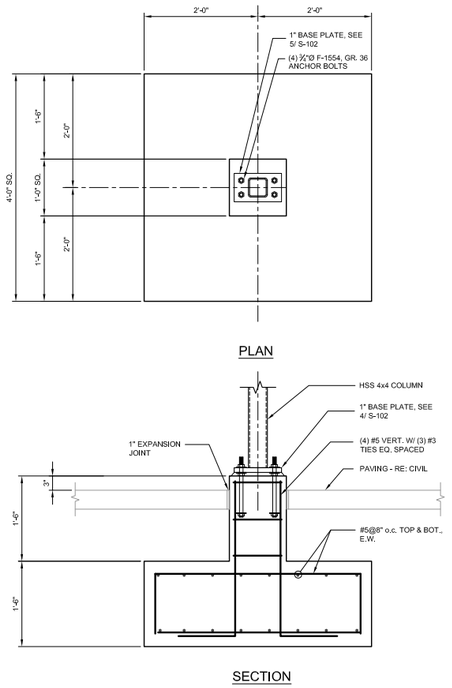

SECTION

3 ELECTRICL CANOPY FOUNDATION

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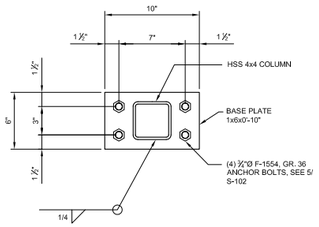
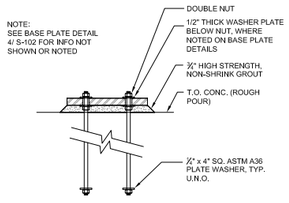


4 BASE PLATE DETAIL

SCALE: 3/4"=1'-0"



5 ANCHOR BOLT TYPICAL DETAIL

SCALE: 3/4"=1'-0"

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KEY PLAN

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Date: November 2016

ELECTRICAL CANOPY FOUNDATION AND FRAMING PLAN AND DETAILS

S-102

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ABBREVIATIONS

A	AMMETER, AMPERE, AMBER
AF	AMPERE FRAME
AFD	ADJUSTABLE FREQUENCY DRIVE
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AS	AMMETER SWITCH, AMPERE SENSOR
ASU	AIR SUPPLY UNIT
AT	AMPERE TRIP
ATC	AUTOMATIC THROWOVER CONTROL
ATS	AUTOMATIC TRANSFER SWITCH
BC	BARE COPPER
BRKR	BREAKER
BLWR	BLOWER
BUP	BACK UP PANEL
BV	BUTTERFLY VALVE
C	CONDUIT, CONTACTOR
CB	CIRCUIT BREAKER
CC	CONTROL CABLE
CFE	CITY FURNISHED EQUIPMENT
CKT	CIRCUIT
CP	CONTROL PANEL
CPT	CONTROL POWER TRANSFORMER
CR	CONTROL RELAY
CRE	CORROSION-RESISTANT
CRS	COATED RIGID STEEL CONDUIT
CT	CURRENT TRANSFORMER
DC	DIRECT CURRENT
DIV	DIVISION
E	EMPTY
EHH	ELECTRIC HAND HOLD
ELEC	ELECTRIC
EMH	ELECTRIC MANHOLE
ENCL	ENCLOSURE
EO	ELECTRIC OPERATOR
EQPT	EQUIPMENT
ESS	EMERGENCY SHUTDOWN SWITCH
ETM	ELAPSED TIME METER
EXST	EXISTING
F	FUSE
FDR	FEEDER
FIT	FLOW INDICATING TRANSMITTER
FLR	FLOOR
FLUOR	FLUORESCENT
F0	FIBER OPTIC
FVNR	FULL VOLTAGE NON-REVERSING
FVR	FULL VOLTAGE REVERSING
G	GREEN, GROUND
GALV	GALVANIZED
GFCI	GROUND FAULT CIRCUIT INTERRUPTER 5MA
GFI	GROUND FAULT-INTERRUPTER-EQUIPMENT-30MA
GFR	GROUND FAULT RELAY
GND	GROUND
GV	GLOBE VALVE
H	HIGH SPEED
HH	HANDHOLE
HID	HIGH INTENSITY DISCHARGE
HPS	HIGH PRESSURE SODIUM
HS	HAND SWITCH
HSP	HIGH SERVICE PUMP
HTR	HEATER
IC	INTERRUPTING CAPACITY
I & C	INSTRUMENTATION AND CONTROL
INCAND	INCANDESCENT
JB	JUNCTION BOX
L	LIGHTING CONTACTOR, LOW SPEED
LIT	LEVEL INDICATING TRANSMITTER
LN OR LIN	LIQUID NITROGEN
LOS	LOCKOUT STOP PUSH BUTTON
LOX	LIQUID OXYGEN
LR	LATCHING RELAY
LT FLEX	LIQUID TIGHT FLEX CONDUIT
LTS	LIGHTS
KV	KILOVOLT
KVA	KILOVOLT-AMPERE
M	MAGNETIC CONTACTOR COIL
MCC	MOTOR CONTROL CENTER
MCP	MOTOR CIRCUIT PROTECTOR
MH	MANHOLE, METAL HALIDE
MOV	MOTOR OPERATED VALVE
MO	MOTOR OPERATOR
MS	MOTOR STARTER
MT	MOUNT
MTD	MOUNTED
MV	MEDIUM VOLTAGE
N	NEUTRAL
NA	NON-AUTOMATIC
NC	NORMALLY CLOSED
NL	NIGHT LIGHT
NO	NORMALLY OPEN
NP	NAMEPLATE
OAE	OR APPROVED EQUAL
OC	ON CENTER
OL	OVERLOAD RELAY
PB	PULL BOX, PUSH BUTTON SWITCH
PC	PHOTOCELL
PH	PHASE
PIT	PRESSURE INDICATING TRANSMITTER
PMR	PHASE MONITOR RELAY
PMGR	PAD MOUNTED SWITCHGEAR
PNL	PANEL
PR	PAIR
PS	PRESSURE SWITCH
PT	POTENTIAL TRANSFORMER
PTT	PUSH TO TEST
PVC	POLYVINYL CHLORIDE CONDUIT
R	RED
RA	RIGID ALUMINUM
RCPT	RECEPTACLE
RIO	REMOTE I/O
RS	RIGID STEEL CONDUIT
RT	REMOTE TELEMETRY
RVNR	REDUCED VOLTAGE NON-REVERSING
RVR	REDUCED VOLTAGE REVERSING
SA	SURGE ARRESTOR
SCCR	SHORT CIRCUIT CURRENT RATING
S/N	SOLID NEUTRAL
S.S.	STAINLESS STEEL
SSOL	SOLID STATE OVERLOAD, SOLID STATE OVERLOAD RELAY
STP	SHIELDED TWISTED PAIR
STT	SHIELDED TWISTED TRIAD
SV	SOLENOID VALVE
SW	SWITCH
TB	TERMINAL BOARD
TC	TIME CLOSE
TDR	TIME DELAY RELAY
TIT	TEMPERATURE INDICATING TRANSMITTER
TJB	TERMINAL JUNCTION BOX
T.O.	TIME OPEN
TP	TWISTED PAIR
TS	AUTO TRANSFORMER TEMPERATURE SWITCH
TSP	TWISTED SHIELDED PAIR
TST	TWISTED SHIELDED TRIAD
TYP	TYPICAL
UH	UNIT HEATER
UON	UNLESS OTHERWISE NOTED
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DRAWING SYMBOLS

POINT OF CONNECTION

KEYED NOTES

DETAIL NO./SHEET NO. (PLAN SHEET)

TITLE
SCALE: 1/2" = 1'-0"

SECTION/CUT

INTERIOR SECTION NO./SHEET NO.

EXTERIOR SECTION NO./SHEET NO.

LEADER TITLE

PLAN NORTH

NORTH ARROWS

POWER AND LIGHTING PLAN SYMBOLS

DUPLEX

FLOOR MOUNTED

QUAD

SINGLE

THREE PRONG

SPLIT

ISOLATED GROUND

WP WEATHER PROOF

GFCI WP WP/GFCI WEATHERPROOF WHILE IN USE COVER

GFCI GROUND FAULT

HALF SWITCHED

COMBO 15/20A

PATIENT REF GROUND BUS

SPECIAL

J CEILING MOUNTED

J WALL MOUNTED

J PULL BOX

TV TELEVISION

A WALL-PACK FIXTURE

2X4 FLUORESCENT RECESSED FIXTURE

2X4 FLUORESCENT EMERGENCY RECESSED FIXTURE

2X2 FLUORESCENT RECESSED FIXTURE

2X2 FLUORESCENT EMERGENCY RECESSED FIXTURE

1X4 FLUORESCENT WET LOCATION FIXTURE

1X4 FLUORESCENT EMERGENCY WET LOCATION FIXTURE

PE PHOTOELECTRIC SWITCH

$ SINGLE POLE SWITCH

$3 THREE WAY SWITCH

$M MOTOR SWITCH
- M - MOTOR RATER TOGGLE SWITCH WITHOUT OVERLOAD
- MS - MANUAL MOTOR STARTER WITH OVERLOADS

POWER

COMMUNICATIONS

LOW VOLTAGE

LA-2 HOME RUN - DESTINATION SHOWN

BRANCH CIRCUIT OR FEEDER IN FLOOR SLAB OR UNDERGROUND

OE OVERHEAD POWER DISTRIBUTION BY ELECTRIC UTILITY CO.

BARE STRANDED TINNED-COPPER WIRE, #4/0 UON

SINGLE PHASE

THREE PHASE

MANUAL

MAGNETIC

30A/3P DISCONNECT UON

30A/3P FUSED DISC UON

COMBO

T XFMR

ATS

CONDUIT UP

CONDUIT DOWN

INSTRUMENTATION DEVICE

3/4" x 10'-0" COPPER CLAD GROUND ROD

XXX CONDUIT/CONDUCTOR TAG REFER SCHEDULE ON SHEET E-603

WALL-PACK FIXTURE

GROUND TEST WELL

1X4 FLUORESCENT INDUSTRIAL FIXTURE

FLUORESCENT EMERGENCY INDUSTRIAL FIXTURE

POLE MOUNTED FIXTURE

STANCHION MOUNTED FIXTURE

BRACKET MOUNTED FIXTURE

WALL MOUNTED EXIT FIXTURE

TELEPHONE BACKBOARD

DATA/TELEPHONE OUTLET

CONTROL SCHEMATIC SYMBOLS

LOCAL OFF REMOTE — LOCAL-OFF-REMOTE SWITCH

XOO — CONTACTS CLOSED IN LOCAL POSITION, OPEN IN OTHER POSITIONS

OOX — CONTACTS CLOSED IN REMOTE POSITION, OPEN IN OTHER POSITIONS

M — MOTOR STARTER CONTACTOR COIL

C — MOTOR STARTER CONTACTOR (CLOSE) COIL IN VALVE MOTOR OPERATOR

O — MOTOR STARTER CONTACTOR (OPEN) COIL IN VALVE MOTOR OPERATOR

CRXX — CONTROL RELAY COIL, CRXX INDICATES CONTROL RELAY NUMBER

XXXX TRXX — TIMER COIL, TRXX INDICATES TIMER NUMBER XXXX INDICATES TIME DURATION AND TIMER TYPE, I.E. IS ON DELAY OR OFF DELAY

NORMALLY OPEN RELAY OR CONTACTOR CONTACTS

NORMALLY CLOSED RELAY OR CONTACTOR CONTACTS

NORMALLY CLOSED TIMER CONTACTS

NORMALLY OPEN TIMER CONTACTS

XXXX — NORMALLY OPEN PUSHBUTTON

XXXX INDICATES FUNCTION OF PUSHBUTTON

XXXX — NORMALLY CLOSED PUSHBUTTON

XXXX INDICATES FUNCTION OF PUSHBUTTON

XXXX — SWITCH CONTACTS, TYPE AS INDICATED
LSO=LIMIT SWITCH OPEN
LSC=LIMIT SWITCH CLOSED
TSO=TORQUE SWITCH OPEN
TSC=TORQUE SWITCH CLOSED

PFR — PHASE FAIL RELAY CONTACTS

OR — THERMAL SWITCH CONTACTS

XXXX R — INDICATING LIGHT, COLOR AS INDICATED. R= RED, G=GREEN, A=AMBER, W=WHITE XXXX INDICATES CONDITION INDICATED BY LIGHT

ETM — ELAPSED TIME METER

FUSE

OR — PRESSURE SWITCH CONTACTS

OR — FLOAT SWITCH CONTACTS

FIELD WIRING TERMINATION

ONE-LINE DIAGRAM SYMBOLS

POT HEAD

UTILITY CONNECTION

BREAKER

DRAW OUT TYPE

FUSE

AS P AF FUSIBLE DISCONNECT SWITCH

AS P NON-FUSIBLE DISCONNECT SWITCH

M METER; TYPE AS INDICATED

7.5 THREE PHASE MOTOR - HP AS NOTED

G GENERATOR

PANEL 'X' PANEL

TRANSFORMER T-03 5kVA 600-120/208V Z=0.8%

AUTO TRANSFORMER

CONDUIT SEAL

GROUND

GROUND/RESISTOR

LIGHTNING ARRESTOR

AS AMMETER SWITCH

VS VOLTMETER SWITCH

X METER INDICATING

X METER RECORDING

K KEY INTERLOCK

XXXX METER

ETM ELAPSED TIME METER

3 /5 CURRENT TRANSFORMER - QUANTITY AND RATIO AS INDICATED

VFD VARIABLE FREQUENCY DRIVE

COMBINATION MOTOR STARTER-SIZE AS INDICATED; OR NORMALLY OPEN (N.O.) CONTACTOR

MOTOR SPACE HEATER

TS MOTOR TEMPERATURE SWITCH

RTD MOTOR REMOTE TEMPERATURE DEVICE

VS VIBRATION SWITCH

DELTA

GROUNDED Y

A CPT 480/120V HOA 3 M OL 3 W R G A ETM

COMBINATION MOTOR STARTER WITH CIRCUIT BREAKER (CB) AND SOLID STATE OVERLOAD RELAY, NEMA SIZE AND RATINGS AS INDICATED. PROVIDE CONTROL SWITCH AS INDICATED WITH CONTROL POWER TRANSFORMER (CPT), AND LIGHT-EMITTING DIODE (LED) PILOT/ INDICATING LIGHTS.

