Artesia Pump Station Well Pumps, Motors, and Piping - RFCSP
Solicitation Number: CO-00732
Job No.: 22-8611

ADDENDUM 3

April 16, 2024

To Respondent of Record:

This addendum, applicable to work referenced above, is an amendment to the bid proposal, plans and specifications and as such will be a part of and included in the Contract Documents. Acknowledge receipt of this addendum by entering the Addendum number and issue date on the space provided in submitted copies of the Respondent Questionnaire.

RESPONSES TO QUESTIONS

1. **Question: Please provide size/amperage and enclosure rating/type for 5kV Disconnect Switch for WP 7 and 8.**
   Response: See Section 26 13 26. 5kV disconnect switches are to be rated 600A provided in a NEMA 3R enclosure.

2. **Question: Key Note 2 on E-03 and Key Note 1 on E-05 and E-06 references specification Section 26 13 16,. This specification was not provided in the [Bid Documents].**
   Response: This specification reference is incorrect. See Section 26 13 26. See Changes to the Plans Numbers 9, 11, and 12.

3. **Question: Please Provide kAIC rating for existing panels 'HA' and 'HB' as specified on E-03, Key Notes 3 and 4.**
   Response: Existing rating is 50kAIC.

4. **Question: Please clarify [if] LC-7 and LC-8 shall be in a 304 or 316 SS N3R Enclosure.**
   Response: In accordance with Section 26 24 16, a 304 stainless steel enclosure is acceptable.

5. **Question: Please confirm MPZs winding type (AL/CU).**
   Response: Either winding type is acceptable.

6. **Question: Please classify enclosure rating for SPDs.**
   Response: A NEMA 3R enclosure type is acceptable.

7. **Question: Please clarify which trade shall supply/install the PFCCs.**
   Response: PFCCs shall be provided by the electrical contractor under Section 26 35 33.

8. **Question: Please provide size for the PFCCs.**
   Response: In accordance with Section 26 35 33, specific kVAR rating shall be provided as recommended by the motor manufacturer.

9. **Question: No geotechnical report is provided in the specifications nor drawings. Drawings reference geotechnical report ARIAS NO. 2017-157 but cannot be found online. Please provide geotechnical report accordingly.**
   Response: A geotechnical report will not be provided for this project. See Changes to the Plans Number 6. Sheet S-01, Note 7 will be deleted.

10. **Question: Foundation Preparation Detail on sheet S-06 is unclear whether 7' or 8' select fill is required. Please provide clarification.**
Response: Select fill shall be as shown on Detail 1 on sheet S-06. Excavation depth shall be 7'-0" in accordance with note 4 (not including the subgrade preparation in accordance with note 1).

11. **Question: Please clarify on quantity of steel canopies required per sheet S-03.**
Response: Electrical canopies shall be provided for associated electrical equipment at Wells Nos. 7 and 8.

12. **Question: Please clarify on Drawing No C-09 detail 4 steel pipe lap welds are double welded, internal and external.**
Response: Field welds shall be double welded internal and external as shown on Sheet C-09. Internal field welds shall be provided in accordance with ANSI/AWWA C206 and Section 33 05 05 3.1.H.6.b.

13. **Question: Section 43 24 13.33 1.1.B.4: Recommend requiring pump supplier to provide blind flange covers for all Well Pumps in event that pump must be removed at some point in future. This will prevent leakage from wells in Artesian conditions.**
Response: Contractor to provide blind flange covers for Wells Nos. 3, 4, 5, 7 and 8. Flanges covers are to be fabricated such that bolt configuration shall match. Flanges shall be provided to SAWS for storage in accordance with Section 01 78 43, Spare Parts. See Changes to the Specifications Number 4.

14. **Question: Section 43 24 13.33 2.1.C: Please revise maximum 16" bowl diameter for WP-3 to 17.5". The well casing ID at WP-3 bowl elevation will allow for 17.5" bowl to be installed. Pre-approved selection is 17.5" diameter.**
Response: SAWS will defer to manufacturer recommendations. See revised Section 43 24 13.33 2.1.C. and Changes to the Specifications Number 4.

15. **Question: Section 43 24 13.33 2.1.C: Plan sheet M-04 shows 24" discharge for existing WP-4/5. Please confirm that new WP-4/5 are to have 20" discharge.**
Response: Data shown is based on field conditions discovered during SAWS Job No. 18-8603. See revised Section 43 24 13.33 2.1.C and revised drawing M-04 to reflect field conditions. See Changes to the Specifications Number 4 and Changes to the Plans Number 5.

16. **Question: Section 43 24 13.33 2.4.A.g: Confirm well casing OD at surface mounting elevation to assist design of surface plate assemblies.**
Response: Contractor shall field verify all values provided prior to installation. Well casing OD according to record data is as follows:
    - Well No. 3: 26 inches
    - Well No. 4: 30 inches
    - Well No. 5: 30 inches
    - Well No. 7: 30 inches
    - Well No. 8: 30 inches

17. **Question: Section 43 24 13.33 2.4.A.1 End Connections: Formatting of paragraphs is off. Please revise to avoid confusion.**
Response: Section 43 24 13.33.2.4. formatting has been revised for clarity. See Changes to the Specifications Number 4.

18. **Question: Section 43 24 13.33 2.4.C: Add SS shaft sleeve requirement through stuffing box area.**
Response: See revised Section 43 24 13.33 2.4.C. to include a hardened stainless steel alloy shaft sleeve. See Changes to the Specifications Number 4.

19. **Question: Section 43 24 13.33 2.4.I.5: Per manufacturer, bowls of this size would receive powder epoxy coating on flow passages, not a polish. Will this be acceptable?**
Response: All coatings shall be NSF 61 approved for contact or submergence in potable water. No exceptions noted to epoxy coating for fully enclosed impellers.

20. **Question: Section 43 24 13.33 2.5.A.1: Specification references pre-lubrication tank, but plan sheets indicate pre-lubrication line will be connected to discharge piping. Please confirm which method will be utilized and update specifications/plan sheets accordingly.**
Response: Pre-lubrication line will be used for this Project. Section 43 24 13.33 2.5.A.1. has been modified accordingly. See Changes to the Specifications Number 4.

21. **Question: Section 43 24 13.33 2.10: Confirm that required testing is bowl performance. Confirm if factory calibrated motors can be used during Witness performance testing.**
Response: Required testing is bowl performance. Contractor shall provide project motors for factory witness testing. The use of factory calibrated motors will not be allowed during witness testing.

22. **Question: Section 40 05 93 2.3.A.12.c: Remove 60-degree limit for bearing temperature rise. This will be determined by manufacturer and will be higher than 60-degrees.**
Response: Deferring to manufacturer's setpoints will be acceptable. Contractor shall provide bearing temperature rise limits for review in shop drawing submission. See Changes to the Specifications Number 3.

23. **Question: Section 40 05 93 2.3.A.12.e: Manufacturer states that lower guide bearing for WP-3 motor must be grease lubricated due to smaller frame size. Please confirm if grease lubricated lower bearing would be acceptable. Upper thrust bearing would be oil lubricated as specified.**
Response: This will be acceptable. See Changes to the Specifications Number 3.

24. **Question: Section 40 05 93 2.3.A.18: Per manufacturer, specified junction box is very large and may not be able to be supported by motor frame. Please confirm if motors requiring external j-box support would be acceptable.**
Response: This will be acceptable.

25. **Question: Section 40 05 93 General: Confirm material requirement for rotor bar (copper or aluminum).**
Response: Rotor bar materials shall be copper.

26. **Question: Plan Sheet M-03/04: Butterfly valve weight must be completely supported without anchoring to discharge head. Pipe support shown on plan sheets is not adequate. Please revise detail drawing.**
Response: See Changes to the Plans Numbers 4 and 5 and refer to revised Sheet M-03 and M-04 attached.

27. **Question: Section 40 05 33: Will DR11 or 13.5 be allowed, DR 9 is not as common, and you won't need the 250PSI rating since pressure on the pipe is open ended**
Response: HDPE pipe shall be SDR 11. See revised Section 40 05 33 2.1.B. and Changes to the Specifications Numbers 1 and 2.

28. **Question: Section 40 05 33: Fittings made from the same pipe manufacturer are not common, can that be removed (1.3.A.2)**
Response: No exceptions noted to separate HDPE pipe and fittings vendors. See revised Section 40 05 33 1.3.A.2. and Changes to the Specifications Number 2.

29. **Question: Section 40 05 33: Regarding standard laying length of the pipe, will 40' lengths be acceptable (2.3.A.1).**
Response: No exceptions noted to 40-foot lengths.

30. **Question: Section 40 05 33: Please confirm the pipe is DIPS or IPS**
Response: HDPE pipe shall be IPS.

31. **Question: Section 40 05 33: On the installation 3.2.B.3, will a bent strap test be required, DR 9 will require a special machine to facilitate, and the test takes about 2-3 hours. Will an infield tensile test work. A data logger is already required so, you will see if there are any issues during a fuse.**
Response: See response to Question Number 27 in this addendum. For wall thickness less than 1-inch, provide bent strap testing per ASTM F2620 Appendix X4. Clarification of testing requirements is provided Changes to the Specifications Number 2. For wall thickness of 1-inch and greater, the Contractor shall use Guided Side Bend Evaluation per ASTM F3183. Proposals shall be based on the specified testing methods and frequency.

32. **Question: Contract drawing C-03 shows the two proposed area paving are predetermine quantities, however calculated take-off show different quantities please advise on which to use.**
Response: See revised Sheet C-03 and Changes to the Plans Number 2. Proposed concrete driveway quantities have been updated to Well No. 7.

33. **Question: Please confirm demolition scope for the electrical trade. Note 1 refers to the electrical drawings for more information, however no Electrical demo drawings are included in the set.**
Response: No electrical demolition is proposed under the scope of this Project. See Changes to the Plans Numbers 1 and 8.

34. **Question: Please confirm the scale for drawing E-04.**
Response: Drawing scale is 1/4" = 1'-0". See Changes to the Plans Number 10.

35. **Question: The specifications say to test underground piping for lead and asbestos. If hazardous material is found, will a change order be issued or do we need to include hazard material removal in our bid?**
Response: Artesia Pump Station is suspect for lead and asbestos materials. If existing utilities are uncovered and require disturbance, mitigation shall be provided in accordance with Section 02 41 02. Payment via Change Order can be reviewed on a case-by-case basis during construction.

36. **Question: Please confirm who is responsible for payment for on-site material testing, specifications are contradictory.**
Response: Contractor shall be responsible for all on-site Quality Control testing. The laboratory performing testing must be selected and submitted in accordance with Section 01 45 00 1.08.

37. **Question: Section 40 05 05-12: Can [we] use AWWA C205 cement mortar lining in lieu of Fusion Bond Epoxy on the exposed piping?**
Response: See response to Addendum 1, Question 4.

38. **Question: Section 33 05 05-24 Please verify if AWWA C222 Polyurethane is acceptable for buried pipe coating.**
Response: Polyurethane is acceptable for buried pipe exterior coating. See modified Table 33 05 05-A, Buried Piping Schedule and Changes to the Specifications Number 1 for clarity.

39. **Question: Contract drawing C-03 shows a new section of Chain-Link Fence length in dark and represented with an X, while the call out is light gray. Please confirm a new fence is required to be installed.**
Response: A new perimeter fencing will not be required under the scope of this Project. See revised Sheet C-03 and Changes to the Plans Number 2 for linework clarity.

40. **Question: Contract drawing C-10 (section 3) refers to typical equipment site pad, however, no typical detail for this pad exists in the structural drawing section. Please provide typical equipment pad detail including the excavation and backfill requirements.**
Response: Site pad detail has been included in Structural Drawings. See Changes to the Plans Numbers 3 and 7.

41. **Question: Section 40 05 33: Clarify [HDPE] pipe.**
Response: See response to Question Number 27 in this addendum.

42. **Question: Section 40 05 33 2.3: Clarify fitting dimensions.**
Response: If the Contractor chooses fittings in lieu of bending HDPE flush line piping during installation, fittings shall be compatible with 18-inch, or 24-inch HDPE flush line piping as shown on Sheet C-04 of Bid Drawings. See response to Question Numbers 27 and 28 in this addendum and Changes to the Specifications Numbers 1 and 2.

CHANGES TO THE SPECIFICATIONS

1. **Section 33 05 05, Buried Piping Installation**
   Remove its entirety and **replace with** the revised attached version.

2. **Section 40 05 33, High Density Polyethylene Pipe**
   Remove in its entirety and **replace with** the revised attached version.

3. **Section 40 05 93, Well Pump Motors**
   Remove in its entirety and **replace with** the revised attached version.

4. **Section 43 24 13.33, Vertical Lineshaft Pumps**
   Remove in its entirety and **replace with** the revised attached version.

CHANGES TO THE PLANS

1. **Sheet D-01, Demolition Details**
   Delete Sheet D-01 in its entirety and **replace with** revised Sheet D-02 attached.

2. **Sheet C-03, Paving and Grading Site Plan**
   Delete Sheet C-03 in its entirety and **replace with** revised Sheet C-03 attached.

3. **Sheet C-10, Details II**
   Delete Sheet C-10 in its entirety and **replace with** revised Sheet C-10 attached.

4. **Sheet M-03, Well No. 7 & 8 Section**
   Delete Sheet M-03 in its entirety and **replace with** revised Sheet M-03 attached.

5. **Sheet M-04, Well No. 3, 4, & 5 Installation of Pumps and Motors Details**
   Delete Sheet M-04 in its entirety and **replace with** revised Sheet M-04 attached.

6. **Sheet S-01, Structural General notes**
   Delete Sheet S-01 in its entirety and **replace with** revised Sheet S-01 attached.

7. **Sheet S-06, Typical Details**
   Delete Sheet S-06 in its entirety and **replace with** revised Sheet S-06 attached.

8. **Sheet E-02, Electrical Site Plan**
   Delete Sheet E-02 in its entirety and **replace with** revised Sheet E-02 attached.

9. **Sheet E-03, Existing MVMCC-A/B One Line Diagram**
   Delete Sheet E-03 in its entirety and **replace with** revised Sheet E-03 attached.

10. **Sheet E-04, Pump Station Building Basement Level Floor Plan**
    Delete Sheet E-04 in its entirety and **replace with** revised Sheet E-04 attached.

11. **Sheet E-05, Well No. 7 Electrical Plan**
    Delete Sheet E-05 in its entirety and **replace with** revised Sheet E-05 attached.

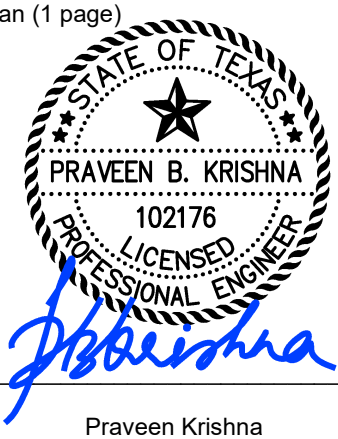
12. **Sheet E-06, Well No. 8 Electrical Plan**
    Delete Sheet E-05 in its entirety and **replace with** revised Sheet E-05 attached.

END OF ADDENDUM

This Addendum, including these six (6) pages, is eighty (80) pages with attachments in its entirety.
Attachments:

Section 33 05 05, Buried Piping Installation (25 pages)
Section 40 05 33, High Density Polyethylene Pipe (10 pages)
Section 40 05 93, Well Pump Motors (10 pages)
Section 43 24 13.33, Vertical Lineshaft Pumps (17 pages)
Sheet D-01, Demolition Details (1 page)
Sheet C-03, Paving and Grading Site Plan (1 page)
Sheet C-10, Details II (1 page)
Sheet M-03, Well No. 7 & 8 Section (1 page)

Sheet M-04, Well No. 3, 4, & 5 Installation of Pumps and Motors Details (1 page)
Sheet S-01, Structural General notes (1 page)
Sheet S-06, Typical Details (1 page)
Sheet E-02, Electrical Site Plan (1 page)
Sheet E-03, Existing MVMCC-A/B One Line Diagram (1 page)
Sheet E-04, Pump Station Building Basement Level Floor Plan (1 page)
Sheet E-05, Well No. 7 Electrical Plan (1 page)
Sheet E-06, Well No. 8 Electrical Plan (1 page)



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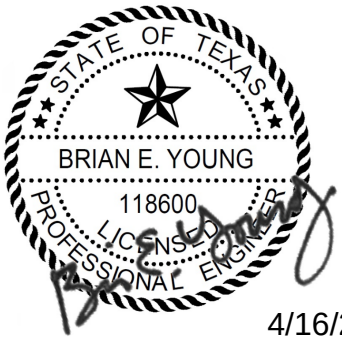
Arcadis, Inc.



4/16/2024

Brian Young
Arcadis, Inc.

SECTION 33 05 05

BURIED PIPING INSTALLATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to install and test all buried piping, fittings, and specials. The Work includes the following:
      a. All types and sizes of buried piping, except where buried piping installations are specified under other Sections.
      b. Unless otherwise shown or specified, this Section includes all buried piping Work required, beginning at the outside face of structures or structure foundations, including piping beneath structures, and extending away from structures.
      c. Work on or affecting existing buried piping.
      d. Installation of all jointing and gasket materials, specials, flexible couplings, mechanical couplings, harnessed and flanged adapters, sleeves, tie rods, cathodic protection, and other Work required for a complete, buried piping installation.
      e. Supports, restraints, and thrust blocks.
      f. Pipe encasements, with the exception of piping embedded in concrete within a structure or foundation specified under Section 40 05 05, Exposed Piping Installation.
      g. Field quality control, including testing.
      h. Cleaning and disinfecting.
      i. Incorporation of valves, meters, and special items shown or specified into piping systems in accordance with the Contract Documents and as required.

B. Coordination:
   1. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before buried piping Work.
   2. Coordinate with appropriate piping Sections of Division 40, Process Integration.

C. Related Sections:
   1. Section 03 30 00, Cast-In-Place Concrete.
   2. Section 09 91 00, Painting.
   3. Section 31 23 05, Excavation and Fill.
   4. Section 40 05 24.23, Steel Process Pipe
   5. Section 40 05 31, Thermoplastic Process Pipe
   6. Section 40 05 33, High Density Polyethylene Yard Pipe.

1.2 REFERENCES

A. Standards referenced in this Section are:
1. ASME Boiler and Pressure Vessel Code.
2. ASME B31.3, Process Piping.
3. American Society for Non-Destructive Testing (ASNT), ASNT-TC-1A, Recommended Practice, Personnel Qualification, and Certification in Non-destructive Testing.
4. ASTM B32, Specification for Solder Metal.
5. ASTM C12, Practice for Installing Vitrified Clay Pipe Lines.
6. ASTM C425, Specification for Compression Joints for Vitrified Clay Pipe and Fittings.
7. ASTM C828, Test Method for Low-Pressure Air Test of Vitrified Clay Pipe Lines.
8. ASTM C924, Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Test Method.
9. ASTM D2321, Practice for Underground Installation of Thermoplastic Pipe for Sewers and other Gravity-Flow Applications.
10. ASTM D2774, Practice for Underground Installation of Thermoplastic Pressure Piping.
11. ASTM D4174, Practice for Cleaning, Flushing and Purification of Petroleum Fluid Hydraulic Systems.
12. ASTM F1417, Test Method for Installation Acceptance of Plastic Gravity Sewer Lines using Low-Pressure Air.
13. ASTM F2164, Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure.
14. ANSI/AWWA C105, Polyethylene Encasement for Ductile-Iron Pipe Systems.
15. ANSI/AWWA C111, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
16. ANSI/AWWA C206, Field Welding of Steel Water Pipe.
17. ANSI/AWWA C600, Installation of Ductile-Iron Water Mains and Their Appurtenances.
18. ANSI/AWWA C604, Installation of Buried Steel Water Pipe, 4” and Larger.
19. ANSI/AWWA C605, Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.
20. ANSI/AWWA C606, Grooved and Shouldered Joints.
21. ANSI/AWWA C651, Disinfecting Water Mains.
22. AWWA M9, Concrete Pressure Pipe.
23. AWWA M11, Steel Water Pipe - A Guide for Design and Installation.
24. AWWA M23, PVC Pipe - Design and Installation.
25. AWWA M41, Ductile-Iron Pipe and Fittings.
26. AWWA M45, Fiberglass Pipe Design.
27. AWWA M55, PE Pipe - Design and Installation.
28. ASCE 37, Design and Construction of Sanitary and Storm Sewers.
29. American Concrete Pipe Association, Concrete Pipe Handbook.
30. Chlorine Institute, Inc., Piping Systems for Dry Chlorine, Pamphlet No. 6.

31. NFPA 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Comply with requirements and recommendations of authorities having jurisdiction over the Work, including.
      a. Texas Commission on Environmental Quality
   2. Obtain required permits for Work in roads, rights-of-way, railroads, and other areas of the Work.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Laying schedules for steel pipe and piping with restrained joints.
      b. Details of piping, specials, joints, harnessing and thrust blocks, and connections to piping, structures, equipment, and appurtenances.
   2. Product Data:
      a. Manufacturer's literature and specifications, as applicable, for products specified in this Section.
   3. Testing Procedures:
      a. Submit proposed testing procedures, methods, apparatus, and sequencing. Obtain ENGINEER's approval prior to commencing testing.

B. Informational Submittals: Submit the following:
   1. Certificates:
      a. Certificate signed by manufacturer of each product certifying that product conforms to applicable referenced standards.
   2. Field Quality Control Submittals:
      a. Results of each specified field quality control test.

C. Closeout Submittals: Submit the following:
   1. Record Documentation:
      a. Maintain accurate and up-to-date record documents showing modifications made in the field, in accordance with approved submittals, and other Contract modifications relative to buried piping Work. Submittal shall show actual location of all piping Work and appurtenances at same scale as the Drawings.
      b. Show piping with elevations referenced to Project datum and dimensions from permanent structures. For each horizontal bend in piping, include dimensions to at least three permanent structures, when possible. For straight runs of piping provide offset dimensions as required to document piping location.
      c. Include profile drawings with buried piping record documents when the Contract Documents include piping profile drawings.
      d. Conform to Section 01 78 39, Project Record Documents.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery:
   1. Deliver materials to the Site to ensure uninterrupted progress of the Work.
   2. Upon delivery inspect pipe and appurtenances for cracking, gouging, chipping, denting, and other damage and immediately remove from Site and replace with acceptable material.

B. Storage:
   1. Store materials to allow convenient access for inspection and identification. Store material off ground using pallets, platforms, or other supports. Protect packaged materials from corrosion and deterioration.
   2. Pipe and fittings other than thermoplastic pipe and fittings may be stored outdoors without cover. Cover thermoplastic pipe and fittings stored outdoors.

C. Handling:
   1. Handle pipe, fittings, specials, and accessories carefully in accordance with pipe manufacturer's recommendations. Do not drop or roll material off trucks. Do not drop, roll or skid piping.
   2. Avoid unnecessary handling of pipe.
   3. Keep pipe interiors free from dirt and foreign matter.
   4. Protect interior linings and exterior coatings of pipe and fittings from damage. Replace pipe and fittings with damaged lining regardless of cause of damage.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Piping materials are specified in the Buried Piping Schedule at end of this Section. Piping materials shall conform to Specifications for each type of pipe and piping appurtenances in applicable Sections of Division 40, Process Integration.

B. General:
   1. Pipe Markings:
      a. Factory-mark each length of pipe and each fitting with designation conforming to those on approved laying schedules.
      b. Manufacturer shall cast or paint on each length of pipe and each fitting pipe material, diameter, and pressure or thickness class.

C. Cathodic Protection:
   1. Bonding Cables: Bonding cable and test lead wires shall be not less than No. 6 AWG, Type CP copper cathodic protection cable, with low density, high molecular weight polyethylene insulation.

2.2 BURIED PIPING IDENTIFICATION

A. Polyethylene Underground Warning Tape for Metallic Pipelines:
   1. Tracer tape shall be of inert, acid- and alkali-resistant, polyethylene, four mils thick, six inches wide, suitable for direct burial. Tape shall be capable of stretching to twice its original length.
   2. Message shall read, "CAUTION [insert customized name of pipe service, i.e., "POTABLE WATER", "SANITARY SEWER", "CHLORINE GAS", or other service as appropriate, as indicated in the Buried Pipe Schedule at the end of this Section] PIPE BURIED BELOW", with bold letters approximately two inches high. Messages shall be printed at maximum intervals of two feet. Tape shall be custom colored the same as pipeline colors specified for associated pipe service in Section 09 91 00, Painting.
   3. Manufacturer: Provide products of one of the following:
      a. Brady Corporation
      b. Seton Identification Products
      c. Marking Services, Inc.
      d. Or equal.

B. Detectable Underground Warning Tape for Non-Metallic Pipelines:
   1. Tape shall be of inert, acid- and alkali-resistant, polyethylene, five mils thick, six inches wide, with aluminum backing, and have 15,000 psi tensile strength and 80 percent elongation capability. Tape shall be suitable for direct burial.
   2. Message shall read, "CAUTION [insert customized name of pipe service, i.e., "POTABLE WATER", "SANITARY SEWER", "CHLORINE GAS", or other appropriate service, as indicated in the Buried Pipe Schedule at the end of this Section] PIPE BURIED BELOW" with bold letters approximately two inches high. Messages shall be printed at maximum intervals of two feet. Tape shall be custom colored the same as the pipeline colors as specified for the associated pipe service in Section 09 91 00, Painting.
   3. Manufacturer: Provide products of one of the following:
      a. Brady Corporation
      b. Seton Identification Products
      c. Marking Services, Inc.
      d. Or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
   1. Install piping as shown, specified, and as recommended by pipe and fittings manufacturer.
   2. In event of conflict between manufacturer's recommendations and the Contract Documents, request interpretation from ENGINEER before proceeding.

3. ENGINEER will observe excavations and bedding prior to laying pipe by CONTRACTOR. Notify ENGINEER in advance of excavating, bedding, pipe laying, and backfilling operations.
4. Minimum cover over buried piping shall be 3 feet, unless otherwise shown on plans or approved by ENGINEER.
5. Earthwork is specified in Section 31 23 05, Excavation and Fill.
6. Excavation in excess of that required or shown, and that is not authorized by ENGINEER shall be filled at CONTRACTOR's expense with granular material furnished, placed, and compacted in accordance with Section 31 23 05, Excavation and Fill.
7. Comply with NFPA 24 for "Outside Protection", where applicable to water piping systems used for fire protection.

B. Manufacturer's Installation Specialist:
   1. Provide services of competent installation specialist of pipe manufacturer when pipe installation commences for:
      a. Steel pipe.
      b. Thermoplastic pipe.
      c. HDPE pipe.
   2. Retain installation specialist at the Site for minimum of 2 days (eight hours per day at the Site) or until competency of pipe installation crew has been satisfactorily demonstrated.

C. Separation of Sewers and Potable Water Piping:
   1. Horizontal Separation:
      a. Where possible, existing and proposed potable water mains and service lines, and sanitary, combined, and storm sewers shall be separated horizontally by clear distance of at least nine feet.
      b. If local conditions preclude the specified clear horizontal separation, installation will be allowed if potable water main is in separate trench or on undistributed earth shelf on one side of sewer and with bottom of potable water main at least 24 inches above top of non-pressure rated sewer line.
      c. Exception:
         1) Where it is not possible to provide minimum horizontal separation described above, construct potable water main of cement-lined ductile iron pipe with restrained push-on joint or restrained mechanical joint pipe complying with public water supply design standards of authority having jurisdiction. Hydrostatically test water main and sewer as specified in this Section prior to backfilling. Hydrostatic test pressure at crossing shall be at least 150 psi.
   2. Vertical Separation:
      a. Provide minimum vertical distance of 24 inches between outside of potable water main and outside of sewer when sewer crosses over potable water main.
      b. Center a section of potable water main pipe at least 18 feet long over sewer so that sewer joints are equidistant from potable water main joints.

c. Provide adequate structural support where potable water main crosses under sewer. At minimum, provide compacted select backfill for nine feet on each side of crossing.
d. Exceptions:
1) Where it is not possible to provide minimum vertical separation described above, construct potable water main of cement-lined steel pipe with welded joint pipe. Hydrostatically test water main and sewer as specified in this Section, prior to backfilling. Hydrostatic test pressure at crossing shall be at least 150 psi.
2) Encase either potable water main or sewer in watertight carrier pipe extending nine feet on each side of crossing, measured perpendicular to potable water main.

3. At a minimum, separation distances must comply with requirements of TCEQ 290.44.

D. Plugs:
1. Temporarily plug installed pipe at end of each day of work or other interruption of pipe installation to prevent entry of animals, liquids, and persons into pipe, and entrance or insertion of deleterious materials into pipe.
2. Install standard plugs in bells at dead ends, tees, and crosses. Cap spigot and plain ends.
3. Fully secure and block plugs, caps, and bulkheads installed for testing to withstand specified test pressure.
4. Where plugging is required for phasing of the Work or subsequent connection of piping, install watertight, permanent type plugs, caps, or bulkhead acceptable to ENGINEER.

