

ADDENDUM NO. 2

TO CONTRACT DOCUMENTS

**FOR: CITY OF TURLOCK
CITY PROJECT NO. 20-027 "CITY-WIDE CHLORINATION"**

November 12, 2020

NOTICE TO BIDDERS

This Addendum is attached to and made a part of the above entitled Contract Documents for the City of Turlock.

This **Addendum No.2** consists of 144 pages.

Response to Bidder's Questions

Question No. 1: *What is the Engineer's Estimate for the project?*

Answer No. 1: *The Engineer's estimate has been revised to incorporate the SCADA improvements described in this Addendum to \$4,857,000*

Question No. 2: *How will the SCADA improvements be handled?*

Answer No. 2: *Refer to the Revisions to the Plans and Specifications in this Addendum.*

Question No. 3: *Request approval for the JESCO Memdos Smart Stepper LP dosing pump as an equal to the Grundfos pump specified.*

Answer No. 3: *The Memdos Smart Stepper LP shall not be considered an equal to the Grundfos pumps specified for this project.*

Revisions to Plans and Specifications

The following additions, deletions or modifications shall become part of the Contract Documents:

Strikethrough text (~~text~~) indicates deletions.

Bold Italicized text (***text***) indicates additions.

ITEM NO. 1:

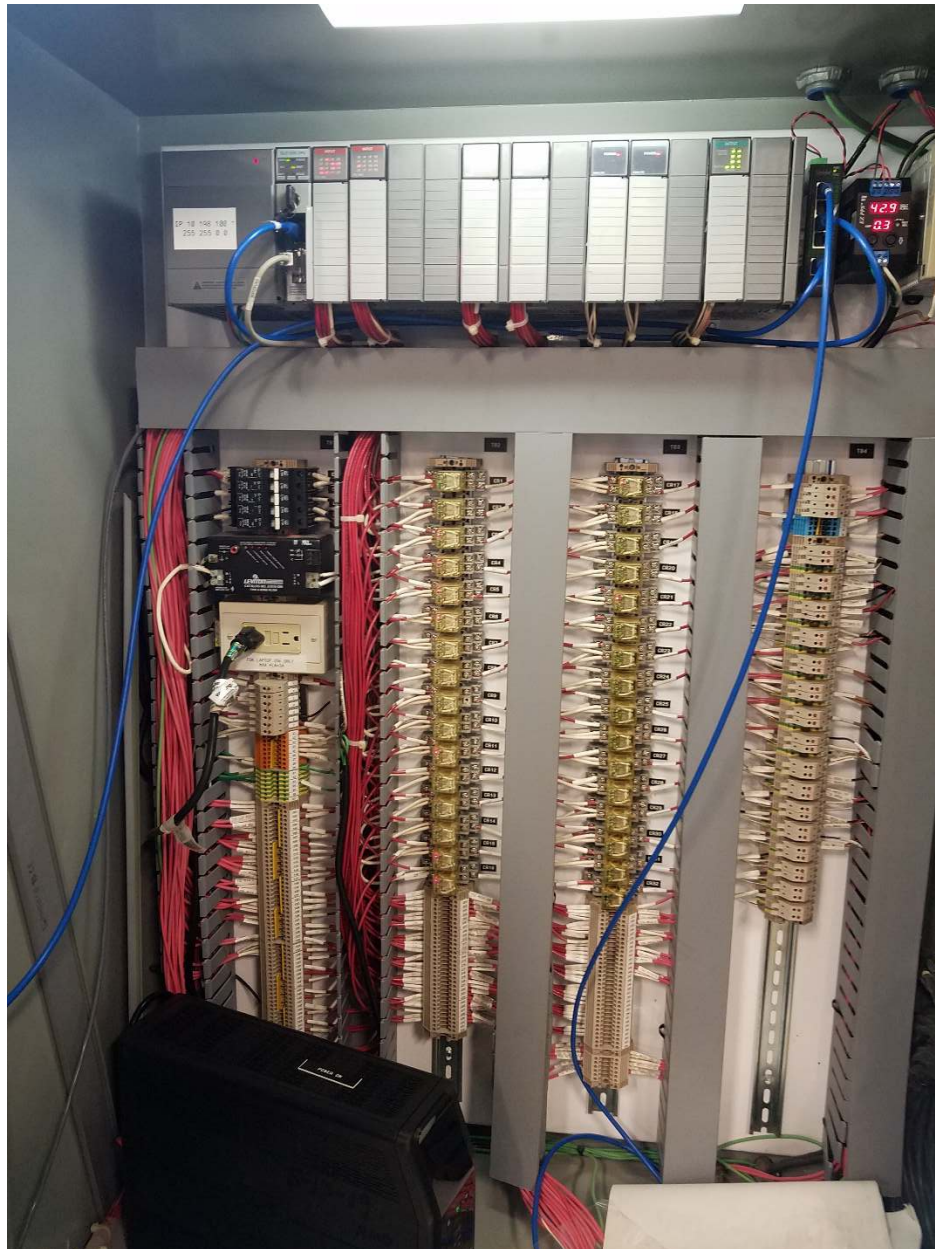
Add the following bid item description to Section 01 22 00 and shall cover the scope of Work for Bid Item 89:

Bid Item 89 – SCADA Installation:

89. The integration scope for the various sites are as follows: The PCSS shall provide hardware and instrumentation under this Project. Programming of the PLC and OITs will be by the City's Integrator.

89.1. DST Tank

89.1.1. Scope of Work: *PCSS will replace the existing AB SLC5 in kind within the existing cabinet as identified as Plan Note #1 on Sheet #37. The following is a photo of the existing backpan:*



89.1.2. New PLC per Section 40 64 01 with (3) DI, (2) DO, (2) AI, and (2) AO modules and wiring to accommodate the new chlorination I/O per Sheet 56 as well as 70 existing I/O points associated with booster pump operation and related onsite instrumentation. Reconnect existing I/O onto new PLC.

89.1.3. New radio within PLC cabinet with hardline cable (75 foot max) to new Yagi antenna on the existing 25' high mast per Section 40 66 70. Contractor to remove the existing cabling and antenna at time of new installation. Route

new antenna cabling through existing PLC/HSQ RTU pathway to existing mast.

89.1.4. Replace the existing OIT with a new industrial computer per Section 40 62 14.

89.1.5. Contractor to demo the existing HSQ backpan and related wiring between the PLC cabinet and HSQ RTU. Remove existing 120Vac to source and label as spare.