Forest Creek Lift Station Rehabilitation
Round Rock, TX

ROUND ROCK TEXAS

Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY
8911 N. Capital of Texas Hwy
Building 2, Suite 2300
Austin, TX 78759
Tel 512-338-4212
www.lan-inc.com

KEY PLAN

REVISIONS

NO.	DESCRIPTION	DATE

FILE LOG

ACTIVITY	BY
Manager	DRH
Design	GDG
Draw	ZTJ
Check	MDM

STAMP

STATE OF TEXAS
JENNIFER N. SAVAGE
111686
LICENSED
PROFESSIONAL ENGINEER
11/18/16

Lockwood, Andrews & Newnam, Inc.
Texas Registered Engineering Firm F-2614

Project No. 160-10727-001
Date: November 2016

ELECTRICAL SYMBOLS AND LEGENDS

E-001

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ABBREVIATIONS

A	AMMETER, AMPERE, AMBER
AF	AMPERE FRAME
AFD	ADJUSTABLE FREQUENCY DRIVE
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AS	AMMETER SWITCH, AMPERE SENSOR
ASU	AIR SUPPLY UNIT
AT	AMPERE TRIP
ATC	AUTOMATIC THROWOVER CONTROL
ATS	AUTOMATIC TRANSFER SWITCH
BC	BARE COPPER
BRKR	BREAKER
BLWR	BLOWER
BUP	BACK UP PANEL
BV	BUTTERFLY VALVE
C	CONDUIT, CONTACTOR
CB	CIRCUIT BREAKER
CC	CONTROL CABLE
CFE	CITY FURNISHED EQUIPMENT
CKT	CIRCUIT
CP	CONTROL PANEL
CPT	CONTROL POWER TRANSFORMER
CR	CONTROL RELAY
CRE	CORROSION-RESISTANT
CRS	COATED RIGID STEEL CONDUIT
CT	CURRENT TRANSFORMER
DC	DIRECT CURRENT
DIV	DIVISION
E	EMPTY
EHH	ELECTRIC HAND HOLD
ELEC	ELECTRIC
EMH	ELECTRIC MANHOLE
ENCL	ENCLOSURE
EO EQPT	ELECTRIC OPERATOR EQUIPMENT
ESS	EMERGENCY SHUTDOWN SWITCH
ETM	ELAPSED TIME METER
EXST	EXISTING
F	FUSE
FDR	FEEDER
FIT	FLOW INDICATING TRANSMITTER
FLR	FLOOR
FLUOR	FLUORESCENT
F0	FIBER OPTIC
FVNR	FULL VOLTAGE NON-REVERSING
FVR	FULL VOLTAGE REVERSING
G	GREEN, GROUND
GALV	GALVANIZED
GFCI	GROUND FAULT CIRCUIT INTERRUPTER 5MA
GFI	GROUND FAULT-INTERRUPTER-EQUIPMENT-30MA
GFR	GROUND FAULT RELAY
GND	GROUND
GV	GLOBE VALVE
H	HIGH SPEED
HH	HANDHOLE
HID	HIGH INTENSITY DISCHARGE
HPS	HIGH PRESSURE SODIUM
HS	HAND SWITCH
HSP	HIGH SERVICE PUMP
HTR	HEATER
IC	INTERRUPTING CAPACITY
I & C	INSTRUMENTATION AND CONTROL
INCAND	INCANDESCENT
JB	JUNCTION BOX
L	LIGHTING CONTACTOR, LOW SPEED
LIT	LEVEL INDICATING TRANSMITTER
LN OR LIN	LIQUID NITROGEN
LOS	LOCKOUT STOP PUSH BUTTON
LOX	LIQUID OXYGEN
LR	LATCHING RELAY
LT FLEX	LIQUID TIGHT FLEX CONDUIT
LTS	LIGHTS
KV	KILOVOLT
KVA	KILOVOLT-AMPERE
M	MAGNETIC CONTACTOR COIL
MCC	MOTOR CONTROL CENTER
MCP	MOTOR CIRCUIT PROTECTOR
MH	MANHOLE, METAL HALIDE
MOV	MOTOR OPERATED VALVE
MO	MOTOR OPERATOR
MS	MOTOR STARTER
MT	MOUNT
MTD	MOUNTED
MV	MEDIUM VOLTAGE
N	NEUTRAL
NA	NON-AUTOMATIC
NC	NORMALLY CLOSED
NL	NIGHT LIGHT
NO	NORMALLY OPEN
NP	NAMEPLATE
OAE	OR APPROVED EQUAL
OC	ON CENTER
OL	OVERLOAD RELAY
PB	PULL BOX, PUSH BUTTON SWITCH
PC	PHOTOCELL
PH	PHASE
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DRAWING SYMBOLS

- POINT OF CONNECTION
- KEYED NOTES
- DETAIL NO./SHEET NO. (PLAN SHEET)
- TITLE — SCALE: 1/2" = 1'-0"
- SECTION/CUT
- INTERIOR SECTION NO./SHEET NO.
- EXTERIOR SECTION NO./SHEET NO.
- LEADER TITLE
- PLAN NORTH
- NORTH ARROWS

POWER AND LIGHTING PLAN SYMBOLS

- DUPLEX
- FLOOR MOUNTED
- QUAD
- SINGLE
- THREE PRONG
- SPLIT
- ISOLATED GROUND
- WP WEATHER PROOF
- GFCI WP WP/GFCI WEATHERPROOF WHILE IN USE COVER
- GFCI GROUND FAULT
- HALF SWITCHED
- COMBO 15/20A
- PATIENT REF GROUND BUS
- SPECIAL
- CEILING MOUNTED
- WALL MOUNTED
- PULL BOX
- TV TELEVISION
- WALL-PACK FIXTURE
- 2X4 FLUORESCENT RECESSED FIXTURE
- 2X4 FLUORESCENT EMERGENCY RECESSED FIXTURE
- 2X2 FLUORESCENT RECESSED FIXTURE
- 2X2 FLUORESCENT EMERGENCY RECESSED FIXTURE
- 1X4 FLUORESCENT WET LOCATION FIXTURE
- 1X4 FLUORESCENT EMERGENCY WET LOCATION FIXTURE
- PE PHOTOELECTRIC SWITCH
- SINGLE POLE SWITCH
- THREE WAY SWITCH
- MOTOR SWITCH — M - MOTOR RATER TOGGLE SWITCH WITHOUT OVERLOAD; MS - MANUAL MOTOR STARTER WITH OVERLOADS
- POWER
- COMMUNICATIONS
- LOW VOLTAGE
- LA-2 HOME RUN - DESTINATION SHOWN
- BRANCH CIRCUIT OR FEEDER IN FLOOR SLAB OR UNDERGROUND
- OE OVERHEAD POWER DISTRIBUTION BY ELECTRIC UTILITY CO.
- BARE STRANDED TINNED-COPPER WIRE, #4/0 UON

- SINGLE PHASE
- THREE PHASE
- MANUAL
- MAGNETIC
- 30A/3P DISCONNECT UON
- 30A/3P FUSED DISC UON
- COMBO
- XFMR
- ATS
- CONDUIT UP
- CONDUIT DOWN
- INSTRUMENTATION DEVICE
- 3/4" x 10'-0" COPPER CLAD GROUND ROD
- XXX CONDUIT/CONDUCTOR TAG REFER SCHEDULE ON SHEET E-603
- WALL-PACK FIXTURE
- GROUND TEST WELL
- 1X4 FLUORESCENT INDUSTRIAL FIXTURE
- FLUORESCENT EMERGENCY INDUSTRIAL FIXTURE
- POLE MOUNTED FIXTURE
- STANCHION MOUNTED FIXTURE
- BRACKET MOUNTED FIXTURE
- WALL MOUNTED EXIT FIXTURE
- TELEPHONE BACKBOARD
- DATA/TELEPHONE OUTLET

CONTROL SCHEMATIC SYMBOLS

- LOCAL-OFF-REMOTE SWITCH
- XOO CONTACTS CLOSED IN LOCAL POSITION, OPEN IN OTHER POSITIONS
- OOX CONTACTS CLOSED IN REMOTE POSITION, OPEN IN OTHER POSITIONS
- M MOTOR STARTER CONTACTOR COIL
- C MOTOR STARTER CONTACTOR (CLOSE) COIL IN VALVE MOTOR OPERATOR
- O MOTOR STARTER CONTACTOR (OPEN) COIL IN VALVE MOTOR OPERATOR
- CRXX CONTROL RELAY COIL, CRXX INDICATES CONTROL RELAY NUMBER
- XXXX TRXX TIMER COIL, TRXX INDICATES TIMER NUMBER; XXXX INDICATES TIME DURATION AND TIMER TYPE, I.E. IS ON DELAY OR OFF DELAY
- NORMALLY OPEN RELAY OR CONTACTOR CONTACTS
- NORMALLY CLOSED RELAY OR CONTACTOR CONTACTS
- NORMALLY CLOSED TIMER CONTACTS
- NORMALLY OPEN TIMER CONTACTS
- XXXX NORMALLY OPEN PUSHBUTTON; XXXX INDICATES FUNCTION OF PUSHBUTTON
- XXXX NORMALLY CLOSED PUSHBUTTON; XXXX INDICATES FUNCTION OF PUSHBUTTON
- XXXX SWITCH CONTACTS, TYPE AS INDICATED LSO=LIMIT SWITCH OPEN; LSC=LIMIT SWITCH CLOSED; TSO=TORQUE SWITCH OPEN; TSC=TORQUE SWITCH CLOSED
- PFR PHASE FAIL RELAY CONTACTS
- OR THERMAL SWITCH CONTACTS
- XXXX R INDICATING LIGHT, COLOR AS INDICATED. R= RED, G=GREEN, A=AMBER, W=WHITE; XXXX INDICATES CONDITION INDICATED BY LIGHT
- ETM ELAPSED TIME METER
- FUSE
- OR PRESSURE SWITCH CONTACTS
- OR FLOAT SWITCH CONTACTS
- FIELD WIRING TERMINATION

ONE-LINE DIAGRAM SYMBOLS

- POT HEAD
- UTILITY CONNECTION
- BREAKER
- DRAW OUT TYPE
- FUSE
- AS P AF FUSIBLE DISCONNECT SWITCH
- AS P NON-FUSIBLE DISCONNECT SWITCH
- M METER; TYPE AS INDICATED
- 7.5 THREE PHASE MOTOR - HP AS NOTED
- G GENERATOR
- PANEL "X" PANEL
- TRANSFORMER T-03 5kVA 600-120/208V Z=0.8%
- AUTO TRANSFORMER
- CONDUIT SEAL
- A CPT 480/120V HOA 3 M 3 OL W R G A ETM — COMBINATION MOTOR STARTER WITH CIRCUIT BREAKER (CB) AND SOLID STATE OVERLOAD RELAY, NEMA SIZE AND RATINGS AS INDICATED. PROVIDE CONTROL SWITCH AS INDICATED WITH CONTROL POWER TRANSFORMER (CPT), AND LIGHT-EMITTING DIODE (LED) PILOT/ INDICATING LIGHTS.

- GROUND
- GROUND/RESISTOR
- LIGHTNING ARRESTOR
- AS AMMETER SWITCH
- VS VOLTMETER SWITCH
- X METER INDICATING
- X METER RECORDING
- K KEY INTERLOCK
- XXXX METER
- ETM ELAPSED TIME METER
- 3 /5 CURRENT TRANSFORMER - QUANTITY AND RATIO AS INDICATED
- VFD VARIABLE FREQUENCY DRIVE
- COMBINATION MOTOR STARTER-SIZE AS INDICATED; OR NORMALLY OPEN (N.O.) CONTACTOR
- MOTOR SPACE HEATER
- TS MOTOR TEMPERATURE SWITCH
- RTD MOTOR REMOTE TEMPERATURE DEVICE
- VS VIBRATION SWITCH
- DELTA
- GROUNDED Y

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KEY PLAN

REVISIONS

NO.	DESCRIPTION	DATE

FILE LOG

ACTIVITY	BY
Manager	DRH
Design	GDG
Draw	ZTJ
Check	MDM

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STATE OF TEXAS — GASPAR D. GARCIA — 104970 — LICENSED — PROFESSIONAL ENGINEER

11/18/2016

Lockwood, Andrews & Newnam, Inc.
Texas Registered Engineering Firm F-2614

Project No. 160-10727-001
Date: November 2016

ELECTRICAL SYMBOLS AND LEGENDS

E-001

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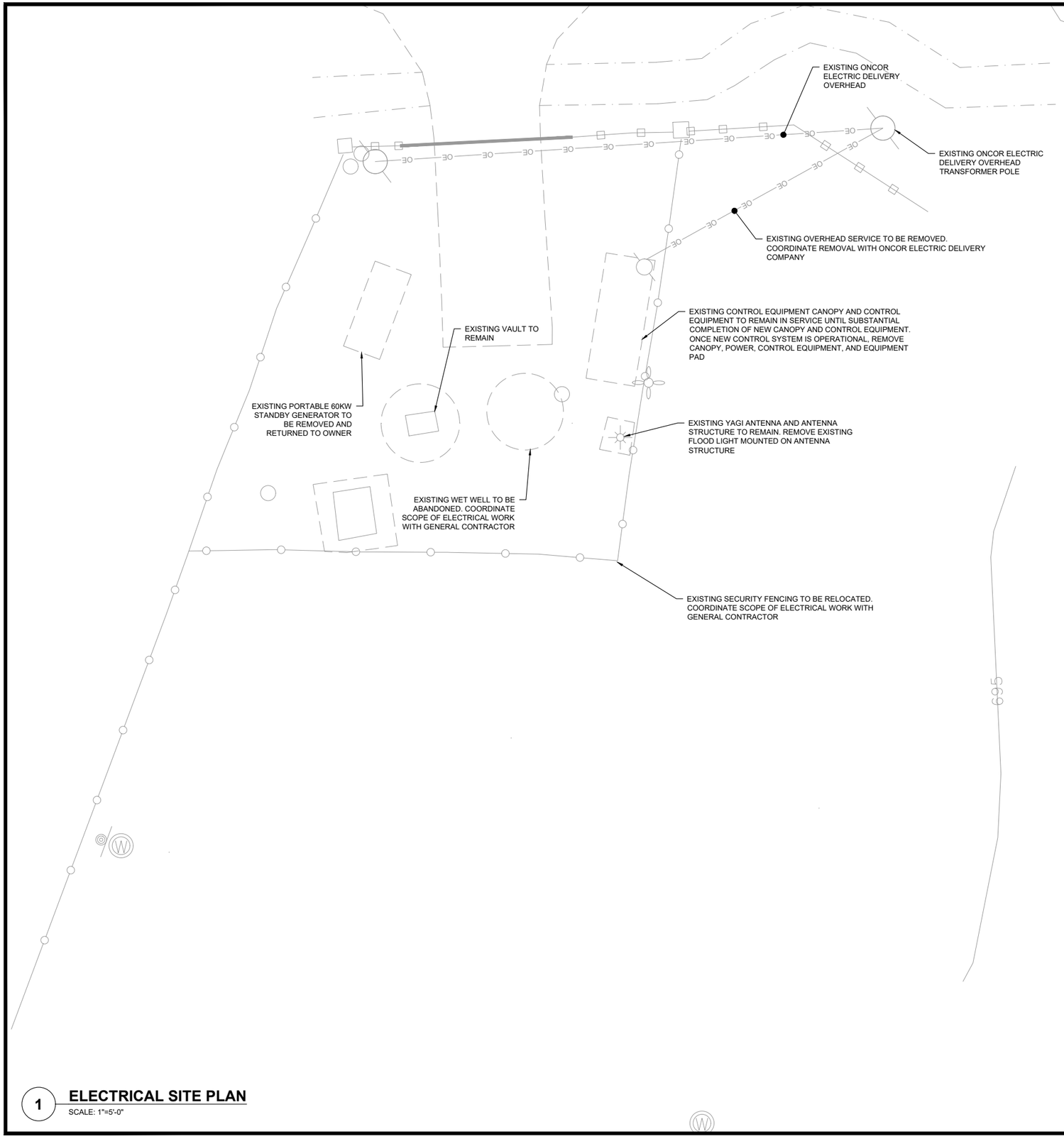

1 **ELECTRICAL SITE PLAN**
SCALE: 1"=5'-0"

GENERAL NOTES:

1. REFER TO SHEET E-001 FOR SYMBOL LEGEND, GENERAL NOTES, AND ABBREVIATIONS.
2. ALL EXISTING EQUIPMENT REMOVED FROM SITE AFTER SUBSTANTIAL COMPLETION OF WORK, SHALL BE RETURNED TO OWNER. OWNER SHALL HAVE RIGHT OF FIRST REFUSAL FOR EQUIPMENT TO BE REMOVED FROM SITE. COORDINATE DELIVERY METHODS WITH OWNER PRIOR TO REMOVAL.
3. FIELD VERIFY ALL EXISTING UNDERGROUND ELECTRICAL CONDUITS PRIOR TO CONSTRUCTION.
4. REFER TO SHEET E-102 FOR NEW ELECTRICAL SITE PLAN.