E. Bedding Pipe: Bed pipe as specified and in accordance with details on the Drawings.
1. Trench excavation and backfill, and bedding materials shall conform to Section 31 23 05, Excavation and Fill, as applicable.
2. Where ENGINEER deems existing bedding material unsuitable, remove and replace existing bedding with approved granular material furnished, placed, and compacted in accordance with Section 31 23 05, Excavation and Fill, as applicable. Payment for additional excavation and providing granular material will be made under the unit price payment items in the Contract.
3. Where pipe is installed in rock excavation, provide minimum of three inches of granular bedding material underneath pipe smaller than four-inch nominal diameter, and minimum of six inches of granular bedding material underneath pipes four-inch nominal diameter and larger.
4. Excavate trenches below bottom of pipe by amount shown and indicated in the Contract Documents. Remove loose and unsuitable material from bottom of trench.
5. Carefully and thoroughly compact pipe bedding with hand held pneumatic compactors.
6. Do not lay pipe until ENGINEER approves bedding condition.
7. Do not bring pipe into position until preceding length of pipe has been bedded and secured in its final position.
8. Pipe bedding shall comply with SAWS standard specifications.

F. Laying Pipe:
   1. Conform to manufacturer's instructions and requirements of standards and manuals listed below, as applicable:
      a. Steel Pipe: ANSI/AWWA C206, AWWA M11.
      b. Thermoplastic Pipe: ASTM D2321, ASTM D2774, ANSI/AWWA C605, AWWA M23, AWWA M45, AWWA, M55.
      c. Sanitary and Storm Sewers: ASCE 37.
   2. Install pipe accurately to line and grade shown and indicated in the Contract Documents, unless otherwise approved by ENGINEER. Remove and reinstall pipes that are not installed correctly.
   3. Slope piping uniformly between elevations shown.
   4. Keep groundwater level in trench at least 18 inches below bottom of pipe before laying pipe. Do not lay pipe in water. Maintain dry trench conditions until jointing and backfilling are complete. Keep clean and protect interiors of pipe, fittings, valves, and appurtenances.
   5. Start laying pipe at lowest point and proceed towards higher elevations, unless otherwise approved by ENGINEER.
   6. Place bell and spigot-type pipe so that bells face the direction of laying, unless otherwise approved by ENGINEER.
   7. Excavate around joints in bedding and lay pipe so that pipe barrel bears uniformly on trench bottom.
   8. Deflections at joints shall not exceed 75 percent of amount allowed by pipe manufacturer, unless otherwise approved by ENGINEER.
   9. For thermoplastic piping with solvent welded joints, 2.5-inch diameter and smaller, and copper tubing, snake piping in trench to compensate for thermal expansion and contraction.
   10. Carefully examine pipe, fittings, valves, and specials for cracks, damage, and other defects while suspended above trench before installation. Immediately remove defective materials from the Site and replace with acceptable products.
   11. Inspect interior of all pipe, fittings, valves, and specials and completely remove all dirt, gravel, sand, debris, and other foreign material from pipe interior and joint recesses before pipe and appurtenances are moved into excavation. Bell and spigot-type mating surfaces shall be thoroughly wire brushed, and wiped clean and dry immediately before pipe is laid.
   12. Field cut pipe, where required, with machine specially designed for cutting the type of pipe being installed. Make cuts carefully, without damage to pipe, coating or lining, and with smooth end at right angles to axis of pipe. Cut ends on push-on joint type pipe shall be tapered and sharp edges filed off smooth. Do not flame-cut pipe.
   13. Do not place blocking under pipe, unless specifically approved by ENGINEER for special conditions.
   14. Touch up protective coatings in manner satisfactory to ENGINEER prior to backfilling.
   15. Notify ENGINEER in advance of backfilling operations.
   16. On steep slopes, take measures acceptable to ENGINEER to prevent movement of pipe during installation.

17. Thrust Restraint: Where required, provide thrust restraint conforming to Article 3.3 of this Section.
18. Exercise care to avoid flotation when installing pipe in castin-place concrete, and in locations with high groundwater.

G. Steel Encasement:
1. Provide steel encasement under pavement as stated in the Plans.
2. Steel encasement installation shall be in accordance with ANSI/AWWA C200.
3. Steel encasement shall extend a minimum of 5 feet beyond the edge of pavement.

H. Jointing Pipe:
1. Steel and HDPE Mechanical Joint Pipe:
a. Immediately before making joint, wipe clean the socket, plain end, and adjacent areas. Taper cut ends and file off sharp edges to provide smooth surface.
b. Lubricate plain ends and gasket with soapy water or manufacturer's recommended pipe lubricant, in accordance with ANSI/AWWA C111, just prior to slipping gasket onto plain end of the joint assembly.
c. Place gland on plain end with lip extension toward the plain end, followed by gasket with narrow edge of gasket toward plain end.
d. Insert plain end of pipe into socket and press gasket firmly and evenly into gasket recess. Keep joint straight during assembly.
e. Push gland toward socket and center gland around pipe with gland lip against gasket.
f. Insert bolts and hand-tighten nuts.
g. If deflection is required, make deflection after joint assembly and prior to tightening bolts. Alternately tighten bolts approximately 180 degrees apart to seat gasket evenly. Bolt torque shall be as follows:

Pipe Diameter (inches)	Bolt Diameter (inches)	Range of Torque (ft-lbs)
3	5/8	45 to 60
4 to 24	3/4	75 to 90
30 to 36	1	100 to 120
42 to 48	1.25	120 to 150

h. Bolts and nuts, except those of stainless steel, shall be coated with two coats, minimum dry film thickness of eight mils each, of high build solids epoxy or bituminous coating manufactured by Tnemec, or equal.
i. Restrained mechanical joints shall be in accordance with SAWS standard specifications.
3. Steel Proprietary Joints:
a. Install pipe that utilizes proprietary joints for restraint specified in SAWS standard specifications, or other such joints, in accordance with manufacturer's instructions.
4. Steel Flanged Joints:

a. Assemble flanged joints using ring-type gaskets, thickness as recommended by pipe manufacturer but not less than 1/8-inch thick, for raised face flanges. Use full face gaskets for flat face flanges, unless otherwise approved by ENGINEER or recommended by pipe manufacturer. Gaskets shall be suitable for service intended in accordance with manufacturer's ratings and instructions. Gaskets shall be properly centered.
b. Bolts shall be tightened as recommended by the manufacturer in sequence that ensures equal distribution of bolt loads.
c. Length of bolts shall be uniform. Bolts shall not project beyond the nut more than 1/4-inch when fully tightened. Bolts shall not fall short of the nut when fully taken up. Ends of bolts shall be machine cut and neatly rounded. Do not use washers.
d. Prior to assembly, lubricate bolt threads and gasket faces.
e. After assembly, coat all bolts and nuts, except those of stainless steel, with two coats, minimum dry film thickness of eight mils each, of high-build epoxy or bituminous coating manufactured by Tnemec, or equal.

6. Steel Pipe Joints:
   a. Joints in steel pipe shall be bell and spigot when so specified for steel water pipe in accordance with AWWA C200, or butt welded or lap welded joints, except that mechanical couplings~~,~~ or flanged connections shall be provided at connections to valves, meters, and similar equipment, and where shown or indicated in the Contract Documents. Mechanical couplings are specified in Section 40 05 06, Couplers, Adapters, and Specials for Process Piping.
   b. Welding shall conform to ANSI/AWWA C206. When butt-welding or lap welding joints, weld pipe 36-inch diameter and larger both inside and outside of pipe.
   c. Field welded lap joints shall have fillet welds both inside and outside. Outside weld may be seal weld.
   d. After welding, coat the joint and surrounding damaged or uncoated area with same coating and thickness as shop-applied coating.
   e. Where flanged connections or couplings are provided, flanges, couplings, bolts, and nuts, except when stainless steel, shall be coated with two coats, minimum dry film thickness of eight-mils each, of high-build epoxy or bituminous coating manufactured by Tnemec, or equal.
   f. Welds shall be free from embedded scale and slag and shall have tensile strength across weld not less than thinnest of connected sections.
   g. Welds shall be watertight.
   h. Provide cathodic protection at steel pipe joints as specified in this Section.
7. Heat Shrink Sleeves:
   a. Coating System:
      1) The coating system shall be compliant with AWWA C216, Type I or Type II at a minimum, or as specified herein.
      2) Filler Material: Filler material shall adhere to the pipe and heat shrink sleeve. Size and type shall be as recommended by the sleeve manufacturer for type of pipe and joint.

3) Heat Shrink Sleeve:
   a) Heat shrink, cross-linked poloyolefin wrap or sleeve with a mastic sealant, 85-mil nominal thickness, suitable for pipeline operating temperature, as recommended by the Manufacturer.
   b) Provide standard recovery sleeve for welded and bell and spigot steel pipe fittings. High recovery sleeve for welded and bell and spigot steel pipe fittings.
   c) Width of heat shrink sleeves shall be 17 inches minimum or sufficient to overlap existing coating by a minimum of 4 inches, whichever provides greater overlap.
4) Coating Manufacturers:
   a) Canusa-CPS, Aqua-Shield AQW-HS.
   b) Berry CPG-Covalence, WPC, Water Wrap.

8. PVC Pipe Joints:
   a. Solvent Cement Welded Joints:
      1) Bevel pipe ends and remove all burrs before making joints. Clean pipe and fittings thoroughly. Do not attempt to make solvent cement joints if temperature is below 40 degrees F. Do not make solvent cement welded joints in wet conditions.
      2) Use solvent cement supplied or recommended by pipe manufacturer.
      3) Apply joint primer and solvent cement and assemble joints in accordance with recommendations and instructions of manufacturer of joint materials and pipe manufacturer.
      4) Take appropriate safety precautions when using joint primers and solvent cements. Allow air to circulate freely through pipelines to allow solvent vapors to escape. Slowly admit water when flushing or filling pipelines to prevent compression of gases within pipes.
   b. Bell and Spigot Joints:
      1) Bevel pipe ends, remove all burrs, and provide a reference mark at correct distance from pipe end before making joints.
      2) Clean spigot end and bell thoroughly before making the joint. Insert O-ring gasket while ensuring that gasket is properly oriented. Lubricate spigot with manufacturer's recommended lubricant. Do not lubricate bell and O-ring. Insert spigot end of pipe carefully into bell until reference mark on spigot is flush with bell.
9. Mechanical Coupling Joints:
   a. Mechanical couplings include: sleeve-type flexible couplings, split flexible couplings, ANSI/AWWA C606 grooved or shouldered end couplings, plasticized PVC couplings, and other mechanical couplings specified in Section 40 05 06, Couplers, Adapters, and Specials for Process Piping.
   b. Prior to installing and assembling mechanical couplings, thoroughly clean joint ends with wire brush to remove foreign matter.
   c. For mechanical couplings that incorporate gaskets, after cleaning apply lubricant to rubber gasket or inside of coupling housing and to joint ends. After lubrication, install gasket around joint end of previously installed piece and mate joint end of subsequent piece to installed piece. Position gasket and place coupling housing around gasket and over grooved or

shouldered joint ends. Insert bolts and install nuts tightly by hand. Tighten bolts uniformly to produce an equal pressure on all parts of housing. When housing clamps meet metal to metal, joint is complete and further tightening is not required.

d. For plasticized PVC couplings, loosen the stainless steel clamping bands and remove clamps from coupling. Slide coupling over plain ends of pipes to be joined without using lubricants. Place clamps over each end of coupling at grooved section and tighten with torque wrench to torque recommended by manufacturer.

10. HDPE Pipe Joints:

b. Butt Fusion Welded Joints:

1) Install joints in accordance with manufacturer's instructions using hydraulic butt fusion machine or manual machine equipped with torque wrench. Equipment shall be able to achieve and maintain heating tool temperature range of 400 to 450 degrees F and an interface pressure of 60 to 90 psi.

2) Clean interior and exterior of pipe and fitting ends with clean, dry, lint-free cloth.

3) Align ends to be joined in the fusion machine without forcing ends into alignment. Adjust alignment as necessary and tighten clamps to prevent slippage.

4) Place facing tool between ends to be joined and face them to provide clean, smooth, parallel mating surface. If stops are present, face ends down to the stops. Remove all shavings after facing without touching ends.

5) Re-check alignment of ends and check for slippage against fusion pressure. There shall be no detectable gaps between ends. Align outside diameters.

6) Heating tool shall maintain pipe manufacture's recommended temperature range. Place the tool between ends to be joined. Move ends against heating tool to achieve full contact. Hold ends against heating tool without force until the following melt bead size is formed:

Pipe Diameter (inches)	Required Melt Bead Size (inches)
2 to 4	1/8 to 3/16
4 to 12	3/16 to 1/4
12 to 24	1/4 to 7/16
24 to 54	7/16 to 9/16

7) Upon forming proper melt bead size, quickly separate ends and remove heating tool. Quickly inspect melted ends and bring ends together applying joining force recommended by manufacturer, using 60 to 90 psi interfacial pressure to form double bead rolled over surface of pipe on both ends.

8) Hold joining force against ends until joint is cool to the touch. Cooling period shall be 30 to 90 seconds per inch of pipe diameter. Heavier wall thicknesses may require longer cooling times as

recommended by pipe manufacturer.

9) Upon completing joint, inspect to verify double bead has been formed on both sides, uniformly rounded and consistent in size all around joint. Remove faulty joints and re-joint.

I. Backfilling:
   1. Conform to applicable requirements of Section 31 23 05, Excavation and Fill.
   2. Place backfill as Work progresses. Backfill by hand and use power tampers until pipe is covered by at least one foot of backfill.

J. Connections to Valves and Hydrants:
   1. Install valves and hydrants as shown and indicated in the Contract Documents.
   2. Provide suitable adapters when valves or hydrants and piping have different joint types.
   3. Provide thrust restraint at all hydrants and at valves located at pipeline terminations.

K. Transitions from One Type of Pipe to Another:
   1. Provide necessary adapters, specials, and connection pieces required when connecting different types and sizes of pipe or connecting pipe made by different manufacturers.

L. Closures:
   1. Provide closure pieces shown or required to complete the Work.

3.2 TRACER TAPE INSTALLATION

A. Polyethylene Underground Warning Tape for Metallic Pipelines:
   1. Provide polyethylene tracer tape for buried metallic piping, which includes pipe that is steel, ductile iron, cast iron, concrete, copper, and corrugated metal.
   2. Provide tracer tape 12 to 18 inches below finished grade, above and parallel to buried pipe.
   3. For pipelines buried eight feet or greater below finished grade, provide second line of magnetic tracer tape 2.5 feet above crown of buried pipe, aligned along pipe centerline.
   4. Tape shall be spread flat with message side up before backfilling.

B. Detectable Underground Warning Tape for Non-Metallic Pipelines:
   1. Provide polyethylene tracer tape with aluminum backing for buried, non-metallic piping, which includes pipe that is PVC, CPVC, polyethylene, HDPE, FRP, ABS, and vitrified clay.
   2. Provide magnetic tracer tape 12 to 18 inches below finished grade, above and parallel to buried pipe.
   3. For pipelines buried eight feet or greater below finished grade, provide second line of magnetic tracer tape 2.5 feet above crown of buried pipe, aligned along the pipe centerline.
   4. Tape shall be spread flat with message side up before backfilling.

3.3 THRUST RESTRAINT

A. Provide thrust restraint on pressure piping systems where shown or indicated in the Contract Documents.

B. Thrust restraint may be accomplished by using restrained pipe joints, concrete thrust blocks, or harnessing buried pipe. Thrust restraints shall be designed for axial thrust exerted by test pressure specified in the Buried Piping Schedule at the end of this Section.

C. Place concrete thrust blocks against undisturbed soil. Where undisturbed soil does not exist, or for projects where the Site consists of backfill material, thrust restraint shall be provided by restrained pipe joints.

D. Restrained Pipe Joints:
   1. Pipe joints shall be restrained by means suitable for the type of pipe being installed.
      a. Mechanical Joints: Restrain with proprietary restrained joint system as specified in Section 40 05 19, Ductile Iron Process Pipe; lugs and tie rods; or other joint restraint systems approved by ENGINEER.
      b. Steel Pipe Joints: Provide buttwelded joints, lap welded joints, flanged joints, or mechanical coupling connections as shown and specified in Buried Piping Schedule in this Section. Provide tie rods connected to lugs welded to the steel pipe for restraint at mechanical couplings.
      c. Thermoplastic and HDPE Joints: Where bell and spigot type or other non-restrained joints are utilized, provide tie rods across joint or other suitable joint restraint system, subject to the approval of ENGINEER.

E. Concrete Thrust Blocks:
   1. Provide concrete thrust blocks on pressure piping at changes in alignment of 15 degrees or more, at tees, plugs and caps, and where shown or indicated in the Contract Documents. Construct thrust blocks of Class B concrete, conforming to 03 30 00, Cast-In-Place Concrete.
   2. Install thrust blocks against undisturbed soil. Place concrete so that pipe and fitting joints are accessible for repair.
   3. Concrete thrust block size shall be as shown on the Drawings or as approved by ENGINEER.

F. Harnessed lengths of buried pipe shall be as shown on the Drawings.

3.4 WORK AFFECTING EXISTING PIPING

A. Location of Existing Underground Facilities:
   1. Locations of existing Underground Facilities shown on the Drawings should be considered approximate.
   2. Determine the true location of existing Underground Facilities to which connections are to be made, crossed, and that could be disturbed, and determine

location of Underground Facilities that could be disturbed during excavation and backfilling operations, or that may be affected by the Work.

B. Taking Existing Pipelines and Underground Facilities Out of Service:
   1. Conform to Section 01 14 19, Use of Site.
   2. Do not take pipelines or Underground Facilities out of service unless specifically listed in Section 01 14 19, Use of Site, or approved by ENGINEER.
   3. Notify ENGINEER in writing prior to taking pipeline or Underground Facilities out of service. Shutdown notification shall be provided in advance of the shutdown in accordance with the General Conditions and Section 01 14 19, Use of Site.

C. Work on Existing Pipelines or Underground Facilities:
   1. Cut or tap piping or Underground Facilities as shown or required with machines specifically designed for cutting or tapping pipelines or Underground Facilities, as applicable.
   2. Install temporary plugs to prevent entry of mud, dirt, water, and debris into pipe.
   3. Provide necessary adapters, sleeves, fittings, pipe, and appurtenances required to complete the Work.
   4. Conform to applicable requirements of Section 01 14 19, Use of Site, Section and 01 73 29, Cutting and Patching.

3.5 FIELD QUALITY CONTROL

A. General:
   1. Test all piping, except as exempted in the Buried Piping Schedule in this Section.
   2. When authorities having jurisdiction are to witness tests, notify ENGINEER and authorities having jurisdiction in writing at least 48 hours in advance of testing.
   3. Conduct all tests in presence of ENGINEER.
   4. Remove or protect pipeline-mounted devices that could be damaged by testing.
   5. Provide all apparatus and services required for testing, including:
      a. Test pumps, compressors, hoses, calibrated gages, meters, test containers, valves, fittings, and temporary pumping systems required to maintain OWNER's operations.
      b. Temporary bulkheads, bracing, blocking, and thrust restraints.
   6. Provide air if an air test is required, power if pumping is required, and gases if gases are required.
   7. Unless otherwise specified, OWNER will provide fluid required for hydrostatic testing. CONTRACTOR shall provide means to convey fluid for hydrostatic testing into piping being tested. CONTRACTOR shall provide fluid for other types of testing required.
   8. Repair observed leaks and repair pipe that fails to meet acceptance criteria. Retest after repair.

9. Unless otherwise specified, testing shall include existing piping systems that connect with new piping system. Test existing pipe to nearest valve. Piping not installed by CONTRACTOR and that fails the test shall be repaired upon authorization of OWNER. Unless otherwise included in the Work, repair of existing piping or Underground Facilities will be paid as extra Work.
10. When testing existing chlorine gas and sulfur dioxide gas systems to nearest isolation valve, provide a tee in the line adjacent to valve. Branch outlet on tee shall be provided with valve and used for cleaning, testing, draining, and drying the pipe. Unless otherwise indicated, existing chlorine or sulfur dioxide system shall not be shut down during testing or for installing tee and valve. Prior to placing pipeline in service, valve on branch outlet of tee shall be plugged or sealed with blind flange or threaded plug. Repair damage to system resulting from this Work at no extra cost to OWNER.

B. Test Schedule:
   1. Refer to the Buried Piping Schedule in this Section for type of test required and required test pressure in accordance with TCEQ and AWWA requirements for hydrostatic testing.
   2. Unless otherwise specified, required test pressures are at lowest elevation of pipeline segment being tested.
   3. For piping not listed in Buried Piping Schedule in this Section:
      a. Hydrostatically test pipe that will convey liquid at a pressure greater than five psig. Provide process air pipe test for pipe that will convey air or gas under pressure or vacuum, except chlorine gas, which requires separate test.
      b. Use exfiltration testing, low-pressure air testing, or vacuum testing for other piping.
      c. Disinfect for bacteriological testing piping that conveys potable water.
   4. Test Pressure:
      a. Use test pressures listed in Buried Piping Schedule in this Section.
      b. If test pressure is not listed in Buried Piping Schedule, or if test is required for piping not listed in the Buried Piping Schedule, test pressure will be determined by ENGINEER based on maximum anticipated sustained operating pressure and methods described in applicable ANSI/AWWA manual or standard that applies to the piping system.

C. Hydrostatic Testing:
   1. Preparation for Testing:
      a. For thermoplastic pipe and HDPE pipe, follow procedures described in Section 7 of ANSI/AWWA Standard C605.
      b. For HDPE pipe, follow procedures described in ASTM F2164. Test duration, including time to pressurize, time for initial expansion, time at test pressure, and time to depressurize, shall not exceed eight hours. If re-testing of a test section or pipeline is required, at least eight hours shall elapse between tests.
      c. For steel pipe, follow procedures described in ANSI/AWWA Manual M11 and AWWA C604.

d. For other piping follow procedures described in ANSI/AWWA Manual M9, except that minimum wetting period required immediately prior to testing for asbestos cement pipe shall be 24 hours rather than the 48 hours prescribed for concrete pipe. Wetting period is not required for pipe that is not cement mortar-lined.
e. Prior to testing, ensure that adequate thrust protection is in place and joints are properly installed.
f. Piping for Hydraulic Fluid, Lube Oil, and Diesel Fuel: Hydrostatically test system using the fluid with which system will function permanently. Allowable leakage is zero. For fluid power systems, pipe manufacturer shall supervise installation and testing of system components, including field piping.

2. Test Procedure:
   a. Fill pipeline slowly to minimize air entrapment and surge pressures. Fill rate shall not exceed one foot of pipe length per second in pipe being tested.
   b. Expel air from pipe as required. Obtain approval of ENGINEER prior to tapping pipe for expelling air.
   c. Examine exposed joints and valves, and make repairs to eliminate visible leakage.
   d. After specified wetting period, add fluid as required to pressurize line to required test pressure. Maintain test pressure for a stabilization period of ten minutes before beginning test.
   e. HDPE Pipe: After filling pipeline, gradually pressurize pipe to test pressure and maintain required test pressure for three hours for pipe to expand. During expansion, add fluid to maintain required test pressure. Begin timed test period after expansion period and other requirements are met.
   f. Timed test period shall not begin until after pipe has been filled, exposed to required wetting period, air has been expelled, and pressure stabilized.
   g. Timed Test Period: After stabilization period, maintain test pressure for at least two hours. During timed testing period, add fluid as required to maintain pressure within five psig of required test pressure. For HDPE pipe, after three hour expansion phase, reduce test pressure by ten psig and do not add liquid. Test pressure shall then remain steady for one hour, indicating no leakage.
   h. Pump from test container to maintain test pressure. Measure volume of fluid pumped from test container and record on test report. Record pressure at test pump at 15 minute intervals for duration of test.

3. Allowable Leakage Rates: Leakage is defined as the quantity of fluid supplied to pipe segment being tested to maintain pressure within five psi of test pressure during timed test period. Allowable leakage rates for piping are:
   a. No Leakage: Pipe with flanged, welded, fused, threaded, soldered, or brazed joints.
   b. Rates based on formula or table in ANSI/AWWA Manual M41:
      1) Metal and fiberglass pipe joined with rubber gaskets as sealing members, including the following joint types:
         a) Bell and spigot and push-on joints.

b) Mechanical joints.
c) Bolted sleeve type couplings.
d) Grooved and shouldered couplings.

c. Rates based on make-up allowance in ANSI/AWWA Manual M9:
1) Prestressed concrete cylinder pipe and other types of concrete pipe joined with O-ring rubber gasket sealing members.

d. Rates based on formula or table in ANSI/AWWA C605:
1) Plastic pipe joined with O-ring gasket sealing members.

e. Rates based on formula or table in ANSI/AWWA C603:
1) Asbestos-cement pipe.

D. Exfiltration Testing:
1. Plug and bulkhead ends and lateral connections of pipe segment to be tested and admit fluid until the pipe is full. Admit fluid slowly to minimize air entrapment. Groundwater level shall be below the pipe during exfiltration test.
2. Before measuring leakage, allow fluid to wet pipe interior for the following period:
a. Concrete Pipe: 48 hours.
b. Cement Mortar-lined Pipe: 24 hours.
c. Asbestos-cement Pipe: 24 hours.
d. Other Pipe: Wetting period not required.
3. Maintain hydrostatic head during test to equal an elevation two feet above present and future maximum groundwater elevation at pipe segment tested. ENGINEER will determine test water surface elevation for each pipe segment.
4. Provide minimum hydrostatic head during test of two feet above crown of upstream end of pipe segment tested.
5. Add fluid from test container or from metered supply as required to maintain test water level within three inches of test head throughout the test.
6. Test duration shall be at least two hours.
7. Allowable Leakage Rates:
a. Leakage is defined as the quantity of fluid that must be supplied to pipe segment tested to maintain hydrostatic head within three inches of test head during the test after pipe has been filled and exposed to required wetting period, plus quantity required to refill to original head at end of test.
b. Leakage shall not exceed that allowed by authority having jurisdiction.

D. Vacuum Testing:
1. Plug and bulkhead ends and lateral connections of pipe segment or manhole to be tested.
2. Following set-up of test apparatus, draw vacuum of ten inches of mercury on pipe segment or manhole being tested.
3. Start test upon reaching specified test vacuum. Test duration shall be 15 minutes.
4. Record vacuum drop at end of test. If vacuum drop is greater than one inch of mercury, pipe segment or manhole fails the test and shall be repaired and retested. If vacuum drop is less than one inch of mercury, pipe segment or manhole passes the test.

E. Vertical Deflection Test for Thermoplastic and HDPE Pipe:
   1. Conduct vertical deflection test at least thirty days after backfill has been placed.
   2. Manually pull pin-type vertical gauge mounted on sled through pipe. Gauge shall be manufactured by Quality Test Products, or equal. Set gauge so that sled will stop if vertical deflection of pipe exceeds five percent. Excavate and re-install piping that fails deflection test, and retest.
   3. Use rigid ball or mandrel for deflection test, which shall have diameter of at least 95 percent of base inside diameter or average inside diameter of piping, depending on which is specified in applicable ASTM standard, including appendix, to which pipe is manufactured. Perform test without mechanical pulling devices. Re-install and retest pipe segments that exceed deflection of five percent.

F. Process Air Pipe Testing:
   1. General:
      a. Test pipe before backfilling pipe trench.
      b. Maintain groundwater level below bottom of trench until test is successfully completed.
      c. Required test pressure is listed in Buried Piping Schedule.
   2. Preparation for Testing:
      a. Provide temporary tie rods at expansion joints as required.
      b. Verify that pipe supports, where present, are secure.
      c. Test one pipe segment at a time. Use temporary blind flanges and isolators as required.
      d. Install corporation cocks for filling and relieving air. Provide temporary automatic pressure relief valve and pressure gauge with range suitable for test pressure.
   3. Test Procedure:
      a. Pressurize pipe segment being tested with air to required test pressure. Maintain pressure for at least two hours.
      b. Apply soapy water solution to all joints to check for leakage, indicated by presence of bubbles, while test pressure is maintained.
      c. Allowable Leakage: Zero
   4. Repair and retest pipelines that fail test.
   5. After testing is complete remove temporary measures provided for testing and provide Type 304 stainless steel threaded plugs at taps used for testing.
   6. Pressure Testing:
      a. Fill pipe with water and hydrostatically test in accordance with Paragraph 3.5.C of this Section.
      b. Hydrostatic test pressure shall be in accordance with the Buried Piping Schedule in this Section. When hydrostatic test pressure is not specified in Buried Piping Schedule, for pressure piping use test pressure of 1.5 times maximum operating pressure to which system may be subjected. If not otherwise specified in the Buried Piping Schedule, hydrostatically test vacuum piping to at least 25 psig.

c. After hydrostatic testing, replace all moisture absorbing gaskets and valve packing.
d. Steel Pipe: If drying after hydrostatic testing is impractical or cannot be accomplished, test steel piping by either pneumatic testing or alternate testing (weld examination) in accordance with Chlorine Institute Pamphlet No. 6. When performing pneumatic test, implement precautions to safeguard personnel and minimize risk.