89.2. Fulkerth Tank

89.2.1. Scope of Work: PCSS will replace the existing AB SLC5 in kind within the existing cabinet as identified as Plan Note #1 on Sheet #37. The following is a photo of the existing backpan:



89.2.2. *New PLC per Section 40 64 01 with (3) DI, (2) DO, (2) AI, and (2) AO modules and wiring to accommodate the new chlorination I/O per Sheet 56 as well as 70 existing I/O points associated with booster pump operation and related onsite instrumentation. Reconnect existing I/O onto new PLC.*

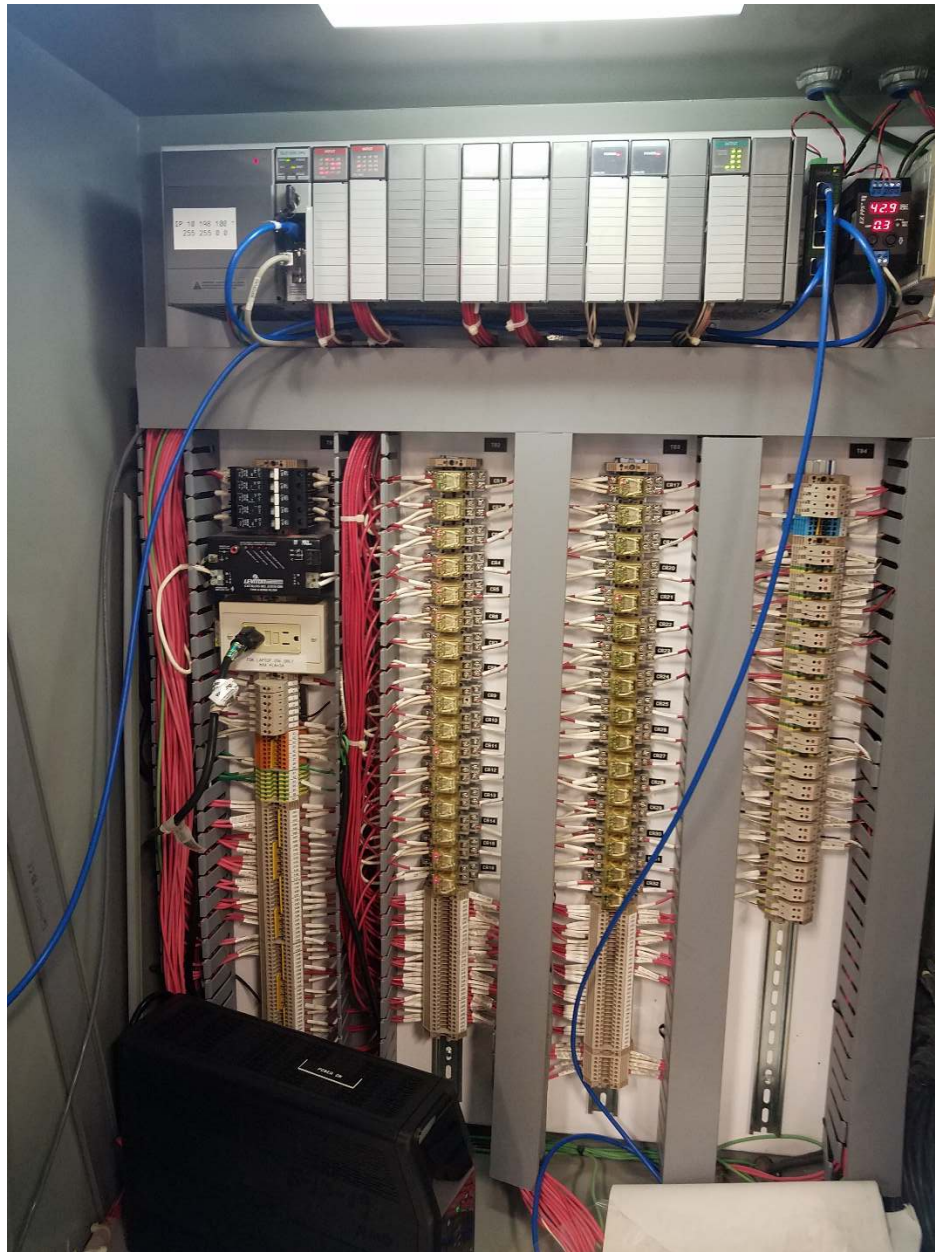
89.2.3. *New radio within PLC cabinet with hardline cable (75 foot max) to new Yagi antenna on the existing 25' high mast per Section 40 66 70. Contractor to remove the existing cabling and antenna at time of new installation. Route new antenna cabling through existing PLC/HSQ RTU pathway to existing mast.*

89.2.4. *Replace the existing OIT with a new industrial computer per Section 40 62 14.*

89.2.5. *Contractor to demo the existing HSQ backpan and related wiring between the PLC cabinet and HSQ RTU. Remove existing 120Vac to source and label as spare.*

89.3. *Kilroy Tank*

89.3.1. *Scope of Work: PCSS will replace the existing AB SLC5 in kind within the existing cabinet as identified as Plan Note #1 on Sheet #37. The following is a photo of the existing backpan:*



- 89.3.2. New PLC per Section 40 64 01 with (3) DI, (2) DO, (2) AI, and (2) AO modules and wiring to accommodate the new chlorination I/O per Sheet 56 as well as 70 existing I/O points associated with booster pump operation and related onsite instrumentation. Reconnect existing I/O onto new PLC.**
- 89.3.3. New radio within PLC cabinet with hardline cable (75 foot max) to new Yagi antenna on the existing 25' high mast per Section 40 66 70. Contractor to remove the existing cabling and antenna at time of new installation. Route new antenna cabling through existing PLC/HSQ RTU pathway to existing mast.**
- 89.3.4. Replace the existing OIT with a new industrial computer per Section 40 62 14.**
- 89.3.5. Contractor to demo the existing HSQ backpan and related wiring between the PLC cabinet and HSQ RTU. Remove existing 120Vac to source and label as spare.**

89.4. Well #13

89.4.1. Scope of Work: *PCSS will replace the existing HSQ RTU cabinet as follows.*

89.4.2. Remove the existing HSQ cabinet and install a new 36"x42"x10" min. NEMA-4X wall mounted, single door with 3-point locking door painted white in the same location in accordance to Section 40 67 01 with the following major components:

89.4.2.1. New PLC per Section 40 64 01 with (1) DI, (1) DO, (1) AI, and (1) AO modules to accommodate the new chlorination I/O per Sheet 56 as well as 20 existing I/O points associated with well pump operation and related onsite instrumentation. Reconnect existing I/O onto new terminal blocks.

89.4.2.2. New radio with hardline cable (50 foot max) to new Yagi antenna on the existing 25' high mast per Section 40 66 70. Contractor to remove the existing cabling and antenna at time of new installation.

89.5. Well #15

89.5.1. Scope of Work: *PCSS will replace the existing HSQ RTU cabinet as follows.*

89.5.2. Remove the existing HSQ cabinet and install a new 36"x42"x10" min. NEMA-4X wall mounted, single door with 3-point locking door painted white in the same location in accordance to Section 40 67 01 with the following major components:

89.5.2.1. New PLC per Section 40 64 01 with (1) DI, (1) DO, (1) AI, and (1) AO modules to accommodate the new chlorination I/O per Sheet 56 as well as 20 existing I/O points associated with well pump operation and related onsite instrumentation. Reconnect existing I/O onto new terminal blocks.

89.5.2.2. New radio with hardline cable (50 foot max) to new Yagi antenna on the existing 25' high mast per Section 40 66 70. Contractor to remove the existing cabling and antenna at time of new installation.

89.6. Well #20

89.6.1. Scope of Work: *PCSS will replace the existing HSQ RTU cabinet as follows.*

89.6.2. Remove the existing HSQ cabinet and install a new 36"x42"x10" min. NEMA-4X wall mounted, single door with 3-point locking door painted white in the same location in accordance to Section 40 67 01 with the following major components:

89.6.2.1. New PLC per Section 40 64 01 with (1) DI, (1) DO, (1) AI, and (1) AO modules to accommodate the new chlorination I/O per Sheet 56 as well as 20 existing I/O points associated with well pump operation and related onsite instrumentation. Reconnect existing I/O onto new terminal blocks.

89.6.2.2. New radio with hardline cable (50 foot max) to new Yagi antenna on the existing 25' high mast per Section 40 66 70. Contractor to remove the existing cabling and antenna at time of new installation.