Forest Creek Lift Station Rehabilitation
Round Rock, TX

ROUND ROCK TEXAS

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A LEO A DALY COMPANY
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Austin, TX 78759
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KEY PLAN

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GASPAR D. GARCIA
104970
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PROFESSIONAL ENGINEER

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0 5 10
SCALE: 1"=5'

Project No. 160-10727-001
Date: November 2016

ELECTRICAL DEMOLITION SITE PLAN

E-101

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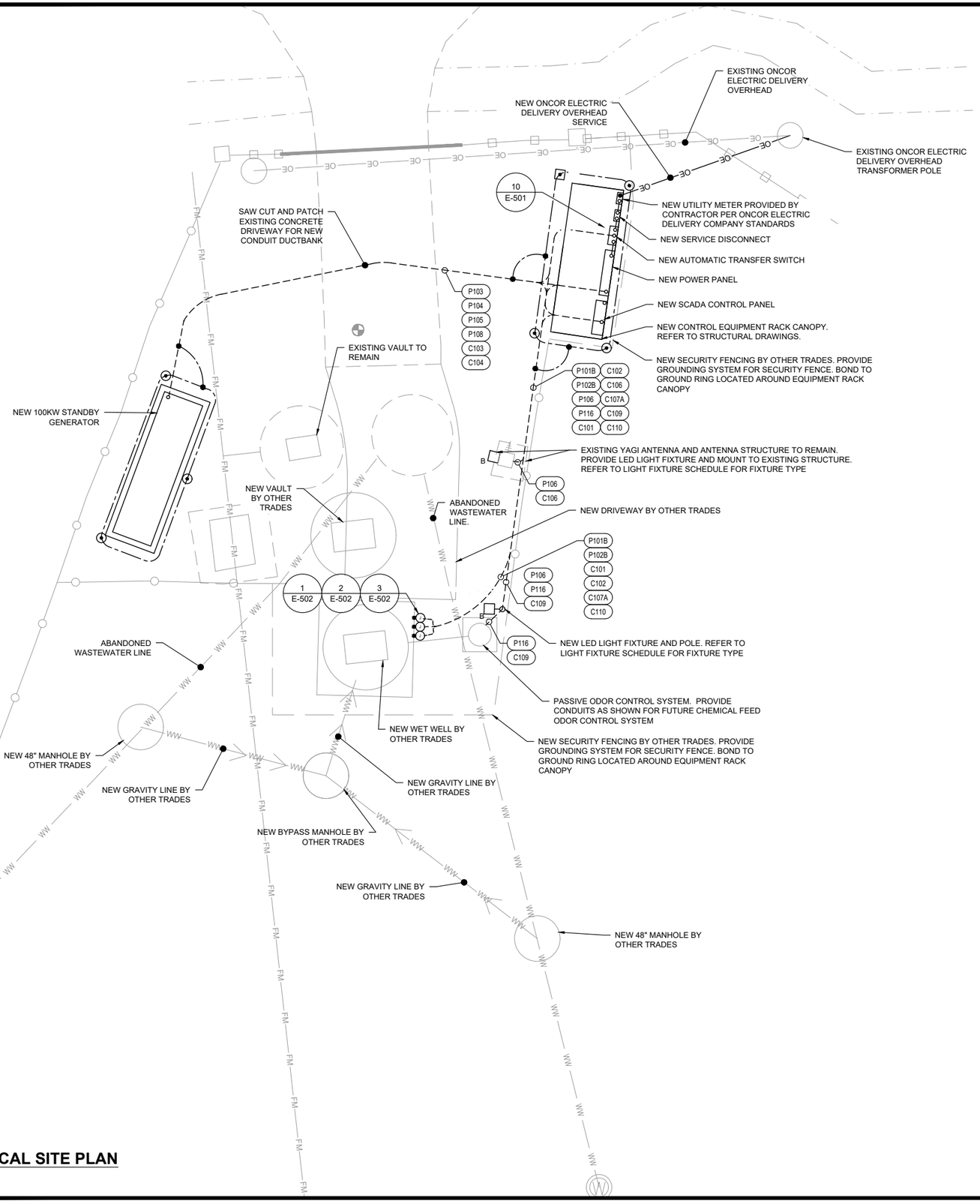

1 ELECTRICAL SITE PLAN

SCALE: 1"=5'-0"

GENERAL NOTES:

1. REFER TO SHEET E-001 FOR SYMBOL LEGEND, GENERAL NOTES, AND ABBREVIATIONS.
2. REFER TO SHEET E-601 ONE-LINE DIAGRAM.
3. REFER TO SHEET E-602 FOR CONDUIT SCHEDULE AND LIGHT FIXTURE SCHEDULE.
4. PROVIDE GROUND RODS AS INDICATED. IF GROUND RODS ARE NOT ABLE TO BE DRIVEN, PROVIDE GROUNDING ENHANCEMENT MATERIAL AS SHOWN ON SHEET E-501/8.
5. COORDINATE ROUTING OF UNDERGROUND CONDUITS WITH EXISTING AND NEW UNDERGROUND UTILITIES.

Forest Creek Lift Station Rehabilitation Round Rock, TX

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0 5 10
SCALE: 1"=5'

Project No. 160-10727-001
Date: November 2016

ELECTRICAL SITE PLAN

E-102

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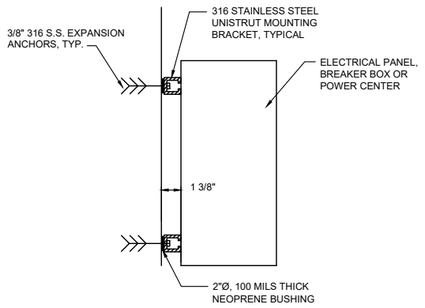
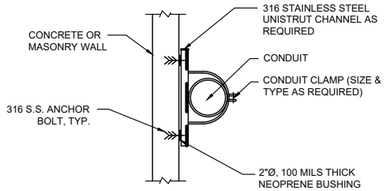


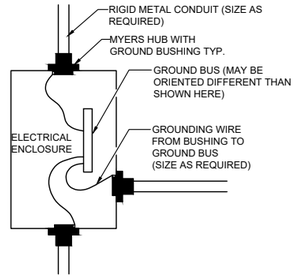
1 EQUIPMENT WALL-MOUNTING DETAIL

SCALE:NTS



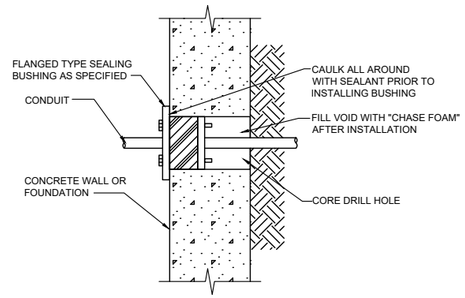
2 CONDUIT SUPPORT

SCALE:NTS



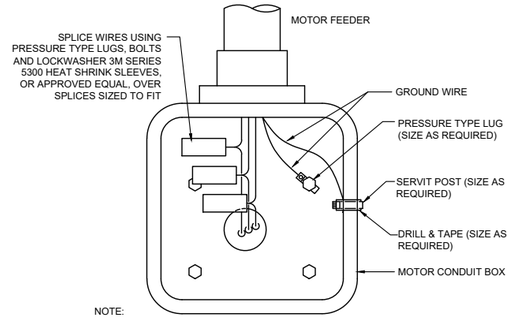
3 ENCLOSURE/CONDUIT DETAIL

SCALE:NTS



4 WATERTIGHT CONDUIT PENETRATION

SCALE:NTS

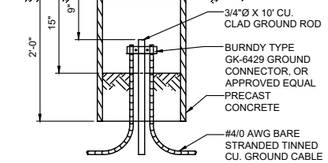


NOTE:

1. ALTERNATIVE GROUNDING METHOD WHEN THERE ARE NO MOUNTING BOLTS.
2. DRILL & TAP BOX FOR NON-EXPLOSION-PROOF MOTOR. INSTALL GROUND LUG.

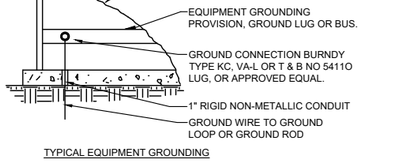
5 MOTOR CONDUIT BOX CONNECTION DETAIL

SCALE:NTS



6 GROUND TEST WELL

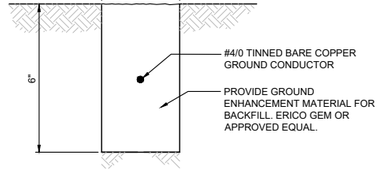
SCALE:NTS



TYPICAL EQUIPMENT GROUNDING

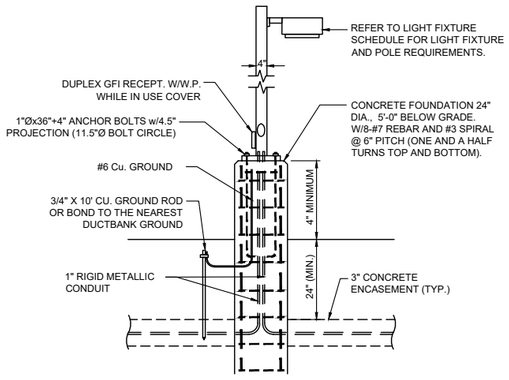
7 EQUIPMENT GROUND DETAIL

SCALE:NTS



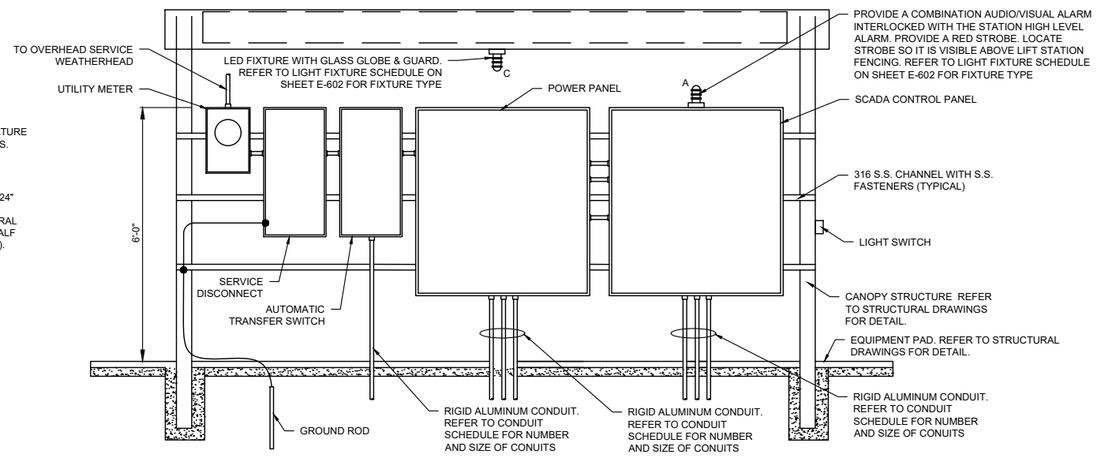
8 GROUND RING SECTION

SCALE:NTS



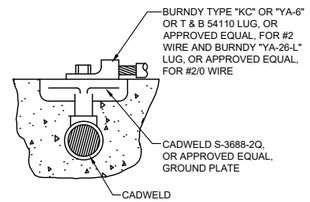
9 LIGHT POLE DETAIL

SCALE:NTS



10 EQUIPMENT RACK DETAIL

SCALE:NTS



11 GROUNDING PAD IN SLAB

SCALE:NTS

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KEY PLAN

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Texas Registered Engineering Firm F-2614

Project No. 160-10727-001
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ELECTRICAL DETAILS

E-501

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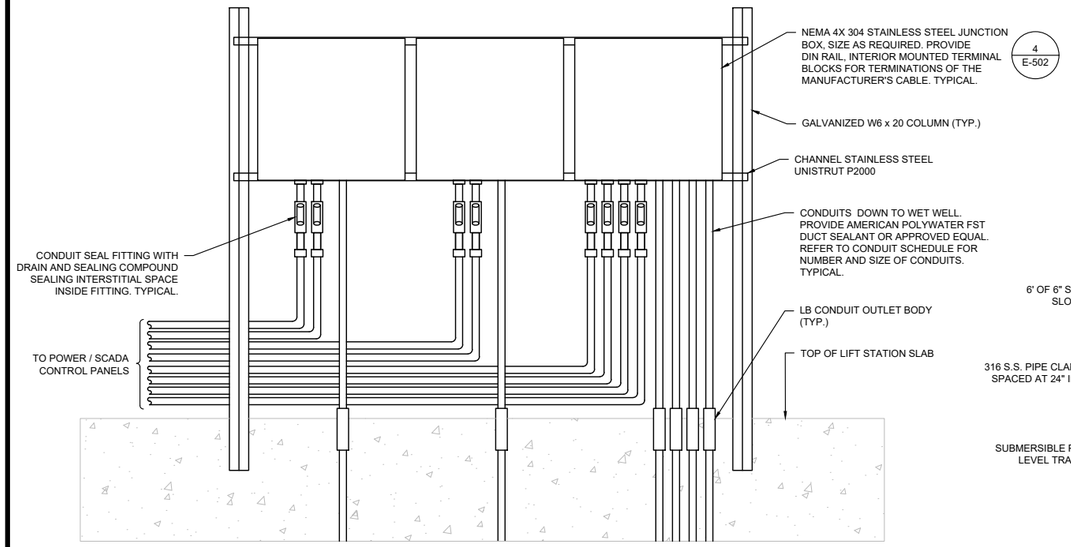
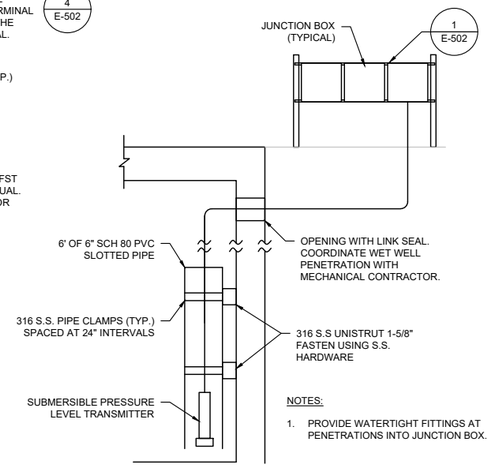


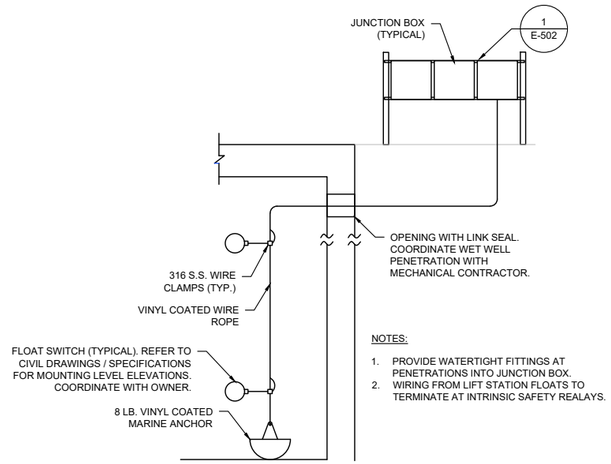
1 LIFT STATION RACK ELEVATION

SCALE:NTS



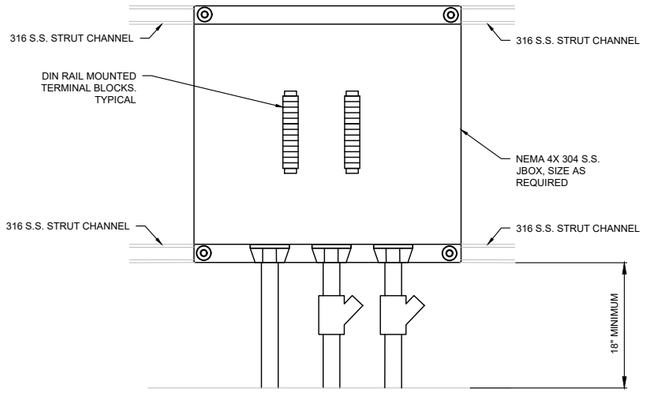
2 LIFT STATION SUBMERSIBLE PRESSURE LEVEL TRANSMITTER

SCALE:NTS



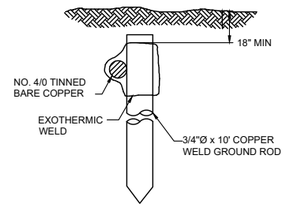
3 LIFT STATION FLOAT DETAIL

SCALE:NTS



4 LIFT STATION JUNCTION BOX DETAIL

SCALE:NTS



5 GROUND ROD DETAIL

SCALE:NTS

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KEY PLAN

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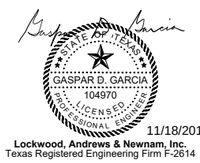