7. Drying:
   a. Dry out chlorine piping systems prior to placing in service. Drying is required for all piping regardless of whether water has been purposely introduced to system.
   b. Steel Pipe: Accomplish drying by passing steam through piping from high end of system until piping is heated to approximately 200 degrees F unless lower temperature is required to protect system from damage. While steaming, allow condensate and foreign matter to drain from pipe. Disconnect steam supply and drain pockets and low spots in pipe. While pipe is still warm, blow dry, oil-free air with dew point of -40 degrees F or below, or nitrogen, through pipe until exiting air dew point is equal to supply air dew point. Valves shall be at half-open position during drying. Valves removed temporarily from system during drying must be free of moisture before being re-installed.
   c. Plastic Pipe: Dry gas piping only. Drain and remove all water and moisture from system. After draining, "pig" the pipe to remove excess water. Dry system with air or nitrogen in accordance with requirements for steel pipe, except that steam shall not be used on plastic pipe.
8. Air or Nitrogen Leak Testing:
   a. Do not leak-test plastic piping with nitrogen or air.
   b. Use nitrogen gas or oil-free dry air to test steel piping. Gradually introduce nitrogen or dry air and pressurize to 50 psig. Maintaining this pressure while testing all joints along pipe for leaks with soapy water solution. When system is free from leaks at this pressure, increase test pressure in increments of approximately 50 psig up to the lower of either 150 psig or 110 percent of maximum system operating pressure. After each increase in pressure, check for leaks using soapy water solution and implement corrective action as necessary.
   c. When system has no leaks at final test pressure, depressurize the system, disconnect the test source, and cap the system to prevent entrance of water.
   d. Nitrogen Gas: Use cylinders of dry, high-purity nitrogen gas, nitrogen handling cylinder mounted pressure regulator with zero to 300 psig range, and necessary fittings and adapters to connect source to pipe being tested. Pressure regulator shall be self-relieving type, venting to atmosphere, and include throttling valve.
   e. Dry Air: Provide oil-free air with relative humidity of zero. Fittings, adapters, and accessories, pressure regulator, and throttling valve shall be suitable for pressure testing with air and rated for 300 psig.
9. Service Gas (Chlorine Gas) Leak Testing:

a. After pressure testing and immediately after chlorine system has been dried, gradually introduce service gas to pipe; service gas is gas that will be conveyed through pipe when pipe is in use. After gas has completely filled pipe, increase service gas pressure to five psig and check all joints for leaks.
b. Implement precautions to safeguard personnel and minimize risk when performing service gas leak test.
c. Use liquid ammonia solution or chlorine gas detector to check for chlorine leaks. When using liquid ammonia solution, spray solution at pipe joints and connections. Do not squirt liquid on pipe or fittings. Chorine gas and ammonia solution will react to produce a dense, white cloud. Leaks in piping and equipment, if detected, shall not be repaired until all gas has been purged from system being tested. Upon completion of repairs, repeat cleaning, drying, nitrogen or air leak testing, and service gas leak testing.
d. Do not perform service gas leak testing on liquid chlorine piping.

I. Examination of Welds:
1. CONTRACTOR shall hire personnel qualified for examination of welds. Personnel performing examination of welds shall be qualified to at least Level II in accordance with ASNT SNT-TC-1A.
2. Conform to ASME Boiler and Pressure Vessel Code Section V and applicable articles for examination of welds.
3. Visually examine all welds, Category D Fluid Service, in conformance with ASME B31.3.
4. Examine at least ten percent of welds using liquid penetrant examination.
5. If defect is detected, all welds shall be examined by liquid penetrant examination.
6. At conclusion of liquid penetrant examination, remove penetrant test materials by flushing, washing, or wiping clean with applicable solvents.

J. Bacteriological Testing:
1. Bacteriological testing for potable water lines, finished water lines, and other piping in accordance with the Buried Piping Schedule, is specified in Article 3.6 of this Section.

3.6 CLEANING AND DISINFECTION

A. Cleaning, General: Clean pipe systems as follows:
1. Thoroughly clean all piping, including flushing with water, dry air, or inert gas as required, in manner approved by ENGINEER, prior to placing in service. Flush chlorine solution and sodium hypochlorite piping with water.
2. Piping 24-inch diameter and larger shall be inspected from inside and debris, dirt and foreign matter removed.
3. For piping that requires disinfection and has not been kept clean during storage or installation, swab each section individually before installation with five percent sodium hypochlorite solution.

B. Cleaning of Gas and Air Piping:
   1. Unless otherwise specified, non-chlorine gas and air system piping six-inch diameter and smaller shall be blown out, using air or testing medium specified. Piping larger than six-inch diameter shall be cleaned by having a swab or "pig" drawn through each pipe reach.
   2. After connecting to equipment, blow out pipe using the equipment.
   3. Upon completion of cleaning, piping shall be drained and dried with blown air. Propane systems shall be purged with nitrogen and nitrogen pad maintained at ten psi until pipe is placed in service. Purge digester gas systems with nitrogen and maintain nitrogen pad at three psi until line is placed in service.

C. Cleaning of Hydraulic and Fluid Power Oil Systems: Upon completion of field piping, but before connection to control components, hydraulic and fluid power oil systems shall be flushed and cleaned by circulating special flushing oil through system. Flushing oil and procedures shall comply with ASTM D4174. Clean system such that internal contamination of system, when tested using procedures specified in SAE J1227, Section 2.3, shall not exceed the Allowable Cleanliness Level (ACL). Unless otherwise specified, ACL value shall be established by manufacturer of major hydraulic system components in accordance with SAE J1227, Section 9.1.

D. Disinfection:
   1. Disinfect all potable and finished water piping.
   2. Suggested procedure for accomplishing complete and satisfactory disinfection is specified below. Other procedures may be considered for acceptance by ENGINEER.
      a. Prior to disinfection, clean piping as specified and flush thoroughly.
      b. Conform to procedures described in ANSI/AWWA C651. Use continuous feed method of disinfecting, unless alternative method is acceptable to ENGINEER.
   3. Water for initial flushing, testing, and disinfection will be furnished by OWNER. CONTRACTOR shall provide all temporary piping, hose, valves, appurtenances, and services required. Cost of water required for redisinfection will be paid by CONTRACTOR to OWNER at water utility's standard rates.
   4. Chlorine shall be provided by CONTRACTOR.
   5. Bacteriologic tests will be performed by OWNER. Certified test laboratory report will be provided to CONTRACTOR, if requested.
   6. Chlorine concentration in water entering the piping shall be between 50 and 100 ppm, such that minimum residual concentration of 25 mg/L remains after 24hour retention period. Disinfect piping and all related components. Repeat as necessary to provide complete disinfection.
   7. After required retention period, flush chlorinated water to closed drain line, unless otherwise acceptable to ENGINEER. Properly dispose of chlorinated water in accordance with Laws and Regulations. Do not discharge chlorinated water to storm sewers, ditches, or overland.

3.7 CATHODIC PROTECTION

A. General:

1. Cathodic protection for buried steel pipelines and associated test lead stations shall be provided under SAWS Job No. 18-8603. Coordinate with Contractor for access.
2. Provide insulated joint where indicated on the Contract Drawings.
3. Provide electrical bond across all other gasketed steel pipe joints.

B. Details of Cathodic Protection:
1. Insulated Joints: Where shown or indicated in the Contract Documents, provide insulated flange type joints. After joint is made, provide exterior coating around joint as specified for piping being joined.
2. Electrical Bond Across Rubber Gasket Joints: Provide two electrical bonding cables across each rubber-gasketed bell and spigot joint. Before exterior coating is applied to bell and spigot joints, two small areas of metal shall be exposed on each side of joint, one on spigot ring and one on bell. Thoroughly clean each area and bond two cathodic protection cables to pipe, one on each side of joint. Bond each cable by thermite process. Coat completed connections and exposed metal as specified for exterior coating of pipe being joined.
3. Electrical Bond Across Mechanical Couplings: Provide two electrical bonding cables across each mechanical coupling. Before the exterior coating is applied to mechanical couplings, expose two small areas of metal on pipe surface on each side of coupling, on middle ring and on each follower ring of coupling. Thoroughly clean each area and bond two cathodic protection cables to pipe, one on each side of joint and to middle ring and follower rings of mechanical coupling. Bond each cable by thermite process. Coat completed connections and exposed metal as specified for exterior coating of pipe being joined.
4. Electrical Bond Across Valves and Flanges: Provide two electrical bonding cables across valves and flanged connections other than insulated flange type joints. Provide electrical bond as specified for bond across rubber gasket joints.

3.8 SCHEDULES

A. Schedules listed below, following the “End of Section” designation, are part of this Specification section.
1. Table 33 05 05-A, Buried Piping Schedule.

+ + END OF SECTION + +

TABLE 33 05 05-A, BURIED PIPING SCHEDULE

Service	Diameter (inch)	Material	Interior Lining	Exterior Coating (1)	Pressure Class/ Thickness	Joint	Test
RW	24”	CS	CL	P**, PUR**	See Note 2	LW, BW, FLG	HYD(150), DBT, EW
RW	36”	CS	CL	P**, PUR**	See Note 2	LW, BW, FLG	HYD(150), DBT, EW
FLU	**18”**	HDPE	-	P**, PUR**	**DR 11**	BFW/RMJ	HYD(150)
FLU	**24”**	HDPE	-	P**, PUR**	**DR 11**	BFW/RMJ	HYD(150)

Notes:
1. Prime and paint exposed piping in accordance with Section 09 91 00, Painting.
2. See Specification Section 40 05 24.23.

The following abbreviations are used in the Buried Piping Schedule.

A. Service Abbreviations

Service	Abbrev		Service	Abbrev.
Raw Water	RW		Well Flush Water Line	FLU

B. Material Abbreviations

Material	Abbrev		Material	Abbrev.
Ductile Iron	DI		Polyvinyl Chloride	PVC
Carbon Steel	CS		High Density Polyethylene	HDPE

C. Lining/Coating Abbreviations

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Lining	Abbrev		Coating	Abbrev.
Cement Mortar Lined	CL		Asphaltic Coated	AC
Galvanized	Galv		Polyethylene Wrapped	PEW
Plastic Lined	PL		Insulated	I
Polyurethane	**PUR**		Painted	P

D. Joint Abbreviations

Joint Type	Abbrev		Joint Type	Abbrev.
Bell and Spigot	BS		Butt Weld	BW
Restrained Bell and Spigot	RBS		Lap Weld	LW
Solvent Weld	SW		Butt Fusion Weld	BFW
Mechanical Joint	MJ		Sleeve-type Flexible Coupling	SLFC
Restrained Mech. Joint	RMJ		Split Flexible Coupling	SPFC
Threaded	Thd		Flanged	Flg

E. Test Abbreviations

Test	Abbrev		Test	Abbrev.
Hydrostatic Test (test pressure in psig)	HYD ( )		Process Air Pipe Test (test pressure in psig)	PA ( )
Exfiltration	EX		Televising Inspection	TV
Low-pressure Air Sewer Test	AIR		Disinfection and Bacteriological Testing	DBT
Vacuum Test	VAC		Examination of Welds	EW
Vertical Deflection	VD		No Test Required	NR

SECTION 40 05 33

HIGH DENSITY POLYETHYLENE YARD PIPE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish, test, and place in satisfactory service the High Density Polyethylene (HDPE) yard pipe and fittings as shown.
   2. The extent of HDPE pipe and fittings to be furnished is shown.

B. Coordination:
   1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with, or before, the HDPE yard pipe Work.

C. Related Sections:
   1. Section 31 23 05, Excavation and Fill.
   2. Section 03 30 00, Cast-In-Place Concrete.

1.2 REFERENCES

A. Standards referenced in this Section are listed below:
   1. American Society for Testing and Materials, Inc., (ASTM).
      a. ASTM D 638, Test Method for Tensile Properties of Plastics.
      b. ASTM D 696, Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics between - 30°C and 30°C with a Vitreous Silica Dilatometer.
      c. ASTM D 746, Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
      d. ASTM D 790, Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
      e. ASTM D 1238, Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer.
      f. ASTM D 1248, Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.
      g. ASTM D 1505, Test Method for Density of Plastics by the Density-Gradient Technique.
      h. ASTM D 1525, Test Method for Vicat Softening Temperature of Plastics.

i. ASTM D 1598, Test Method for Time-to-Failure of Plastic Pipe under Constant Internal Pressure.
j. ASTM D 1599, Test Method for Resistance to Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings.
k. ASTM D 1603, Test Method for Carbon Black in Olefin Plastics.
l. ASTM D 1693, Test Method for Environmental Stress-Cracking of Ethylene Plastics.
m. ASTM D 2122, Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings.
n. ASTM D 2240, Test Method for Rubber Property-Durometer Hardness.
o. ASTM D 2290, Test Method for Apparent Hoop Tensile Strength of Plasticor Reinforced Plastic Pipe by Split Disk Method.
q. ASTM D 2412, Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
r. ASTM D 2657, Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.
s. ASTM D 2774, Practice for Underground Installation of Thermoplastic Pressure Piping.
t. ASTM D 2837, Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products.
u. ASTM D 3035, Specification for Polyethylene (PE) Plastic Pipe (DR-PR), Based on Controlled Outside Diameter.
v. ASTM D 3261, Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
w. ASTM D 3350, Specification for Polyethylene Plastics Pipe and Fittings Materials.
x. ASTM F 412, Terminology Relating to Plastic Piping Systems.
y. ASTM F 714, Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
z. ASTM F 1248, Test Method for Determination of Environmental Stress Crack Resistance (ESCR) of Polyethylene Pipe.

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aa. ASTM F2620, Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings
bb. ASTM F3124, Standard Practice for Data Recording the Procedure used to Produce Heat Butt Fusion Joints in Plastic Piping Systems or Fittings
cc. ASTM F3183, Standard Practice for Guided Side Bend Evaluation of Polyethylene Pipe Butt Fusion Joint

2. American Water Works Association, (AWWA).
   a. AWWA C901, Polyethylene (PE) Pressure Pipe and Tubing, 1/2-inch through 3-inch, for Water Service.
   b. AWWA C906, Polyethylene (PE) Pressure Pipe and Fittings, 4-inch through 63-inch, for Water Distribution.
3. National Science Foundation, (NSF).
   a. NSF 14, Plastics Piping Components and Related Materials.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications:
   1. Manufacturer shall have a minimum of five years' experience producing substantial similar type materials and shall be able to show evidence of at least five installations in satisfactory operation for at least five years.
   2. ~~HDPE yard pipe and fittings shall be the product of a single manufacturer.~~ 3
   3. The HDPE yard pipe and fittings manufacturer shall have an established Quality Assurance Program responsible for inspecting incoming and outgoing materials.
   4. The HDPE yard pipe and fittings manufacturer shall have an established Quality Assurance program responsible for assuring the long-term performance of materials and products.
   5. The HDPE yard pipe and fitting manufacturer shall maintain permanent Quality Assurance/Quality Control (QA/QC) records.

B. Installer's Qualifications:
   1. Engage a single installer regularly engaged in HDPE yard piping installation and with experience in the installation of the types of materials required; and who agrees to employ only tradesmen with specific skill and experience in this type of Work. Submit name and qualifications to ENGINEER.
   2. Engage a single installer for the entire HDPE yard piping system with undivided responsibility for performance and other requirements.

C. Component Supply and Compatibility:
   1. The HDPE yard pipe and fittings manufacturer shall review and approve or prepare all Shop Drawings and other submittals for all components furnished under this Section.
   2. All components shall be specifically constructed for the specified service conditions and shall be integrated into the overall assembly by the HDPE yard pipe and fittings manufacturer.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Details of piping system including location of restraints, fittings, anchors, termination assemblies and all accessories necessary for piping system.
      b. Pipe laying schedules.
   2. Product Data:
      a. Details of construction, fabrication, and pipe materials.
      b. Detailed procedures to be used in joining and installing piping system, including manufacturer's recommendations.
   3. Testing Plans, Procedures, and Testing Limitations:

a. Pipe testing procedures.

B. Informational Submittals:
1. Certificates:
a. Materials Certificates of Conformance: Submit certificates of conformance with Referenced Standards as required in Article 2.4, below.
b. Upon shipment, CONTRACTOR shall furnish the HDPE pipe manufacturer's Quality Assurance/Quality Control (QA/QC) certifications to verify that the materials supplied for the Project are in accordance with the requirements of this Section and a manufacturer's warranty covering materials and workmanship of the HDPE piping.
2. Suppliers Instructions:
a. Detailed procedures to be used in joining and installing piping system, including manufacturer's recommendations.
3. Qualifications Statements:
a. Installer's qualifications.

1.5 DELIVERY, STORAGE AND HANDLING

A. Delivery:
1. Deliver materials to the Site to ensure uninterrupted progress of the Work.
2. Upon delivery inspect pipe and appurtenances for cracking, gouging, chipping, denting, and other damage and immediately remove from Site and replace with acceptable material.

B. Storage:
1. Store materials to allow convenient access for inspection and identification. Store material off ground using pallets, platforms, or other supports. Protect packaged materials from corrosion and deterioration.
2. Store materials in accordance with manufacturer's recommendation.

C. Handling:
1. Handle pipe, fittings, specials, and accessories carefully in accordance with pipe manufacturer's recommendations. Do not drop or roll material off trucks. Do not drop, roll, or skid piping.
2. Avoid unnecessary handling of pipe.
3. Keep pipe interiors free from dirt and foreign matter.
4. Protect interior linings and exterior coatings of pipe and fittings from damage. Replace pipe and fittings with damaged lining regardless of cause of damage.

PART 2 - PRODUCTS

2.1 SYSTEM PERFOMANCE

A. HDPE piping system shall be specifically designed, constructed, and installed for the service intended and shall comply with the following service conditions.

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B. Design Criteria:

Location:	Yard[1]
Nominal Pipe Size:	18" – 24"
Standard Dimension Ratio:	11

Notes:
1. Provide sizing and location in accordance with Contract Drawings.

2.2 PHYSICAL PROPERTIES

A. Materials used for the manufacture of polyethylene pipe and fittings shall meet the following physical property requirements:

	Property	Unit	Test Procedure	Value
1.	Material Designation	-	PPI/ASTM	-
2.	PPI Material Listing	-	PPI TR-4	PE 3408
3.	Material Classification	-	ASTM D 1248	III C 5 P34
4.	Cell Classification	-	ASTM D 3350	345434C or 355434C
5.	Density	g/cm3	ASTM D 1505	>0.941
6.	Melt Index (E)	g/10 min	ASTM D 1238	<0.15
7.	Flexural Modulus	psi	ASTM D 790	>110,000
8.	Tensile Strength	psi	ASTM D 638	<160,000
9.	ESCR (C)	hours	ASTM D 1693	3,000 to 3,500
10.	HDB	psi	ASTM D 2837	1,600 @ 23°C
11.	UV Stabilizer (C)	percent carbon black	ASTM D 1603	2 to 3
12.	Elastic Modulus	psi	ASTM D 638	110,000
13.	Brittleness Temperature	F	ASTM D 746	<-180
14.	Vicat Softening Temp	F	ASTM D 1525	255
15.	Thermal Expansion	in/in/ F	ASTM D 696	8 x 10E-5
16.	Hardness	Shore D	ASTM D 2240	64
17.	Molecular Weight Category	-	-	Extra-High

B. There shall be no evidence of splitting, cracking, or breaking when the pipe is tested in accordance with Article 2.4, below.

C. Ring Stiffness Constant (RSC) values for the pipe can be directly related to the pipe's class designation. (Nominal RSC of Class 40 pipe = 40, etc.). The minimum RSC is 90 percent of the nominal.

D. The HDPE pipe and fittings shall be homogeneous throughout and free from visible cracks, holes, foreign inclusions, or other injurious defects. The pipe shall be as uniform as commercially practical in color, opacity, density, and other physical properties.

E. Clean rework or recycled material generated by the manufacturer's own production may be used as long as the pipe or fittings produced meet all the requirements of this Section.

2.3 PIPE AND FITTINGS

A. Dimensions:
   1. Pipe Dimensions: The nominal inside diameter of the pipe shall be true to the specified pipe size in accordance with AWWA C901 and AWWA C906. Standard laying lengths shall be 50 feet ± 2-inches.
   2. Fitting Dimensions: Fittings such as couplings, wyes, tees, adapters, etc. for use in laying pipe shall have standard dimensions that conform to ASTM D 3261.

B. Pipe and fittings shall be produced from identical materials, meeting the requirements of this Section, by the same manufacturer. Special or custom fittings may be exempted from this requirement.

C. Molded fittings shall meet the requirements of ASTM D 3261 and this Section. At the point of fusion, the outside diameter and minimum wall thickness of fitting butt fusion outlets shall meet the diameter and wall thickness specifications of the mating system pipe. Fitting markings shall include a production code from which the location and date of manufacture can be determined. The manufacturer shall provide an explanation of the production codes used.

D. Marking:
   1. Each standard and random length of pipe and fitting in compliance with this standard shall be clearly marked with the following information.
      a. ASTM or AWWA Standard Designation.
      b. Pipe Size.
      c. Class and Profile Number.
      d. Production Code.
      e. Standard Dimension Ratio (SDR).

2.4 SOURCE QUALITY CONTROL

A. At a minimum, incoming polyethylene materials shall be inspected for density in accordance with ASTM D 1505 and melt flow rate in accordance with ASTM D 1238. All incoming polyethylene materials shall be certified by the supplier. Certification shall be verified by CONTRACTOR and ENGINEER. Incoming

materials shall be approved by Manufacturer's Quality Assurance Program before processing into finished goods.

B. Representative samples of polyethylene materials shall be tested against the physical property requirements required herein. Each extrusion line and molding machine shall be qualified to produce pressure rated products by taking representative production samples and performing sustained pressure tests in accordance with ASTM D 1598.

C. Quality Assurance test for representative pipe and fitting samples shall include:

Test	Standard	Pipe	Fittings
Ring ESCR	ASTM F 1248	Yes	Not Applicable
Sustained pressure at 176°F/725 psi hoop stress: (f_o>100 h)	ASTM D 1598	Yes	Yes
Sustained pressure at 73°F/1,600 psi hoop stress: (f_o>1000 h)	ASTM D 1598	Yes	Yes

D. Inspection Requirements:
1. Notification: The HDPE pipe and fitting manufacturer shall notify CONTRACTOR in advance of the date, time, and place of testing of the pipe in order that CONTRACTOR may be represented at the test.
2. Access: The OWNER'S representative shall have free access to the Inspection area of the manufacturer's plant. The manufacturer shall make available to the OWNER'S representative, without charge, all reasonable facilities for determining whether the pipe meets the requirements of this Section.
3. Certification: As the basis of the acceptance of the material, the manufacturer will furnish a certificate of conformance of these Specifications upon request. When prior agreement is being made in writing between ENGINEER, CONTRACTOR and the manufacturer, the manufacturer will furnish other conformance certification in the form of affidavit of conformance, test results, or copies of test reports.
4. All outgoing materials shall be inspected for diameter, wall thickness, length, straightness, out-of-roundness, concentricity, toe-in, inside and outside surface finish, markings, and end cut. Manufacturer's Quality Control Program shall perform tests of density, melt flow rate, carbon content, and carbon dispersion. In addition, samples of the pipe provided shall be tested for hoop tensile strength and ductility by either quick burst in accordance with ASTM D 1599 or ring tensile strength in accordance with ASTM D 2290. Molded fittings shall be subject to x-ray inspection for voids, and tests for knit line strength. All fabricated fittings shall be inspected for fusion quality and alignment.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Pipe may be rejected for failure to conform to these Specifications or following:
   1. Fractures or cracks passing through pipe wall, except single crack not exceeding 2-inches in length at either end of pipe which could be cut off and discarded. Pipes within one shipment shall be rejected if defects exist in more than five percent of shipment or delivery.
   2. Cracks sufficient to impair strength, durability or serviceability of pipe.
   3. Defects indicating improper proportioning, mixing, and molding.
   4. Damaged ends, where such damage prevents making satisfactory joint.
   5. Gouges or scrapes exceeding ten percent of the specified wall thickness.

B. Acceptance of fittings, stubs or other specifically fabricated pipe sections shall be based on visual inspection at Site and documentation of conformance to these Specifications.

C. CONTRACTOR to provide as-built of pipe end point and angle point coordinates and elevations prior to backfilling trench.

3.2 INSTALLATION

A. Refer to Section 31 23 05, Excavation and Fill.

B. Heat Fusion of Pipe:
   1. HDPE pipe and fittings joints shall be heat fused by a qualified technician; trained by the manufacturer's representative in accordance with the manufacturer's recommended fusion procedures. Training must have occurred within the previous 12 months, or submittals verifying experience within the previous 12 months for all technicians performing heat fusion on polyethylene pipe and fittings.
   2. Weld in accordance with manufacturer's recommendation for butt fusion methods. Personnel operating fusion equipment shall be certified by the HDPE pipe manufacturer.
   3. **The first butt fusion weld of each day's production welding and for each separate operator shall be tested by bent strap test method.**
      a. Test pipes with a wall thickness of less than 1-in in accordance with ASTM F2620 Appendix X4 Bend Back Testing of Fused Joints.
      b. Test pipes with a wall thickness of 1-in or greater in accordance with ASTM F3183 Guided Side Bend Evaluation.
      c. No production welds shall be performed until successful completion of bent strap test.
   4. Butt fusion equipment for joining procedures shall be capable of meeting conditions recommended by HDPE pipe manufacturer including, but not limited to, temperature requirements, alignment, and fusion pressures. The

equipment used for the heat fusion joints shall be capable of recording the heating and fusion pressures used to join the HDPE pipe, recording heater temperature, and storing this information for future retrieval (data logger). Each field fusion shall be recorded by such equipment and this information shall be made compiled into daily log reports. Log reports shall be submitted to CONTRACTOR and ENGINEER daily. Reports shall also include the results of the bent strap tests.

5. For cleaning pipe ends, solutions such as detergents and solvents, when required, shall be used in accordance with manufacturer's recommendations.
6. Do not bend pipe to greater degree than minimum radius recommended by manufacturer for type and grade, or greater to a degree than shown on Contract Drawings. Shop Drawings shall address locations and deflections of required fittings to prevent installation that exceeds a greater degree of bending than the manufacturer's recommended minimum bending radius for each size and class of HDPE pipe.
7. Do not subject pipe to strains that will overstress or buckle piping or impose excessive stress on joints.
8. Branch saddle fusions shall be joined in accordance with manufacturer's recommendations and procedures. Branch saddle fusion equipment shall be of size to facilitate saddle fusion within trench.
9. Before butt fusing pipe, inspect each length for presence of dirt, sand, mud, shavings, and other debris or animals. Remove debris from pipe.
10. Cover open ends of fused pipe at the end of each day's Work. Cap to prevent entry by animals or debris.

C. Pipe Placement:
1. Grade control equipment shall be of type to accurately maintain design grades and slopes during installation of pipe.
2. Dewatering: Remove standing water in trench before pipe installation.
3. Unless otherwise specifically stated, install pipe in accordance with manufacturer's recommendations.
4. Maximum lengths of fused pipe to be handled as one section shall be placed according to manufacturer's recommendations as to pipe size, pipe SDR, and topography so as not to cause excessive gouging or surface abrasion, but shall not exceed 400 feet.
5. Cap pipe sections longer than single joining (usually 50 feet) on both ends during placement, except during fusing operations.
6. Notify ENGINEER prior to installing pipe into trench and allow time for ENGINEER'S inspection.
   a. Correct irregularities found during inspection.
7. Complete tie-ins within trench whenever possible to prevent overstressed connections.
8. Allow pipe sufficient time to adjust to trench temperature prior to testing, segment tie-ins or backfilling activity.
9. Install reducers adjacent to laterals and tees.

10. To reduce branch saddle stress, install saddles at slope equal to and continuous with lateral piping.
11. Pipe shall be snaked in trench to allow a minimum of 12-inches/100 feet for thermal contraction and expansion.
12. Allow extra length at future connection points to be cut to fit after backfill and prior to tie-in.

++ END OF SECTION ++

SECTION 40 05 93

WELL PUMP MOTORS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:
   1. This Section specifies the requirements for furnishing and installing medium voltage squirrel cage induction motors at Wells 3, 4, 5, 7 and 8.

1.2 REFERENCES

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
   1. ANSI/NETA ATS, Acceptance Testing Specifications for Electrical Power Equipment and Systems.
   2. IEEE 43 - Recommended Practice for Testing Insulation Resistance of Rotating Machinery.
   3. IEEE 112 - Test Procedure for Polyphase Induction Motors and Generators.
   4. IEEE 429 - Standard Test Procedure for the Evaluation of Sealed Insulation Systems for AC Electric Machinery Employing Form-wound Stator Coils.
   5. IEEE 522 - Guide for Testing Turn-to-Turn Insulation on Form-Wound Stator Coils for Alternating Current Electric Machines.
   6. IEEE 1043, Recommended Practice for Voltage Endurance Testing of Form-Wound Bars and Coils.
   7. NEMA MG-1 - Motors and Generators.
   8. NEMA MG-2 - Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators.
   9. NFPA 70 – National Electrical Code (NEC).
   10. UL 1004, Electric Motors.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer shall have not less than five years' experience producing equipment substantially similar to that required and shall be able to submit documentation of at least five installations in satisfactory operation for at least five years each.
   2. Motor manufacturer shall be one of the following:
      a. ABB.
      b. TECO – Westinghouse.
      c. Nidec – US Motors.
      d. General Electric.

e. Siemens.

3. Manufacturers listed are not guaranteed acceptance of a product that is proposed for this project. The motor supplied under this Section is required to meet all requirements stated in the Specifications.
4. Motor Compatibility: Manufacturer shall provide confirmation that motor provided is compatible with driven equipment and complies with this Specification.