89.7. Well #22

89.7.1. Scope of Work: PCSS will replace the existing HSQ RTU cabinet as follows.

89.7.2. Remove the existing HSQ cabinet and install a new 36"x42"x10" min. NEMA-4X wall mounted, single door with 3-point locking door painted white in the same location in accordance to Section 40 67 01 with the following major components:

89.7.2.1. New PLC per Section 40 64 01 with (1) DI, (1) DO, (1) AI, and (1) AO modules to accommodate the new chlorination I/O per Sheet 56 as well as 20 existing I/O points associated with well pump operation and related onsite instrumentation. Reconnect existing I/O onto new terminal blocks.

89.7.2.2. New radio with hardline cable (50 foot max) to new Yagi antenna on the existing 25' high mast per Section 40 66 70. Contractor to remove the existing cabling and antenna at time of new installation.

89.8. Well #24

89.8.1. Scope of Work: PCSS will replace the existing HSQ RTU cabinet as follows.

89.8.2. Remove the existing HSQ cabinet and install a new 36"x42"x10" min. NEMA-4X wall mounted, single door with 3-point locking door painted white in the same location in accordance to Section 40 67 01 with the following major components:

89.8.2.1. New PLC per Section 40 64 01 with (1) DI, (1) DO, (1) AI, and (1) AO modules to accommodate the new chlorination I/O per Sheet 56 as well as 20 existing I/O points associated with well pump operation and related onsite instrumentation. Reconnect existing I/O onto new terminal blocks.

89.8.2.2. New radio with hardline cable (50 foot max) to new Yagi antenna on the existing 25' high mast per Section 40 66 70. Contractor to remove the existing cabling and antenna at time of new installation.

89.9. Well #27

89.9.1. Scope of Work: PCSS will replace the existing HSQ RTU cabinet as follows.

89.9.2. Remove the existing HSQ cabinet and install a new 36"x42"x10" min. NEMA-4X wall mounted, single door with 3-point locking door painted white in the same location in accordance to Section 40 67 01 with the following major components:

89.9.2.1. New PLC per Section 40 64 01 with (1) DI, (1) DO, (1) AI, and (1) AO modules to accommodate the new chlorination I/O per Sheet 56 as well as 20 existing I/O points associated with well pump operation and related onsite instrumentation. Reconnect existing I/O onto new terminal blocks.

89.9.2.2. New radio with hardline cable (50 foot max) to new Yagi antenna on the existing 25' high mast per Section 40 66 70. Contractor to remove the existing cabling and antenna at time of new installation.

89.10. Well #30

89.10.1. Scope of Work: PCSS will replace the existing HSQ RTU cabinet as follows.

- 89.10.2. Remove the existing HSQ cabinet and install a new 36"x42"x10" min. NEMA-4X wall mounted, single door with 3-point locking door painted white in the same location in accordance to Section 40 67 01 with the following major components:**
- 89.10.2.1. New PLC per Section 40 64 01 with (1) DI, (1) DO, (1) AI, and (1) AO modules to accommodate the new chlorination I/O per Sheet 56 as well as 20 existing I/O points associated with well pump operation and related onsite instrumentation. Reconnect existing I/O onto new terminal blocks.**
- 89.10.2.2. New radio with hardline cable (50 foot max) to new Yagi antenna on the existing 25' high mast per Section 40 66 70. Contractor to remove the existing cabling and antenna at time of new installation.**
- 89.11. Well #31**
- 89.11.1. Scope of Work: PCSS will replace the existing HSQ RTU cabinet as follows.**
- 89.11.2. Remove the existing HSQ cabinet and install a new 36"x42"x10" min. NEMA-4X wall mounted, single door with 3-point locking door painted white in the same location in accordance to Section 40 67 01 with the following major components:**
- 89.11.2.1. New PLC per Section 40 64 01 with (1) DI, (1) DO, (1) AI, and (1) AO modules to accommodate the new chlorination I/O per Sheet 56 as well as 20 existing I/O points associated with well pump operation and related onsite instrumentation. Reconnect existing I/O onto new terminal blocks.**
- 89.11.2.2. New radio with hardline cable (50 foot max) to new Yagi antenna on the existing 25' high mast per Section 40 66 70. Contractor to remove the existing cabling and antenna at time of new installation.**
- 89.12. Well #32**
- 89.12.1. Scope of Work: PCSS will replace the existing HSQ RTU cabinet as follows.**
- 89.12.2. Remove the existing HSQ cabinet and install a new 36"x42"x10" min. NEMA-4X wall mounted, single door with 3-point locking door painted white in the same location in accordance to Section 40 67 01 with the following major components:**
- 89.12.2.1. New PLC per Section 40 64 01 with (1) DI, (1) DO, (1) AI, and (1) AO modules to accommodate the new chlorination I/O per Sheet 56 as well as 20 existing I/O points associated with well pump operation and related onsite instrumentation. Reconnect existing I/O onto new terminal blocks.**
- 89.12.2.2. New radio with hardline cable (50 foot max) to new Yagi antenna on the existing 25' high mast per Section 40 66 70. Contractor to remove the existing cabling and antenna at time of new installation.**
- 89.13. Well #33**
- 89.13.1. Scope of Work: PCSS will replace the existing HSQ RTU cabinet as follows.**
- 89.13.2. Remove the existing HSQ cabinet and install a new 36"x42"x10" min. NEMA-4X wall mounted, single door with 3-point locking door**

Painted white in the same location in accordance to Section 40 67 01 with the following major components:

89.13.2.1. New PLC per Section 40 64 01 with (1) DI, (1) DO, (1) AI, and (1) AO modules to accommodate the new chlorination I/O per Sheet 56 as well as 20 existing I/O points associated with well pump operation and related onsite instrumentation. Reconnect existing I/O onto new terminal blocks.

89.13.2.2. New radio with hardline cable (50 foot max) to new Yagi antenna on the existing 25' high mast per Section 40 66 70. Contractor to remove the existing cabling and antenna at time of new installation.

89.14. Well #34

89.14.1. Scope of Work: PCSS will replace the existing HSQ RTU cabinet as follows.

89.14.2. Remove the existing HSQ cabinet and install a new 36"x42"x10" min. NEMA-4X wall mounted, single door with 3-point locking door painted white in the same location in accordance to Section 40 67 01 with the following major components:

89.14.2.1. New PLC per Section 40 64 01 with (1) DI, (1) DO, (1) AI, and (1) AO modules to accommodate the new chlorination I/O per Sheet 56 as well as 20 existing I/O points associated with well pump operation and related onsite instrumentation. Reconnect existing I/O onto new terminal blocks.

89.14.2.2. New radio with hardline cable (50 foot max) to new Yagi antenna on the existing 25' high mast per Section 40 66 70. Contractor to remove the existing cabling and antenna at time of new installation.

89.15. Well #36

89.15.1. Scope of Work: PCSS will replace the existing HSQ RTU cabinet as follows.

89.15.2. Remove the existing HSQ cabinet and install a new 36"x42"x10" min. NEMA-4X wall mounted, single door with 3-point locking door painted white in the same location in accordance to Section 40 67 01 with the following major components:

89.15.2.1. New PLC per Section 40 64 01 with (1) DI, (1) DO, (1) AI, and (1) AO modules to accommodate the new chlorination I/O per Sheet 56 as well as 20 existing I/O points associated with well pump operation and related onsite instrumentation. Reconnect existing I/O onto new terminal blocks.