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Project No. 160-10727-001
Date: November 2016

ELECTRICAL DETAILS

E-502

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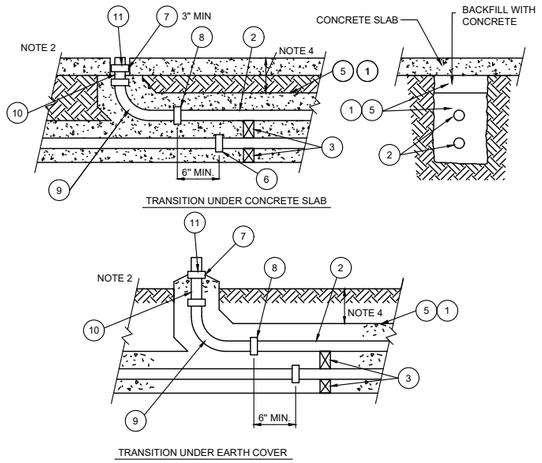
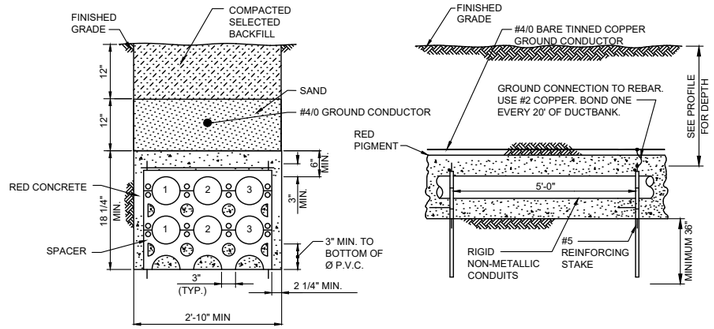


NOTES:

1. CLASS 'C' CONCRETE.
2. SEE DESIGN DRAWINGS FOR NUMBER AND SIZE OF CONDUITS. ALL UNDERGROUND CONDUITS SHALL BE RIGID NON-METALLIC UNLESS OTHERWISE INDICATED ON THE PLANS.
3. SPACERS SHALL BE JOHNS MANVILLE PLASTIC SPACERS OR EQUIVALENT. SPACED 5'-0" O.C.
4. COVER SHALL BE 2'-0" MINIMUM BELOW SOIL SURFACE AND 1'-0" MINIMUM BELOW CONCRETE SLABS, OR AS SHOWN ON PLANS.
5. UNDERGROUND CONDUIT SHALL BE ENCASED IN AN ENVELOPE OF CONCRETE WITH RED PIGMENT STAIN ON THE TOP OF THE DUCTBANK.
6. COUPLING
7. PROTECT EXPOSED CONDUIT ENDS DURING CONSTRUCTION WITH PIPE PLUG OR CAPS. FUTURE AND SPARE CONDUIT ENDS SHALL HAVE PIPE PLUGS OR CAPS.
8. ADAPTOR FROM NON-METALLIC CONDUIT AS REQUIRED.
9. PVC COATED RIGID METALLIC CONDUIT BENDS.
10. PVC COATED RIGID METALLIC CONDUIT SIZE AND TYPE AS REQUIRED. EXTEND THIS CONDUIT A MINIMUM OF 6" INTO CONCRETE.
11. CONDUIT TERMINATING IN AN ENCLOSURE CONTAINING A GROUND BUS SHALL HAVE A GROUNDING BUSHING WITH A GROUND WIRE TO THE GROUND BUS.

1 UNDERGROUND CONDUIT INSTALLATION

SCALE:NTS



NOTES:

1. CONDUIT TO BE RIGID NON-METALLIC TYPE FOR CONCRETE ENCASEMENT, SIZE AND NUMBER AS INDICATED ON DRAWING.
2. CONCRETE ENCASEMENT: ALL CONCRETE TO HAVE COMPRESSIVE STRENGTH OF 2500 P.S.I. AT 28 DAYS. NO AGGREGATE LARGER THAN 3/4".
3. INSTALL SPACERS EVERY 5 FEET. ALL SPACERS TO PROVIDE 3" VERTICAL AND HORIZONTAL SEPARATION BETWEEN CONDUITS.

2 ELECTRICAL CONDUIT SPACE FOR U/G

SCALE:NTS

Forest Creek Lift Station Rehabilitation Round Rock, TX

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ELECTRICAL DETAILS

E-503

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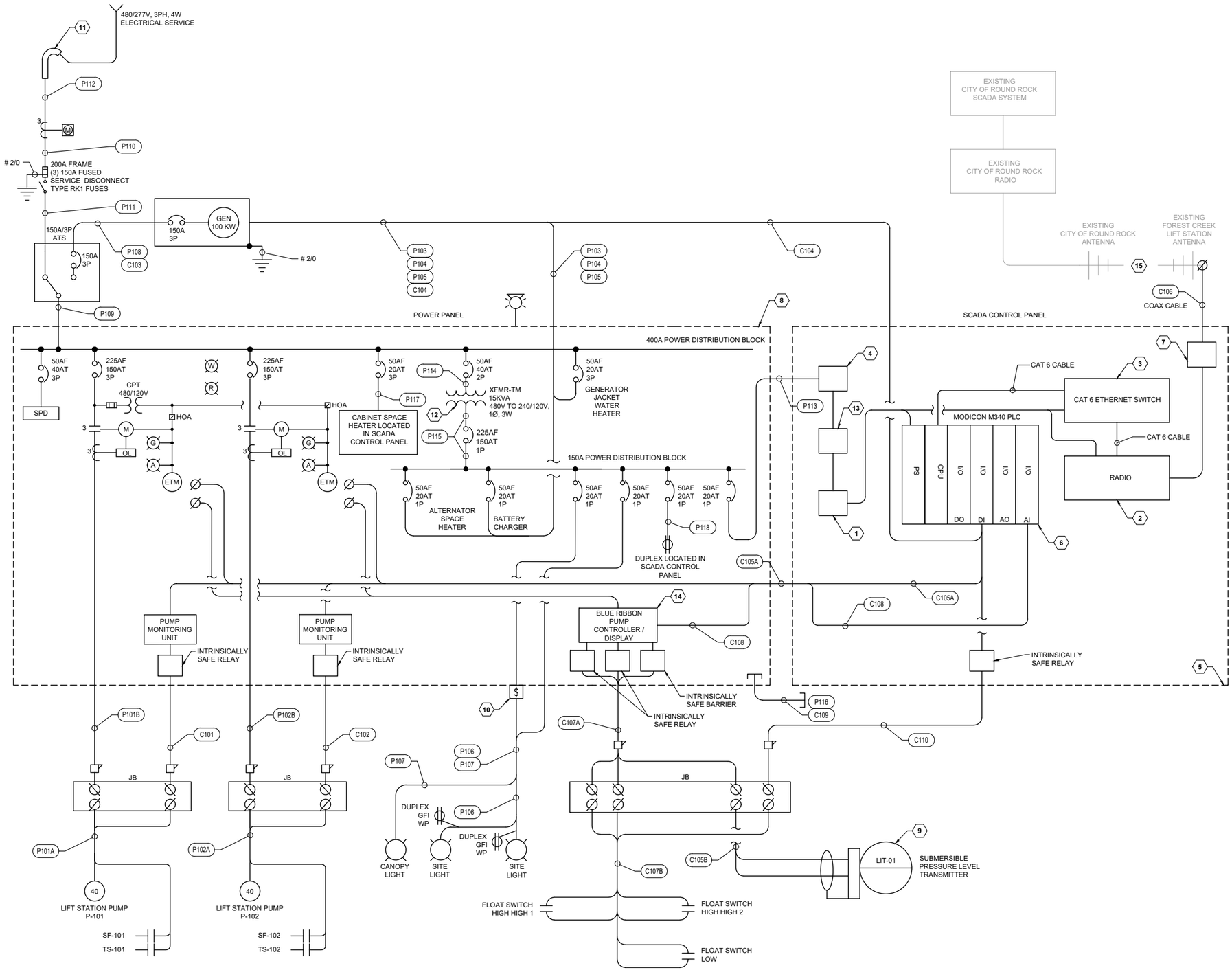

GENERAL NOTES:

1. REFER TO SHEET E-001 FOR SYMBOL LEGEND, GENERAL NOTES, AND ABBREVIATIONS.
2. REFER TO SHEET E-602 FOR CONDUIT SCHEDULE AND AND LOAD ANALYSES.
3. PROVIDE PROVISIONS WITHIN SCADA CONTROL PANEL FOR 16 INTERPOSING RELAYS FOR DISCRETE OUTPUTS, FINDER 34.51.7.024.0010 W/ SOCKET TYPE 93.01.7.024, OAE. PREWIRE RELAYS TO TERMINALS BLOCKS.
4. WITHIN SCADA CONTROL PANEL PROVIDE PHOENIX CONTACT TERMINAL BLOCKS TYPE UT-4; FUSE, TYPE UT-4-HESI; AND GROUND TYPE UT-4-PE AS REQUIRED. PROVIDE PHOENIX CONTACT TT-2-PE-24TT DIN RAIL MOUNTED ANALOG SURGE PROTECTORS FOR ALL ANALOG OUTPUTS.
5. REFER TO E-603 FOR POWER AND SCADA CONTROL SCHEMATICS FOR MORE DETAIL.

KEYED NOTES:

1. ALTECH 24VDC POWER SUPPLY, PART NUMBER PS-10024. ALTECH 24VDC UPS, PART NUMBER PS-UPS40. UPS BATTERY, PART NUMBER UB1280.
2. MDS SD9 FIXED FREQUENCY RADIO, PART NUMBER SD09MD-*ES-NSNN.
3. SIXNET UNMANAGED ETHERNET SWITCH, PART NUMBER SLX-5ES-1.
4. PHOENIX CONTACT 120VAC SURGE PROTECTION DEVICE PLUG & BASE, PART NUMBER PTL-SEC-T3-120-FM.
5. RITTAL ENCLOSURE & BACKPANEL, PART NUMBER WM363612 AND WMMP3636. ENCLOSURE SHALL BE 304 S.S. NEMA 4X ENCLOSURE WITH PAD LOCKING HANDLE.
6. MODICON M340 PLC:
   - MODICON SIX SLOT RACK, MODEL NUMBER BMXXBP0600
   - MODICON POWER SUPPLY, MODEL NUMBER BMXCPS2010
   - MODICON PROCESSOR WITH ETHERNET PORT, MODEL NUMBER M340 BMX P34 2020 PLC
   - MODICON 16 CHANNEL DISCRETE INPUT CARD, MODEL NUMBER M340 BMX DDI1602
   - MODICON 16 CANNEL DISCRETE OUTPUT CARD, MODEL NUMBER M340 BMX DDO1602
   - MODICON 4 CHANNEL ANALOG INPUT / 2 CHANNEL ANALOG OUTPUT CARD, PART NUMBER M340 BMX AMM 0600
7. TIMES LIGHTNING ARRESTOR, PART NUMBER LP-BTR-NFF.
8. 304 S.S. NEMA 4X ENCLOSURE. SIZE PANEL TO HOUSE PUMP MOTOR STARTERS AND OVERCURRENT PROTECTION DEVICES.
9. BIRDCAGE BC001 SUBMERSIBLE PRESSURE TRANSMITTER.
10. PROVIDE SINGLE GANG WEATHERPROOF BOX FOR LIGHT SWITCH.
11. WEATHER HEAD PROVIDED BY CONTRACTOR PER ONCOR ELECTRIC DELIVERY COMPANY STANDARDS.
12. COMBINATION TRANSFORMER AND SINGLE POLE POWER CIRCUIT BREAKERS MAY BE PROVIDED IN AN EXTERNAL NEMA 4X TRANSFORMER/PANELBOARD ENCLOSURE. SIZE CONDUITS AS REQUIRED PER THE NATIONAL ELECTRICAL CODE.
13. CONTROL POWER TRANSFORMER.
14. BLUE RIBBON PUMP CONTROLLER / DISPLAY, MODEL NUMBER BD300-15X.
15. ENSURE EXISTING RADIO COMMUNICATION REMAINS OPERATIONAL DURING AND AFTER CONSTRUCTION OF NEW LIFT STATION.

Forest Creek Lift Station Rehabilitation Round Rock, TX

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Project No. 160-10727-001
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ELECTRICAL ONE-LINE DIAGRAM

E-601

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ELECTRICAL LOAD ANALYSIS					
	MOTOR HP	MOTOR FLA	CONNECTED KVA	DEMAND FACTOR	DEMAND KVA
LIFT STATION PUMP P-101	40.0	52.0	43.2	1.0	43.2
LIFT STATION PUMP P-102	40.0	52.0	43.2	1.0	43.2
GENERATOR HEATER	-	-	3.0	1.0	3.0
CABINET SPACE HEATER	-	-	2.0	1.0	2.0
PANEL LP-1 TRANSFORMER	-	-	15.0	0.4	6.0
SUB-TOTAL			106.5		97.5
25% LARGEST MOTOR					10.8
TOTAL:					108.3
DEMAND LOAD IN AMPS @480V, 3PH					130.2

GENERATOR ELECTRICAL LOAD ANALYSIS					
	MOTOR HP	MOTOR FLA	CONNECTED KVA	DEMAND FACTOR	DEMAND KVA
LIFT STATION PUMP P-101	40.0	52.0	43.2	1.0	43.2
LIFT STATION PUMP P-102	40.0	52.0	43.2	0.0	0.0
GENERATOR HEATER	-	-	3.0	0.0	0.0
CABINET SPACE HEATER	-	-	2.0	1.0	2.0
PANEL LP-1 TRANSFORMER	-	-	15.0	0.4	6.0
SUB-TOTAL			106.5		51.2
25% LARGEST MOTOR					10.8
TOTAL:					62.0
DEMAND LOAD IN AMPS @480V, 3PH					74.6

LIGHT FIXTURE SCHEDULE				
TYPE	MANUFACTURER	DESCRIPTION	LAMP	NOTES
A	INGRAM	LED FIXTURE - SCADA CONTROL PANEL STROBE	LED	PROVIDE LX25 LED FIXTURE WITH RED GLOBE OR APPROVED EQUAL
B	KIM	KIM WARP9 LED - SITE LIGHTING	LED	PROVIDE GRAY KIM WARP9 LED FIXTURE, TYPE IV DISTRIBUTION, 4K COLOR TEMPERATURE, 120V SINGLE FUSE, OR APPROVED EQUAL
B (POLE)	KIM	GRAY 20' POLE	NA	PROVIDE KIM 20' GRAY POLE TO MOUNT SITE LIGHT FIXTURE OR APPROVED EQUAL
C	LITHONIA	LED FIXTURE- CANOPY LIGHTING	LED	PROVIDE GRAY LITHONIA OLVTCM CEILING MOUNT LED FIXTURE, 4K COLOR TEMPERATURE, MVOLT, OR APPROVED EQUAL