1.4 SUBMITTALS

A. The following information shall be provided for each motor in accordance with Division 01 and the requirements of this Section.
   1. Datasheets including motor outline, dimensions, and weight.
   2. Provide the following rating information for each motor:
      a. Motor nameplate drawing.
      b. Rotor moment of inertia (WK^2).
      c. Maximum sound level.
      d. Maximum capacitor switching kVAR.
      e. Alarm and trip setpoints for thermal protection devices.
      f. Quantity of rotor bars and stator slots.
   3. Manufacturer's general descriptive information relative to motor features.
   4. Datasheets and wiring diagrams of motor heaters, winding thermal protection, lubrication equipment and other accessories.
   5. Motor terminal box dimensions including elevation drawing showing terminations and surge protection devices.
   6. Copies of motor characteristic curves including speed-torque curve, motor thermal damage curve, and power factor vs. speed curve during startup.
   7. Data input for programming motor protection relays when required.
   8. Motor test data:
      a. Submit preliminary testing datasheets for proposed motor(s) prior to fabrication. Values indicated on testing datasheets shall be from tests of a previously manufactured, electrically duplicate motor or calculated data. Mark each test data sheet to indicate the Project motor application location, manufacturer, type, frame size, horsepower, voltage, speed, bearing type, lubrication medium and enclosure type. Test datasheet shall also include:
         1) Winding resistances.
         2) Torque values.
         3) Efficiency at 100, 75, 50 and 0 percent of full load.
         4) Power factor at 100, 75, 50 and 0 percent of full load.
         5) Slip.
         6) Full load amperes.
         7) Locked rotor and no load amperes.
         8) Nameplate temperature and results of dielectric tests.
      b. Submit results of required factory testing specified herein. Factory test reports shall be dated and signed by motor manufacturer.

c. Submit results of required field testing and inspections specified herein. Field testing reports shall be dated and signed by CONTRACTOR.

9. Manufacturer's Instructions:
   a. Instructions and recommendations for handling, storing, protecting the motors.
   b. Installation data for motors, including setting drawings, templates, and directions and tolerances for installing anchorage devices.
10. Qualifications Statements:
    1. Submit manufacturer's qualifications data when requested by ENGINEER.
11. Applicable operation and maintenance information specified in Division 01, including overhaul instructions for the motor.

1.5 DELIVERY, STORAGE AND HANDLING

A. Delivery, storage, and handling shall comply with all manufacturer's recommendations.

B. Ship motors with all enclosure openings sealed.

C. Protect materials and equipment from corrosion and deterioration. Store equipment in a clean, dry location with controls for uniform temperature and humidity. Protect equipment with coverings and maintain environmental controls.

D. Provide and maintain temporary power for space heater operation during storage and prior to energization once installed in permanent location. Failure to energize space heaters during storage shall dictate that motors are subject to rejection as determined by the ENGINEER or OWNER pending any inspection or testing. All expenses for inspection, testing, returning motor to factory, and shipping replacement motor to the site shall be solely the responsibility of the CONTRACTOR. Prepare and complete a weekly inspection log. The log shall include the date, time, and amp draw on the circuit feeding each motor space heater.

E. Fill bearing oil reservoirs and bearing grease cavities to confirm bearings are properly lubricated and to prevent ingress of moisture during storage. Rotate motor shaft during storage in intervals recommended by the manufacturer. Include field on the weekly storage log to confirm motor shaft has been rotated by several hand revolutions.

1.6 WARRANTY

A. The manufacturer shall provide a single warranty against faults and defects in material and workmanship for a period of five (5) years of operation from the date of successful commissioning. Warranty shall provide for free replacement or repair of parts during that time period including all necessary labor. Warranty shall be administered by the manufacturer or its authorized service representative.

PART 2 – PRODUCTS

2.1 AMBIENT CONDITIONS

A. Motors shall be suitable for the following service conditions:
   1. Outdoor installation exposed to weather.
   2. Continuous operation in a 50°C ambient temperature.
   3. Elevation of approximately 3300 feet above mean sea level.

2.2 POWER REQUIREMENTS

A. Motors shall operate from a power system supplying 4160 volts, 3 phase, 60 hertz alternating current power.

B. Provide motors with the following horsepower ratings:
   1. Well Pump 3: 200HP.
   2. Well Pump 4: 200HP.
   3. Well Pump 5: 200HP
   4. Well Pump 7: 200HP.
   5. Well Pump 8: 200HP.

C. Motors shall successfully operate under power supply variations in accordance with NEMA MG 1-14.30.

D. Motor current imbalance shall not exceed 10% when the motor is operating at any load within its service factor rating and is supplied by a balanced voltage system. Imbalance criteria shall be based upon the lowest current value measured.

2.3 CONSTRUCTION

A. Motors provided under this Section shall have the following features of construction and operation:
   1. Motor shall be three phase, full voltage start, squirrel cage induction motor that is suitable for operation on a full voltage motor controller. Motor shall have either a Design B or C torque-speed characteristic as required by the vertical turbine pump that it will power.
   2. Fabricated steel or cast-iron frames with integrally cast bases, cast-iron end bells, cast iron or steel conduit boxes and bases with precision machined bearing fits, ASTM A48/A48M, Class 25 minimum.
   3. Motors shall have sufficient horsepower and torque capacity to drive the equipment without overloading under all conditions. Motors shall operate within their full load rating without applying the service factor.
   4. Service Factor: Motors shall be rated for 1.15 Service Factor while operating on sine wave power in a 50°C ambient. Motors that can only operate at 1.15 Service Factor in a 40°C ambient will not be accepted. Motors that can only operate at 1.0 Service Factor at 50°C ambient will not be accepted.

5. Speed: As listed in the driven equipment specification.
6. Locked Rotor KVA/HP Code: G.
7. Efficiency: Motor minimum nameplate efficiency when operating on a sinusoidal power source shall comply with Table 12-12 of NEMA MG-1. Motor shall qualify for and be labeled as NEMA Premium Efficient.
8. Stator Construction:
   a. Windings shall be copper.
   b. Stator core assembly shall consist of stacked lamination made from specially selected electrical sheet silicon steel.
   c. Insulation materials shall be non-hygroscopic and meet or exceed Class F definition, utilizing materials and insulation systems evaluated in accordance with IEEE 117 classification tests. Motor temperature rating shall not exceed Class B temperature limits as measured by resistance method when the motor is operated at full load at 1.0 service factor continuously in a maximum ambient temperature of 50°C.
9. Rotor Construction:
   a. Rotor cages shall be copper or copper alloy. Shafts shall be made from carbon steel.
   b. Rotors on frames shall be keyed shrunk or welded to shaft and rotating assembly dynamically balanced to NEMA limits in accordance with MG 1-17.1. Balance weights, if required, shall be secured to the rotor resistance ring or fan blades by rivets. Machine screws and nuts are prohibited. The entire rotating assembly between bearing inner caps shall be coated with a corrosion resistant epoxy.
10. Bolt and cap screws shall be high-strength, SAE Grade 5 zinc-plated chromatic steel. Screwdriver slot fasteners are unacceptable.
11. Motors shall be factory-painted at the motor fabrication facility. Finish coat shall be the same color as the associated driven equipment. Final paint finish shall be corrosive resistant and capable of passing ASTM B117 250-hour salt spray test. Motors that will be located outdoors shall have coating resistant to degradation or chalking in sunlight.

3

12. Bearings:
    a. Motor bearings shall be adequately designed for the maximum load imposed by the driven equipment and motor and shall be selected for a L10 life of at least 100,000 hours when operated at rated speed and full load thrust.
    b. Motors shall be provided with an insulated bearing on the non-drive end and a shaft grounding ring on the drive end of the motor.
    c. Maximum bearing temperature rise shall be in accordance with manufacturer recommendations.
    d. Thrust bearing on top of motor shall be oil-lubricated, anti-friction type with oil reservoir and other necessary accessories.
    e. Well No. 3: Lower radial guide bearings shall be grease-lubricated, oil-lubricated, anti-friction or sleeve type bearing with oil reservoir.
    f. Wells Nos. 4, 5, 7, and 8: Lower radial guide bearings shall be oil-lubricated, anti-friction or sleeve type bearing with oil reservoir.
13. Lubrication Accessories:

a. Oil lubricated bearings contained in oil reservoirs shall be provided with oil level sight gauges, oil fill and drain openings with plugs.
b. Sight gauges shall be transparent vertical tube indicators with permanently marked easily discernible oil level. Sight gauges shall be mounted beside the bearing oil reservoir and shall be equal in height to the reservoir.
c. Drain plugs shall be magnetic type with clear sediment traps.
d. Insulating means shall also be provided for any oil-supply connections and monitoring equipment.

14. Insulation:
    a. Insulation systems shall be rated Class F, with a service factor of 1.15 times motor's nameplate horsepower rating when operated on a sine wave power supply. Temperature rise shall be limited to Class B insulation system when motor is operated continuously at rated horsepower with ambient temperature not exceeding 50 degrees C, unless specified otherwise in the Section for the associated driven equipment.
    b. Windings shall be epoxy-coated. Treat windings with insulating compound suitable for protecting against moisture, salt air, and slightly acidic and alkaline conditions. Insulation system for enclosed motors shall be upgraded to increase moisture resistance.
    c. Motors shall have vacuum/pressure-impregnated epoxy insulation (VPI) for moisture resistance. Motors shall be preheated before VPI and baked in temperature-controlled oven.
    d. Stator windings and end turn connections shall be fully brazed to withstand full voltage starting, regardless of the starting method indicated in the Section for the associated driven equipment. Bracing system shall essentially eliminate coil vibration under the high-current conditions of starting as well as during normal operation. When a tied system is used, system shall be such that no tie depends on the integrity of another tie within the system.
    e. Motors shall be form wound. Form wound coils with micaceous ground wall insulation shall have additional insulation and hot-pressed to provide sealed system. Complete stator shall be vacuum/ pressure-impregnated.
15. Enclosure: Totally enclosed fan-cooled (TEFC).
16. Motors shall have a Type P base specifically constructed for vertical installation. Universal position motors are unacceptable.
17. Motors shall be provided with hollow shaft connections to the driven pump.
18. Motor Terminal Box:
    a. Provide three porcelain insulated standoff isolators with connections to NEMA standard mounting pads for incoming field wiring in the motor terminal box. Provide 30” minimum distance from lowest isolator to the bottom of the motor terminal box.
    b. Minimum terminal box sizes shall be in accordance with NEMA MG-1 requirements and shall accommodate medium-voltage terminations and all other requirements specified herein.
    c. Provide three heavy duty, distribution class lightning arrestors and surge capacitors within motor terminal box.

d. All other protective and auxiliary devices shall terminate in auxiliary conduit boxes.
e. Provide opening in terminal box housing with conduit hub type fitting to allow threaded conduit connections.
f. Provide motor frame grounding stud inside conduit box. Stud shall include a drilled and tapped hole.
g. Motor terminal box shall be fabricated from carbon steel and shall be painted to match the finish coat color of the motor enclosure.

19. Lifting Eyes:
    a. Provide two lifting eyes for the motor. Construct motor and lifting eyes to bear full weight of motor.
20. Non-Reverse Ratchet:
    a. Provide non-reverse ratchet (NRR) on motor to prevent spinning in opposite direction.

2.4 ACCESSORIES

A. Space Heater:
   1. Provide space heater within motor for condensation prevention. Space heater wattage shall maintain motor interior above dew point temperature at all times. Space heaters shall be low-density type for low surface temperature and long service life. Space heaters shall operate on 120 volts, single phase power.

B. Resistance Temperature Detectors (RTDs):
   1. Provide each motor with two 100 ohm platinum RTDs in each phase of the stator windings (total of six stator RTDs) and one 100 ohm platinum RTD for each bearing (total of 2 bearing RTDs). The RTDs shall be three wire type.
   2. Leads from the RTDs shall be protected from sunlight and physical damage. Terminate leads at a separate terminal box and install through flexible sleeves from the stator windings. Sleeves shall be free of insulating varnish or coating material applied to stator windings. Do not ground sensors or shields at motor.

C. Nameplates:
   1. Nameplates shall be stainless steel with engraved or embossed lettering and shall be fastened to the motor frame with Type 316 stainless steel pins. Nameplates shall contain the following information:
      a. Motor manufacturer’s name.
      b. Motor manufacturer type designation.
      c. Serial number.
      d. Frame designation.
      e. Enclosure.
      f. Weight.
      g. Balance.
      h. Shaft end bearing designation.
      i. Opposite shaft end bearing designation.
      j. Voltage
      k. Phase.

l. Hertz.
m. RPM.
n. Maximum Ambient Temperature.
o. Duty.
p. Insulation class.
q. Horsepower.
r. Full load (FL) amps.
s. Service factor (SF) amps.
t. NEMA nominal efficiency.
u. Guaranteed efficiency.
v. NEMA design letter.
w. NEMA code letter.
x. Nominal power factor.
y. FL Kilowatt.
z. Max Capacitor KVAR.
aa. FL torque.

2. Nameplates shall indicate that each motor is rated for the following:
   a. 50°C ambient.
   b. NEMA Premium Efficient.

2.7 SOURCE QUALITY CONTROL

A. Factory Tests:
   1. Perform factory testing on the specific motors provided for this project at the manufacturer's facility. Factory testing shall be in accordance with NEMA MG-1 and IEEE Standard 112 and shall demonstrate that the motors tested comply with the Contract Documents.
   2. Submit factory test reports identifying tests performed and results obtained.
   3. Motors shall be given a "Routine Test" in accordance with NEMA MG-1 and IEEE Standard 112 that consists of the following:
      a. Measurement of winding resistance.
      b. No-load readings of current and speed at normal voltage and frequency.
      c. Current input at rated frequency with rotor at standstill for squirrel-cage motors (locked rotor amperes).
      d. High-potential test.
      e. Bearing inspection.
      f. Sound level measurements under load conditions.
   4. Motors shall also be given a "Complete Test" in accordance with NEMA MG-1 and IEEE Standard 112 that consists of the following:
      a. Percent slip.
      b. No-load speed, voltage, current, and losses at rated frequency.
      c. Full-load current.
      d. Locked-rotor torque.
      e. Locked-rotor current.
      f. Breakdown torque (calculated).
      g. Starting torque (squirrel-cage).
      h. Winding resistance.

i. Sound level at no load condition.
j. Vibration levels.
k. Efficiency current, and power factor at 100, 75, and 50 percent of full load and at service factor load.
l. Stabilized full load temperature rise.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General:
1. Install motor in accordance with the Contract Documents and manufacturer's instructions and recommendations. Obtain written interpretation from ENGINEER in the event of conflict between manufacturer's instructions and recommendations and the Contract Documents.
2. Install in accordance with Laws and Regulations.
3. Do not modify structures to facilitate installation of motors, unless approved in writing by ENGINEER.
4. Carefully and properly align motors with the driven equipment.
5. Secure motors to mounting surfaces with anchorage devices (complying with manufacturer's recommendations) that are of sufficient size and quantity to secure motor to equipment.
6. Until start-up and operation, tightly cover and protect motors from dirt, water, and chemical and mechanical damage.

3.2 FIELD QUALITY CONTROL

A. Site Tests:
1. Inspect motors prior to supplying electricity to (energizing) equipment. Do not energize equipment without OWNER's permission. Inspections shall include the following:
a. Inspect motor and equipment for physical damage.
b. Inspect motor for proper anchorage, mounting, grounding, connection, and lubrication.
c. Check for unusual noise and indications of overheating during initial or test operation.
2. Perform testing at the Site per the following:
a. Testing shall be witnessed by OWNER.
b. Initial inspections and testing shall include the following:
1) Electrical and grounding connections.
2) Shaft alignment, proper mounting and lubrication.
3) Check ventilating air passageways for blockage.
4) Excessive noise, noise shall not exceed 85 dB at 1 meter (3.2 feet) from motor.
5) Overheating.
6) Correct rotation.

7) Protective detectors operation.
8) Excessive vibration.
9) Space heater operation.

c. Electrical testing shall include the following:
1) Insulation resistance test.
2) Surge comparison test.
3) Vibration test.
4) Bearing insulation resistance test on insulated bearings.
5) Running current and voltage measurements and evaluations relative to load conditions over full range of operations and nameplate full-load amperes.
6) High-potential test.
7) Motor operation with the driven equipment for not less than 48 continuous hours, with checks for overheating and vibration during operation.

d. Tests and values shall be in accordance with motor manufacturer's recommendations and ANSI/NETA ATS.

e. Prepare and submit field testing report in accordance with ANSI/NETA ATS.

B. Manufacturer's Services: Provide the following:
1. Furnish services of motor manufacturer's qualified service representative to assist with installing motors, checking installed motors before initial operation, assisting in performing field quality control tests and inspections, observing and assisting initial operations, and training operations and maintenance personnel in caring for, operating, and maintaining motors. Training shall comply with Section 01 79 00 – Demonstration and Training.
2. Prepare and submit manufacturer's field report for each visit to the Site.

+ + END OF SECTION + +

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VERTICAL LINESHAFT PUMPS

PART 1 – GENERAL

1.1 SCOPE

A. Scope:
1. Provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install vertical lineshaft pumps complete and operational.
2. Included are pump, motor, coupling, surface plate assemblies, base, drive, pre-lubrication, and anchorage systems and all appurtenances.

3 **3. Included are blind flange covers for Wells Nos. 3, 4, 5, 7, and 8 with matching bolt configuration to the surface plate assembly.**

B. Coordination:
1. Review installation procedures under this and other Sections and coordinate installation of items that are required with or before vertical lineshaft pump Work.
2. Review existing surface plate assembly and cut, level, and weld as required to meet new surface plate assembly in accordance with this Section.
3. Review new manufacturer discharge flange elevation against existing pump discharge flange elevation. CONTRACTOR shall expose and adjust steel yard piping downstream of existing 45 degree elbow; and adjust existing pipe supports as required. CONTRACTOR shall adjust piping in accordance with Section 40 05 24.23, Steel Process Pipe for Liquid Service.
4. Monitor and maintain awareness of current Edwards Aquifer Water Level utilizing the SAWS J-17 Edwards Aquifer Index Well water level as published daily on the SAWS website. CONTRACTOR shall control artesian conditions encountered in the field by approved methods.

C. Related Sections:
1. Section 03 60 00 – Grouting
2. Section 05 05 33 – Anchor Systems
3. Section 09 91 00 – Painting
4. Section 40 05 24.23 – Steel Process Pipe for Liquid Service
5. Section 40 05 93 – Well Pump Motors

1.2 DEFINITIONS

A. Submergence: Vertical distance in feet between the pumping water level and the pump inlet.

B. Pump Efficiency: Pump efficiency as defined herein shall include all losses from the pump intake suction case to the pump discharge flange. Losses through blank bowls (if any) for initial conditions shall also be considered.

C. Bowl Efficiency: Efficiency obtained from the bowl assembly.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications:
   1. Manufacturer shall have minimum of five years of experience producing substantially similar materials and equipment to that required and be able to provide evidence of at least five installations in satisfactory operation for at least five years.
   2. The Pump Supplier must provide the complete pump from the Pump Manufacturer and the supplier shall be a licensed well installer with including but not limited to the crew, pump hoist, and rigging for field assembly and installation to ensure single source responsibility for the equipment described under this Section.

B. Component supply, compatibility, and coordination responsibility specific to this Section:
   1. Obtain all equipment in this Section regardless of the component manufacturer from a single pump supplier.
   2. The Pump Supplier shall prepare Shop Drawings, pump equipment details and other submittals for all components furnished under this Section and Section 40 05 93 – Well Pump Motors for approval prior to fabrication.
   3. All components shall be specifically constructed for the specified service conditions and shall be integrated into the overall assembly by the Pump Supplier.
   4. To ensure equipment compatibility, the Pump Supplier is responsible for coordination and procurement of the following equipment:
      a. Electric drive motors per Section 40 05 93 – Well Pump Motors

1.4 SUBMITTALS

A. Action Submittals: Submit the following:

   1. Shop Drawings:
      a. Manufacturer's literature, illustrations, specifications, paint certification and engineering data including; dimensions, materials, size, weight. and part lists for all components in sufficient detail to allow an item by item comparison with the Contract Documents.
      b. Performance data and curves showing overall pump efficiencies, required net positive suction head, flow rate, head, brake horsepower, motor horsepower, speed, and shut-off head. Curves shall range from minimum flow to shut-off head at rated speed. Provide data on pump head losses to include entrance, bowl, column, and discharge head losses.

c. Minimum submergence required over suction case at minimum head listed in service conditions in Part 2 of this Specification.
d. Thrust at rated condition and maximum thrust value for the entire pump curve.
e. Upthrust at starting.
f. Wr2 of pump.
g. Impeller diameter.
h. Stress relief certifications.

2. Shop Drawings:
   a. Drawings of the products, including fabrication methods, assembly, accessories, installation details, dimensions, and wiring diagrams.
3. Delegated Design Submittals:
   a. Analysis and calculations by a qualified specialist for critical speed of pump and motor shaft.
   b. Results of torsional and lateral vibration analyses.
   c. Calculations of the maximum forces acting on the pump support structure.
   d. Motor bearing life and shaft deflection calculations at the design point.
   e. For a historical maximum reverse flow pressure of 18 psig at the discharge head flange, provide the expected reverse speed and plot result on the four-quadrant curve for this design..
4. Testing Plans, Procedures and Testing Limitations:
   a. Shop plan including shop test procedures, material certifications, and quality certifications.
   b. Field Plan including jobsite storage plan, installation plan, commissioning plan, and field testing plan.
   c. Location of nearest permanent service headquarters of pump manufacturer to the Site.
5. Fluids Control Plan:
   a. Drilling fluid management and best management practices for capture of sediment from water discharge.
   b. Artesia fluid control for capture and control of any fluids leaving the well.

B. Informational Submittals: Submit the Following:
1. Certificates:
   a. Provide welding certifications.
2. Source Quality Control Submittals:
   a. Shop tests. Provide prior to shipment from factory.
   b. For Project with required efficiency guarantees by pump manufacturer, provide a report that includes raw data, reduced data, and resulting performance curves. Include a statement regarding compliance with the specified guaranteed upbowl efficiency and wire-to-water efficiency for each pump/motor combination at design point listed in the service conditions in Part 2 of this Section.
3. Site Quality Control Submittals:
   a. Field operating tests.

4. Manufacturer's Instructions: Submit manufacturer's instructions and recommendations for:
   a. Storage.
   b. Handling.
   c. Setting drawings, templates, and directions for installing anchor bolts and other anchorages.
   d. Installation.
5. Manufacturer's Reports:
   a. Submit a written report of the results of each visit by a manufacturer's serviceman, including purpose and time of visit, tasks performed, and results obtained.
6. Motor test reports for furnished motors, including running light current, locked rotor current, winding resistance measurement, bearing inspection, and efficiency at 1/2, 3/4, and full load.Qualifications Statements:
   a. Submit qualifications data as specified in the Quality Assurance section.

C. Closeout Submittals: Submit the following:
   1. Operation and Maintenance Data:
      a. Submit complete operation and maintenance manuals, including copies of test reports, maintenance data, and schedules, description of operation, and spare parts information.
      b. Furnish operation and maintenance manuals per Section 01 78 23, Operations and Maintenance Data.
   2. Warranty Documentation:
      a. Provide a copy of the manufacturer's standard warranty for parts and labor.

D. Maintenance Materials Submittals: Furnish the Following:
   1. Spare Parts:
      a. Provide tools and spare parts as specified in the Maintenance article of this Specification.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling and Unloading:
   1. Prior to shipping, completely inspect products to assure that components are complete and comply with all requirements. Box or crate products as required to prevent damage during shipment. Protect machined surfaces and matching connections to prevent damage.
   2. Deliver products to Site to ensure uninterrupted progress of the Work. Deliver anchorage products that are to be embedded in cast-in-place concrete in ample time to prevent delay of the Work.
   3. Inspect all boxes, crates, and packages upon delivery to Site and notify ENGINEER in writing of loss or damage to products. Promptly remedy loss and damage to new condition per manufacturer's instructions.

B. Storage and Protection:
1. Keep all products off ground using pallets, platforms, or other supports. Protect steel, packaged materials, and electronics from corrosion and deterioration.

PART 2 – PRODUCTS

2.1 EQUIPMENT PERFORMANCE AND SIZE REQUIREMENTS

A. Performance Criteria: Comply with the following minimum performance requirements:

Pump ID:	Well Pump #3	Well Pumps #4, #5, #7, #8
Design flow (1st design point) (gpm):	7,000	7,000
Design tdh (1st design point) (ft)[3]	80	80
Min. Bowl efficiency at design (1st design point) (%):	80%	83%
Design flow (2nd design point) (gpm):	6,600	4,000
Design tdh (2nd design point) (ft)[3]	95	95
Min. Bowl efficiency at design (2nd design point) (%):	73%	62%
Shut-off head (ft):	176	132
Maximum pump speed (rpm)[1]:	1,780	1,185
Max. Motor horsepower[2]:	200	200

Notes:
1. This is the maximum pump speed to meet the specified operating conditions and the speed that the pump is to be tested at in the factory to demonstrate compliance with these specifications.
2. Pump horsepower requirements shall not exceed stated horsepower at all points on pump curve.
3. All TDH values are bowl head.

B. Pump Construction:

Pump ID:	Well Pumps #3, #4, #5, #7, #8
Pump Type:	VS6
Prime Mover:	VHS Electric Motor
Lineshaft Construction:	Open
Lineshaft Lubrication:	Product Lubricated
Shaft Sealing:	Packing, see Paragraph 2.4.B
Shaft Sleeve:	**Stainless steel, ASTM A582, Type 416**
Suction Strainer:	316SS Conical Strainer, mounted to min. 5' carbon steel suction pipe.
Impeller Style/Type:	Enclosed
NSF 61 Materials / Coatings	Yes

3

C. Size and Service Conditions:

3

Pump ID:	Well Pump #3	Well Pump #5	Well Pumps #4, #7, #8
Number of Stages:	1	1	1
Max. Pump Discharge Head Dia. (in)[1]:	20	**24**	20
Max Column Diameter (in):	14	18	18
Max Bowl Outside Diameter (in):	**17.5**	23	23
Well Casing Inner Diameter (in)[2]:	21.25	25.25	29
Location	As shown on drawings	As shown on drawings	As shown on drawings
Installation Condition:	Exterior, Exposed to Weather	Exterior, Exposed to Weather	Exterior, Exposed to Weather
Drive Configuration:	Direct	Direct	Direct
Speed/Capacity Control:	N/A	N/A	N/A
Top of Pump Bowl Elevation (ft):	550	550	550
Min. Water Surface Elevation at Pump Suction (ft):	596	596	596
Max. Water Surface Elevation at Pump Suction (ft):	703	703	703
Pump Discharge Center-Line Elevation (ft)[3]:	646.40	662.50	Well Pump #4: 646.75 Well Pumps #7&#8 – See Drawings.

Notes:

1. Discharge Head sizes shall be field verified by Contractor prior to pump fabrication.
2. Well casing diameter shown is at top of anticipated pump bowl.
3. Contractor to field verify discharge head center line elevations prior to pump fabrication.

D. Fluid Data:

Pump ID:	Well Pumps #3, #4, #5, #7, #8
Fluid Pumped:	Ground Water
Fluid Temperature Range:	50 - 90
Fluid pH:	6.5 – 8.5
Fluid Specific Gravity:	1.0
Chemical Concentrations, maximum:	0.3 mg/L Fluoride (background)

E. Equipment provided shall be suitable for process and service conditions specified in the Contract Documents and shall conform to ANSI/HI 9.8 and ANSI/HI 14.3. Pumps shall be designed, constructed, and installed for the service intended and shall comply with the service conditions listed.

F. Pump's characteristic curve shall rise continuously from minimum head condition to shut off without dips. Complete pumping unit, consisting of suction/intake, bowl(s), column, pump head, motor, and appurtenances shall be suitable in all respects for continuous, stable performance when operating at each point on pump's characteristic curve within the pump's AOR (Allowable Operating Range) without exceeding the specified vibration.

G. Each pumping unit and its driving equipment shall be designed and constructed to withstand the maximum turbine run-away speed of the unit due to backflow through the pump with the primary TDH specified available at the pump discharge flange. Maximum reverse run-away speed shall not exceed 130 percent of the design operating speed. Otherwise include a non-reverse ratchet in the motor.

2.2 MANUFACTURERS

A. The naming of a manufacturer in this Section is not an indication that the manufacturer's standard equipment is acceptable in lieu of the specified component features. Naming is only an indication that the manufacturer may have the capability of engineering and supplying the pump(s) specified.

B. Provide Vertical Lineshaft Pumps from the following manufacturers:
1. Flowserve
2. Patterson Pump Company
3. Pentair Fairbanks Nijhuis
4. Xylem (Goulds)
5. Floway (Trillium Flow Technologies/Weir)
6. Peerless Pumps (Grundfos)

C. Provide motors from one of the manufacturers listed in Section 40 05 93, Well Pump Motors.

2.3 SPECIFIC MATERIALS OF CONSTRUCTION

A. Special Requirements for pumps handling Potable Water:
   1. Components wetted by the water shall not contain more lead than permitted by Annex G of NSF Standard 61 which specifies restrictions for maximum lead content of materials in contact with drinking water.
   2. All submerged surfaces of the pump, both interior and exterior, or any surfaces exposed to the water being pumped shall be coated with an NSF approved coating.