89.15.2.2. New radio with hardline cable (50 foot max) to new Yagi antenna on the existing 25' high mast per Section 40 66 70. Contractor to remove the existing cabling and antenna at time of new installation.

89.16. Well #37

89.16.1. Scope of Work: PCSS will replace the existing HSQ RTU cabinet as follows.

89.16.2. Remove the existing HSQ cabinet and install a new 36"x42"x10" min. NEMA-4X wall mounted, single door with 3-point locking door painted white in the same location in accordance to Section 40 67 01 with the following major components:

- 89.16.2.1. New PLC per Section 40 64 01 with (1) DI, (1) DO, (1) AI, and (1) AO modules to accommodate the new chlorination I/O per Sheet 56 as well as 20 existing I/O points associated with well pump operation and related onsite instrumentation. Reconnect existing I/O onto new terminal blocks.**
- 89.16.2.2. New radio with hardline cable (50 foot max) to new Yagi antenna on the existing 25' high mast per Section 40 66 70. Contractor to remove the existing cabling and antenna at time of new installation.**
- 89.17. Well #39**
- 89.17.1. Scope of Work: PCSS will replace the existing HSQ RTU cabinet as follows.**
- 89.17.2. Remove the existing HSQ cabinet and install a new 36"x42"x10" min. NEMA-4X wall mounted, single door with 3-point locking door painted white in the same location in accordance to Section 40 67 01 with the following major components:**
- 89.17.2.1. New PLC per Section 40 64 01 with (1) DI, (1) DO, (1) AI, and (1) AO modules to accommodate the new chlorination I/O per Sheet 56 as well as 20 existing I/O points associated with well pump operation and related onsite instrumentation. Reconnect existing I/O onto new terminal blocks.**
- 89.17.2.2. New radio with hardline cable (50 foot max) to new Yagi antenna on the existing 25' high mast per Section 40 66 70. Contractor to remove the existing cabling and antenna at time of new installation.**
- 89.18. Well #40**
- 89.18.1. Scope of Work: PCSS will replace the existing HSQ RTU cabinet as follows.**
- 89.18.2. Remove the existing HSQ cabinet and install a new 36"x42"x10" min. NEMA-4X wall mounted, single door with 3-point locking door painted white in the same location in accordance to Section 40 67 01 with the following major components:**
- 89.18.2.1. New PLC per Section 40 64 01 with (1) DI, (1) DO, (1) AI, and (1) AO modules to accommodate the new chlorination I/O per Sheet 56 as well as 20 existing I/O points associated with well pump operation and related onsite instrumentation. Reconnect existing I/O onto new terminal blocks.**
- 89.18.2.2. New radio with hardline cable (50 foot max) to new Yagi antenna on the existing 25' high mast per Section 40 66 70. Contractor to remove the existing cabling and antenna at time of new installation.**

ITEM NO. 2:

Add the following to Specification Section 40 50 00

Incorporate the following into 1.01.B:

40 50 01 I & C Testing

40 64 01	<i>Control Systems: Programmable Logic Controllers</i>
40 66 70	<i>Control Systems: Wireless Communications -Radio</i>
40 67 01	<i>Control Systems: Panels, Enclosures and Panel Components</i>
40 62 14	<i>Control Systems: PCS Computer Equipment</i>

ITEM NO. 3:

Add the following attached specification sections to the Project Specifications:

04 22 00	<i>Concrete Block Masonry</i>
40 50 01	<i>I&C Testing</i>
40 50 30	<i>Water Quality Analyzers</i>
40 62 14	<i>Control Systems: PCS Computer Equipment</i>
50 51 50	<i>Control Panels and Panel Mounted Equipment</i>
40 64 01	<i>Control Systems: Programmable Logic Controllers</i>
40 66 70	<i>Control Systems: Wireless Communications -Radio</i>
40 67 01	<i>Controls Systems: Panels, Enclosures and Panel Components</i>

ITEM NO. 4:

Replace the following revised sheets with the attached and incorporate into the Project Plan Set:

G-1	<i>COVER SHEET</i>
G-3	<i>GENERAL NOTES</i>
G-4	<i>GENERAL NOTES</i>
C-13	<i>WELL 13 SITE PLAN</i>
C-24	<i>WELL 24 SITE PLAN</i>
C-27	<i>WELL 27 SITE PLAN</i>
C-34	<i>WELL 34 SITE PLAN</i>
C-36	<i>WELL 36 SITE PLAN</i>
C-40	<i>WELL 40 SITE PLAN</i>
D-1	<i>CHLORINATION DETAILS</i>
D-2	<i>CHLORINATION DETAILS</i>
D-5	<i>CHLORINATION DETAILS</i>
D-7	<i>STRUCTURAL DETAILS</i>
D-8	<i>STRUCTURAL DETAILS</i>
D-8B	<i>STUCTURAL DETAILS (NEW SHEET)</i>
D-8C	<i>STRUCTRAL DETAILS (NEW SHEET)</i>
D-10	<i>CITY STANDARD DETAILS</i>
E-1	<i>PARTIAL SITE PLAN – DST TANK</i>
E-2	<i>PARTIAL SITE PLAN – FULKERTH TANK</i>

E-3 PARTIAL SITE PLAN – KILROY TANK
E-30 PARTIAL SITE PLAN – WELL 30

SECTION 04 22 00
CONCRETE BLOCK MASONRY

SECTION 04 22 00
CONCRETE BLOCK MASONRY

PART 1 GENERAL

1.1 WORK INCLUDED

- A. All concrete block masonry and related items necessary and required to complete the work as indicated in the Contract Documents.
- B. All labor, materials, equipment, and incidentals necessary and required for their completion.

1.2 RELATED WORK

- A. Division 3 Concrete

1.3 REFERENCES

- A. American Concrete Institute (ACI)
- B. American Society for Testing and Materials (ASTM)
- C. Section 58 – Sound Walls, State Standard Specifications
- D. California Building Code (CBC)

1.4 SUBMITTALS

- A. As specified in Section 01 33 00 – Submittal Procedures.

1.5 TESTS AND SAMPLES

- A. Tests of mortar and grout shall be made in accordance with the requirements of Section 1705.4, California Code of Regulations, Title 24, Part 2, by an independent laboratory selected by the Owner.
- B. QA shall be performed to a minimum of QA Level 2.
- C. Testing and sampling shall be coordinated by the Contractor, and copies of test reports shall be submitted to the Engineer.
- D. Cost of initial testing shall be borne by the Owner, any re-testing shall be charged to the Contractor, including time for the Engineer.

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PART 2 PRODUCTS

2.1 CONCRETE BLOCK

- A. Concrete block shall be lightweight concrete masonry units as manufactured by Blocklite Company, or Engineer approved equivalent. Units shall be lightweight conforming to ASTM C90 and shall have a maximum linear shrinkage of .06 percent from the saturated to the oven-dry condition.
 - 1. Units shall be as indicated on the Plans.
 - 2. Concrete block colors to be a standard color as selected by Owner
- B. Bars for reinforcement shall be ASTM A706 Grade 60.