CONDUIT SCHEDULE					
CONDUIT TAG	FROM	TO	WIRE SIZE	CONDUIT SIZE	COMMENTS
P101A	JUNCTION BOX	LIFT STATION PUMP (P-101)	MANUFACTURER'S CABLE	1-1/2"	
P101B	POWER PANEL	JUNCTION BOX	3 #6, #6 GND	1-1/2"	
P102A	JUNCTION BOX	LIFT STATION PUMP (P-102)	MANUFACTURER'S CABLE	1-1/2"	
P102B	POWER PANEL	JUNCTION BOX	3 #6, #6 GND	1-1/2"	
P103	POWER PANEL	GENERATOR JACKET WATER HEATER	3 #12, #12 GND	1"	
P104	POWER PANEL	GENERATOR BATTERY CHARGER	2 #12, #12 GND	1"	
P105	POWER PANEL	GENERATOR ALTERNATOR SPACE HEATER	2 #12, #12 GND	1"	
P106	POWER PANEL	SITE LIGHTING LIGHT POLE DUPLEX RECEPTACLES	2 #12, #12 GND 2 #12, #12 GND	1"	LIGHTING AND POWER CIRCUITS IN SAME CONDUIT TO SERVE ANTENNA MOUNTED LIGHT FIXTURE, POLE MOUNTED LIGHT FIXTURE AND POLE MOUNTED DUPLEX RECEPTACLES. PROVIDE CONDUIT SEAL ON CONDUIT AT THE POWER PANEL
P107	POWER PANEL	CANOPY LIGHT	2 #12, #12 GND	3/4"	LIGHT SWITCH AT POWER PANEL TO CONTROL SITE LIGHTING AND CANOPY LIGHT
P108	GENERATOR	ATS	4 1/0, #6 GND	2"	
P109	ATS	POWER PANEL	4 1/0, #6 GND	2"	
P110	UTILITY METER	SERVICE DISCONNECT	4 1/0, #6 GND	2"	
P111	SERVICE DISCONNECT	ATS	4 1/0, #6 GND	2"	
P112	UTILITY TRANSFORMER	UTILITY METER	4 1/0, #6 GND	2"	EXTEND SERVICE CONDUCTORS 24" OUTSIDE OF SERVICE WEATHER HEAD. COORDINATE CONNECTION TO OVERHEAD SERVICE LATERAL WITH ONCOR ELECTRIC DELIVERY COMPANY
P113	POWER PANEL	SCADA CONTROL PANEL	2 #12, 1#12 GND	3/4"	POWER PANEL TO CPT IN SCADA CONTROL PANEL
P114	480V POWER DISTRIBUTION BLOCK	TRANSFORMER	2 #8, #10 GND	-	ROUTE WITHIN POWER PANEL
P115	TRANSFORMER	120V POWER DISTRIBUTION BLOCK	2 #2/0, #6 GND	-	ROUTE WITHIN POWER PANEL
P116	POWER PANEL	ODOR CONTROL	-	1"	PROVIDE PULLSTRING IN CONDUIT. STUB UP AND CAP CONDUIT ON BOTH ENDS
P117	POWER PANEL	CABINET HEATER DUPLEX RECEPTACLE	3 #12, #12 GND 2 #12, #12 GND	3/4"	
C101	JUNCTION BOX	POWER PANEL	(1) 8PR, #16 TP	1"	SEAL FAIL AND TEMPERATURE SWITCH
C102	JUNCTION BOX	POWER PANEL	(1) 8PR, #16 TP	1"	SEAL FAIL AND TEMPERATURE SWITCH
C103	GENERATOR	ATS	(1) 4PR, #16 TP	1"	GENERATOR START
C104	GENERATOR	PLC	(1) 8PR, #16 TP	1"	GENERATOR STATUS / ALARM POINTS
C105A	POWER PANEL	SCADA CONTROL PANEL	(3) 4PR, #16 TP	2"	DISCRETE ALARM POINTS FROM POWER PANEL TO SCADA CONTROL PANEL
C105B	JUNCTION BOX	SUBMERSSIBLE PRESSURE LEVEL	MANUFACTURER'S CABLE	1"	
C106	SCADA CONTROL PANEL	EXISTING LIFT STATION ANTENNA	7/8" HELIAX COAX CABLE	1-1/2"	RADIO TO ANTENNA
C107A	SCADA CONTROL PANEL	JUNCTION BOX	(1) 4PR, #16 TP (1) 2PR, #16 TSP	1-1/2"	(1) HIGH LEVEL FLOAT, LOW LEVEL FLOAT, AND SUBMERSSIBLE PRESSURE LEVEL
C107B	JUNCTION BOX	WET WELL FLOATS	MANUFACTURER'S CABLE	1-1/2"	(2) HIGH LEVEL FLOATS AND (1) LOW LEVEL FLOAT
C108	BLUE RIBBON PUMP CONTROLLER	RTU/PLC	(1) 2PR, #16 TSP	C105A	SUBMERSIBLE PRESSURE LEVEL OUTPUT FROM BLUE RIBBON CONTROLLER: ROUTE WITHIN CONDUIT C105A TO SCADA CONTROL PANEL
C109	SCADA CONTROL PANEL	ODOR CONTROL	-	1"	PROVIDE PULLSTRING IN CONDUIT. STUB UP AND CAP CONDUIT ON BOTH ENDS
C110	SCADA CONTROL PANEL	JUNCTION BOX	(1) 2PR, #16 TP	1"	(1) HIGH LEVEL FLOAT

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Forest Creek Lift Station Rehabilitation
Round Rock, TX

ROUND ROCK TEXAS

Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY

8911 N. Capital of Texas Hwy
Building 2, Suite 2300
Austin, TX 78759
Tel 512-338-4212
www.lan-inc.com

KEY PLAN

REVISIONS

NO.	DESCRIPTION	DATE

FILE LOG

ACTIVITY	BY
Manager	DRH
Design	GDG
Draw	ZTJ
Check	MDM

STAMP

STATE OF TEXAS
GASPAR D. GARCIA
104970
LICENSED
PROFESSIONAL ENGINEER

11/18/2016
Lockwood, Andrews & Newnam, Inc.
Texas Registered Engineering Firm F-2614

Project No. 160-10727-001
Date: November 2016

ELECTRICAL SCHEDULES

E-602

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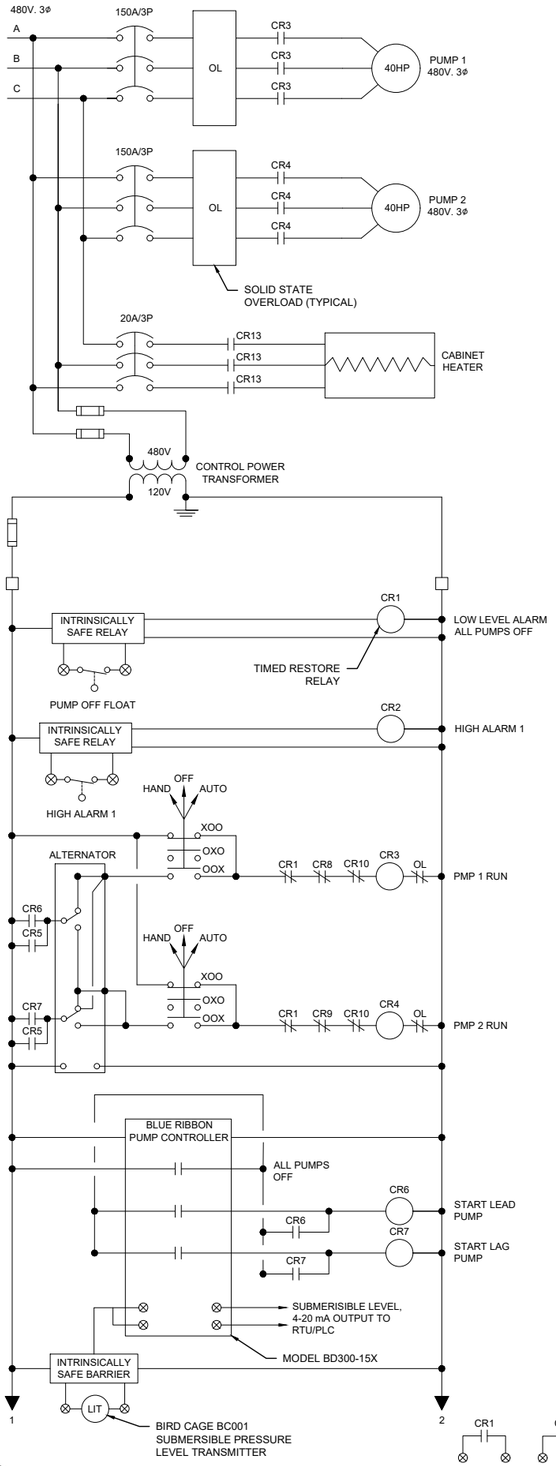

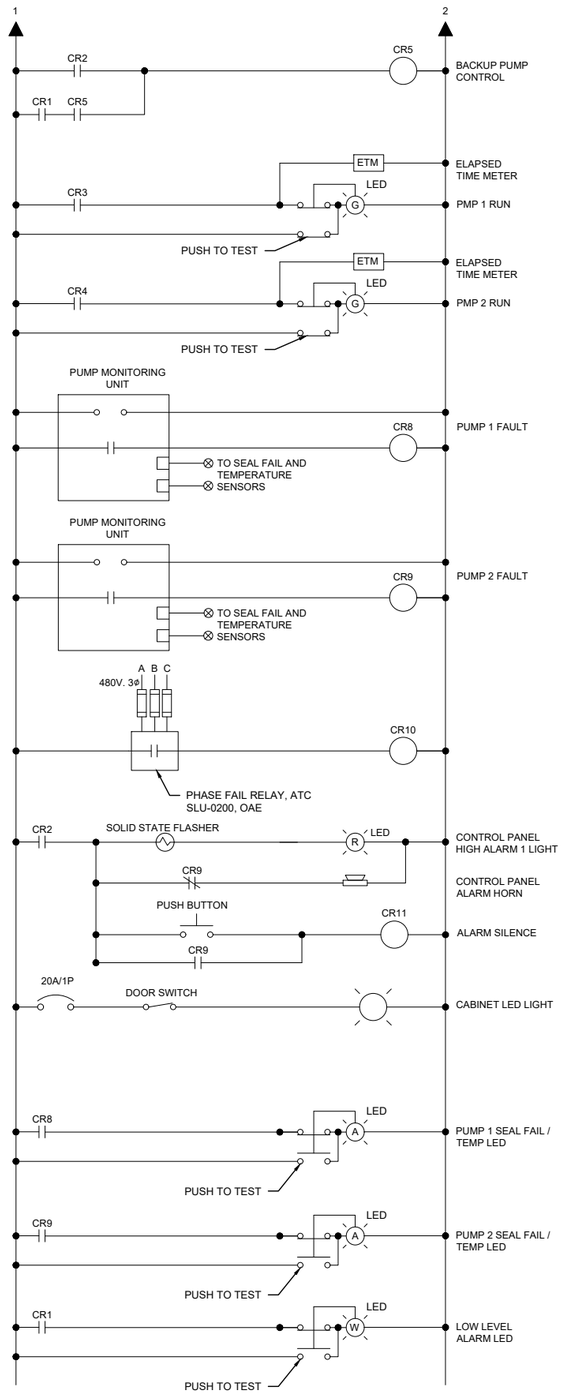

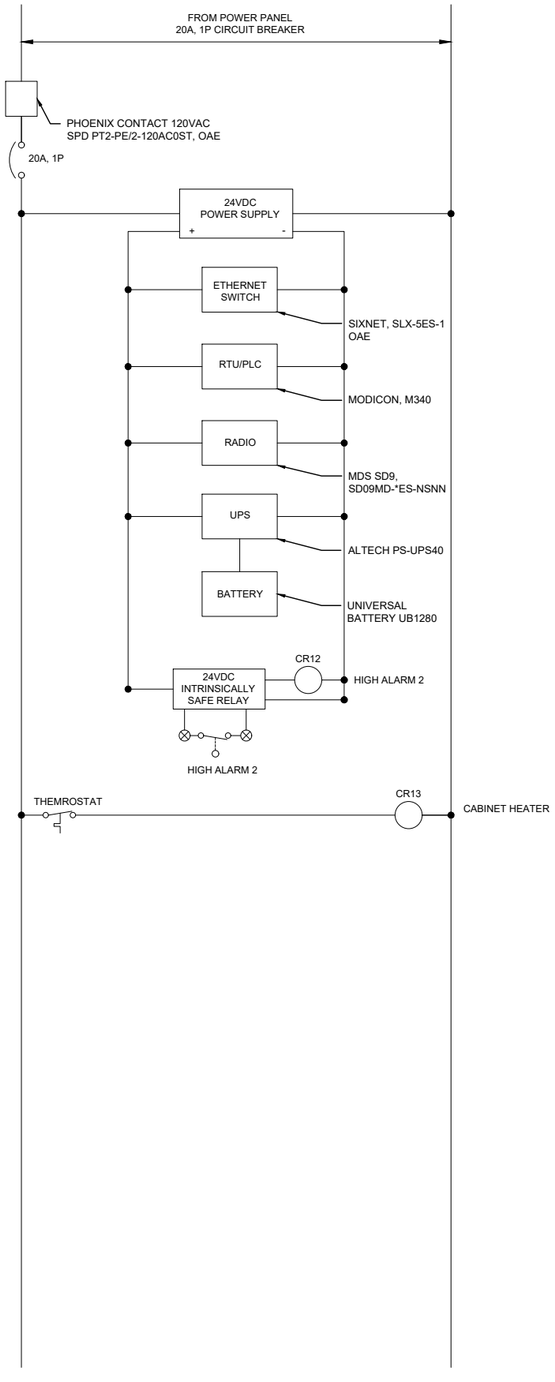

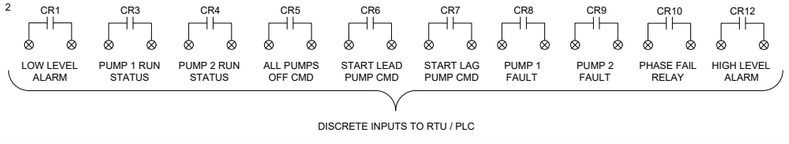

1 POWER PANEL SCHEMATIC

SCALE:NTS

2 SCADA CONTROL PANEL SCHEMATIC

SCALE:NTS

Forest Creek Lift Station Rehabilitation
Round Rock, TX

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LICENSED
PROFESSIONAL ENGINEER

11/18/2016

Lockwood, Andrews & Newnam, Inc.
Texas Registered Engineering Firm F-2614

Project No. 160-10727-001
Date: November 2016

ELECTRICAL CONTROL SCHEMATIC

E-603

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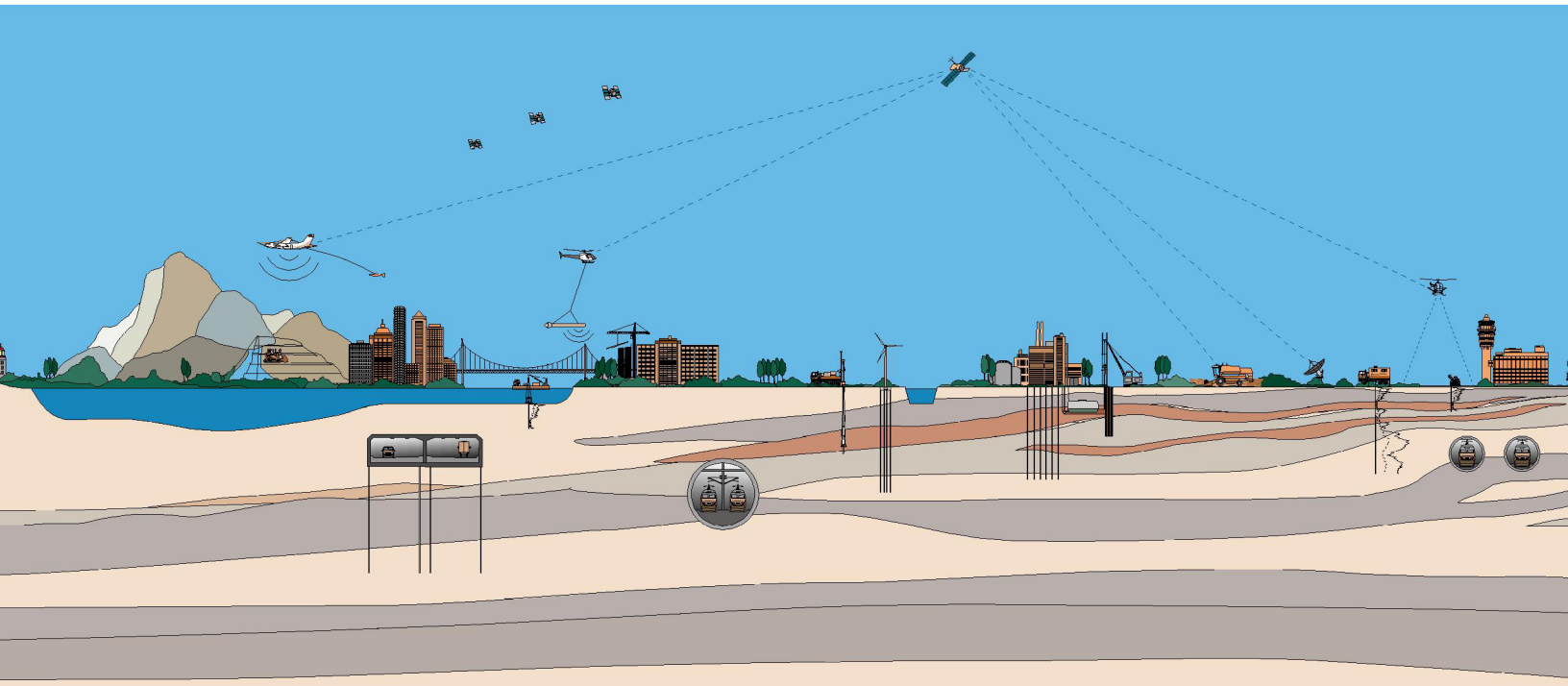
FUGRO CONSULTANTS, INC.