B. Materials of construction are to conform to the requirements listed below:

Pump ID:	Well Pumps #3, #4, #5, #7, #8
Discharge Head:	Carbon Steel, ASTM A53, Grade B
Sole Plate, Mounting Flange:	Carbon Steel, ASTM A36
Discharge Column Pipe:	Carbon Steel, ASTM A53, Grade B
Pump Bowls, Discharge Case, and Suction Case:	Cast Iron, ASTM A48, Class 30
Bowl Liner/Wear Rings:	Nickel-Aluminum-Bronze, ASTM B148, Grade C95800
Impeller Material:	Nickel-Aluminum-Bronze, ASTM B148, Grade C95800
Impeller Wear Rings:	Nickel-Aluminum-Bronze, ASTM B148, Grade C95800, 50 BHN less than Casing Wear Ring
Pump Shaft and Line Shafts:	Stainless steel, ASTM A582, Type 416
Line Shaft Couplings:	Stainless steel, ASTM A582, Type 416
Line Shaft Bearing Type:	Self-lubricating abrasion resistant thermoplastic, See Paragraph 2.4.F
Suction Barrel	N/A
Suction Strainer:	316SS Conical Strainer, Carbon Steel Suction Pipe
Exterior Bolting and Fastening:	Type 316 SS, ASTM A193 (Grade B8M) for bolts and ASTM A194 (Grade 8M) for nuts.

2.4 DETAILS OF CONSTRUCTION

A. Discharge Head:
   1. Materials of construction per the table above in paragraph “Specific Materials of Construction”.
   2. Design the discharge head to mount the driver, support the weight of the suspended pump components, and resist hydrostatic and hydrodynamic heads. Design discharge head for 150% of the pump discharge pressure (suction pressure plus pump differential pressure) at shutoff.
   3. Discharge head is to include the following features:
      a. Machine discharge head and stress relieve prior to machining. Provide machining on discharge base, discharge top, discharge flange, and stuffing box mounting area.

b. Provide a bolted, registered or rabbet-fit, at the top of the discharge head for mounting the drive motor, and providing concentric alignment with the seal plate and column flange register. Motor mounting flange surface shall be machined flat, and perpendicular to the centerline, and be parallel to the seal plate and column flange mating surface.
c. Integral discharge elbow for above grade discharge. On fabricated discharge heads 12-inches and larger, provide a minimum 3-segment mitered elbow.
d. Provide lifting lugs designed to support the weight of the complete pump assembly less the motor.
e. Provide the discharge head with bolt-in stuffing box or seal chamber. Access to the stuffing box area is to be through extra-large windows placed at 90 degrees from the discharge for pump adjustment and seal maintenance. Size stuffing box to accommodate throttle bushing with a minimum of five rings of backing.
f. Provide tapped hole, of the size noted above in the "Size and Service Conditions" paragraph, for drainage of seal/flushing water.
g. Provide surface plate assembly to match the pump discharge head base mounting arrangement. Contractor shall remove the old surface plate, and weld new surface plate assembly to the casing level to within 0.002 inch/foot of span. Pump supplier shall assist and certify surface plate is acceptable prior to pouring housekeeping pad and placing grout
h. Provide removable corrosion resistant screen to prevent access to coupling/seal area.

3

4. End Connections:

a. Provide end connection type as shown on the Drawings. All end connections shall be flanged.
b. Flanged Connections:
   1) Fabricated Discharge Heads:
      i. Shutoff Head less than 250 psi: Provide Class 150 flanges complying with ANSI B16.5
      ii. Shutoff Head greater than 250 psi: Provide Class 300 flanges complying with ANSI B16.5
c. For pumps mounted on suction barrels, drill and tap hole in mounting flange for installing an air/vacuum valve to purge air that may accumulate in barrel with varying water levels. Hole size as noted above in the table of "Pump Size Limitations". Discharge head shall have NPT connection through base for air relief connection.

B. Seal Chamber:
1. Seal housing shall mount to match bolt pattern on discharge head.
2. Provide a bronze alloy throttle bushing – alloy C89835.
3. Drill and tap gland for a minimum 2-inch clean water seal flushing connection.
4. Drill and tap gland area for seal water drain.
5. On well pumps with open lineshaft construction, provide a water pre-lubrication connection at the stuffing box/seal chamber, designed to

distribute water around the shaft for pre-lubrication of the lineshaft bearings before pump start-up.

C. Shaft Sealing:

1. Packing as noted in "Pump Construction" table above.
   a. Packing shall be NSF 61 compliant and in accordance with SAWS Standard Specifications and from the following manufacturer:
      1) SEPCO, 100% GFO, Style ML400
      2) UTEX, Style 210

3 **2. Shaft sleeve through stuffing box as noted in "Pump Construction" table above.**

D. Lineshafts:
1. Materials of construction per the table above in paragraph "Specific Materials of Construction".
2. Minimum shaft diameter determined by the formulas in AWWA E103.
3. Lengths: Furnish in interchangeable lengths not exceeding the following:
   a. Open lineshafts: 10 feet
4. Surface Finish: Polished over the entire length to a surface finish of 40 Ra per ASTM B46.1.
5. Straightened to 0.003 inches (total indicator reading) per 10 foot section.
6. Machine ends square to the axis of the shaft and provide a center relief.
7. Total lateral deflection of the shaft above the stuffing box/seal chamber is not to exceed 0.005-inch total indicator reading.

E. Lineshaft Couplings:
1. Materials: Machined from solid bar stock that matches the material listed in the table above in the paragraph for "Specific Materials of Construction".
2. Design couplings in accordance with AWWA E103.
3. Coupling Type:
   a. For line shafts smaller than 2.5" in diameter: Threaded sleeve-type couplings. Threaded couplings are to be designed to tighten during normal pump operation.
   b. For line shafts 2.5" and larger: Key and thrust-ring type or other non-threaded design.

F. Lineshaft Bearings:
1. Bearing material type as noted in table above in the paragraph for "Specific Materials of Construction".
   a. Lineshaft Bearings: Self-lubricating abrasion resistant thermoplastic
      1) Vesconite Hilube
      2) No equal
2. Bearing lubrication as noted in table above regarding pump construction.
3. Mounting:

a. Open Lineshafts: bearing retainers, integrally welded and centered in flanged column pipe.

4. Spacing: Locate bearings so that no pump operating speed is within 25% of the first critical shaft speed. Maximum spacing:
   a. Open Lineshafts: 10 feet

G. Pump Shaft:
1. Material as noted in table above in the paragraph for "Specific Materials of Construction".
2. Pump shaft shall be a single piece extending from the suction case bearing through the discharge case or upper bowl case bearing.
3. Sized for total axial thrust and weight of all rotating parts supported by shaft and horsepower transmitted.
4. Design shaft diameter so that the maximum combined shear stress does not exceed 30 percent of elastic limit in tension or more than 18 percent of ultimate tensile strength of shafting material.
5. Shaft is to be heat-treated, ground, and polished over the entire length.
6. Cut impeller keyways for multistage pumps at differing positions and equal angular spacing on the impeller shaft to avoid multiple simultaneous vane passing pulses.

H. Impellers:
1. Single piece castings made from the material option listed in the Table above in the paragraph for "Specific Materials of Construction".
2. Machined to fit the contour of the bowl, hand filed in the waterways.
3. Securely fasten impeller to shaft with stainless steel lock collets or keys and thrust ring retainers in such a manner that they cannot come loose under any operating condition or under reverse rotation. For pump shafts larger than 2.5 inches, use only keys and thrust ring retainers.
4. Impellers are to be statically and dynamically balanced.
5. Wear Rings: Provide impellers with a renewable wear ring fabricated from the materials listed in the Table above in the paragraph for "Specific Materials of Construction".
   a. Provide a radial type wear ring on enclosed impellers of nominal size 8-inches and larger.
   b. Secure wear rings to impellers to prevent rotation using an interference fit and anaerobic adhesive, pins, or set screws, depending on impeller size.

I. Bowl Assembly:
1. Fabricate the pump bowls from the material listed in the Table above in the paragraph for "Specific Materials of Construction".
2. Each bowl assembly is to consist of the discharge bowl, impeller, pump shaft, and bowl bearings.
3. Design bowls with sufficient rigidity to prevent adverse changes in bearing alignment and to maintain the running clearances of wear rings.

4. Join bowls to the suction case and the discharge column with flanged male and female rabbeted joints.
5. Waterways and diffusion vanes are to be smooth and free from nodules, bumps, and dips. Flow passages through the bowl and diffuser vanes shall be polished.
6. Bowl discharge diffuser vanes shall not be a multiple of impeller vanes.
7. Bowl Bearings:
   a. Bearings shall be located above and below the impeller
   b. Type: Close tolerance, spiral grooved, sleeve type, pressed into bowl body.
   c. Bowl sleeve bearings shall be lubricated by the pumped fluid.
   d. Bearings: Bronze alloy C89835
8. All bowl assembly hardware shall be 316 stainless steel.
9. Wear Rings:
   a. Provide the bowls with a renewable wear ring fabricated from the materials listed in the Table above in the paragraph for "Specific Materials of Construction".
   b. Provide radial style wear rings on bowl diameters 6-inches in diameter and larger on pumps that utilize enclosed impellers.
   c. Secure wear rings to bowls to prevent rotation using an interference fit and anaerobic adhesive, pins, or set screws, depending on impeller size.

J. Suction Case:
1. The diameter of the suction case is to be at least the same diameter as the bowl assembly and designed for a maximum entrance velocity of 7 fps.
2. The contour between the outer edge and the impeller suction eye shall be smooth, continuous, and bell shaped.
3. The pump shall be equipped with a suction bearing, provide a streamlined bearing housing with rigid cast vanes supporting and centering the suction bearing central hub below the first stage impeller. The bearing housing and vanes shall be designed to conduct the flow efficiently into the impeller eye.

K. Discharge Column Pipe:
1. Size and wall thickness as noted in Table above for "Pump Size Limitations"
2. Furnish in interchangeable sections of maximum nominal 10-foot lengths.
3. To ensure proper alignment of the bearing retainers when assembled, the ends of each fabricated section are to be machined parallel so that the ends will butt. Stress relieve sections prior to machining.
4. Furnish column pipes 12-inches and larger with flanged end connections. Column joints are to be butted to insure perfect column alignment after assembly. Column flanges shall be sized in order to fit within the well casing.
5. Column friction losses are not to exceed five feet of head per 100 feet of length, at pump's rated capacity. Well Pump #3 column friction losses can allow up to 8fps. Maximum flow velocity
   a. 15 fps for Well Pump #3

b. 10 fps for Well Pumps #4, 5, 7, and 8

6. Provide lifting lugs with lifting eyes 180 degrees apart below each column flanged connection for pump removal.
7. All column hardware shall be 316 stainless steel. Flange, bolt, and o-ring design shall be determined by the pump manufacturer based on the pump shut off head.
8. Flange thickness/OD shall be designed and confirmed by pump manufacturer to be rated for application while fitting in existing casing diameter per 2.1.C.

2.5 PUMP ACCESSORIES AND APPURTENANCES

3

A. Lubrication System:
   1. Open Lineshaft Pumps: For all pumps with a setting depth greater than 30 feet, furnish a pre-lubrication system **in accordance with details provided in Contract Drawings.**
   2. Contractor is responsible for providing the pre-lubrication system. Pump manufacturer will confirm capacity requirements.

B. Provide each pump with the following accessories. Reference Section 40 05 93 – Well Pump Motors for detailed requirements.
   1. Stainless Steel Nameplates:
      a. Attached to the pump and drive motor giving the manufacturer's model and serial number, rated capacity, head, speed, and all pertinent data.
      b. Mount pump nameplate at an accessible location between three and five feet above the pump soleplate.
   2. Coupling Guard: All metal construction (stainless steel) hinged to discharge head with lockable clasp. The guard is to be OSHA approved.
   3. Lifting lugs on motor and pump to facilitate maintenance activities.
   4. Bolting and Anchorage: Provide bolting materials per the Table above in paragraph for "Specific Materials of Construction".

2.6 ELECTRIC MOTORS

A. General: Unless specifically modified herein, furnish vertical hollow shaft motors meeting the requirements of Section 40 05 93 – Well Pump Motors.

B. Specific Motor Requirements

Pump ID:	Well Pump #3	Well Pumps #4, #5, #7, #8
Motor Type:	Induction	Induction
Shaft Type:	Hollow	Hollow
Motor Hp:	200	200
Nominal Speed, (rpm):	1,800	1,200
Voltage – Frequency – Phase:	4160V, 3ph, 60 Hz	4160V, 3ph, 60 Hz
Enclosure Type:	TEFC	TEFC
Ambient Temperature Rating:	50 C	50 C
Insulation:	F	F
Service Factor (sinewave power):	1.15	1.15
Space Heater:	Y	Y
Thermal Protection		
Motor Winding RTDs:	Y	Y
Bearing RTDs:	Y	Y

2.7 CONTROLS AND ACCESSORIES

A. When noted above in "Pump Construction" table or "Specific Motor Requirements" table, provide the following control sensors in accordance with specification Section 40 05 93 – Well Pump Motors:
   1. Motor Sensors:
      a. Stator RTDs
      b. Motor bearing RTDs

B. Non-Reverse Ratchet: To prevent motor from back-spinning due to large column of water above rotating assembly during shutdown.

C. Pre-lubrication System:

   1. Lubricate open lineshaft pump bearings by a manual system. System shall consist of an adequately sized liquid supply line, gate shutoff valve, and pre-lubrication piping. Pre-lubrication piping shall connect liquid supply to pump pre-lubricating liquid inlet. Opening shutoff valve shall supply pre-lubrication liquid to open lineshaft bearings. Pump shall be started after lineshaft bearings are sufficiently wetted. Refer to SAWS Detail DD-902-01 and Contract Drawings.

2.8 TOOLS, SPARE PARTS, AND MAINTENANCE MATERIALS

A. Furnish the following spare parts for each size/model of pump(s) furnished:

1. One (1) seal packing set per pump.
2. One (1) set of gaskets and O-ring seals.
3. One (1) set of wear rings (impeller and casing).
4. One (1) shaft sleeve.
5. Confirm One (1) complete set of bearings.
6. One (1) blind flange for pump discharge head (to allow for future maintenance)
7. One set of special tools required for normal maintenance or operation.

2.9 SURFACE PREPARATION AND PAINTING

A. Pumps, motor, drive, and appurtenances shall receive shop primer and shop finish coating conforming to requirements of Section 09 91 00, Painting.

B. Surface preparation and painting shall conform to the requirements of Section 09 91 00, Painting. The interior surfaces of the pump, suction case and discharge column pipes, and the interior surfaces of the pump head shall be cleaned with a Near White Metal Sandblast (SSPC SP 10). Number of coatings and coatings thickness shall be as recommended by coating system manufacturer for the intended application.

C. All gears, bearing surfaces, machined surfaces and other surfaces which are to remain unpainted shall receive a heavy application of grease or other rust-resistant coating. This coating shall be maintained during storage and until the equipment is placed into operation.

D. CONTRACTOR shall certify, in writing, that the shop primer and shop finish coating system conforms to the requirements of Section 09 91 00, Painting.

2.10 FACTORY WITNESS TESTING

A. Pump columns and discharge heads shall be hydrostatically tested to twice the discharge head or one and a half times the shutoff head, whichever is greater. Pump bowl shall be hydrostatically tested to twice the discharge head or one and a half times the shutoff head, whichever is greater. Hydrostatic tests are unwitnessed.

B. Perform Hydraulic Performance Testing Grade: 1U in accordance with ANSI/HI-14.6

C. Manufacturer shall be responsible for all expenses associated with Witnessed Factory Testing for two (2) representatives of the OWNER and one (1) representative of the ENGINEER. Witnessed Factory Testing not completed in a single week shall have at least one week break before resuming. Expenses shall include, but are not limited to, all expenses associated with airfare, lodging, meals, transportation, and incidentals. Expenses shall be reimbursed by CONTRACTOR directly to OWNER and ENGINEER for a minimum of one full day (8 hours) of witness testing and shall be included in the price of

CONTRACTOR's bid.

D. Pumps shall not be shipped until the ENGINEER has approved the test reports.

PART 3 – EXECUTION

3.1 WELL LOG – WELLS

A. While existing well pumps have been removed from Well Nos. 3, 4, and 5, and prior to installation of the new well pumps, CONTRACTOR shall perform a color video logging, 4-arm caliper log, and deviation inclination gyroscopic survey of the well casing, for each of the three wells. Bail out any oil in the well, if present, prior to the video-logging run. Run fresh water into the well for at least 24 hours prior to the run. Only perform video-logging run at least 48 hours after pump removal. Color video log shall be GeoCAM or Engineer-approved equal. Provide digital copies of each video-logging run.

3.2 INSTALLATION – WELL PUMPS

A. Wells Nos. 3, 4, 5, 7, and 8 at Artesia Pump Station are suspect to operate under artesian conditions. CONTRACTOR shall plan for and exercise procedures for control of the wells as required such that it is not in a flowing condition during pump installation procedures.
   1. Drilling fluid management and best management practices for capture of sediment from water discharge.
   2. Control fluids plan including materials and weighting fluids proposed, estimated quantities, rheologic properties, and equipment proposed for controlling the flow of the well.

B. Pump supplier is responsible for field assembly and installation of well pumps. Pump supplier must supply licensed well installer for duration of the field assembly/installation. Contractor shall not source their own independent well installer. Well pump field requirements shall include but are not limited to the following:
   1. Surface plate level inspection
   2. Field assembly, alignment, and installation of well pumps.
   3. Start up and training.

C. Installation shall include furnishing and applying an initial supply of grease and oil, recommended by the manufacturer and NSF-61 certified.

D. Support piping independent of pump.

E. Check and align pump, motor, and shafting.

3.3 DISINFECTION

A. The well pump(s) shall be disinfected by CONTRACTOR conforming to AWWA requirements. To disinfect the pumps, CONTRACTOR shall use a sodium hypochlorite solution to provide a minimum 100 parts per million (ppm) of available chlorine concentration.

B. After introduction of the disinfectant, the solution shall be thoroughly mixed in the well. The solution shall remain in the well for at least 24 hours during which time the well shall be surged at two-hour intervals. If the chlorine residual in the water supply after 24 hours is found to be less than 10 ppm, additional sodium hypochlorite shall be added as directed by ENGINEER.

C. CONTRACTOR shall be responsible for obtaining proper disinfection as determined by the bacteriological tests made by the OWNER. If additional disinfection is required, CONTRACTOR shall repeat the above disinfection procedures until satisfactory bacteriological samples are obtained.

3.4 START-UP AND FIELD TESTING

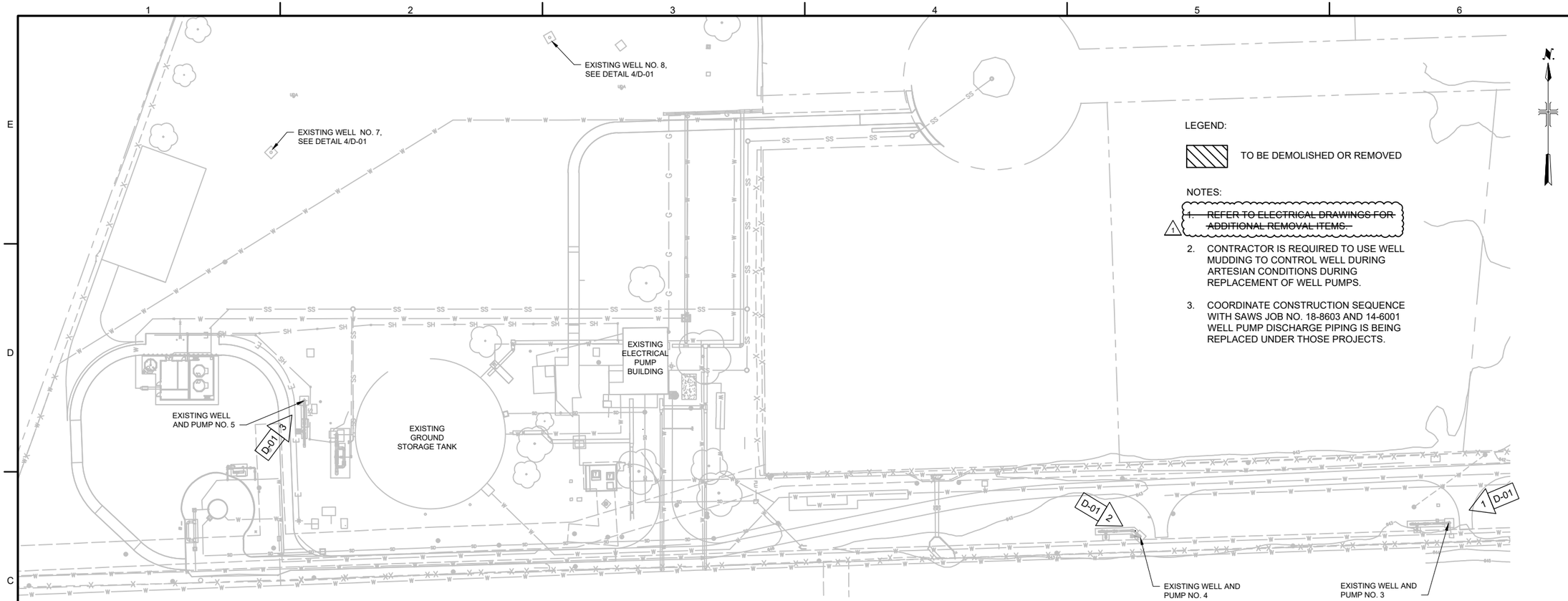
A. A factory trained representative shall be provided for installation supervision, start-up and test services and operation and maintenance personnel training services. Field services are to include the following site visits for each pump supplied:

Service	**Number of Trips**	**Number of Days/Trip**
Pre-grout surface plate level inspection	1	1
Post-grout surface plate level inspection	1	1
Installation and Testing	3	2
Startup and Training	1	2
Services after Startup	1	1

B. Manufacturer's representative shall test operate the system in the presence of the ENGINEER and verify that the equipment conforms to the requirements. Representative shall revisit the Site as often as necessary until all trouble is corrected and the installation is entirely satisfactory.

C. All costs, including travel, lodging, meals and incidentals, for additional visits shall be at no additional cost to the OWNER.

+ + END OF SECTION + +



SITE PLAN

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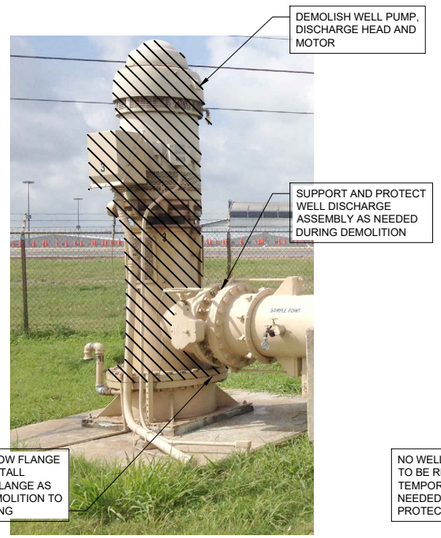
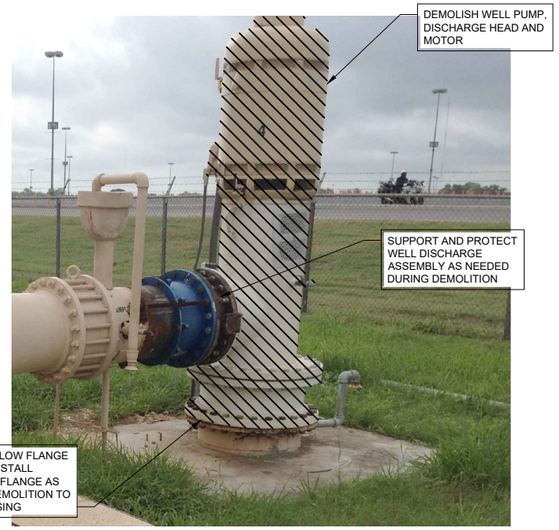
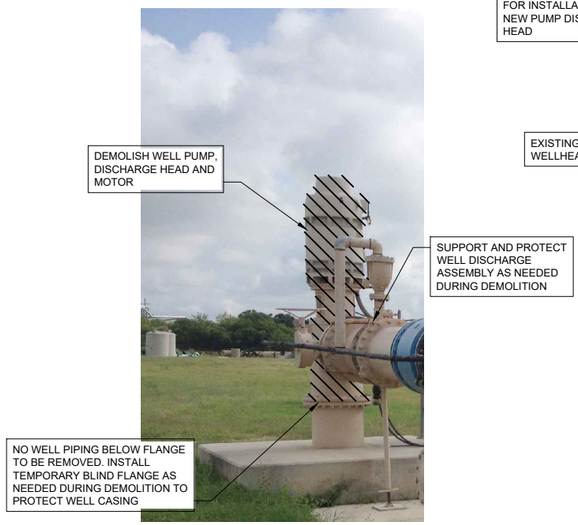


1 D-01 EXISTING WELL NO. 3



2 D-01 EXISTING WELL NO. 4



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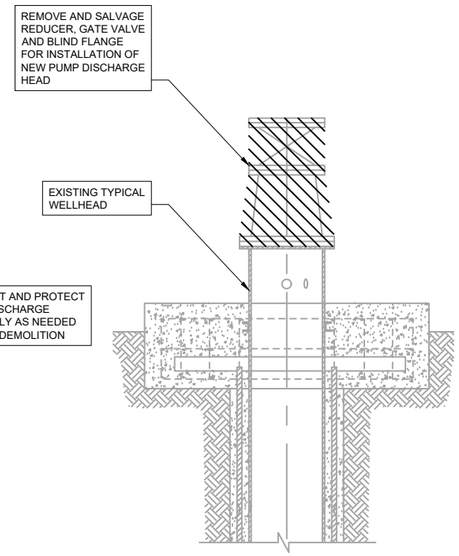


4 D-01 TYPICAL WELL HEADWORKS DETAIL

ARCADIS

ARCADIS U.S., INC.
TBPE FIRM REGISTRATION NO.: F-533

SEALS:

SEALS:

STATE OF TEXAS
PRAVEEN B. KRISHNA
102176
LICENSED
PROFESSIONAL ENGINEER
4/15/2024

SAN ANTONIO WATER SYSTEM

San Antonio Water System

ARTESIA PUMP STATION
WELL PUMPS, MOTORS, AND PIPING PROJECT

REVISIONS

NO.	DATE	ISSUED FOR	BY
1	4/15/2024	ADDENDUM NO. 3	AM

STATUS: BID SET

ARCADIS PROJECT NO.: 30065933
DATE: MARCH 2024
DESIGNED BY: A. MUSIL
DRAWN BY: N.CANDELAS
CHECKED BY: P.KRISHNA

SHEET TITLE:

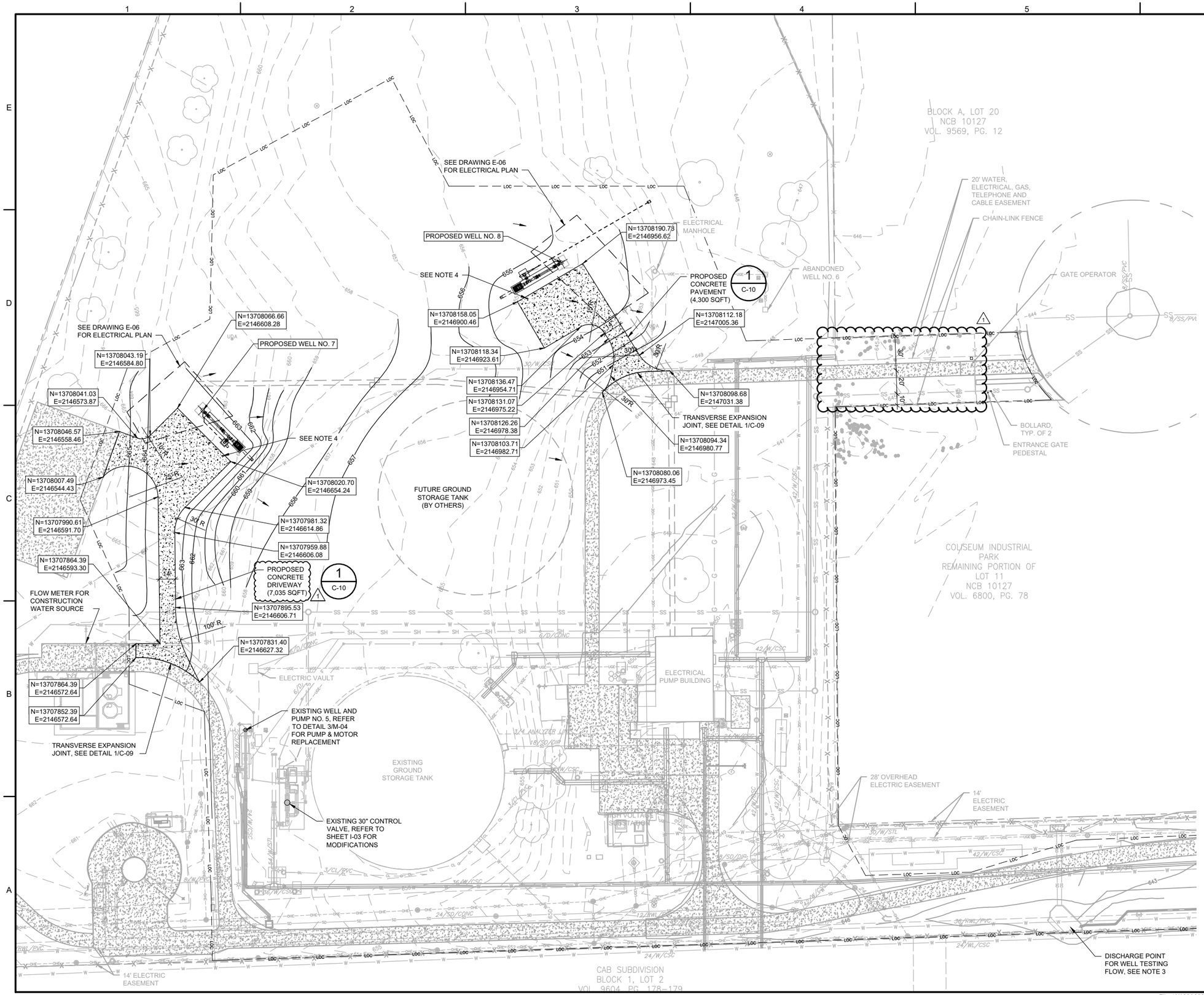
DEMOLITION

DEMOLITION DETAILS

SCALE: AS SHOWN
0" 1" BAR IS ONE INCH ON UNREDUCED DRAWING

DRAWING NO.: D-01
SHEET NO.: 5 OF 55

File: W:\30065933-SAWS\2-SHEETS\03-D-DEMOLITION\30065933-D-01 Date: 4/15/2024 10:04 AM Last Saved By: NCANDELAS



LEGEND:

- EXISTING ASPHALT
- EXISTING CONCRETE
- PROPOSED CONCRETE

NOTES:

1. CONTRACTOR SHALL VERIFY THE DEPTH OF ALL UTILITIES THAT NEW ROADWAY CROSSES PRIOR TO SUBMISSION OF PAVING PLAN. CONTRACTOR SHALL NOTE ANY LOCATIONS IN WHICH EXISTING UTILITIES ARE EXPECTED TO CONFLICT WITH ROADWAY AND/OR ROADWAY BASE.
2. CROSS SLOPE OF ROADWAY SHALL NOT EXCEED 4% AND SHALL NOT BE LESS THAN 1%.
3. FILTER OR SETTLE WATER IN ACCORDANCE WITH CITY OF SAN ANTONIO TEMPORARY EROSION, SEDIMENT & WATER POLLUTION CONTROL MEASURE STANDARDS. NOTIFY AUTHORITIES PRIOR TO DISCHARGE.
4. BOLLARDS (TYP. OF 7) SPACED 8' ON CENTER REFER TO SAWS DETAIL DD-903-20.