2.2 MORTAR

Mortar materials shall comply with Section 58-2.02C, "Mortar", of the State Standard Specifications as follows:

- A. Portland Cement: Cement shall conform to ASTM C150, Type II.
- B. Lime: Hydrated Lime shall be Type S or Type N, conforming to ASTM C207. Quicklime shall conform to ASTM C5. It shall be slaked in accordance with the manufacturer's directions.
- C. Lime Putty: Putty shall be a stiff mixture of lime and water. Keep putty moist until used. Putty made from quicklime shall be slaked and allowed to soak at least 24 hours before using. Putty made from Type S hydrated lime may be used immediately after mixing. All resulting lime putty shall weigh not less than 83 pounds per cubic foot.
- D. Sand & Pea Gravel: Sand for mortar shall conform to the "Standard Specifications for Aggregate for Masonry Mortar", ASTM C144", except that not less than 3 percent of the sand shall pass the number 100 sieve. Sand and pea gravel for grout shall conform to the requirements of the CBC, and be well graded.
- E. Cement Admixtures: Mortar containing admixtures shall comply with ASTM C270.
- F. Water: Used for mortar and grout shall be clean and free from deleterious amounts of acids, salts, alkalis, or organic materials.

2.3 GROUT

- A. Grout shall comply with Section 58-2.02D, "Grout", of the State Standard Specifications as follows:
- B. Cementitious material shall comply with Section 90-1.02B of the State Standard Specifications.

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- C. Grout shall have a minimum of 550 pounds of cementitious material per cubic yard as well as a minimum 28 day compressive strength of 2,000 psi or masonry design strength whichever is greater.
- D. Water: Used for mortar and grout shall be clean and free from deleterious amounts of acids, salts, alkalis, or organic materials.

2.4 STORAGE OF MATERIALS

Store materials under cover in a dry place and in a manner to prevent damage or intrusion of foreign matter. During freezing weather protect all masonry units with tarpaulins or other suitable material. Store concrete masonry units under covers that will permit circulation of air and prevent excessive moisture absorption. Store cement, lime and air-setting mortars in water-tight sheds with elevated floors. Protect reinforcement from the elements; immediately before placing, reinforcement shall be free from loose rust, ice or other foreign coatings that will destroy or reduce the bond. Concrete masonry units shall be protected against wetting prior to use.

2.5 MORTAR AND GROUT MIXES

- A. Mortar shall be composed of one-fourth to one-half part hydrated lime, one part Portland Cement and the sand shall not be more than two and one-quarter to three times the sum of the separate volumes of cementitious material based on damp loose volumes.
 - 1. The minimum compressive strength at 28 days shall be at least 1,800 psi.
- B. Grout shall consist of one part portland cement to not more than three parts sand. Sufficient water shall be added to grout to cause it to flow into all joints of the masonry. Where practicable, pea gravel may be added to the grout in approved amounts to make a workable mix, but the combined mix shall not exceed 1:3:2.
 - 1. Grout shall attain a minimum compressive strength of 2,000 lbs. per square inch but not less than the minimum compressive strength of masonry at 28 days.

PART 3 EXECUTION

3.1 MIXING OF MORTAR AND GROUT

- A. Measurements: Materials for mortar and grout shall be accurately measured in suitable calibrated devices. Shovel measurements will not be acceptable. Ninety-four pounds of Portland Cement (one sack) shall be considered as one cubic foot.
- B. Mixing of Mortar or Grout: The sand, cement and water shall be placed in the mix in that order for each batch of mortar or grout and shall be mixed for a period of at least two minutes, the lime shall then be added and mixing continued as long as needed to secure a uniform mass, but in no case less than 10 minutes. Equipment for mixing and handling mortar and grout shall be acceptable to the Engineer.
 - 1. Mixers of at least one-sack capacity shall be used. Batches requiring fractional sacks will not be permitted unless the cement is weighed for each

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such batch. Retempering by dashing water over the mortar shall not be permitted. Any mortar or grout which is unused within one hour after the initial mixing shall be removed from the work. Mortar shall be mixed and maintained on the boards to a slump of 2-3/4", plus or minus one-quarter inch, using a truncated cone 4" x 2", 8" high.

3.2 PRECAUTIONS AND GENERAL REQUIREMENTS

- A. Do not lay masonry when the temperature of the outside air is below 40 °F, unless suitable means as approved by the Engineer are provided to heat materials, protect work from cold and frost and insure that mortar will harden without freezing. No anti-freezing ingredient shall be used in the mortar.
- B. Protect facing material against staining, and keep tops of wall covered with non-staining waterproof coverings when work is not in progress. When work is resumed, top surface of work shall be cleaned of all loose mortar.
- C. Before closing up any pipe, duct or similar inaccessible spaces or shafts with masonry, remove all rubbish and sweep out the area to be enclosed.
- D. Provide level and solid bearing in masonry walls directly under poured concrete slabs, structural steel beams, trusses, and steel joists. Solid bearing shall be of sizes and thickness indicated.
- E. Where fresh masonry joins masonry that is partially set or totally set, clean the exposed surface of the set masonry so as to obtain the best possible bond with the new work. Remove all loose block and mortar. If it is necessary to "stop off" a horizontal run of masonry, this shall be done by racking back one-half block length in each course.
- F. Consult other trades and make provisions that will permit the installation of their work in a manner to avoid cutting and patching. Build in work specified under other sections, as necessary, and as the work progresses.

3.3 LAYING CONCRETE MASONRY UNITS

- A. Set units plumb and true to line. All units shall be laid with level horizontal joints. Except where specified or shown otherwise, units shall be laid in "running or stacked" or other bond as indicate on Drawings.
- B. Finish joints by tooling to dense, concave condition.
- C. Where electric conduits, outlet and switch boxes occur, grind and cut units before building-in services. Coordinate work with other trades. Cutting of all units exposed in finished work shall be done with an approved type of power saw.
- D. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Make joints uniform, approximately 3/8 inch thick unless indicated otherwise.
- E. All units shall be fully grouted.

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- F. Make provision for all units as may be required to form all offsets and maintain a proper pattern throughout the length of the wall.
- G. Provision shall be made for the installation of bolts, anchors, wall plugs and frames, as required.
- H. Contractor shall coordinate the masonry work with other trades.

3.4 *GROUTING*

- A. The methods and procedures for grouting shall conform to the requirements Chapter 21 of the CBC (Current Edition).
- B. No grout shall be placed until the mortar has set and cured two days minimum.
- C. Under normal weather conditions with typical masonry units the individual lifts of grout shall be limited to four feet in height with a waiting period between lifts of thirty to sixty minutes.
- D. Succeeding lifts shall be poured and alternate cells vibrated twelve to eighteen inches into preceding lift.
- E. The top lift shall also be reconsolidated after the required waiting period and any space left by settlement shrinkage filled with grout.

3.5 *FOUNDATIONS*

- A. The contact surfaces of all foundations and floors that are to receive masonry work shall be cleaned and roughened before start of laying. It shall be protected during construction to insure a good bond between the grout fill and the concrete surface.

3.6 *CLEANOUTS*

- A. Cleanout openings shall be provided through block faces for all cells at the bottom of each pour. The openings shall be made by removing the face shell of the bottom block for the entire length and height of each block unit.
- B. One inch layer of clean sand, placed on top of preceding pour after course with cleanouts is laid, shall be used to prevent mortar droppings from adhering to bearing surface below.
- C. After the laying of masonry units is completed, the cells cleaned, the reinforcing positioned and inspection completed, the cleanouts shall be closed by inserting face shells of masonry units. Face shell plugs shall have a minimum curing time of two days and shall be adequately braced to resist the pressure of the fluid grout.

3.7 *REINFORCEMENT*

- A. All reinforcing steel shall be accurately placed in strict accordance with the approved Plans and Specifications. Both horizontal and vertical reinforcing shall be held in position by wire ties or spacing devices near ends and of intervals not exceeding 160 diameters of the reinforcement.