GEOTECHNICAL INVESTIGATION
FOREST CREEK LIFT STATION REHAB
ROUND ROCK, TEXAS

LOCKWOOD, ANDREWS, AND NEWNAM, INC.

AUSTIN, TEXAS



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Report No. 04.30151036
August 1, 2016

Attention: Mr. Ryan D. Owen, P.E.

Geotechnical Investigation
Forest Creek Lift Station Rehab
Round Rock, Texas

Submitted herewith is the report of the Geotechnical Investigation for the above referenced project. The project consists of a new lift station to augment and replace a damaged system. The new lift station will include a deep wet well, generator pad, and gravity line. The proposed lift station improvements are located near the existing lift station on Forest Creek Dr., just west of Twin Ridge Parkway adjacent to Forest Creek Golf Course in Round Rock, Texas. In brief, our report includes a plan of boring, boring logs with results of laboratory tests, and descriptions of subsurface conditions. Based on these findings, recommendations are set forth for the design and construction of structures.

Fugro appreciates the opportunity to provide these geotechnical engineering services to Lockwood, Andrews, and Newnam, Inc. (LAN). We look forward to our continued association throughout design and construction.

Sincerely,

FUGRO CONSULTANTS, INC.
TBPE Firm Registration No. F-299

Yanfeng Li, Ph.D., P.E.
Senior Geotechnical Engineer

Bryan B. Rose, P.E.
Senior Project Manager

Distribution:
Addressee (4) (email)
File (2)

GEOTECHNICAL INVESTIGATION
FOREST CREEK LIFT STATION REHAB
ROUND ROCK, TEXAS

Report to:

LOCKWOOD, ANDREWS, AND NEWNAM, INC.
Austin, Texas

Submitted by:

FUGRO CONSULTANTS, INC.
August 2016

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INTRODUCTION

On June 20, 2016, Fugro Consultants, Inc. (Fugro) initiated the geotechnical investigation by drilling two (2) borings for the proposed lift station improvements to be located near the existing lift station. The project site is located off of Forest Creek Drive, just west of Twin Ridge Parkway adjacent to Forest Creek Golf Course in Round Rock, Texas, as shown on the Vicinity Map, Plate 1.

Lockwood, Andrews Newnam, Inc. (LAN) is providing the civil design services for the proposed lift station. Fugro was retained by LAN to provide geotechnical engineering services. Based on the plans dated June 15, 2016 provided by Mr. Ryan Owen, P.E. with LAN, the lift station will include a 30-ft deep wet well, a generator pad, and gravity line.

AUTHORIZATION

The project was authorized on June 3rd, 2016 by Mr. Drew P. Hardin, P.E. of Lockwood, Andrews Newnam, Inc. (LAN) Inc. with acceptance of Fugro Consultants, Inc. proposal dated September 28, 2015. The proposal outlines the scope of services with the following changes. One 40-ft boring and one 10-ft boring were drilled instead of two 35-ft deep borings per LAN's request.

PURPOSE AND SCOPE

The purpose of the investigation was to determine subsurface conditions at the project site to develop design criteria and construction considerations for 1) lift station foundations, and 2) ancillary structure foundations and 3) the selection of materials and compaction requirements for earthwork construction.

The scope of the investigation included 1) a field investigation to evaluate subsurface conditions and obtain representative samples for classification and testing, 2) a laboratory testing program to aid in the classification of soil and rock, and provide parameters for foundation design, and 3) engineering analyses of field and laboratory data to develop geotechnical design recommendations and construction considerations.

Field sampling, laboratory testing, soil classification, and strata descriptions were in general accordance with methods, procedures, and practices set forth by the American Society for Testing and Materials, 2015 Annual Book of ASTM Standards, where applicable.

FIELD INVESTIGATION

The field investigation consisted of drilling two borings (B-1, B-2) to respective depths of 10 and 40 feet below existing grade. Boring B-1 was drilled at the proposed generator pad location, inside the existing lift station fence. Boring B-2 was drilled at the proposed wet well outside the existing fence. Boring locations were determined by LAN. The borings were staked in the field by Fugro personnel. The approximate boring locations are shown on the Plan of Borings, Plate 2.

Detailed descriptions of the subsurface materials encountered at the boring locations are presented on the boring logs, Plates 3 and 4. Keys to Terms and Symbols used on the boring logs are shown on Plates 5 and 6. Pocket penetrometer values, in tons per square foot (tsf), Standard Penetration Test (SPT) N-values, and core recovery and Rock Quality Designation (ASTM D 6032) values, in percent, are shown on the boring logs under the appropriate column. The surface elevations shown on the boring logs were interpolated from the topographic information on the site plan provided by LAN and should be considered approximate. Latitude and longitude GPS coordinates were obtained at the boring locations using a hand-held GPS device (accurate to about 3 horizontal meters) are shown at the bottom of the boring logs and should be considered approximate.

The borings were drilled with a truck-mounted drill rig equipped with 1) continuous flight augers for advancing the holes dry and recovering disturbed samples (ASTM D 1452), 2) seamless push tubes for obtaining relatively undisturbed soil samples of cohesive strata (ASTM D 1587), 3) split-barrel samplers and drive weight assembly for obtaining representative samples and measuring the penetration resistance (blowcounts) of non cohesive soil strata, and 4) double-tube wireline core barrels equipped with carbide bits for obtaining 2-inch diameter rock cores (ASTM D 2113).

LABORATORY TESTING

The laboratory testing program included identification and classification testing of the soil and rock strata encountered. Soil classifications tests, including Atterberg limit determinations (ASTM D 4318) and partial grain size analyses (ASTM D 422) and natural water content determinations (ASTM D 2216) were conducted on representative soil samples. Unconfined

compression tests (ASTM D 7012) were conducted on representative intact limestone samples. The classification and compressive tests included natural water content determinations (ASTM D 2216) with the compression tests also including unit dry weight determinations. The results of the tests are tabulated on the boring logs at their respective sampling depths.

Descriptions of strata made during the field exploration were modified in accordance with test results and visual examination in the laboratory. Recovered soil samples were examined and classified in general accordance with ASTM D 2487 and described as recommended by ASTM D 2488. Rock strata were classified in general accordance with "Rock Classification and Description", Chapter 1, Section 5, NAVFAC DM-7.[1] Classifications of the soils and finalized descriptions of both rock and soil strata are shown on the boring logs.

SITE PHYSIOGRAPHY

The lift station site is located off of Forest Creek Drive, just west of Twin Ridge Parkway adjacent to Forest Creek Golf Course in Round Rock, Texas. The proposed lift station rehabilitation consists of a new generator pad to be located inside the fence of the existing lift station and one 30-ft deep wet well, and associated gravity lines located immediately south of the existing fence. Soil Conservation Service Site 19 Reservoir is located about 700 feet east of the lift station site. According to provided contour information, existing ground surface elevation across the project site generally ranges from about 696 to 697 feet.

Mapped Geology

According to the geologic map of the Austin area[2], the site is underlain by limestone of the Austin Group. The Austin Group generally consists of light gray chalk, limestone, marly limestone and marl often referred to as the Austin Chalk. Made up of seven different units, the Austin chalk in the subject area consists of chalky and clayey limestone, with occasional to numerous fossils and interbedded with marl (soft rock). The unweathered Austin Chalk is gray to light gray in color. Weathering produces a tan to white color. Surficial remnants usually consist of weathered fat and lean clay mixtures.

Site Stratigraphy and Engineering Properties

Subsurface conditions can be best understood by a thorough review of the boring logs presented on Plates 3 and 4. In general, the borings encountered fill material underlain by highly weathered limestone and further underlain by tan to gray limestone of the Austin Group. A brief

[1] U.S. Navy (1971), Design Manual - Soil Mechanics, Foundations, and Earth Structures, NAVFAC DM-7.
[2] Barnes, Virgil., et al. (1974), "Geologic Atlas of Texas - Austin Sheet, Map and accompanying bulletin.

discussion of the subsurface conditions and engineering properties are provided in the following section.

Tan to brown clayey gravel with limestone fragments was encountered at ground surface in borings B-1 and B-2. This material is likely fill material from construction of the existing lift station. The clayey gravel fill extended to respective depths of 8.5 and 2.0 feet and was described as loose to very dense with scattered roots and limestone fragments. Measured liquid limits ranged from 39 to 57 (average 47), plasticity indices ranged from 19 to 34 (average 25), and percent fines (material passing the No. 200 sieve) ranged from 17 to 38 (average 30). Standard penetration test (SPT) N-values ranged from 7 blows per foot (bpf) to 50 blows for 6 inches of penetration indicating loose to very dense consistency.

Tan and gray limestone (Austin Group) was encountered beneath the surficial fill. Tan highly weathered limestone was encountered from 8.5 feet to the 10-ft termination depth of Boring B-1, and between depths of 2.0 and 5.0 feet in Boring B-2, where relatively less weathered limestone was encountered. The Austin Group limestone was generally described as moderately to slightly weathered and moderately hard to hard with orange colored iron staining and discontinuities. The Austin Group limestone typically had core recoveries of 100 percent, with Rock Quality Designation (RQD) varying from 48 to 100 (average 83), and unconfined compressive strengths ranging from 14 to 125 tsf (average 72).

Groundwater

Groundwater was not encountered during dry advancement of the borings. However, it is not uncommon for perched or transient groundwater to be present near the interface of the upper clayey gravel material and the underlying limestone. Further, transient groundwater can also migrate laterally across the bedrock interface. The quantity of perched water is usually strongly influenced by antecedent rainfall conditions and proximity of nearby creeks, tributaries, drainage ways, or swales.

LIFT STATION STRUCTURE DESCRIPTION AND EVALUATION

Based on the lift station drawing provided by LAN, the wet well will have an inside diameter of approximately 6 feet and will be installed to a depth of about 30 feet, with a top of floor slab elevation of 667.0 feet. The generator pad will have plan dimensions of approximately 14 feet by 5 feet with a generator weight of approximately 10 kips. We anticipate that the generator pad will consist of thickened concrete slab or mat. The associated gravity lines will have diameters ranging from 8 to 18 inches at an elevation of about 681 feet, approximately 16

feet below existing ground surface. Our recommendations for lift station design and construction are presented in the following sections.

FOUNDATION RECOMMENDATIONS

The foundations for the wet well, generator pad may consist of reinforced concrete slabs/footings. Recommendations for bearing strata, footing depth and net allowable bearing pressure, along with comments regarding settlement of the slabs/footings are provided in the following paragraphs.

Wet Well

The slab/footing for the wet well should be founded on the gray Austin Limestone at an elevation of about 666.0 ft (assuming a slab thickness of about 12 inches). The slab/footing should be designed using an allowable net bearing pressure of 8,000 pounds per square foot (psf). Settlement of the slab/footing on the gray Austin limestone should be less than 0.5 inches.

Subgrade Preparation. The bottom of the excavation for the wet well should expose competent gray Austin Group limestone, which may be below the groundwater table at the time of construction. Care should be exercised to avoid exposing the excavation bottom to standing water or stormwater or surface water runoff. Any soft, loose, heaved or disturbed materials encountered at the bottom of the excavation should be removed. In addition, there should not be any standing water in the base of the excavation. If it is not possible to remove the water, provide stabilization such as rock stabilization or overexcavation and replacement of the subgrade with crushed stone, flowable fill, or lean concrete. Prior to construction, the exposed subgrade should be observed by the geotechnical engineer to confirm suitable bearing conditions.

Generator Pad

The proposed generator pad will consist of a reinforced concrete pad with either stiffened beam elements or placed as a mat. Based on conditions encountered within Boring B-1 Generator Pad will be founded on the existing clayey gravel fill material. As such, a prepared pad of structural fill is recommended beneath the Generator pad. Geotechnical recommendations for subgrade preparation and foundation design are provided in the following sections.

Pad Subgrade Preparation. Within the structure footprint and for a distance of 3 feet outside the footprint, remove and dispose of the existing fill material, organics or any other deleterious materials to the depth of at least 2 feet below the existing ground surface or proposed finished grade whichever is deeper.

1. Scarify the subgrade, moisture condition and compact the exposed subgrade to at least 95% of the maximum dry density as determined using TxDOT Test Method 114-E. Hold water contents to within ±2% of the optimum water content.
2. Bring the foundation pad to grade with crushed limestone, a minimum 2 feet of crushed limestone is recommended below the bottom of the slab or footing, conforming to the following:

Retained on 2-1/2" screen	0%
Retained on 7/8" screen	5% - 50%
Retained on 3/8" screen	25% - 65%
Retained on No. 4 mesh	35% - 75%
Retained on No. 40 mesh sieve	60% - 90%

Material passing the No. 40 sieve shall meet the following plasticity requirements:

Passing No. 40 Sieve	Maximum Plasticity Index	Minimum Plasticity Index
25% - 40%	15	3
10% - 25%	20	4

Material meet the specification of City of Round Rock Item 210 flexible base could be used as an alternative of the select crushed limestone.

3. Compact the select material to at least 95% of the maximum dry density as determined using TxDOT Test Method TEX-113-E. Hold water contents within ±3% of the optimum, and maintain compacted lift thicknesses to six inches or less.
4. If moisture migration through the concrete slab is a concern, place a capillary moisture barrier/drainage layer (minimum thickness of four inches) under the entire slab atop the compacted select fill. The material should consist of free-draining, clean, crushed stone with sizes ranging mostly between ½ and ¾ inch. A material conforming to ASTM C 33, Grade 67 is suggested. The purpose of this layer is to break the transmission of capillary moisture to the underside of the slab.
5. If moisture vapor transmission through the concrete slab is a concern, place a vapor retarder of sufficient strength and durability to resist puncture during reinforcing steel and concrete placement atop of the free-draining, clean, crushed stone layer. Placement of the vapor retarder should be in accordance with manufacturer's recommendations.

Grid-Beam Stiffened Slab-on-Ground or Mat Foundation. Provided the subgrade is prepared as recommended above, the Generator Pad may be supported by a monolithic grid-beam stiffened slab-on-ground or mat foundation. The structural engineer should design the grid-beam stiffened slab-on-ground including the slab thickness, beam spacing, and beam depth based on the following parameters:

1. Grid beams generally should be placed along the exterior perimeter of the pad and beneath any heavy concentrated loads.
2. Beams founded over a minimum of 2 ft of compacted crushed limestone underlain by existing fill material may be sized for an allowable bearing pressure of 1,500 psf.
3. Beam widths should be at least 12 inches, and minimum perimeter and interior beam depth should be 24 inches.
4. If design requires a modulus of subgrade reaction, use 100 pci.
5. The settlement of a slab/footing founded on 2 feet of compacted select fill underlain by existing fill material would be on the order of 1 inch or less.