ARCADIS
ARCADIS U.S., INC.
TBPE FIRM REGISTRATION NO.: F-533

SEALS:

SEALS:

STATE OF TEXAS
PRAVEEN B. KRISHNA
102176
LICENSED PROFESSIONAL ENGINEER
4/15/2024

SAN ANTONIO WATER SYSTEM

San Antonio Water System

ARTESIA PUMP STATION
WELL PUMPS, MOTORS, AND PIPING PROJECT

REVISIONS			
NO.	DATE	ISSUED FOR	BY
1	4/15/2024	ADDENDUM NO. 3	AM

STATUS: BID SET

ARCADIS PROJECT NO.: 30065933
DATE: MARCH 2024
DESIGNED BY: A. MUSIL
DRAWN BY: N.CANDELAS
CHECKED BY: P.KRISHNA

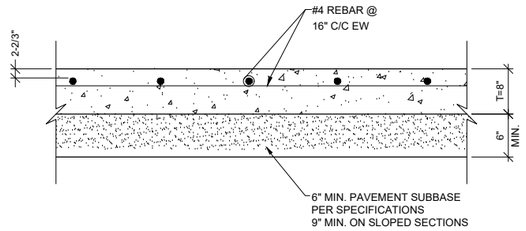
SHEET TITLE:

CIVIL

PAVING AND GRADING SITE PLAN

SCALE: AS SHOWN
0 1" BAR IS ONE INCH ON UNREDUCED DRAWING

DRAWING NO.: C-03
SHEET NO.: 8 OF 55

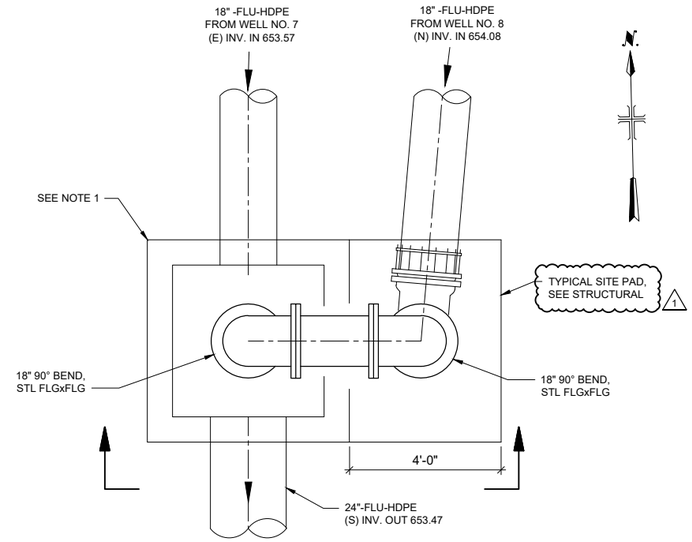


NOTES:

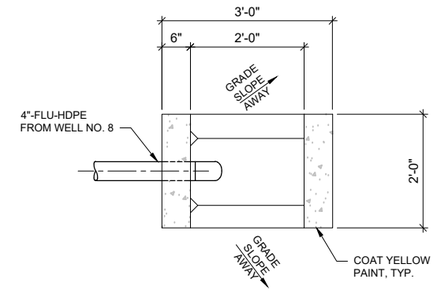
1. CONSTRUCTION JOINT DOWELS - SPACED AT 12-INCHES O.C. LUBRICATED BOTH SIDES AT MID DEPTH. FIRST DOWEL TO BE PLACED BETWEEN 3" TO 9" FROM EDGE OF PAVEMENT.
2. CONTROL JOINT DEPTH - 2½" FROM TOP.
3. CONCRETE SHALL BE CLASS "A" CONCRETE PER SECTION 32 13 13.
4. FOLLOW CURING PRACTICES IN ACCORDANCE WITH SPECIFICATIONS.
5. DOWEL DIAMETER - 7/8".
6. DOWEL LENGTH - 14".
7. MAXIMUM CONTROL JOINT SPACING - 15 FEET.
8. ALL JOINTS SHALL BE SEALED WITH SILICONE JOINT SEALANT DOW CORNING 888 OR APPROVED EQUAL.
9. DOWELS ARE REQUIRED AT ALL TRANSVERSE JOINTS UNLESS OTHERWISE NOTED ON PLANS.
10. CONTRACTOR TO PROVIDE PROPOSED LOCATIONS FOR CONCRETE JOINTS IN ALL DRIVEWAYS.

1 C-10 TYPICAL CONCRETE ROADWAY DETAIL

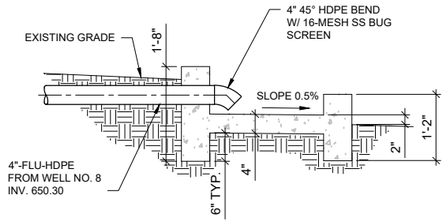
N.T.S.



PLAN



PLAN

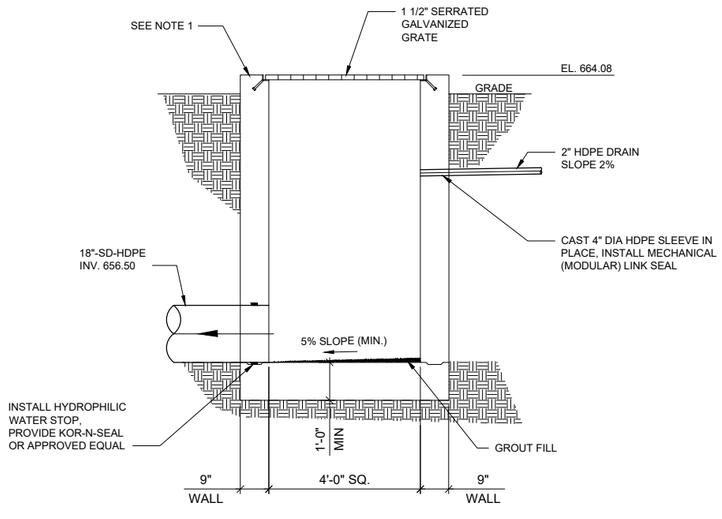


SECTION

4 C-10 WELL NO. 8 BLOW OFF SPILLWAY

0 1' 2' 3'

SCALE IN FEET



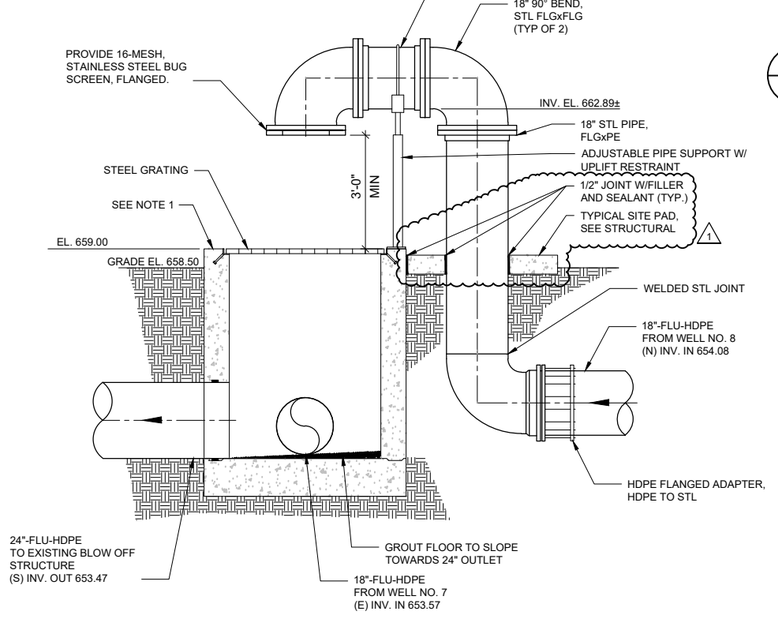
NOTE:

1. PRECAST CONCRETE VAULT. SUBMIT SIGNED AND SEALED SHOP DRAWINGS AND CALCULATIONS TO ENGINEER FOR APPROVAL BEFORE CASTING.

2 C-10 CATCH BASIN STRUCTURE DETAIL

0 1' 2' 4'

SCALE IN FEET



SECTION

PIPING ORIENTATION
SHOWN FOR CLARITY

NOTES:

1. PRECAST CONCRETE VAULT. SUBMIT SIGNED AND SEALED SHOP DRAWINGS AND CALCULATIONS TO ENGINEER FOR APPROVAL BEFORE CASTING.

3 C-10 WELLS NO. 7 & 8 BLOW OFF STRUCTURE

0 1' 2' 4'

SCALE IN FEET

ARCADIS

ARCADIS U.S., INC.
TBPE FIRM REGISTRATION NO.: F-533

SEALS:

SEALS:

STATE OF TEXAS
PRAVEEN B. KRISHNA
102176
LICENSED
PROFESSIONAL ENGINEER
4/15/2024

SAN ANTONIO
WATER SYSTEM

San Antonio Water System

ARTESIA PUMP STATION
WELL PUMPS, MOTORS, AND
PIPING PROJECT

REVISIONS

NO.	DATE	ISSUED FOR	BY
1	4/15/2024	ADDENDUM NO. 3	AM

STATUS:
BID SET

ARCADIS PROJECT NO.: 30065933
DATE: MARCH 2024
DESIGNED BY: A. MUSIL
DRAWN BY: N.CANDELAS
CHECKED BY: P.KRISHNA

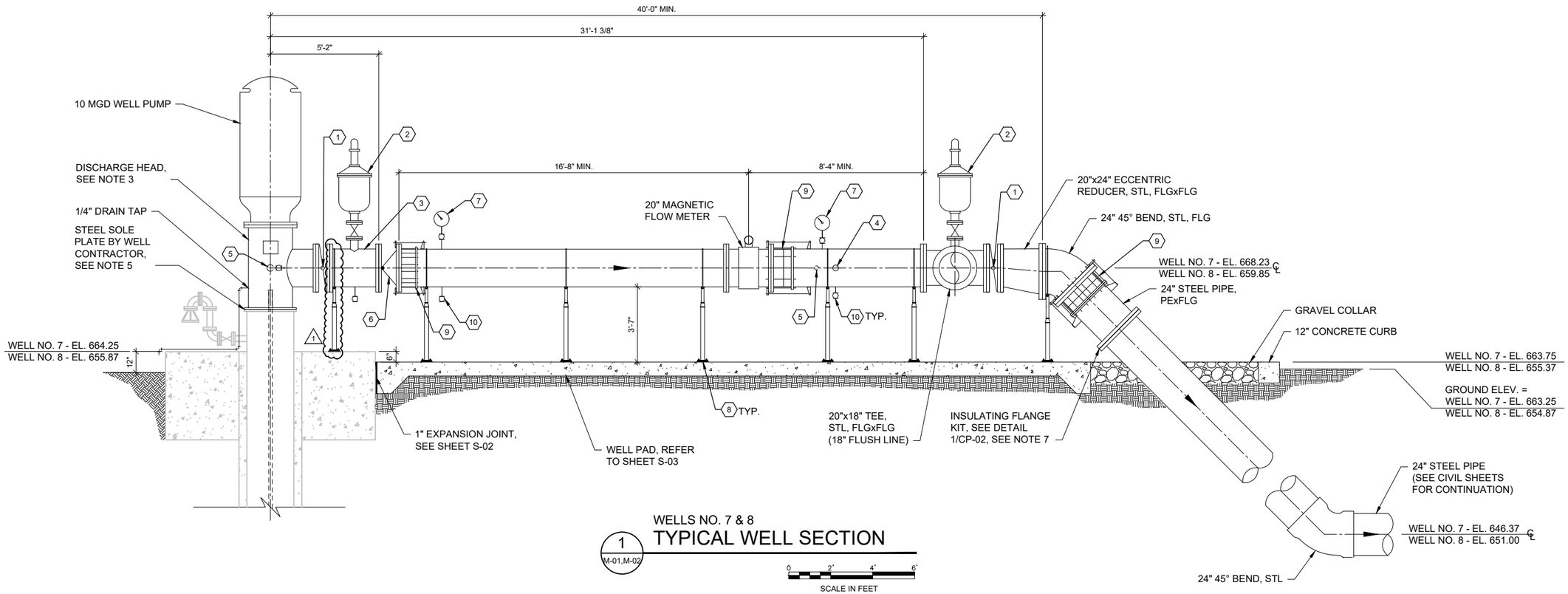
SHEET TITLE:

CIVIL

DETAILS II

SCALE: AS SHOWN
0 BAR IS ONE INCH ON UNREDUCED DRAWING

DRAWING NO.: C-10
SHEET NO.: 15 OF 55

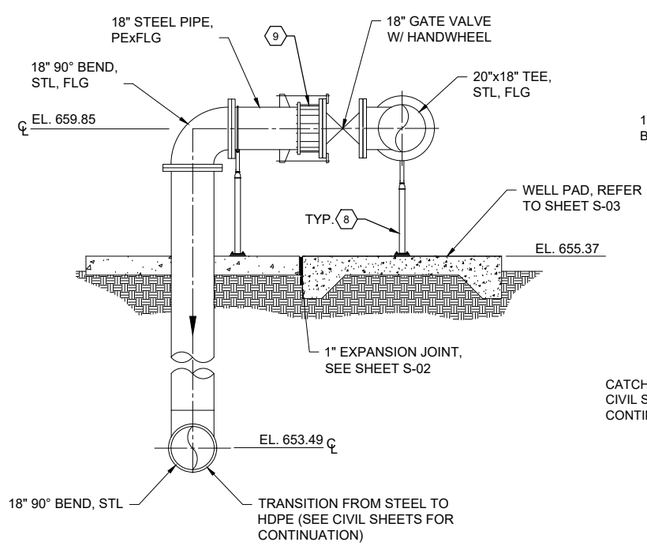


1 M-01,M-02

WELLS NO. 7 & 8

TYPICAL WELL SECTION

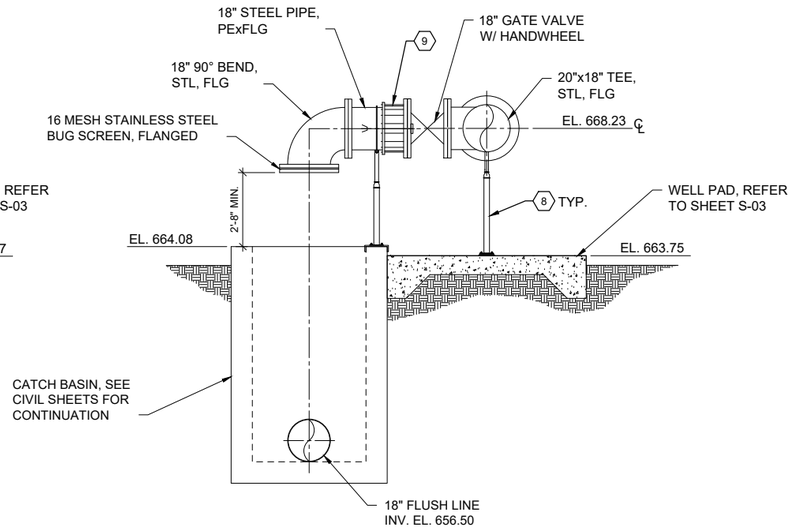
SCALE IN FEET



2 M-02

WELL NO. 8 SECTION

SCALE IN FEET



3 M-01

WELL NO. 7 SECTION

SCALE IN FEET

KEYNOTES " (X) "

1. 20" BUTTERFLY VALVE W/ HANDWHEEL, FLG.
2. 4" COMBINATION AIR VALVE, SEE DETAIL 2/M-06.
3. 20"x20"x2" TEE, STL, FLGxFLG
4. 3/4" SAMPLE TAP, REFER TO SAWS DETAIL DD-901-03.
5. BEARING PRELUBE WATER LINE, SEE DETAIL 1/M-06.
6. 20" DUAL PLATE WAFER STYLE CHECK VALVE.
7. PRESSURE GAUGE, SEE DETAIL 2/M-07.
8. PROVIDE MIN. NUMBER OF ADJUSTABLE PIPE SUPPORTS SHOWN. SEE DETAIL 1/M-08 AND 2/M-08 ADD ADDITIONAL SUPPORTS IF NECESSARY TO LIMIT MAX. SPACING TO 10'-0".
9. RESTRAINED FLANGED COUPLING ADAPTER, REFER TO SAWS DETAIL DD-902-02.
10. 2" DRAIN TAP W/ BALL VALVE, REFER TO SAWS DETAIL DD-901-03.

NOTES:

1. ALL BURIED PIPING SHALL BE RESTRAINED WITH RESTRAINED JOINTS.
2. SEE SPECIFICATIONS FOR PIPE SUPPORT SPACING REQUIREMENTS.
3. CENTERLINE ELEVATION OF WELL DISCHARGE PIPING TO BE BASED ON WELL HEAD ELEVATIONS AND DIMENSIONS SHOWN AND TYPE OF WELL PUMP DISCHARGE HEAD PROVIDED.
4. INSULATE ALL PIPING SMALLER THAN 4 INCHES IN ACCORDANCE WITH SPECIFICATIONS.
5. WELL CONTRACTOR SHALL PROVIDE 316SS ANCHOR BOLTS AND PUMP HEAD ANCHOR SCREENS AS REQUIRED TO COMPLETE THE WORK.
6. PAINT ALL EXPOSED PIPING BOTH NEW AND EXISTING IN ACCORDANCE WITH SPECIFICATIONS.
7. CATHODIC PROTECTION FOR BURIED PIPE WILL BE PROVIDED UNDER SEPARATE PROJECT, SAWS JOB NO. 18-8603. COORDINATE WITH SAWS AS REQUIRED.
8. DISCHARGE HEAD SHALL HAVE TWO (2) 1 1/2" PORTS FOR ADDITIONAL CONDUITS, FOR PRESSURE TRANSDUCER AND MANUAL MEASURING PORT.

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ARCADIS PROJECT NO.: 30065933
DATE: MARCH 2024
DESIGNED BY: A. MUSIL
DRAWN BY: N.CANDELAS
CHECKED BY: P.KRISHNA

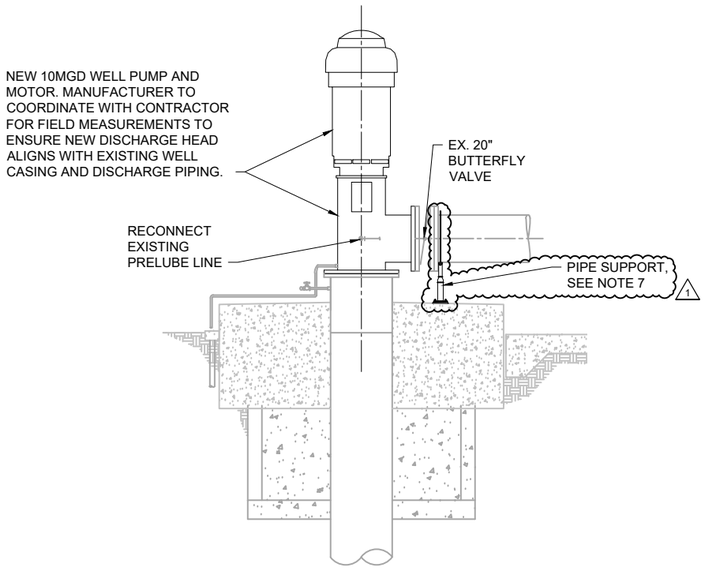
SHEET TITLE:

MECHANICAL

WELL NO. 7 & 8 SECTION

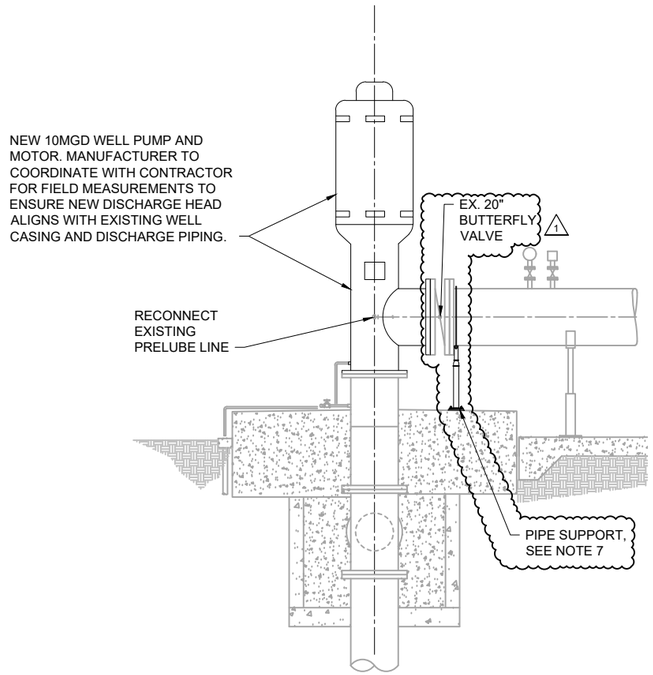
SCALE: AS SHOWN
BAR IS ONE INCH ON UNREDUCED DRAWING

DRAWING NO.: M-03
SHEET NO.: 20 OF 55



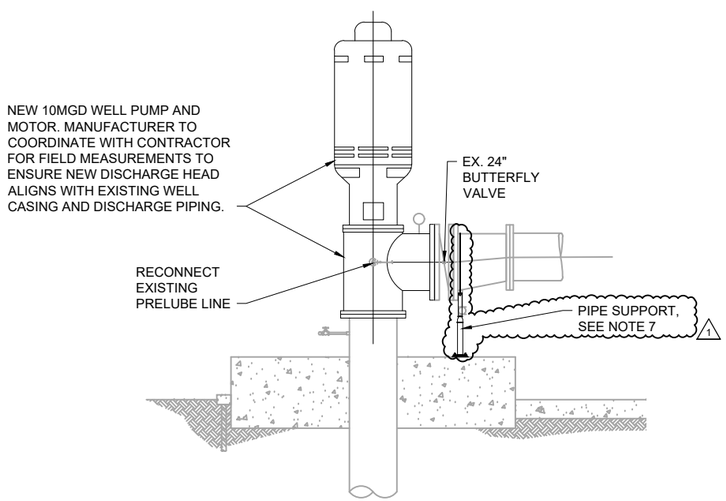
1 M-04 WELL NO. 3 DETAIL

0 2' 4' 6'
SCALE IN FEET



2 M-04 WELL NO. 4 DETAIL

0 2' 4' 6'
SCALE IN FEET



3 M-04 WELL NO. 5 DETAIL

0 2' 4' 6'
SCALE IN FEET

NOTES:

1. CENTERLINE ELEVATION OF WELL HEADS TO BE BASED ON WELL HEAD DISCHARGE PIPING ELEVATIONS. CONTRACTOR TO FIELD VERIFY ELEVATIONS AND COORDINATE WITH MANUFACTURER PRIOR TO ORDERING PUMPS.
2. THE CONTRACTOR SHALL COORDINATE THE CENTERLINE DISCHARGE ELEVATION BY FIELD MEASURING THE EXISTING HEAD AND PIPING PRIOR TO FABRICATION. IN THE EVENT THE SUPPLIED DISCHARGE HEAD AND THE STEEL PIPE ARE MISALIGNED, THE CONTRACTOR SHALL MODIFY THE EXISTING STEEL PIPE BY EXCAVATING TO EXPOSE THE BURIED 45-DEG BEND AND CUTTING THE PIPE BELOW GRADE. CONTRACTOR SHALL ADD OR REMOVE LENGTH AS NECESSARY TO MODIFY AS-BUILD PIPE ELEVATION WITHOUT ADDITIONAL COST. ALL PIPE JOINTS SHALL BE IN ACCORDANCE WITH DETAILS ON C-09. STEEL PIPE AND ANY MODIFICATIONS SHALL BE IN ACCORDANCE WITH SPECIFICATIONS.
3. INSULATE ALL PIPING SMALLER THAN 4 INCHES IN ACCORDANCE WITH SPECIFICATIONS.
4. PROVIDE 316SS ANCHOR BOLTS AND PUMP HEAD ANCHOR SCREENS AS REQUIRED TO COMPLETE THE WORK.
5. PAINT ALL EXPOSED PIPING BOTH NEW AND EXISTING IN ACCORDANCE WITH SPECIFICATIONS.
6. DISCHARGE HEAD SHALL HAVE TWO (2) 1 1/2" PORTS FOR ADDITIONAL CONDUITS, FOR PRESSURE TRANSDUCER AND MANUAL MEASURING PORT.
7. CONTRACTOR SHALL FIELD LOCATE THE PIPE SUPPORTS. CONTRACTOR TO INCLUDE A PIPE SUPPORT AT THE EXISTING BUTTERFLY VALVES AS REQUIRED BY PUMP MANUFACTURER.