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- B. The horizontal reinforcing shall be placed as the work progresses and the vertical reinforcing may be dropped into position after the completion of the laying if adequate positioning devices are provided to hold the reinforcement at proper intervals.

3.8 MASONRY UNITS

- A. Use of open-end concrete masonry is preferred wherever possible and is required for stacked bond. Bond beams shall be used at horizontal bars to provide a minimum opening at all cross webs one and one-half inches high for the width of the cell.

3.9 LAYING

- A. All head and bed joints shall be filled solidly with mortar for a distance in from the face of the unit not less than the thickness of the face shell. Care shall be taken in placing the mortar to keep a minimum of droppings from falling into the block cells. Open-end units used in stacked bond shall be arranged so the closed ends are not abutting.

3.10 WALL TIES AND BRACING

- A. When stacked bond is used or when adequate cross webs between face shells are not provided, ties of heavy gauge wire embedded in the horizontal mortar joints shall be provided across continuous vertical joints or between face shells to prevent "blow-outs" due to the hydrostatics pressure of the fluid grout. External ties or braces may also be used for this purpose.
- B. During construction, the ungrouted walls shall be adequately braced against wind and other forces.

3.11 MORTAR DROPPINGS AND OVERHANGS

- A. All mortar droppings and overhangs shall be removed from the foundation or bearing surface, cell walls, and reinforcing.
- B. Acceptable methods are by hosing with a jet stream at least twice a day (at mid-day and quitting time) or by dislodging any hardened mortar from the cell walls and reinforcing with a pole or rod and removing the mortar debris from the bottom of the cells prior to grouting.

3.12 CONSTRUCTION JOINTS

- A. Intermediate horizontal construction joints are not permitted.
- B. The section of wall to be grouted in any one pour shall be limited to a length in which successive lifts can be placed within one hour of the preceding lift.

3.13 CURING

- A. The concrete block work and top grout pour should be kept damp to prevent too rapid drying during hot or drying weather, and drying winds.

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3.14 POINTING AND CLEANING MASONRY

- A. Point all holes in exposed masonry. Cut out defective joints and repoint them with mortar.
- B. Acid solutions shall not be used for cleaning concrete masonry units. Metal cleaning tools and brushes, or abrasive powders shall not be used.
- C. Clean all loose mortar and remove all stains from the exposed surfaces of the concrete masonry units.

3.15 CLEANUP

- A. All rubbish and/or debris resulting from the operation of this trade shall be cleaned up and removed from the site as the work progresses, and disposed of in a legal manner.

END SECTION

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SECTION 40 50 01

I&C – TESTING

PART 1 — GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor and materials required and installed. Complete as shown on the Drawings and as specified herein.
- B. This section covers the testing requirements for all devices and systems furnished and installed detailed on the Drawings and in the Loop Diagrams, and as described in the related Sections of Division 40.
- C. Refer to Section 40 50 00.

1.02 RELATED WORK

- A. Refer to Section 40 50 00.

1.03 SUBMITTALS

- A. Refer to Section 40 50 00.

1.04 REFERENCE STANDARDS

- A. Refer to Section 40 50 00.

1.05 QUALITY ASSURANCE

- A. Refer to Section 40 50 00.

1.06 SYSTEM DESCRIPTION

- A. N/A

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Section 40 50 00.

1.08 PROJECT/SITE REQUIREMENTS

- A. Refer to Section 40 50 00.

1.09 MAINTENANCE

- A. Refer to Section 40 50 00.

1.10 WARRANTY

- A. Refer to Section 40 50 00.

1.11 NOMENCLATURE AND IDENTIFICATION

- A. Refer to Section 40 50 00.

1.12 COORDINATION MEETINGS

- A. Refer to Section 40 50 00.

PART 2 -PRODUCTS

2.01 NOT USED

PART 3 -EXECUTION

3.01 TESTING - GENERAL

- A. See execution requirements in Section 40 50 00.
- B. The PCSS shall test all equipment at the factory prior to shipment. Unless otherwise specified in the individual specification sections, all equipment provided by the PCSS shall be tested at the factory as a single fully integrated system.
- C. The PCSS shall test the system so that the Owner and Engineer can verify all the points in the existing control system. The PCSS shall coordinate testing of the ORT and FDT with the Owner.
- D. At a minimum, the testing shall include the following:
 - 1. Unwitnessed Factory Test (UFT).
 - 2. System Integration Test (SIT).
 - 3. Operational Readiness Test (ORT).
 - 4. Functional Demonstration Test (FDT).
 - 5. 30-day Site Acceptance Test (SAT).
- E. Each test shall be in the cause and effect format. The person conducting the test shall initiate an input (cause) and, upon the system's or subsystem's producing the correct result (effect), the specific test requirement will have been satisfied.
- F. All tests shall be conducted in accordance with prior Engineer and/or Owner-approved procedures, forms, and all checklists as submitted by the PCSS under Specification 40 50 00 Part 1.03. Each test to be performed shall be described and a space provided after it for sign-off by the appropriate parties after its satisfactory completion. The PCSS shall include "punchlist" forms with the test procedures to document issues that arise during the testing. Punchlist forms, at a minimum, shall include a specification cross reference; an issues description field; a resolution description field; and a sign-off area for the PCSS, Owner, and Engineer.
- G. Copies of the signed-off test procedures, forms, and checklists will constitute the required testing documentation. The test result forms shall be submitted to the Engineer for approval within 10 days of completion of each test.
- H. The PCSS shall provide all special testing materials and equipment. Wherever possible, perform tests using actual process variables, equipment, and data. Where it

is not practical to test with real process variables, equipment, and data, provide suitable means of simulation. These simulation techniques shall be defined in the test procedures.

- I. The PCSS shall coordinate all required testing with the Contractor, all affected Subcontractors, the Engineer, and the Owner.
- J. The PCSS shall furnish the services of field service engineers, all special calibration and test equipment, and labor to perform the field tests.
- K. The Engineer reserves the right to test or retest all specified functions, whether or not explicitly stated on the Test Procedures, as required to determine compliance with the functional requirements of the overall system. Such testing required to determine compliance with the specified requirements shall be performed at no additional cost to the Owner. The Engineer's decision shall be final regarding the acceptability and completeness of all testing.
- L. No equipment shall be shipped until the Engineer and/or Owner has received all test results and approved the system is ready for shipment.
- M. Correction of Deficiencies
 - 1. All deficiencies in workmanship and/or items not meeting specified testing requirements shall be corrected to meet specification requirements at no additional cost to the Owner.
 - 2. Testing, as specified herein, shall be repeated after correction of deficiencies is made until the specified requirements are met. This work shall be performed at no additional cost to the Owner.