Below Ground Walls

Permanent below grade walls restrained from movement will develop the “at rest” (Ko) earth pressure condition. Because of their configuration, the below grade walls for the wet well should be designed for the non-yielding, “at-rest” condition. The walls will be subjected to the permanent lateral earth pressure of the surrounding soil, rock, water, granular backfill materials and temporary fluid pressure of the uncured Controlled Low Strength Material (CLSM) if used, and potential surface loads from construction and maintenance equipment. Recommended equivalent fluid unit weights are set forth below for non-yielding below ground walls, and type of wall backfill.

1. With the use of clean crushed stone, selected in accordance with Item 4 below and placed behind the wall in the zone extending upward from at least 2 ft behind the bottom of the wall to the backfill surface at an angle of 60 degrees from horizontal, use an equivalent fluid unit weight of 95 pounds per cubic foot (pcf), assuming full hydrostatic pressure.
2. With the use of clean crushed stone, selected in accordance with Item 4 below and if the backfill zone is vertical or near-vertical cut with a width of 2 or 3 ft, use an equivalent fluid unit weight of 110 pcf, assuming full hydrostatic pressure.
3. With the use of off-site material that classifies as lean clay (CL), clayey sand (SC) or clayey gravel (GC) material in accordance with ASTM D 2487, use an equivalent fluid unit weight of 110 pcf, assuming full hydrostatic pressure. If off-site material is used

as backfill, the backfill should have a PI less than 20, a maximum particle size of 3 inches, and be free of organics and/or deleterious material. The fill material shall be approved by the geotechnical engineer before use.

4. If free draining material is used, it is recommended that the backfill be a clean crushed stone with sizes ranging mostly between ¼ and ½ inch, and no more than 5% passing the No. 200 sieve. An acceptable gradation would be Grade 5, Item 302, Aggregates for Surface Treatments, TxDOT 2004 Standard Specifications for Construction of Highways, Streets and Bridges.
5. The free-draining material should be placed in maximum 6 inch lifts and compacted with a minimum of four complete overlapping passes over the entire surface with a hand operated vibratory plate compactor until further passes do not result in greater densification. This process should be observed by a representative of the geotechnical engineer.
6. The off-site material classified, as lean clay (CL), clayey sand (SC) or clayey gravel (GC) soil should be compacted to at least 95% of the maximum dry density as determined using TxDOT Test Method TEX-113-E. Hold compacted lift thicknesses to 6 inches or less and water contents within 0% to +3% of optimum.
7. For designs involving any uniform vertical surcharge adjacent to the wall, use a coefficient of lateral earth pressure of 0.5.
8. If clean crushed stone is used, it should be capped with a filter fabric and 18 inches of clays. The clay should be compacted to at least 95% of the maximum dry density as determined using TxDOT Test Method TEX-114-E at moisture content above optimum.
9. If Controlled Low Strength Material is used as a backfill material, use an equivalent fluid unit weight of 130 pcf, assuming full hydrostatic pressure for the uncured state.

Uplift Resistance

After construction, the groundwater level could rise to the ground surface within the backfilled excavations. The resulting buoyancy potential should be accounted for in the design of the below ground structures. The ultimate resistance of below ground structures to buoyant uplift forces is limited to the dead weight of the structure plus the weight of any soil directly above the foundation. If necessary, the uplift resistance of the structures may be increased by thickening and/or extending the mat of the structure outward beyond the exterior perimeter walls. Preliminarily a buoyant unit weight of 60 pcf could be used to calculate the weight of backfill materials meeting the requirements of the previous section. If additional uplift capacity is required, one or more of the following options can increase the capacity:

1. Extending a perimeter “lip” of sufficient size around the base of the proposed below-ground structure to use the buoyant unit weight of the backfill soil directly above the lip;
2. Structurally connecting the below-ground structure to associated large above-grade structures, if applicable; and
3. Installing rock bolts or ground anchors to resist uplift forces.

The calculated ultimate uplift capacity should be reduced by an appropriate factor of safety to compute the allowable uplift resistance.

CONSTRUCTION CONSIDERATIONS

Subgrade Preparation

The bottom of the excavation for the proposed wet well should expose gray Austin limestone. During excavation, any loose or disturbed materials encountered at the bottom of the excavations should be removed. In addition, there should not be any standing water in the base of excavation. Prior to construction, the exposed subgrade should be inspected by the geotechnical engineer. If soft or weak areas are encountered, these areas should be over-excavated and replaced with lean concrete or properly compacted crushed limestone.

Surface and Groundwater Control

As discussed in the “Groundwater” section of this report, groundwater was not encountered in either of the borings during our field exploration. However, perched or transient groundwater may be encountered in the excavations into the limestone especially during and shortly after periods of rainfall. Such perched water and/or seepage along the soil/rock interface or within fractures in the rock, more likely than not, can be handled by sumping and pumping. The possibility of groundwater and seepage should be anticipated during construction of the wet well.

Proposed final grades should provide for positive drainage away from the excavations to prevent surface water from ponding within the excavation during construction and around the completed structures. If possible, the ground surface surrounding structures should be sloped at 5 percent away from the structures for a distance of at least 10 ft from the structure.

Pipe Bedding and Backfill Recommendations

Successful installation of the gravity pipelines will depend on the available support from the surrounding soil and rock and the type of bedding material used. According to the City of Round Rock Standard Specifications Item 510.2, the pipe bedding stone shall be clean gravel, crushed gravel or crushed limestone, hard and insoluble in water, free of mud, clay, silt, vegetation or other debris, conforming to ASTM C33 No. 57 or No. 67 or the following table:

Sieve Size	% Retained by Weight
1½ inch	0
1 inch	0 - 10
½ inch	40 - 85
#4	90 -100
#8	95 -100

If needed for design, a “modulus of soil reaction” of 500 psi may be used for analysis and design for pipes bedded in weathered limestone or limestone if the bedding material satisfies the requirements above and is properly placed and densified in the trench.

Trench Backfill

Trench excavations may be backfilled with the excavated material provided the material is processed and placed in compliance with the following:

1. Excavated trench material should be free of debris, clay lumps, excessive organics, and other deleterious material, and be screened to limit the maximum particle size to 3 inches.
2. Compact the backfill to 95% of the maximum dry density determined using TxDOT Test Method TEX-114-E for clayey soils and TEX-113-E for gravelly soils. Compacted lift thicknesses should not be more than 6 inches. Water contents of the compacted backfill should be within ±2% of optimum.
3. Density testing should be performed on the backfill immediately after placement of each successive horizontal lift and not by “potholing” the fill body afterward. This requirement will necessitate protection for the density testing technician in trenches deeper than 5 feet by some means of trench safety system.

Excavation Potential

Excavation through the upper fill material should proceed without significant excavation difficulty. However, excavation into the tan and gray Austin limestone will require the use of a

large excavator or hoe ram. Assessments of rippability, based on inspection of cores, and RQD data indicate that the limestone is rippable to marginally rippable with a Caterpillar D9 or equivalent, equipped with a multi or single shank ripper[3]. Portions of the limestone may be more easily ripped or excavated due to weathering, jointing and the presence of soft layers. Varying degrees of difficulty will likely be experienced during excavation, and the contractor should be prepared to equip excavators with heavy duty hydraulic hammers.

Construction/Temporary Slopes

The sole responsibility for the design of temporary support systems and construction slopes by the Contractor is well recognized. Therefore, the comments regarding subsurface stability set forth herein are intended for preliminary planning purposes only, to help the contractor's engineer select design parameters and in no way reduce contractor responsibility.

If temporary sloping is feasible, the following suggestions are set forth below in accordance with OSHA[4] for classifying soil and rock encountered in our investigation. It is stressed that these are suggestions only for preliminary planning, and the excavation safety system design is the contractor's responsibility.

Soil/Rock Type	OHSA Classification	Recommended OSHA Slope
Fill (GC)	Type C	1.5H to 1V*
Highly Weathered Limestone	Type B	1H to 1V
Limestone	Stable Rock	Vertical Sides**

* If groundwater is encountered, flatter slopes or a dewatering plan will be required to maintain excavation safety. This flatter slope will control the sloping of the excavation and should be continued to the ground surface.

** If faulting, jointing, and/or inclined discontinuities are exposed, flatter slopes will be required to maintain safe trench excavations. Assume Type A (¾H to 1V).

The contractor is required to evaluate the suitability of all slopes for construction safety purposes and to construct flatter slopes where required. Temporary support systems will need to be designed to take into account the potential groundwater levels. Excavations planned more than twenty (20) feet deep, such as the wet well, will need to be designed by a professional engineer registered in the State of Texas.

3 Caterpillar Performance Handbook, 34th Edition, October 2003, published by Caterpillar, Inc., Peoria, Illinois.

4 Code of Federal Regulations Title 29 Part 1926 (2003), "Labor", Occupational Safety and Health Administration, Department of Labor, Subpart P - Excavations, pgs 373 – 410.

Construction Monitoring

It is recommended that the Geotechnical Engineer of record, or a qualified representative, be present on-site during construction to observe, monitor construction activities and perform quality control tests. Construction monitoring performed by qualified personnel independent of the Contractor is recommended because the performance of foundations and other structures constructed during this project will be directly related to the Contractor's adherence to the recommendations presented in this report and to the specifications prepared by the Designer. Additionally, unanticipated soil and/or groundwater conditions may be encountered during construction. Qualified geotechnical personnel observing construction on-site can monitor construction activities and may aid in recognizing unanticipated subsurface conditions and assist in reconciling these conditions with design recommendations.

CONDITIONS

Since some variation was found in subsurface conditions at boring locations, all parties involved should take notice that even more variation may be encountered between boring locations. Statements in the report as to subsurface variation over given areas are intended only as estimations from the data obtained at specific boring locations.

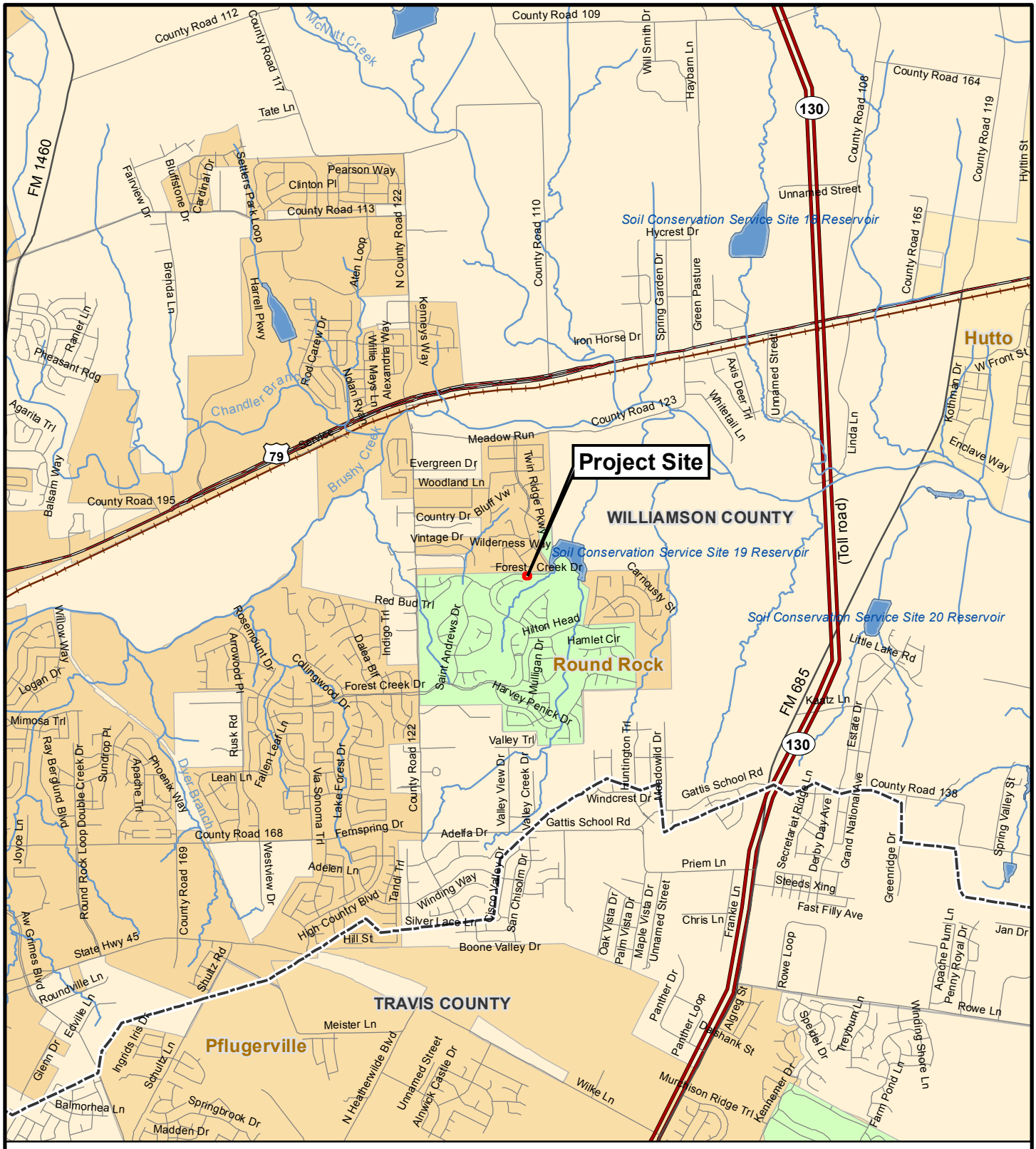
It is recommended that, upon completion of the plans and specifications and the incorporation of the recommendations herein, the geotechnical engineer be retained to review such plans to ensure proper interpretation and implementation of his recommendations in the interest of the best compromise between cost and performance.

The professional services that form the basis for this report have been performed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers practicing in the same locality. No warranty, expressed or implied, is made as the professional advice set forth. Fugro's scope of work does not include the investigation, detection, or design related to the presence of any biological pollutants. The term 'biological pollutants' includes, but is not limited to, mold, fungi, spores, bacteria, and viruses, and the byproducts of any such biological organisms.

The results, conclusions, and recommendations contained in this report are directed at, and intended to be utilized within, the scope of work contained in the agreement executed by Fugro Consultants, Inc. and client. This report is not intended to be used for any other purposes. Fugro Consultants, Inc. makes no claim or representation concerning any activity or condition falling outside the specified purposes to which this report is directed, said purposes being

specifically limited to the scope of work as defined in said agreement. Inquiries as to said scope of work or concerning any activity or condition not specifically contained therein should be directed to Fugro Consultants, Inc. for a determination and, if necessary, further investigation.