ARCADIS
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SEALS:

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WELL PUMPS, MOTORS, AND PIPING PROJECT

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STATUS:
BID SET

ARCADIS PROJECT NO.: 30065933
DATE: MARCH 2024
DESIGNED BY: A. MUSIL
DRAWN BY: N.CANDELAS
CHECKED BY: P.KRISHNA

SHEET TITLE:
MECHANICAL

WELL NO. 3, 4 & 5
INSTALLATION OF
PUMPS AND MOTORS
DETAILS

SCALE: AS SHOWN
0 1
BAR IS ONE INCH ON UNREDUCED DRAWING

DRAWING NO.: M-04
SHEET NO.: 21 OF 55

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GENERAL

1. IT IS SOLELY THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE ERECTION PROCEDURE AND SEQUENCE TO ENSURE THE SAFETY OF THE STRUCTURE AND ITS COMPONENT PARTS DURING ERECTION. THIS INCLUDES, BUT IS NOT LIMITED TO, THE ADDITION OF WHATEVER TEMPORARY BRACING, GUYS OR TIE-DOWNS MAY BE NECESSARY. SUCH MATERIAL SHALL BE REMOVED AND SHALL REMAIN THE PROPERTY OF THE CONTRACTOR AFTER COMPLETION OF THE PROJECT.
2. DESIGN IS IN ACCORDANCE WITH AND CONSTRUCTION SHALL COMPLY WITH THE PROVISIONS OF 2021 INTERNATIONAL BUILDING CODE, EXCEPT WHERE OTHER APPLICABLE CODES AND THE CONTRACT DOCUMENTS ARE MORE RESTRICTIVE.
3. FACILITIES HAVE BEEN DESIGNED FOR DESIGN LOADS SHOWN OR SPECIFIED. THE CONTRACTOR SHALL BE RESPONSIBLE FOR FACILITIES SUBJECT TO CONSTRUCTION LOADS EXCEEDING THE DESIGN LOADS AND SHALL NOTIFY THE ENGINEER OF ANY SUCH ADDITIONAL LOADS.
4. ALL DIMENSIONS AND ELEVATIONS NOTED THUS (*) ON THE DRAWINGS SHALL BE VERIFIED BY CONTRACTOR IN THE FIELD OR WITH THE EQUIPMENT MANUFACTURER APPROVED SHOP DRAWINGS PRIOR TO FABRICATION. NOTIFY ENGINEER IN WRITING OF DEVIATIONS FROM WHAT IS SHOWN ON THE CONTRACT DRAWINGS.
5. CONTRACTOR SHALL SUBMIT FOR REVIEW AND APPROVAL SHOP DRAWINGS AND PRODUCT DATA, INCLUDING CONCRETE LABORATORY TEST REPORTS FOR MATERIALS AND MIXES, STEEL REINFORCING MATERIALS, BENDING AND FABRICATING, PIER INSTALLATION PROCEDURES, REPORTS OF FIELD TESTING, ETC.
6. EQUIPMENT ANCHOR BOLTS SIZES, TYPES AND PATTERN SHALL BE AS REQUIRED BY APPROVED EQUIPMENT MANUFACTURER. ALL BOLT PATTERNS SHALL BE TEMPLATED TO ENSURE ACCURACY OF PLACEMENT.
7. ALL EQUIPMENT SHALL BE PROPERLY ANCHORED INTO THE CONCRETE FOUNDATION SLAB TO MEET ALL APPLICABLE LOADS PER CODE. EQUIPMENT CONNECTION TO CONCRETE FOUNDATION SHALL BE BY CONTRACTOR. CONTRACTOR SHALL PROVIDE SHOP DRAWINGS AND CALCULATIONS SIGNED AND SEALED BY A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF TEXAS.
8. STRUCTURAL DRAWINGS SHALL BE USED IN COORDINATION WITH DRAWINGS OF ALL OTHER DISCIPLINES AND MANUFACTURER'S SHOP DRAWINGS.
9. DESIGN LOAD: BASED ON 2021 INTERNATIONAL BUILDING CODE WITH LOCAL AMENDMENTS.
   - RISK CATEGORY = III
   WIND DESIGN DATA:
   - ULTIMATE DESIGN WIND SPEED = 120 MPH
   - WIND EXPOSURE = C
   EARTHQUAKE DESIGN DATA:
   - SPECTRAL RESPONSE
     ACCELERATION, (Ss) = 0.051
     ACCELERATION, (S1) = 0.023
   - SITE CLASS = D
   - DESIGN SPECTRAL RESPONSE
     SEISMIC COEFFICIENT, (SDS) = 0.054
     SEISMIC COEFFICIENT, (SD1) = 0.037
   - SEISMIC DESIGN CATEGORY = A
   - ANALYSIS PROCEDURE = ASCE 7-16, SECTION 12.8

FOUNDATIONS

1. CONTRACTOR SHALL BECOME FAMILIAR WITH THE SURVEY ~~AND SUBSURFACE~~ INVESTIGATION REPORT BEFORE BEGINNING CONSTRUCTION.
2. ~~NOTIFY ENGINEER AS SOON AS POSSIBLE OF ANY UNUSUAL SOIL CONDITIONS OR SOIL CONDITIONS IN VARIANCE WITH TEST BORINGS SUCH AS UNEXPECTED SEEPAGE WATER, MATERIALS OR SOIL OF QUESTIONABLE BEARING CAPACITY.~~
3. FOUNDATION PREPARATION SHALL FOLLOW THE REQUIREMENTS OF DETAIL 1 ON SHEET S-06.
4. SET FOUNDATIONS AT ELEVATIONS SHOWN. THE CONTRACTOR SHALL VERIFY WITH THE ENGINEER THAT EACH FOOTING PLACED IS BEARING ON DESIGN MATERIAL.
5. ALLOWABLE BEARING PRESSURE: 2500 PSF
6. PROTECT EXCAVATION FROM FLOODING UNTIL ALL WALL AND FLOORS FRAMING UP TO AND INCLUDING GRADE LEVEL FLOORS ARE IN PLACE AND BACKFILLING HAS BEGUN. WATER LEVEL SHALL BE MAINTAINED BELOW EXCAVATION AT ALL TIMES.
7. ~~FOR FOUNDATION SUBGRADE PREPARATION, REFER TO GEOTECHNICAL REPORT BY ARIAS NO. 2017-157, DATED AUGUST, 2017.~~
8. ASSUME ALLOWABLE SOIL BEARING PRESSURE: 1500 PSF. CONTRACTOR SHALL HIRE A GEOTECHNICAL ENGINEER TO VERIFY THE ASSUMED SOIL BEARING PRESSURE. PROVIDE SIGNED AND SEALED LETTER BY GEOTECHNICAL ENGINEER REGISTERED IN THE STATE OF TEXAS CONFIRMING THE ASSUMED BEARING CAPACITY AND CERTIFYING THAT THE EXCAVATION IS CAPABLE OF SUPPORTING THE NEW STRUCTURES SHOWN ON THE DRAWINGS. △1

CAST-IN-PLACE CONCRETE

1. CONCRETE SHALL BE PROPORTIONED TO HAVE A 4,500 PSI MINIMUM COMPRESSIVE STRENGTH AT 28 DAYS WITH 5% TO 7% AIR ENTRAINMENT AND PORTLAND CEMENT: ASTM C150, TYPE I/II. W/C RATIO SHALL BE 0.42. CEMENTITIOUS MATERIAL SHALL BE FLY ASH PER ASTM C618 CLASS F OR SLAG PER ASTM C989 GRADE 120, 25% MAX CONTENT BY WEIGHT.
2. CONCRETE WORK SHALL BE IN ACCORDANCE WITH "THE BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE" ACI 318. TOLERANCES SHALL BE IN ACCORDANCE WITH ACI 347, SECTION 3.3.1, TOLERANCES FOR REINFORCED CONCRETE BUILDINGS.
3. ALL REINFORCING STEEL SHALL BE NEW DOMESTIC DEFORMED BILLET STEEL CONFORMING TO ASTM A-615 GRADE 60.
4. ALL REINFORCING DETAILS SHALL CONFORM TO "DETAILS AND DETAILING OF CONCRETE REINFORCEMENT", ACI 315, UNLESS DETAILED OTHERWISE ON THE STRUCTURAL DRAWINGS.
5. CONTRACTOR SHALL PROVIDE 3/4 INCH CHAMFER USING WOOD CHAMFER STRIPS ON ALL EXPOSED CORNERS.
6. COVER FOR REINFORCING STEEL SHALL CONFORM TO THE FOLLOWING:
   TYPICAL REINFORCING BAR COVER TABLE
   CONCRETE CAST AGAINST EARTH . . . . . 3"
   ALL OTHER SURFACES . . . . . 2"
7. WELDING OF REINFORCING STEEL IS NOT ALLOWED.
8. PROVIDE STANDARD REINFORCING LAPS PLACING BARS IN CONTACT AND TYING TIGHTLY WITH WIRE. COMPLY WITH THE REQUIREMENTS FOR MINIMUM LAPS IN ACCORDANCE WITH ACI 318.
9. CALCIUM CHLORIDE SHALL NOT BE PERMITTED NOR SHALL ANY ADMIXTURE CONTAINING CALCIUM CHLORIDE BE PERMITTED THAT RESULTS IN A TOTAL CONCRETE MIX IN WHICH THE PRESENCE OF CHLORIDE IONS EXCEED 0.10 PERCENT BY WEIGHT OF CEMENT.
10. ALUMINUM PIPE SHALL NOT BE USED WITH CONCRETE PUMPS.
11. DOWEL, ANCHORS, BOLTS, PIPES AND OTHER EMBEDDED ITEMS SHALL HELD SECURELY IN POSITION WHEN CONCRETE IS BEING PLACED.

STATEMENT OF SPECIAL INSPECTIONS

1. OWNER SHALL EMPLOY ONE OR MORE SPECIAL INSPECTORS TO PROVIDE INSPECTION DURING CONSTRUCTION ON THE TYPES OF WORK LISTED BELOW. THE SPECIAL INSPECTION SHALL DEMONSTRATE COMPETENCE, TO THE SATISFACTION OF THE BUILDING OFFICIAL, FOR INSPECTION OF THE PARTICULAR TYPE OF CONSTRUCTION OF OPERATION.

2. STRUCTURAL STEEL
   A. SPECIAL INSPECTION OF STRUCTURAL STEEL SHALL BE IN ACCORDANCE WITH THE QUALITY ASSURANCE INSPECTION REQUIREMENT OF AISC 360

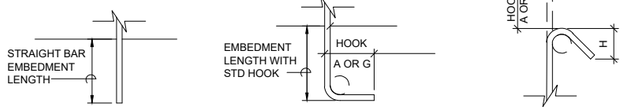
3. CONCRETE CONSTRUCTION
   A. PERIODIC INSPECTION OF REINFORCING STEEL AND PLACEMENT IN ACCORDANCE WITH IBC 2021 TABLE 1705.3, TASK 1.
   B. PERIODIC INSPECTION OF ANCHORS CAST IN CONCRETE IN ACCORDANCE WITH IBC 2021 TABLE 1705.3,TASK 3.
   C. CONTINUOUS INSPECTION OF ANCHORS POST-INSTALLED IN HARDENED CONCRETE MEMBERS IN ACCORDANCE WITH IBC 2021 TABLE 1705.3, TASK 4.
   D. PERIODIC VERIFICATION OF USE OF REQUIRED CONCRETE MIX IN ACCORDANCE WITH IBC 2021 TABLE 1705.3, TASK 5.
   E. PRIOR TO CONCRETE PLACEMENT, FABRICATE SPECIMENS FOR STRENGTH TESTS, PERFORM SLUMP & AIR CONTENT TESTS, AND DETERMINE THE TEMPERATURE OF THE CONCRETE IN ACCORDANCE WITH IBC 2021 TABLE 1705.3,TASK 6.
   F. CONTINUOUS INSPECTION OF SPECIMENS FABRICATION FOR TESTING IN ACCORDANCE WITH IBC 2021 TABLE 1705.3. TASK 6.
   G. CONTINUOUS INSPECTION OF CONCRETE PLACEMENT FOR PROPER APPLICATION TECHNIQUES IN ACCORDANCE WITH IBC 2021 TABLE 1705.3 TASK 7.
   H. PERIODIC INSPECTION FOR MAINTENANCE OF CURING TEMPERATURE AND TECHNIQUES IN ACCORDANCE WITH IBC 2021 TABLE 1705.3, TASK 8.
   I. PERIODIC INSPECTION OF FORM WORK FOR SHAPE , LOCATION AND DIMENSIONS IN ACCORDANCE WITH IBC 2021 TABLE 1705.3, TASK12.

4. SOILS
   A. PERIODIC VERIFICATION THAT MATERIALS BELOW SHALLOW FOUNDATIONS ARE ADEQUATE TO ACHIEVE DESIGN BEARING CAPACITY.
   B. PERIODIC VERIFICATION THAT EXCAVATIONS ARE EXTENDED TO PROPER DEPTH AND HAVE REACHED PROPER MATERIAL.
   C. PERIODIC CLASSIFICATION AND TESTING OF COMPACTED FILL MATERIALS.
   D. CONTINUOUS VERIFICATION OF PROPER MATERIALS, DENSITIES AND LIFT THICKNESS DURING PLACEMENT AND COMPACTION OF COMPACTED FILL.
   E. PRIOR TO PLACEMENT OF COMPACTED FILL, PERIODIC OBSERVATION OF SUBGRADE AND VERIFICATION THAT SITE IS PROPERLY PREPARED.

5. DESIGN STRENGTH OF MATERIALS
   A. MATERIALS SHALL BE SHOWN TO CONFORM TO APPLICABLE STANDARDS IN ACCORDANCE WITH SECTION 1706.1 OF THE IBC 2021 EDITION.

REINFORCEMENT LAP SPLICE, EMBEDMENT LENGTH AND STANDARD HOOKS (INCHES)

BAR SIZE	MIN LAP LENGTHS FOR				MIN EMBEDMENT LENGTHS					MIN STD. HOOKS		
	BEAMS AND COLUMNS* CLASS B		SLABS AND WALLS ** CLASS B		FOR BEAMS AND COLUMNS *		FOR SLABS AND WALLS **		WITH STD HOOKS	90°	135°	
	TOP***	OTHERS	TOP***	OTHERS	TOP***	OTHERS	TOP***	OTHERS		A OR G	A OR G	H
#3	25	19	16	16	19	15	12	12	5	6	4	2.5
#4	33	25	20	16	25	19	15	12	7	8	4.5	3
#5	41	31	25	19	31	24	19	15	9	10	5.5	3.75
#6	49	37	29	23	37	29	23	18	10	12	8	4.5
#7	71	54	43	33	54	42	33	25	12	14	9	5.25
#8	81	62	49	37	62	48	37	29	14	16	10.5	6
#9	91	70	60	46	70	54	46	36	15	19	-	-
#10	102	79	74	57	79	61	57	44	17	22	-	-
#11	114	87	89	69	87	67	68	53	19	24	-	-



STRAIGHT 90° HOOK 135° HOOK

NOTES:

REINFORCEMENT LAP SPLICE, EMBEDMENT LENGTH AND STANDARD HOOKS TABLE IS BASED ON A MINIMUM CONCRETE COMPRESSIVE STRENGTH OF 4000 PSI AND 60000 PSI REINFORCEMENT (WITH NO EPOXY COATING).

ALL LAP SPLICES SHALL BE CLASS B SPLICES.

* THE MINIMUM LAP LENGTH FOR BEAMS, COLUMNS, AND STRAIGHT EMBEDMENTS ARE BASED ON A 3 BAR DIAMETER MINIMUM CENTER TO CENTER BAR SPACING AND A 2 INCH BAR COVER. IF THE SPLICE AND/OR EMBEDMENT DOES NOT CONFORM TO THESE REQUIREMENTS, THEN CONTRACTOR SHALL APPLY APPROPRIATE FACTORS IN COMPLIANCE WITH ACI 318 WITH APPROVAL BY ENGINEER.

** THE MINIMUM LAP LENGTH FOR SLABS, WALLS, AND STRAIGHT EMBEDMENTS ARE BASED ON A 6 INCH BAR SPACING AND A 2 INCH BAR COVER. IF THE LAP CONDITION DOES NOTE CONFORM TO THESE REQUIREMENTS, THEN USE BEAM LAP LENGTHS; OR COMPLY WITH LAP REQUIREMENTS OF ACI 318 WITH APPROVAL BY ENGINEER.

*** TOP BARS ARE DEFINED AS ALL HORIZONTAL BARS, WITH 12" OR MORE FRESH CONCRETE BENEATH.

WHERE SPLICES ARE REQUIRED BETWEEN BARS OF DIFFERENT SIZES, THE LAP LENGTH SHALL BE NO LESS THAN THE EMBEDMENT LENGTH OF THE LARGER BAR OR THE LAP LENGTH OF THE SMALLER BAR, WHICHEVER IS GREATER.

ARCADIS U.S., INC.
TBPE FIRM REGISTRATION NO.: F-533

SEALS:

SEALS:

STATE OF TEXAS
HOUSAM HOBI
120887
LICENSED PROFESSIONAL ENGINEER

04/15/2024

SAN ANTONIO WATER SYSTEM

San Antonio Water System

ARTESIA PUMP STATION WELL PUMPS, MOTORS, AND PIPING PROJECT

REVISIONS

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1	4/15/2024	ADDENDUM NO. 3	SH

STATUS: BID SET

ARCADIS PROJECT NO.: 30065933
DATE: MARCH 2024
DESIGNED BY: H. HOBI
DRAWN BY: J. RAY/ D. OTAROLA
CHECKED BY: C. GALLO

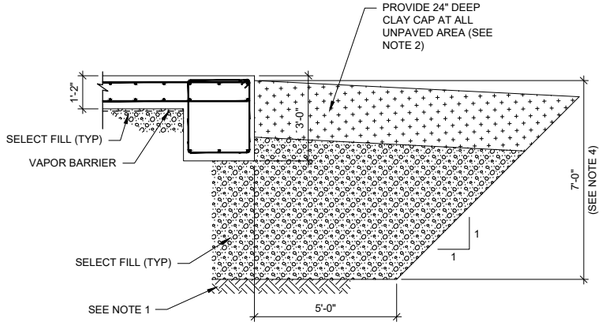
SHEET TITLE:

STRUCTURAL

STRUCTURAL GENERAL NOTES

SCALE: AS SHOWN
0 1
BAR IS ONE INCH ON UNREDUCED DRAWING

DRAWING NO.: S-01
SHEET NO.: 31 OF 55



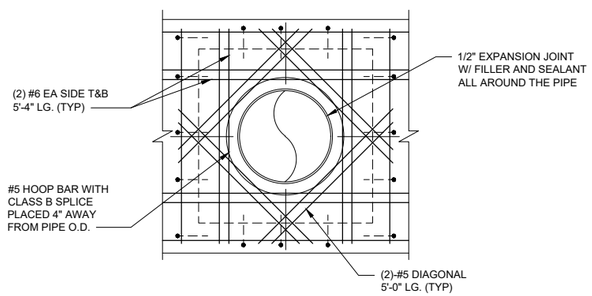
SLAB-ON-GRADE FOUNDATION PREPARATION DETAIL

1 / S-06

SCALE: 3/8" = 1'-0"

0 2' 4' 6'

NOTES:
1. SUBGRADE SHALL BE ROLLED, A MINIMUM OF 12-INCHES REMOVED. MOISTURE CONDITIONED AND COMPACTED. FOR ADDITIONAL SUBGRADE PREPARATION REQUIREMENTS. SEE SPECIFICATION SECTION 31 23 05.
2. CLAY CAP SHALL EXTEND 10'-0" HORIZONTALLY BEYOND PERIMETER OF FOUNDATION.
3. UNDERCUTTING SHALL EXTEND LATERALLY TO PROVIDE AT LEAST A 5'-0' OVERBUILD BEYOND STRUCTURE PERIMETER OR GREATER TO INCLUDE ADJACENT FLATWORK.
4. EXISTING SOIL SHALL BE REMOVED AT LEAST 7'-0" BELOW EXISTING GRADE.
5. PROVIDE A VAPOR BARRIER UNDER ALL STRUCTURAL SLABS.
6. CONTRACTOR SHALL INCLUDE EXTENT OF FOUNDATION PREPARATION IN EXCAVATION PLAN REQUIRED AS IN SPECIFICATION SECTION 31 23 05.

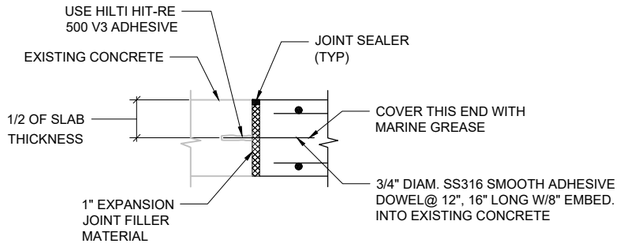


PIPE PENETRATION REINFORCEMENT DETAIL

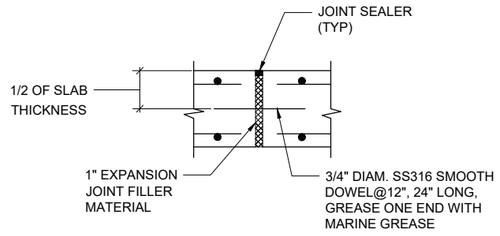
2 / S-06

SCALE: NOT TO SCALE

NOTES:
1. PROVIDE ADDITIONAL REINFORCING AT ALL PIPE PENETRATIONS. EQUAL IN AREA TO TYPICAL REINFORCING CUT BY OPENING IN EACH DIRECTION. ADDITIONAL REINFORCING TO MATCH SIZE OF TYPICAL REINFORCING (MIN 2 BARS ES AND EF) AND PLACED BETWEEN TYPICAL REINFORCING @3" SPACING ON EACH SIDE OF OPENING.



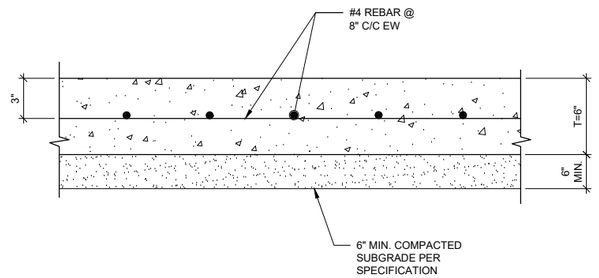
EXPANSION JOINT AT EXISTING CONCRETE



EXPANSION JOINT AT NEW CONCRETE

TYPICAL EXPANSION JOINT DETAIL

NOT TO SCALE



TYPICAL SITE PAD DETAIL

NOT TO SCALE

NOTES:
1. REFER TO CIVIL DRAWINGS FOR LOCATION AND SIZE OF PAD.
2. PROVIDE #4 DIAGONAL BARS AROUND OPENINGS IN PAD.

1

ARCADIS

ARCADIS U.S., INC.
TBPE FIRM REGISTRATION NO.: F-533

SEALS:

SEALS:

STATE OF TEXAS
HOUSAM HOBI
120887
LICENSED
PROFESSIONAL ENGINEER

04/15/2024

SAN ANTONIO WATER SYSTEM

San Antonio Water System

ARTESIA PUMP STATION
WELL PUMPS, MOTORS, AND PIPING PROJECT

REVISIONS			
NO.	DATE	ISSUED FOR	BY
1	4/15/2024	ADDENDUM NO. 3	SH

STATUS: BID SET

ARCADIS PROJECT NO.: 30065933
DATE: MARCH 2024
DESIGNED BY: H. HOBI
DRAWN BY: J. RAY/ D. OTAROLA
CHECKED BY: C. GALLO

SHEET TITLE:

STRUCTURAL

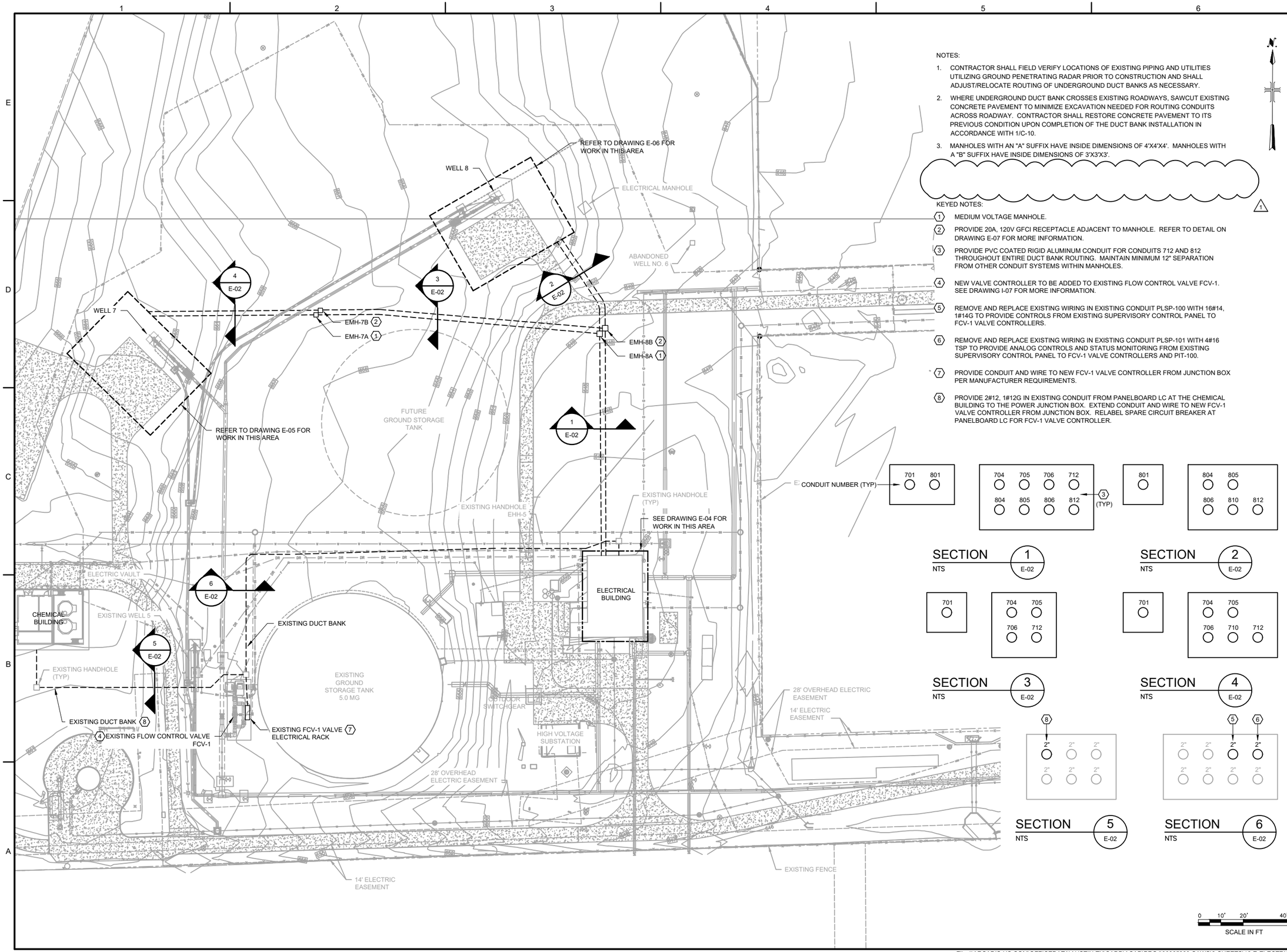
TYPICAL DETAILS

SCALE: AS SHOWN

0 1 BAR IS ONE INCH ON UNREDUCED DRAWING

DRAWING NO.: S-06

SHEET NO.: 36 OF 55



NOTES:

1. CONTRACTOR SHALL FIELD VERIFY LOCATIONS OF EXISTING PIPING AND UTILITIES UTILIZING GROUND PENETRATING RADAR PRIOR TO CONSTRUCTION AND SHALL ADJUST/RELOCATE ROUTING OF UNDERGROUND DUCT BANKS AS NECESSARY.
2. WHERE UNDERGROUND DUCT BANK CROSSES EXISTING ROADWAYS, SAWCUT EXISTING CONCRETE PAVEMENT TO MINIMIZE EXCAVATION NEEDED FOR ROUTING CONDUITS ACROSS ROADWAY. CONTRACTOR SHALL RESTORE CONCRETE PAVEMENT TO ITS PREVIOUS CONDITION UPON COMPLETION OF THE DUCT BANK INSTALLATION IN ACCORDANCE WITH 1/C-10.
3. MANHOLES WITH AN "A" SUFFIX HAVE INSIDE DIMENSIONS OF 4'X4'X4'. MANHOLES WITH A "B" SUFFIX HAVE INSIDE DIMENSIONS OF 3'X3'X3'.

KEYED NOTES:

1. MEDIUM VOLTAGE MANHOLE.
2. PROVIDE 20A, 120V GFCI RECEPTACLE ADJACENT TO MANHOLE. REFER TO DETAIL ON DRAWING E-07 FOR MORE INFORMATION.
3. PROVIDE PVC COATED RIGID ALUMINUM CONDUIT FOR CONDUITS 712 AND 812 THROUGHOUT ENTIRE DUCT BANK ROUTING. MAINTAIN MINIMUM 12" SEPARATION FROM OTHER CONDUIT SYSTEMS WITHIN MANHOLES.
4. NEW VALVE CONTROLLER TO BE ADDED TO EXISTING FLOW CONTROL VALVE FCV-1. SEE DRAWING I-07 FOR MORE INFORMATION.
5. REMOVE AND REPLACE EXISTING WIRING IN EXISTING CONDUIT PLSP-100 WITH 16#14, 1#14G TO PROVIDE CONTROLS FROM EXISTING SUPERVISORY CONTROL PANEL TO FCV-1 VALVE CONTROLLERS.
6. REMOVE AND REPLACE EXISTING WIRING IN EXISTING CONDUIT PLSP-101 WITH 4#16 TSP TO PROVIDE ANALOG CONTROLS AND STATUS MONITORING FROM EXISTING SUPERVISORY CONTROL PANEL TO FCV-1 VALVE CONTROLLERS AND PIT-100.
7. PROVIDE CONDUIT AND WIRE TO NEW FCV-1 VALVE CONTROLLER FROM JUNCTION BOX PER MANUFACTURER REQUIREMENTS.
8. PROVIDE 2#12, 1#12G IN EXISTING CONDUIT FROM PANELBOARD LC AT THE CHEMICAL BUILDING TO THE POWER JUNCTION BOX. EXTEND CONDUIT AND WIRE TO NEW FCV-1 VALVE CONTROLLER FROM JUNCTION BOX. RELABEL SPARE CIRCUIT BREAKER AT PANELBOARD LC FOR FCV-1 VALVE CONTROLLER.