3.02 FACTORY TESTING - UNWITNESSED FACTORY TEST (UFT)

- A. Prior to shipment of the equipment, the entire system, except primary elements, final control elements, and field-mounted transmitters, shall be interconnected and tested to ensure the system will operate as specified. All analog and discrete input/output points not interconnected at this time shall be simulated to ensure proper operation of all alarms, monitoring devices/functions, and control devices/functions.
- B. All panels, consoles, and assemblies shall be inspected and tested to verify their conformance with related submittals, Specifications, and Drawings.
- C. During the tests, all digital system hardware and software shall be operated for at least five days continuously without a failure to verify the system is capable of continuous operation.
- D. Tests to be performed shall include, but not be limited to, the following. Each of these tests shall be specifically addressed in the Test Procedure submittal.
 - 1. All panels and enclosures being provided shall undergo a thorough inspection to verify the integrity of the cabinet enclosures, frame structures, paint work and

- finish, etc. Additionally, the PCSS shall review the panel drawings with the Owner and/or Engineer to ensure they accurately reflect the panel layout and wiring.
2. Panel wire pull tests shall be performed on all wiring to ensure all wiring has been connected to the appropriate torque to prevent wires from coming loose.
 3. For panels provided in new enclosures, heat loading tests shall be performed to ensure proper cooling/ventilation is being provided.
 4. UPSs shall be tested with all equipment connected to verify the UPSs have been sized correctly to maintain the specified run time.
 5. An I/O point checkout of at least 50 percent of each I/O module shall be performed to verify proper operation of the input/output points. To perform this test, the PCSS shall obtain copies of the PLC configuration files from the Application Engineering Services (AES) Supplier prior to proceeding with the UFT. The verification of the signals will be accomplished via the use of the PLC programming software. At a minimum, the I/O checkout shall consist of four steps.
 - a. Digital input signals shall be jumpered within the termination connections of the PLC panels and verification of proper alarming, statuses, etc., shall be performed utilizing the tools available in the PLC programming software.
 - b. Analog input signals shall be connected to a signal generator at the termination connections and signals shall be verified at zero percent, 25 percent, 50 percent, 75 percent, and 100 percent of full scale. The appropriate scaled value shall be verified utilizing the tools available in the PLC programming software.
 - c. Digital output signals shall be initiated by the user by writing to the signals utilizing the PLC programming software. Verification shall occur in the PLC panel by connecting a digital multimeter to measure the continuity at the terminations, thus verifying the command from the PLC has properly executed the contact closure.
 - d. Analog output signals shall be initiated by the user by writing to the signals utilizing the PLC programming software. Verification shall occur in the PLC panel by utilizing a digital multimeter to measure the current/voltage generated at the termination points.
- E. All control panels provided or modified under the requirements of the related technical specification sections of Division 40 shall be included in these tests.
- F. Upon successful completion of the UFT, the PCSS shall submit a record copy of the test results to the Owner and Engineer and coordinate the scheduling of the SIT with the AES Supplier.

3.03 *FACTORY TESTING - SYSTEM INTEGRATION TEST (SIT)*

- A. Before scheduling the SIT, the PCSS shall determine through his own UFT and through his internal quality assurance program that the equipment is ready for the SIT.
- B. The SIT shall be conducted a minimum of three weeks before the Witnessed Factory Test. The SIT shall be a joint test by the PCSS and the AES Supplier conducted at the PCSS's facility. As part of the requirements of Section 40 50 00-1.06, the PCSS's factory testing facility shall be within 200 miles of project site. The test will be an unwitnessed test, and the PCSS shall include time within the construction schedule for this test.
- C. The purpose of the SIT is to allow the PCSS and the AES Supplier to jointly verify the functionality, performance, and stability of the hardware and software as a complete integrated system. The AES Supplier will load the application software on the PLCs, SCADA servers, and historian. The entire system will then be tested. All process control strategies shall be simulated to ensure proper operation. The primary objective of the SIT is to allow the PCSS and the AES Supplier to perform a dry run of the WFT and thus verify the system's readiness to move forward with the WFT.
- D. The PCSS and AES Supplier shall utilize the approved WFT Procedures as the basis for the tests to be performed during the SIT.
- E. Minimum testing to be performed during the SIT shall include, but not be limited to, the following:
 - 1. Verification of proper scanning, communication, and complete data acquisition of the entire system.
 - 2. Verification of all redundant functionality of components.
 - 3. Verification of proper power failure recovery.
 - 4. Verification of proper indication for communication error issues.
 - 5. A complete I/O point checkout shall be performed to verify proper operation of each input/output point. The I/O checkout shall consist of four steps.
 - a. Digital input signals shall be jumpered within the termination connections of the PLC panels and verification of proper alarming, statuses, etc., shall be performed at the HMI.
 - b. Analog input signals shall be connected to a signal generator at the termination connections and signals shall be verified at zero percent, 25 percent, 50 percent, 75 percent, and 100 percent of full scale. The appropriate scaled value shall be verified at the HMI. Simultaneously, verification of alarming shall occur. The alarming verification shall, at a minimum, include HiHi, Hi, Lo, LoLo, Rate of Change, and Alarm Deadband.
 - c. Digital output signals shall be initiated by the user from the HMI system. Verification shall occur within the PLC panel by connecting a digital

multimeter to measure the continuity at the terminations, thus verifying the command from the PLC has properly executed the contact closure.

- d. Analog output signals shall be initiated by the user from the HMI system. Verification shall occur in the PLC panel by utilizing a digital multimeter to measure the current/voltage generated at the termination points.
6. Upon successful completion of the SIT, the PCSS shall submit a record copy of the test results to the Owner and Engineer and request the scheduling of the WFT as noted below.

3.04 FIELD TESTING - OPERATIONAL READINESS TEST (ORT)

- A. Following installation of the process control system components and prior to startup and the Functional Demonstration Test, the entire system shall be certified (inspected, wired, calibrated, tested, etc., and documented) that it is installed and ready for the ORT as defined below.
- B. Loop/Component Inspections and Tests: The entire system shall be checked for proper installation, calibrated, and adjusted on a loop-by-loop and component-by-component basis to ensure that it is in conformance with related submittals and these Specifications.
- C. The Loop/Component Inspections and Tests shall be implemented using Engineer-approved forms and checklists. Each loop shall have a Loop Status Report to organize and track its inspection, adjustment, and calibration. These reports shall include the following information and check-off items with spaces for sign-off by the system supplier:
 1. Project Name, Test Date, PCSS Name, and Lead PCSS Technician Name.
 2. Loop Number.
 3. Tag Number for each component.
 4. Check-offs/sign-offs for each component: Tag/identification; installation; termination (wiring and tubing); scale, range, and setpoint as applicable; and calibration/adjustment (four-point for analog, set point for switches) rising and falling.
 5. Check-offs/sign-offs for the loop: Panel interface terminations; I/O interface terminations; I/O signal operation; inputs/outputs operational (received/sent, processed, adjusted); total loop operation; process controller scaling and adjustment; and space for comments.
 6. Each active Analog Subsystem element and each I/O module shall have a Component Calibration Sheet. These sheets shall have the following information, spaces for data entry, and a space for sign-off by the PCSS.
 - a. Project Name.