PLATES



Scale: 1 inch = 4,000 feet

0 2,000 4,000 8,000 Feet

N

Coordinate System: State Plane Texas Central FIPS 4203 Ft
Datum: D North American 1983

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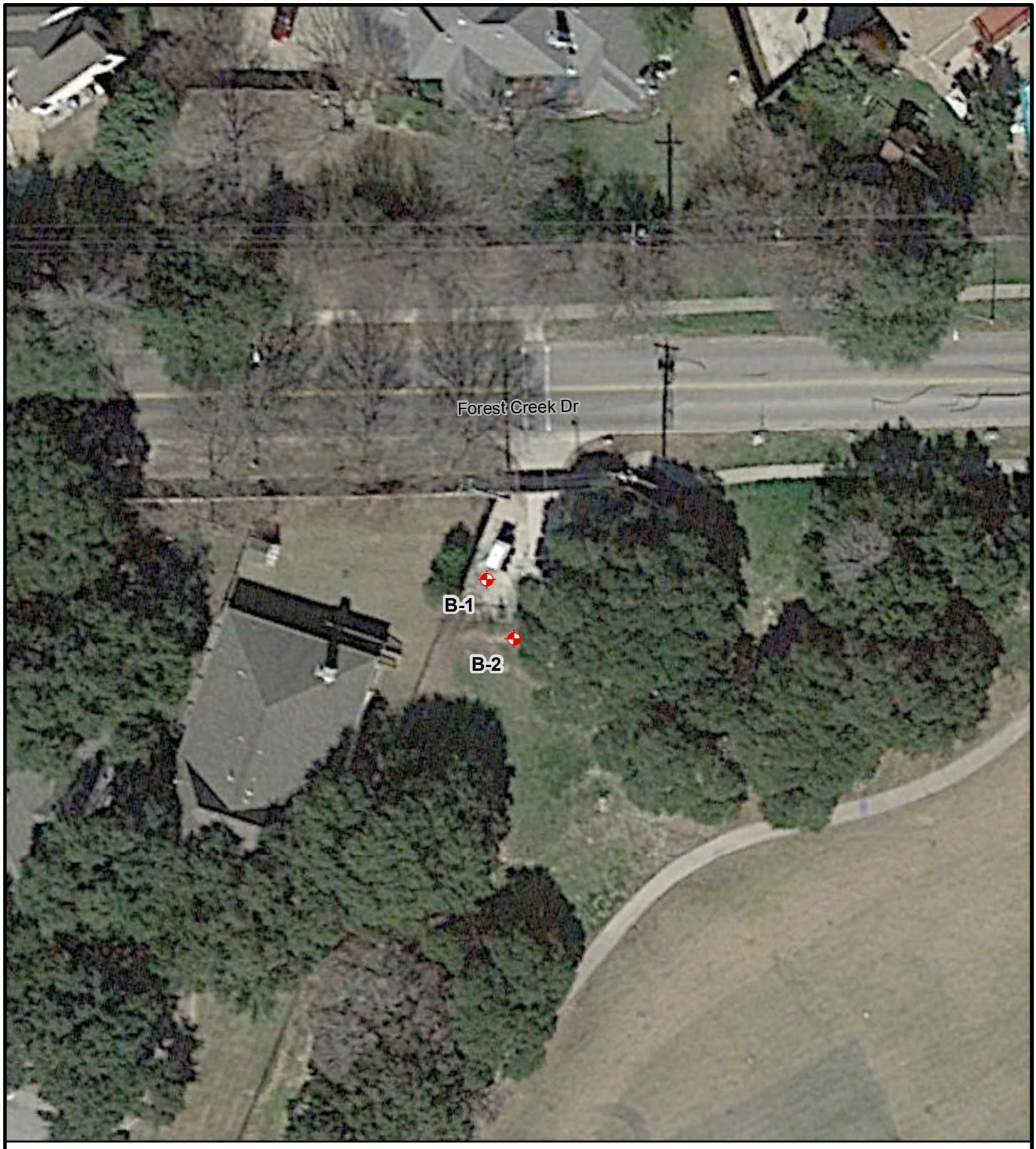
Forest Creek Lift Station Rehab

VICINITY MAP

Round Rock, Texas

Source:	Drawn By:	Date:	Project No.:	
Street map: ESRI ArcGIS Online, 2015	DG	June 27, 2016	04.30151036	PLATE 1



Legend

Approximate Boring Location

Scale: 1 inch = 40 feet

0 20 40 80 Feet

Coordinate System: State Plane Texas Central FIPS 4203 Ft
Datum: D North American 1983

N

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Forest Creek Lift Station Rehab

PLAN OF BORINGS

Round Rock, Texas

Source:	Drawn By:	Date:	Project No.:	
Orthophotography: Google Earth Pro, 2016	DG	June 27, 2016	04.30151036	PLATE 2

LOG OF BORING NO. B-1
Forest Creek Lift Station Rehab
Forest Creek Drive & Twin Ridge Parkway
Round Rock, Texas
PROJECT NO. 04.30151036

Fugro Consultants, Inc.

DEPTH, FT	SYMBOL	SAMPLES	POCKET PEN, tsf Blows/ft. REC./RQD, %	STRATUM DESCRIPTION	LAYER ELEV./ DEPTH	WATER CONTENT, %	LIQUID LIMIT, %	PLASTICITY INDEX (PI), %	PASSING NO. 4 SIEVE, %	PASSING NO. 200 SIEVE, %	UNIT DRY WEIGHT, PCF	COMPRESSIVE STRENGTH TSF
				SURF. ELEVATION: 697.0 ft±								
			N = 14	Tan to brown clayey GRAVEL, medium dense to very dense, moist, w/limestone fragments and clay pockets. (Fill Material)		12	57	34	73	34		
			N = 50/6"									
5			N = 7									
			N = 50/6"	Tan LIMESTONE, hard, highly weathered, highly fractured. (Austin Group)	688.5 8.5	8	39	19	56	17		
10					687.0 10.0							
15												
20												

NOTES:

1) Boring was advanced dry to the boring termination depth of 10 ft and groundwater was not encountered.

2) Approximate GPS coordinates: N: 30°31'3.71", W: 97°36'12.11".

3) Ground surface elevation was interpolated from provided contour plan and should be considered approximate.

COMPLETION DEPTH: 10.0

DATE DRILLED: 6-20-16 to 6-20-16

WATER LEVEL / SEEPAGE: See Notes

UPON COMPLETION: See Notes

KEY:
N = Standard Penetration Test, bpf
P = Pocket Penetrometer, tsf
U = Unconfined
Q = Unconsolidated Undrained Triaxial

PLATE 3

FUGRO STD PLATE (AUSTIN) 04.30151036.GPJ FUGRO AUSTIN DATA TEMPLATE.GDT 7/14/16

LOG OF BORING NO. B-2
Forest Creek Lift Station Rehab
Forest Creek Drive & Twin Ridge Parkway
Round Rock, Texas
PROJECT NO. 04.30151036

Fugro Consultants, Inc.

DEPTH, FT	SYMBOL	SAMPLES	POCKET PEN, tsf Blows/ft. REC./RQD, %	STRATUM DESCRIPTION	LAYER ELEV./ DEPTH	WATER CONTENT, %	LIQUID LIMIT, %	PLASTICITY INDEX (PI), %	PASSING NO. 4 SIEVE, %	PASSING NO. 200 SIEVE, %	UNIT DRY WEIGHT, PCF	COMPRESSIVE STRENGTH TSF
				SURF. ELEVATION: 696.5 ft±								
			P = 4.0	Tan to brown clayey GRAVEL, medium dense, w/limestone fragments and roots. (Fill Material)	694.5	10	44	22	75	38		
			N = 50/5"	Tan LIMESTONE, highly weathered, highly fractured. (Austin Group)	2.0							
					691.5							
5			5'-10' 100 / 48	Tan to light gray LIMESTONE, hard to very hard, moderately to slightly weathered, highly to moderately fractured, w/orange color iron stains (Austin Group)	5.0	7					134	125(U)
10			10'-15' 100 / 83		684.5							
				Gray to light gray LIMESTONE, hard to very hard, slightly weathered, moderately fractured, w/orange color iron stains (Austin Group)	12.0	11					129	49(U)
15			15'-20' 100 / 72	*- w/fracture at 18.5 ft (45 degrees)*								
20			20'-25' 100 / 100			24					102	14(U)

COMPLETION DEPTH: 40.0
DATE DRILLED: 6-20-16 to 6-20-16
WATER LEVEL / SEEPAGE: See Notes
UPON COMPLETION: See Notes

KEY:
N = Standard Penetration Test, bpf
P = Pocket Penetrometer, tsf
U = Unconfined
Q = Unconsolidated Undrained Triaxial

PLATE 4a

FUGRO STD PLATE (AUSTIN) 04.30151036.GPJ FUGRO AUSTIN DATA TEMPLATE.GDT 7/14/16

LOG OF BORING NO. B-2
Forest Creek Lift Station Rehab
Forest Creek Drive & Twin Ridge Parkway
Round Rock, Texas
PROJECT NO. 04.30151036

Fugro Consultants, Inc.

DEPTH, FT	SYMBOL	SAMPLES	POCKET PEN, tsf Blows/ft. REC./RQD, %	STRATUM DESCRIPTION	LAYER ELEV./ DEPTH	WATER CONTENT, %	LIQUID LIMIT, %	PLASTICITY INDEX (PI), %	PASSING NO. 4 SIEVE, %	PASSING NO. 200 SIEVE, %	UNIT DRY WEIGHT, PCF	COMPRESSIVE STRENGTH TSF
				SURF. ELEVATION: 696.5 ft±								
			25'-30' 100 / 93	Gray to light gray LIMESTONE, hard to very hard, slightly weathered, moderately fractured, w/orange color iron stains (Austin Group) *(continued)*		10					132	61(U)
30			30'-35' 100 / 83									
35			35'-40' 100 / 100			6					126	110(U)
40					656.5 40.0							
45				*NOTES:* *1) Boring was advanced dry to the boring termination depth of 40 ft and groundwater was not encountered.* *2) Approximate GPS coordinates: N: 30°31'3.50", W: 97°36'11.89".* *3) Ground surface elevation was interpolated from provided contour plan and should be considered approximate.*								

COMPLETION DEPTH: 40.0
DATE DRILLED: 6-20-16 to 6-20-16
WATER LEVEL / SEEPAGE: See Notes
UPON COMPLETION: See Notes

KEY:
N = Standard Penetration Test, bpf
P = Pocket Penetrometer, tsf
U = Unconfined
Q = Unconsolidated Undrained Triaxial

PLATE 4b

FUGRO STD PLATE (AUSTIN) 04.30151036.GPJ FUGRO AUSTIN DATA TEMPLATE.GDT 7/14/16

TERMS AND SYMBOLS USED ON BORING LOGS FOR SOIL

SOIL TYPES

FAT CLAY (CH)

LEAN CLAY (CL)

SILT (ML)

FILL

Well-Graded **SAND (SW)**

Poorly-Graded **SAND (SP)**

SILTY SAND (SM)

CLAYEY SAND (SC)

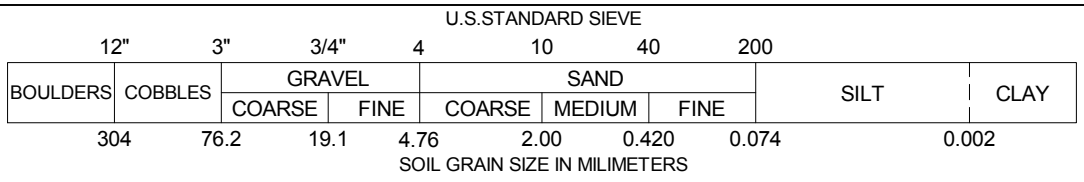
Well-Graded **GRAVEL (GW)**

Poorly-Graded **GRAVEL (GP)**

SILTY GRAVEL (GM)

CLAYEY GRAVEL (GC)

SOIL GRAIN SIZE



STRENGTH OF COHESIVE SOILS (2)

CONSISTENCY	UNDRAINED COMPRESSIVE STRENGTH Tons Per Sq. Ft.
Very Soft	Less Than 0.25
Soft	0.25 to 0.50
Firm	0.5 to 1.00
Stiff	1.00 to 2.00
Very Stiff	2.00 to 4.00
Hard	greater than 4.00

DENSITY OF GRANULAR SOILS (2)

NUMBER OF BLOWS PER FT., N	RELATIVE DENSITY
0-4	Very Loose
4-10	Loose
10-30	Medium
30-50	Dense
Over 50	Very Dense

DESCRIPTIVE TERMS FOR SOIL (1)

DESCRIPTION	CRITERIA
Stratified	Alternating layers of varying material or color with layers at least 6 mm thick.
Laminated	Alternating layers of varying material or color with the layers less than 6 mm thick.
Fissured	Breaks along definite planes of fracture with little resistance to fracturing.
Slickensided	Fracture planes appear polished or glossy, sometimes striated.
Blocky	Cohesive soil that can be broken down into small angular lumps which resist further breakdown.
Lensed	Inclusions of small pockets of different soils.

MOISTURE

Dry	No water evident in sample; fines less than plastic limit.
Moist	Sample feels damp; fines near the plastic limit
Very Moist	Water visible on sample; fines greater plastic limit and less than liquid limit
Wet	Sample bears free water; fines greater than liquid limit.

INCLUSIONS (1)

Parting	Inclusion <1/8" thick extending through sample
Seam	Inclusion 1/8" to 3" thick extending through sample.
Layer	Inclusion >3" thick extending through sample.
Trace	<5% of sample.
Few	5% to 10% of sample.
Little	15 to 25% of sample.
With	15% to 29% of sample.

NOTE: Information on each boring log is a compilation of subsurface conditions and soil and rock classifications obtained from the field as well as from laboratory testing of samples. Strata have been interpreted from commonly accepted procedures. The stratum lines on the logs may be transitional and approximate in nature. Water level measurements refer only to those observed at the times and places indicated, and may vary with time, geologic condition or construction activity.

REFERENCES: 1) ASTM D 2488 2) Peck, Hanson and Thornburn, (1974), Foundation Engineering.

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PLATE 5

TERMS AND SYMBOLS USED ON BORING LOGS FOR ROCK

ROCK TYPES

LIMESTONE

SHALE

SANDSTONE

HIGHLY WEATHERED LIMESTONE

HIGHLY WEATHERED SHALE

WEATHERED SANDSTONE

HIGHLY WEATHERED DOLOMITIC LIMESTONE

DOLOMITIC LIMESTONE

MARL

SAMPLER TYPES

Thin-walled Tube

Rock Core

Standard Penetration Test

Auger Sample

THD Cone Penetration Test

Bag Sample

SOLUTION & VOID CONDITIONS

Void	Interstice; a general term for pore space or other openings in rock.
Cavities	Small solutional concavities.
Vuggy	Containing small cavities, usually lined with a mineral of different composition from that of the surrounding rock.
Vesicular	Containing numerous small, unlined cavities, formed by expansion of gas bubbles or steam during solidification of the rock.
Porous	Containing pore, interstices, or other openings which may or may not interconnect.
Cavernous	Containing cavities or caverns, sometimes quite large. Most frequent in limestones and dolomites.

WEATHERING GRADES OF ROCKMASS(1)

Slightly	Discoloration indicates weathering of rock material and discontinuity surfaces.
Moderately	Less than half of the rock material is decomposed or disintegrated to a soil.
Highly	More than half of the rock material is decomposed or disintegrated to a soil.
Completely	All rock material is decomposed and/or disintegrated to soil.The original mass structure is still largely intact.
Residual Soil	All rock material is converted to soil.The mass structure and material fabric are destroyed.

HARDNESS

Friable	Crumbles under hand pressure
Low Hardness	Can be carved with a knife
Moderately Hard	Can be scratched easily with a knife
Very Hard	Cannot be scratched with a knife

BEDDING THICKNESS(2)

Very Thick	>4'
Thick	2'-4'
Thin	2"-2'
Very Thin	1/2"-2"
Laminated	0.08"-1/2"
Thinly-Laminated	<0.08"

JOINT DESCRIPTION

SPACING		INCLINATION		SURFACES	
Very Close	<2"	Horizontal	0-5	Slickensided	Polished, grooved
Close	2"-12"	Shallow	5-35	Smooth	Planar
Medium Close	12"-3'	Moderate	35-65	Irregular	Undulating or granular
Wide	>3'	Steep	65-85	Rough	Jagged or pitted
		Vertical	85-90		

FUGRO
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NOTE: Information on each boring log is a compilation of subsurface conditions and soil and rock classificaitons obtained from the field as well as from laboratory testing of samples. Strata have been interpreted by commonly accepted procedures. The stratum lines on the logs may be transitional and approximate in nature. Water level measurements refer only to those observed at the times and places indicated, and may vary with time, geologic condition or construction activity.

REFERENCES: 1) British Standard(1981) Code of Practice for Site Investigation BS 5930.
2) The Bridge Division, Texas Highway Dept. Foundation Exploration & Design Manual, 2nd Edition,revised June,1974.

PLATE 6