ARCADIS

ARCADIS U.S., INC.
TBPE FIRM REGISTRATION NO.: F-533

SEALS:

SEALS:

STATE OF TEXAS
BRIAN E. YOUNG
118600
LICENSED
PROFESSIONAL ENGINEER
4/15/24

SAN ANTONIO WATER SYSTEM

San Antonio Water System

ARTESIA PUMP STATION
WELL PUMPS, MOTORS, AND PIPING PROJECT

REVISIONS			
NO.	DATE	ISSUED FOR	BY
1	4/9/2024	ADDENDUM NO. 3	BY

STATUS: BID SET

ARCADIS PROJECT NO.:	30065933
DATE:	MARCH 2024
DESIGNED BY:	B. YOUNG
DRAWN BY:	H. WALTERS
CHECKED BY:	J. SOKOL

SHEET TITLE:

ELECTRICAL

ELECTRICAL SITE PLAN

SCALE: NONE

BAR IS ONE INCH ON UNREDUCED DRAWING

DRAWING NO.: E-02

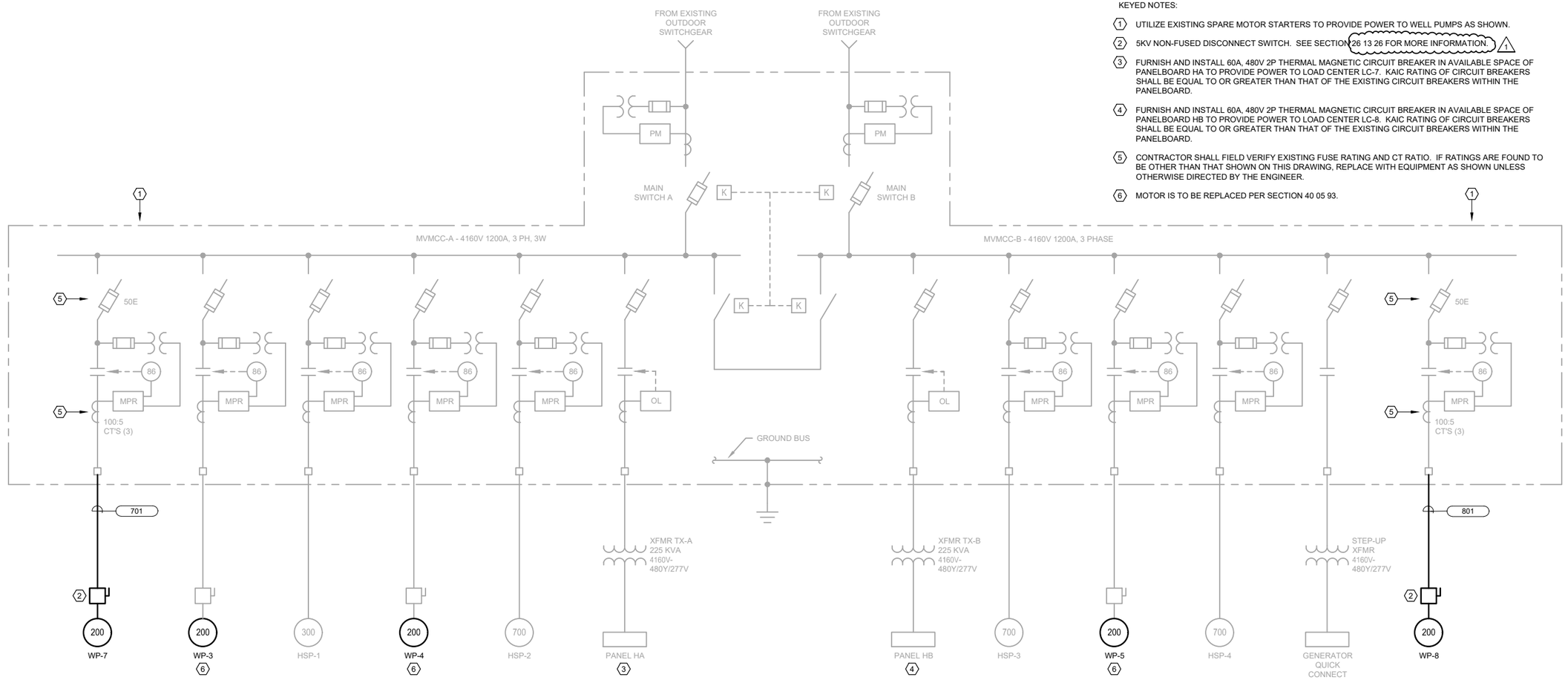
SHEET NO.: 38 OF 55

NOTES:

1. POWER FACTOR CORRECTION CAPACITORS (PFCC'S) SHALL BE PROVIDED FOR WP-7 AND WP-8 AT EACH MOTOR AND AS SHOWN ON THE MOTOR CONTROL SCHEMATIC. PFCC'S SHALL BE SIZED BY THE MOTOR MANUFACTURER.

KEYED NOTES:

1. UTILIZE EXISTING SPARE MOTOR STARTERS TO PROVIDE POWER TO WELL PUMPS AS SHOWN.
2. 5KV NON-FUSED DISCONNECT SWITCH. SEE SECTION 26 13 26 FOR MORE INFORMATION. (1)
3. FURNISH AND INSTALL 60A, 480V 2P THERMAL MAGNETIC CIRCUIT BREAKER IN AVAILABLE SPACE OF PANELBOARD HA TO PROVIDE POWER TO LOAD CENTER LC-7. KAIC RATING OF CIRCUIT BREAKERS SHALL BE EQUAL TO OR GREATER THAN THAT OF THE EXISTING CIRCUIT BREAKERS WITHIN THE PANELBOARD.
4. FURNISH AND INSTALL 60A, 480V 2P THERMAL MAGNETIC CIRCUIT BREAKER IN AVAILABLE SPACE OF PANELBOARD HB TO PROVIDE POWER TO LOAD CENTER LC-8. KAIC RATING OF CIRCUIT BREAKERS SHALL BE EQUAL TO OR GREATER THAN THAT OF THE EXISTING CIRCUIT BREAKERS WITHIN THE PANELBOARD.
5. CONTRACTOR SHALL FIELD VERIFY EXISTING FUSE RATING AND CT RATIO. IF RATINGS ARE FOUND TO BE OTHER THAN THAT SHOWN ON THIS DRAWING, REPLACE WITH EQUIPMENT AS SHOWN UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
6. MOTOR IS TO BE REPLACED PER SECTION 40 05 93.



EXISTING MVMCC-A/B ONE-LINE DIAGRAM

SPACE	HSP-1 MOTOR STARTER	HSP-2 MOTOR STARTER	PRIMARY METER	TRANSITION SECTION	MAIN A LOAD BREAK SWITCH	TIE A LOAD BREAK SWITCH	TRANSITION SECTION	TIE B LOAD BREAK SWITCH	MAIN B LOAD BREAK SWITCH	TRANSITION SECTION	PRIMARY METER	HSP-3 MOTOR STARTER	HSP-4 MOTOR STARTER	SPACE
WP-7 MOTOR STARTER (1)	WP-3 MOTOR STARTER	WP-4 MOTOR STARTER	TRANSFORMER TX-A								TRANSFORMER TX-B	WP-5 MOTOR STARTER	GENERATOR QUICK CONNECT	WP-8 MOTOR STARTER (1)

EXISTING MVMCC-A/B ELEVATION

MVMCC-A/B 4160V LOAD SUMMARY

LOAD DESCRIPTION	KVA	HP	AMP
WELL PUMP WP-7		200	25
WELL PUMP WP-3		200	25
HIGH SERVICE PUMP HSP-1		300	37
WELL PUMP WP-4		200	25
HIGH SERVICE PUMP HSP-2		700	86
XFMR TX-A	95		13
XFMR TX-B	53		7
HIGH SERVICE PUMP HSP-3		700	86
WELL PUMP WP-5		200	25
HIGH SERVICE PUMP HSP-4		700	86
WELL PUMP WP-8		200	25
TOTAL CONNECTED LOAD	**3171**		**441**

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STATE OF TEXAS
BRIAN E. YOUNG
118600
LICENSED
PROFESSIONAL ENGINEER
4/15/24

SAN ANTONIO WATER SYSTEM

San Antonio Water System

ARTESIA PUMP STATION
WELL PUMPS, MOTORS, AND PIPING PROJECT

REVISIONS

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STATUS: BID SET

ARCADIS PROJECT NO.: 30065933
DATE: MARCH 2024
DESIGNED BY: B. YOUNG
DRAWN BY: H. WALTERS
CHECKED BY: J. SOKOL

SHEET TITLE:

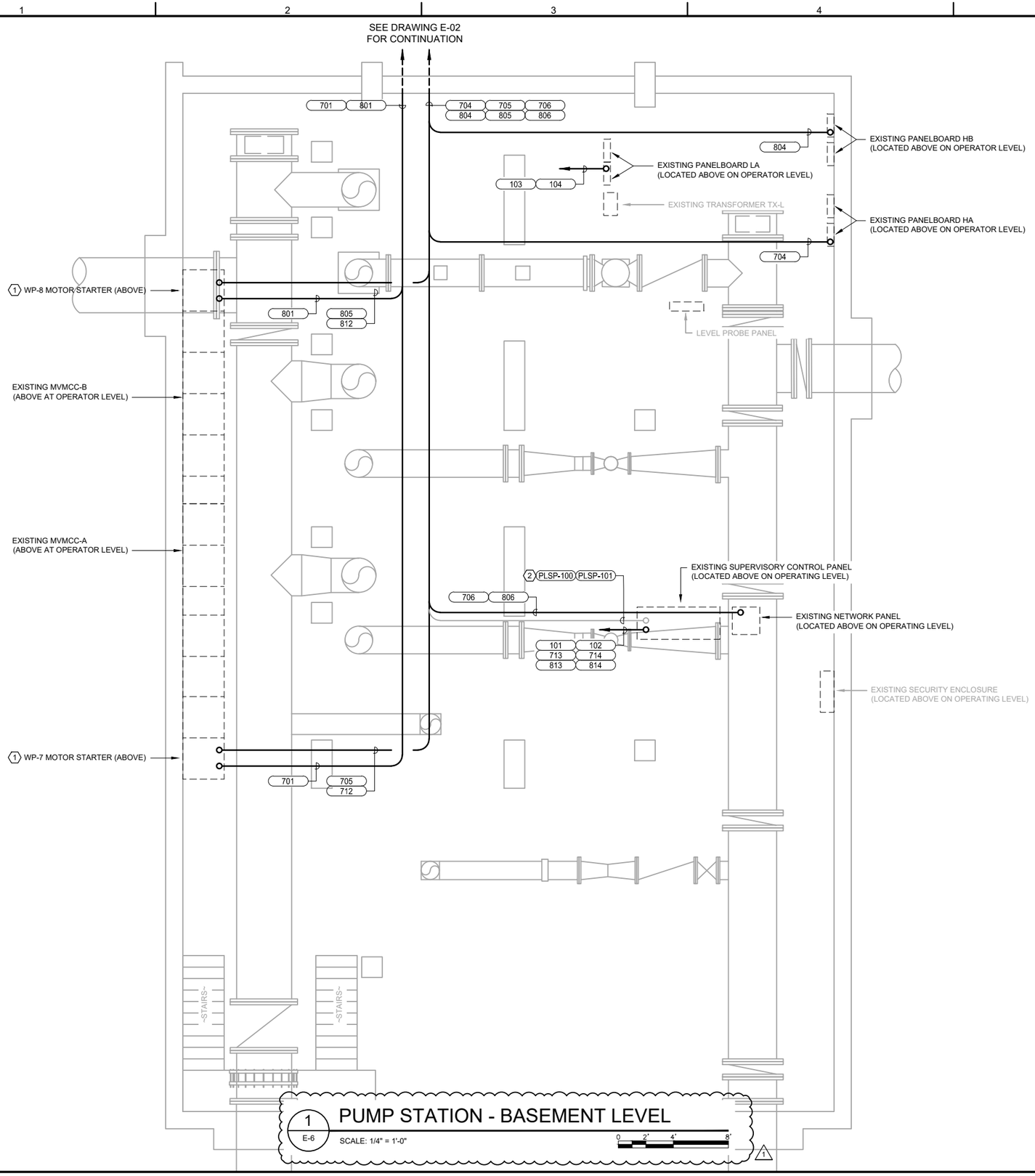
ELECTRICAL

MVMCC-A/B
ONE-LINE DIAGRAM

SCALE: NONE

0 1
BAR IS ONE INCH ON UNREDUCED DRAWING

DRAWING NO.: E-03
SHEET NO.: 39 OF 55



NOTES:

1. CORE DRILL THROUGH OPERATING LEVEL FLOOR TO TRANSITION CONDUITS TO EQUIPMENT. EXTEND CONDUITS THROUGH CORED HOLES AND SEAL ANNULAR SPACE BETWEEN CONCRETE WALL AND CONDUITS WITH NON-SHRINK EPOXY GROUT. REFER TO ELECTRICAL DETAILS FOR MORE INFORMATION.
2. CONDUITS ARE ROUTED EXPOSED THROUGHOUT BASEMENT. REFER TO ELECTRICAL DETAILS FOR CONDUIT SUPPORT INFORMATION. ROUTE CONDUITS AS HIGH AS POSSIBLE ABOVE BASEMENT FLOOR, PIPING, ETC.

KEYED NOTES:

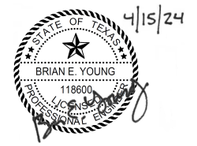
1. EXTEND CONDUIT TO MOTOR STARTER ENCLOSURE ABOVE AND TERMINATE WIRING PER WELL PUMP CONTROL SCHEMATIC.
2. EXISTING CONDUITS PLSP-100 AND PLSP-101 TO BE RE-USED TO PROVIDE CONTROLS TO FLOW CONTROL VALVE FCV-1 CONTROLLERS.

ARCADIS

ARCADIS U.S., INC.
TBPE FIRM REGISTRATION NO.: F-533

SEALS:

SEALS:



SAN ANTONIO
WATER SYSTEM

San Antonio Water System

ARTESIA PUMP STATION
WELL PUMPS, MOTORS, AND
PIPING PROJECT

REVISIONS

NO.	DATE	ISSUED FOR	BY
1	4/9/2024	ADDENDUM NO. 3	BY

STATUS: BID SET

ARCADIS PROJECT NO.: 30065933
DATE: MARCH 2024
DESIGNED BY: B. YOUNG
DRAWN BY: H. WALTERS
CHECKED BY: J. SOKOL

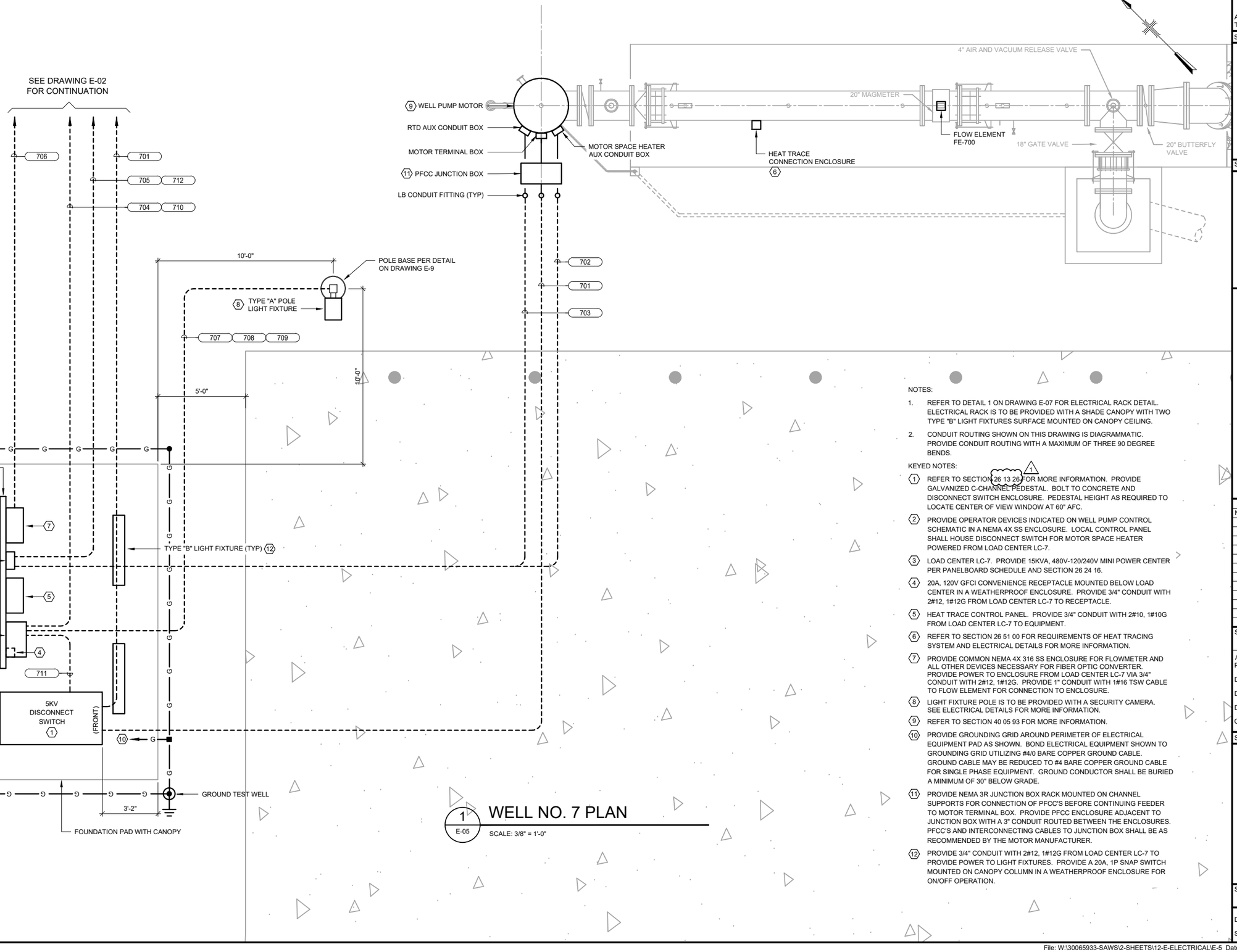
SHEET TITLE:

ELECTRICAL

PUMP STATION BUILDING
BASEMENT LEVEL
FLOOR PLAN

SCALE: 1/4" = 1'-0"
0
BAR IS ONE INCH ON UNREDUCED DRAWING

DRAWING NO.: E-04
SHEET NO.: 40 OF 55



1 E-05 WELL NO. 7 PLAN

SCALE: 3/8" = 1'-0"

NOTES:

1. REFER TO DETAIL 1 ON DRAWING E-07 FOR ELECTRICAL RACK DETAIL. ELECTRICAL RACK IS TO BE PROVIDED WITH A SHADE CANOPY WITH TWO TYPE "B" LIGHT FIXTURES SURFACE MOUNTED ON CANOPY CEILING.
2. CONDUIT ROUTING SHOWN ON THIS DRAWING IS DIAGRAMMATIC. PROVIDE CONDUIT ROUTING WITH A MAXIMUM OF THREE 90 DEGREE BENDS.

KEYED NOTES:

1. REFER TO SECTION 26 13 26 FOR MORE INFORMATION. PROVIDE GALVANIZED C-CHANNEL PEDESTAL. BOLT TO CONCRETE AND DISCONNECT SWITCH ENCLOSURE. PEDESTAL HEIGHT AS REQUIRED TO LOCATE CENTER OF VIEW WINDOW AT 60" AFC.
2. PROVIDE OPERATOR DEVICES INDICATED ON WELL PUMP CONTROL SCHEMATIC IN A NEMA 4X SS ENCLOSURE. LOCAL CONTROL PANEL SHALL HOUSE DISCONNECT SWITCH FOR MOTOR SPACE HEATER POWERED FROM LOAD CENTER LC-7.
3. LOAD CENTER LC-7. PROVIDE 15KVA, 480V-120/240V MINI POWER CENTER PER PANELBOARD SCHEDULE AND SECTION 26 24 16.
4. 20A, 120V GFCI CONVENIENCE RECEPTACLE MOUNTED BELOW LOAD CENTER IN A WEATHERPROOF ENCLOSURE. PROVIDE 3/4" CONDUIT WITH 2#12, 1#12G FROM LOAD CENTER LC-7 TO RECEPTACLE.
5. HEAT TRACE CONTROL PANEL. PROVIDE 3/4" CONDUIT WITH 2#10, 1#10G FROM LOAD CENTER LC-7 TO EQUIPMENT.
6. REFER TO SECTION 26 51 00 FOR REQUIREMENTS OF HEAT TRACING SYSTEM AND ELECTRICAL DETAILS FOR MORE INFORMATION.
7. PROVIDE COMMON NEMA 4X 316 SS ENCLOSURE FOR FLOWMETER AND ALL OTHER DEVICES NECESSARY FOR FIBER OPTIC CONVERTER. PROVIDE POWER TO ENCLOSURE FROM LOAD CENTER LC-7 VIA 3/4" CONDUIT WITH 2#12, 1#12G. PROVIDE 1" CONDUIT WITH 1#16 TSW CABLE TO FLOW ELEMENT FOR CONNECTION TO ENCLOSURE.
8. LIGHT FIXTURE POLE IS TO BE PROVIDED WITH A SECURITY CAMERA. SEE ELECTRICAL DETAILS FOR MORE INFORMATION.
9. REFER TO SECTION 40 05 93 FOR MORE INFORMATION.
10. PROVIDE GROUNDING GRID AROUND PERIMETER OF ELECTRICAL EQUIPMENT PAD AS SHOWN. BOND ELECTRICAL EQUIPMENT SHOWN TO GROUNDING GRID UTILIZING #4/0 BARE COPPER GROUND CABLE. GROUND CABLE MAY BE REDUCED TO #4 BARE COPPER GROUND CABLE FOR SINGLE PHASE EQUIPMENT. GROUND CONDUCTOR SHALL BE BURIED A MINIMUM OF 30" BELOW GRADE.
11. PROVIDE NEMA 3R JUNCTION BOX RACK MOUNTED ON CHANNEL SUPPORTS FOR CONNECTION OF PFCC'S BEFORE CONTINUING FEEDER TO MOTOR TERMINAL BOX. PROVIDE PFCC ENCLOSURE ADJACENT TO JUNCTION BOX WITH A 3" CONDUIT ROUTED BETWEEN THE ENCLOSURES. PFCC'S AND INTERCONNECTING CABLES TO JUNCTION BOX SHALL BE AS RECOMMENDED BY THE MOTOR MANUFACTURER.
12. PROVIDE 3/4" CONDUIT WITH 2#12, 1#12G FROM LOAD CENTER LC-7 TO PROVIDE POWER TO LIGHT FIXTURES. PROVIDE A 20A, 1P SNAP SWITCH MOUNTED ON CANOPY COLUMN IN A WEATHERPROOF ENCLOSURE FOR ON/OFF OPERATION.

ARCADIS

ARCADIS U.S., INC.
TBPE FIRM REGISTRATION NO.: F-533

SEALS:

SEALS:

STATE OF TEXAS
BRIAN E. YOUNG
118606
LICENSED PROFESSIONAL ENGINEER
4/15/24

SAN ANTONIO
WATER SYSTEM

San Antonio Water System

ARTESIA PUMP STATION
WELL PUMPS, MOTORS, AND
PIPING PROJECT

REVISIONS

NO.	DATE	ISSUED FOR	BY
1	4/9/2024	ADDENDUM NO. 3	BY

STATUS:

BID SET

ARCADIS PROJECT NO.: 30065933
DATE: MARCH 2024
DESIGNED BY: B. YOUNG
DRAWN BY: H. WALTERS
CHECKED BY: J. SOKOL

SHEET TITLE:

ELECTRICAL

WELL NO. 7
ELECTRICAL
PLAN

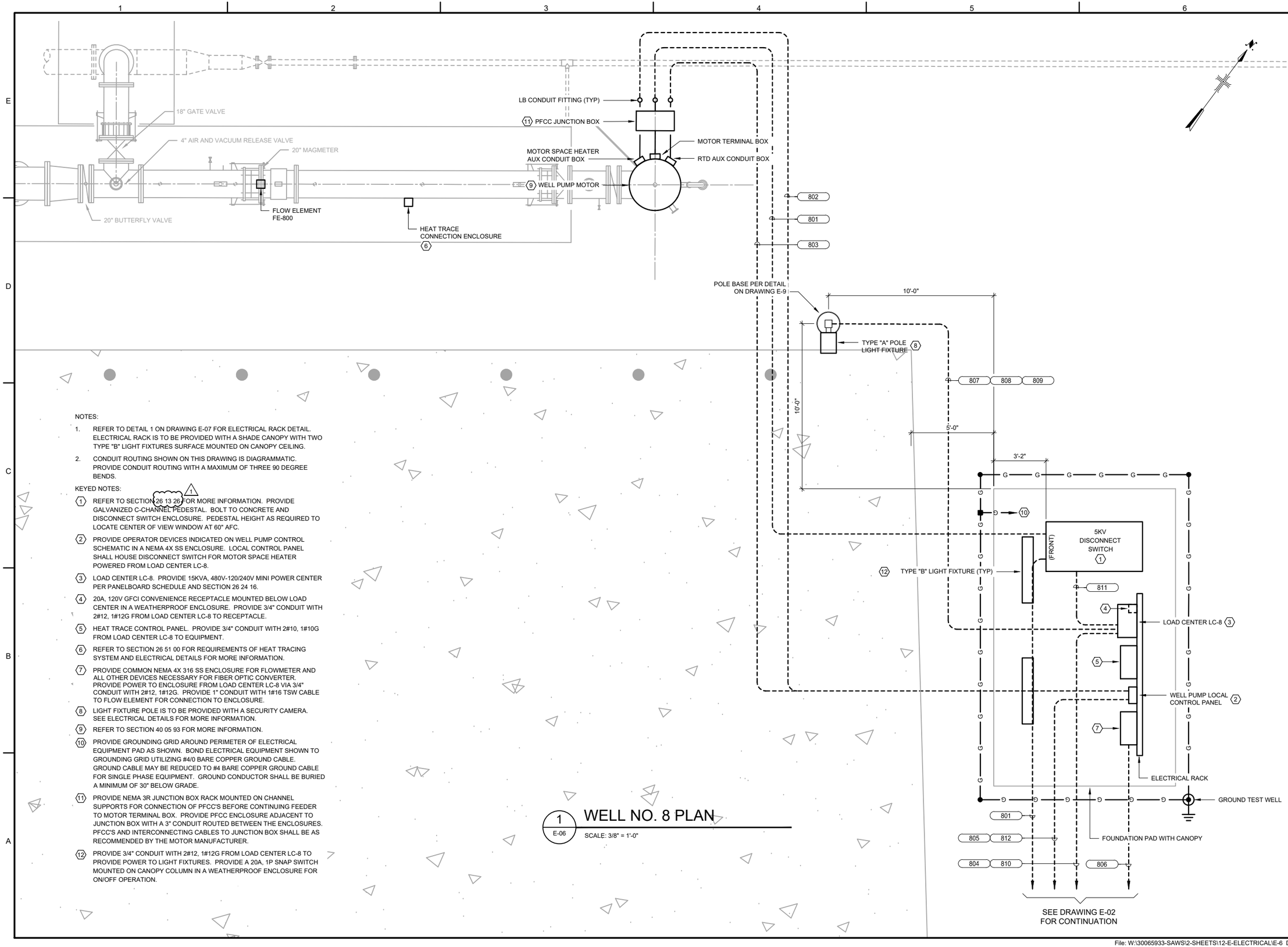
SCALE: AS SHOWN

0 1
BAR IS ONE INCH ON UNREDUCED DRAWING

DRAWING NO.: E-05

SHEET NO.: 41 OF 55

File: W:\30065933-SAWS\2-SHEETS\12-E-ELECTRICAL\E-5 Date: 4/9/2024 3:33 PM Last Saved By: NCANDELAS



NOTES:

1. REFER TO DETAIL 1 ON DRAWING E-07 FOR ELECTRICAL RACK DETAIL. ELECTRICAL RACK IS TO BE PROVIDED WITH A SHADE CANOPY WITH TWO TYPE "B" LIGHT FIXTURES SURFACE MOUNTED ON CANOPY CEILING.
2. CONDUIT ROUTING SHOWN ON THIS DRAWING IS DIAGRAMMATIC. PROVIDE CONDUIT ROUTING WITH A MAXIMUM OF THREE 90 DEGREE BENDS.

KEYED NOTES:

1. REFER TO SECTION 26 13 26 FOR MORE INFORMATION. PROVIDE GALVANIZED C-CHANNEL PEDESTAL. BOLT TO CONCRETE AND DISCONNECT SWITCH ENCLOSURE. PEDESTAL HEIGHT AS REQUIRED TO LOCATE CENTER OF VIEW WINDOW AT 60" AFC.
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3. LOAD CENTER LC-8. PROVIDE 15KVA, 480V-120/240V MINI POWER CENTER PER PANELBOARD SCHEDULE AND SECTION 26 24 16.
4. 20A, 120V GFCI CONVENIENCE RECEPTACLE MOUNTED BELOW LOAD CENTER IN A WEATHERPROOF ENCLOSURE. PROVIDE 3/4" CONDUIT WITH 2#12, 1#12G FROM LOAD CENTER LC-8 TO RECEPTACLE.
5. HEAT TRACE CONTROL PANEL. PROVIDE 3/4" CONDUIT WITH 2#10, 1#10G FROM LOAD CENTER LC-8 TO EQUIPMENT.
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12. PROVIDE 3/4" CONDUIT WITH 2#12, 1#12G FROM LOAD CENTER LC-8 TO PROVIDE POWER TO LIGHT FIXTURES. PROVIDE A 20A, 1P SNAP SWITCH MOUNTED ON CANOPY COLUMN IN A WEATHERPROOF ENCLOSURE FOR ON/OFF OPERATION.

1 E-06 WELL NO. 8 PLAN

SCALE: 3/8" = 1'-0"

ARCADIS

ARCADIS U.S., INC.
TBPE FIRM REGISTRATION NO.: F-533

SEALS:

SEALS:

STATE OF TEXAS
BRIAN E. YOUNG
118600
LICENSED PROFESSIONAL ENGINEER
4/15/24

SAN ANTONIO
WATER SYSTEM

San Antonio Water System

ARTESIA PUMP STATION
WELL PUMPS, MOTORS, AND
PIPING PROJECT

REVISIONS			
NO.	DATE	ISSUED FOR	BY
1	4/9/2024	ADDENDUM NO. 3	BY

STATUS: BID SET

ARCADIS PROJECT NO.:	30065933
DATE:	MARCH 2024
DESIGNED BY:	B. YOUNG
DRAWN BY:	H. WALTERS
CHECKED BY:	J. SOKOL

SHEET TITLE:

ELECTRICAL

WELL NO. 8
ELECTRICAL
PLAN

SCALE: AS SHOWN

0 1
BAR IS ONE INCH ON UNREDUCED DRAWING

DRAWING NO.: E-06

SHEET NO.: 42 OF 55