- b. Loop Number.
 - c. Component Tag Number of I/O Module Number.
 - d. Component Code Number Analog System.
 - e. Manufacturer (for Analog system element).
 - f. Model Number/Serial Number (for Analog system).
 - g. Summary of functional requirements shall include, but not be limited to, scale and chart ranges of indicators, recorders, and transmitters/converters; functions of computing elements; and parameters of controllers (i.e., proportional, integral, derivative, reverse/forward acting, etc.).
 - h. Calibrations shall include testing of analog input and output signals at zero, 10, 50, and 100 percent of span. Where appropriate, discrete input signals shall include details regarding actual trip points and reset points.
 - i. Space for comments.
 - j. Space for sign-off by the PCSS.
- D. The PCSS shall maintain the Loop Status Reports sheets at the job site and make them available to the Engineer/Owner at any time.
- E. These inspections, calibrations, and tests do not require witnessing. However, the Engineer will review Loop Status Sheets and spot-check the PCSS test process periodically. Any deficiencies found shall be corrected by the PCSS prior to commencement of the Functional Acceptance Test.
- F. Prior to checkout of the I/O to the HMI, the PCSS shall thoroughly test all I/O from the field device to the PLC terminals, and verify the PLC is powered up and the PLC is communicating to the SCADA servers. After the PCSS has successfully tested all I/O from the field devices to the PLC terminals, the PCSS and AES Supplier shall jointly test all I/O from the HMI to the field device. Should this test prove to be unsuccessful, the PCSS and AES Supplier shall test from the HMI to the terminations located in the Owner's termination cabinet, and the PCSS shall inform the Owner in writing of the discrepancy with the existing field wire.
- G. Computer-Manual (i.e., Remote-Manual) start/stop, open/close commands of all devices controlled by the SCADA system shall be verified jointly by the PCSS and AES Supplier during the ORT. Subsequent to verification of Computer-Manual control, the PCSS may request from the Owner and Engineer permission to begin replacement of the next PLC. Simultaneously, the AES Supplier may continue with Computer-Automatic testing to confirm the control strategies were implemented as specified.
- H. For all panels with enclosures (new and existing) modified by this contract, heat load tests shall be performed to ensure proper cooling/ventilation is being provided.

- I. Upon successful completion of the ORT, the PCSS shall submit a record copy of the test results to the Owner and Engineer and request the scheduling of the FDT as noted in the following section.

3.05 FIELD TESTING - FUNCTIONAL DEMONSTRATION TEST (FDT)

- A. Prior to startup and the 30-day Site Acceptance Test, the entire installed instrument and control system shall be certified that it is ready for operation. All preliminary testing, inspection, and calibration shall be complete as defined in the ORT. The FDT will be a joint test by the PCSS and the AES Supplier.
- B. Once a process area has been started up and is operating, a witnessed FDT shall be performed on that system to demonstrate that it is operating and is in compliance with these Specifications. A witnessed FDT shall be performed on each process area. Each specified function shall be demonstrated on a paragraph-by-paragraph, loop-by-loop, and site-by-site basis.
- C. Loop-specific and non-loop-specific tests shall be the same as specified under WFT, except that the entire installed system shall be tested and all functions demonstrated using live field-based data to the greatest extent possible.
- D. Updated versions of the documentation specified to be provided for during the factory tests shall be made available to the Engineer at the job site both before and during the tests. In addition, one copy of all O & M Manuals shall be available for reference at the job site, both before and during testing.
- E. The daily schedule specified to be followed during the factory tests shall also be followed during the FDT.
- F. During the FDT, a demonstration of communication failure and recovery shall be accomplished. This test shall be scheduled and coordinated with Owner's personnel to minimize the impact on plant operations.
- G. Following initial startup, the entire process control system shall operate for a continuous 100 hours without failure before this test will be started.
- H. Punchlist items and resolutions noted during the test shall be documented on the Punchlist/Resolution form. In the event of rejection of any part or function test procedure, the PCSS shall perform repairs, replacement, and/or retest within 10 days.
- I. Upon successful completion of the FDT, the PCSS shall submit a record copy of the test results to the Owner and Engineer and request the scheduling of the SAT as noted in the following section.

3.06 FIELD TESTING - 30-DAY SITE ACCEPTANCE TEST (SAT)

- A. After completion of the Operational Readiness and Functional Demonstration Tests, the system shall undergo a 30-day Site Acceptance Test (SAT), under conditions of full plant process operation, without a single non-field-repairable malfunction. The SAT will be a joint test by the PCSS and the AES Supplier.

- B. During this test plant operations, PCSS personnel and AES Supplier personnel shall be present as required to address any potential issues that would impact the overall system operation. The PCSS is expected to provide personnel for this test who have an intimate knowledge of the hardware, software, field wiring and network configuration of the system. The AES Supplier is expected to provide personnel for this test who have an intimate knowledge of the software programming of the system. When PCSS personnel are not on-site, the PCSS shall provide cell phone/pager numbers that Owner personnel can use to ensure that support staff are available by phone and/or on-site within four hours of a request by operations staff.
- C. While this test is proceeding, the Engineer and Owner's Agent shall have full use of the system. Only plant operating personnel shall be allowed to operate equipment associated with live plant processes. Plant operations shall remain the responsibility of Owner and the decision of plant operators regarding plant operations shall be final.
- D. Any malfunction during the tests shall be analyzed and corrections made by the AES Supplier for software programming issues, and the PCSS for hardware, software, field wiring and network configuration issues. The Engineer and/or Owner will determine whether any such malfunctions are sufficiently serious to warrant a repeat of this test.
- E. Any malfunction during this 30 consecutive day test period which cannot be corrected by the PCSS's personnel within 24 hours of occurrence, or more than two similar failures of any duration, will be considered as a non-field-repairable malfunction. Upon completion of repairs by the PCSS, the SAT will be re-started from the date which the PCSS successfully corrected the malfunction(s) and the Owner and Engineer have accepted and signed off on the repairs.
- F. The PCSS shall perform repairs or replacement within 10 days in the event of rejection of any part or function of the hardware, software, field wiring and network configuration systems.
- G. All data base, process controller logic, and graphical interface system errors must be functioning as required per the specifications prior to the start of each test period. The 30-day test will not be considered successful until all data base points and logic functions are tested and verified to be correct.
- H. The total availability of the system shall be greater than 99.5 percent during this test period. Availability shall be defined as: $\text{Availability in percent} = 100 * (\text{Total Testing Time} - \text{Down Time}) / \text{Total Testing Time}$
- I. Down times due to power outages or other factors outside the normal protection devices or backup power supplies provided shall not contribute to the availability test times above.
- J. Throughout the duration of the 30-day SAT, no software or hardware modifications shall be made to the system without prior approval from the Owner and Engineer.
- K. Upon successful completion of the 30-day operation test and subsequent review and approval of complete system final documentation, the system shall be considered substantially complete and the warranty period shall commence.

- L. Certification of Installation: Following successful completion of the 30-day test, the PCSS shall issue a Certification of Installation. Certification shall be on PCSS corporate letterhead and signed by an officer of the firm. Certification shall state that the process control system has been completed in conformance with plans and specifications. Certification shall be submitted to the Engineer as specified herein.

END OF SECTION

SECTION 40 51 50

CONTROL PANELS AND PANEL MOUNTED EQUIPMENT

PART 1 — GENERAL

1.01 SCOPE OF WORK

- A. Refer to Section 40 50 00.
- B. Furnish and install control panels and panel mounted equipment as specified herein and shown on the Drawings.
- C. All new panels and panel components shall match existing equipment makes and models wherever possible, so that system additions can be most easily integrated with respect to operation and maintenance training, spare parts inventory, and service contracts. Even when exact matches are not possible, equipment furnished must be fully compatible with the existing system. Color, size, and material of new panels should conform to that of existing panels.
- D. Furnish the following panels and consoles. Each panel shall be supplied with full sub-panels and side panels as required.

1.02 RELATED WORK

- A. Refer to Section 40 50 00.

1.03 SUBMITTALS

- A. Refer to Section 40 50 00.

1.04 COORDINATION MEETINGS

- A. Refer to Section 40 50 00.

1.05 REFERENCE STANDARDS

- A. Refer to Section 40 50 00.

1.06 QUALITY ASSURANCE

- A. Refer to Section 40 50 00.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 40 50 00.

1.08 NOMENCLATURE AND IDENTIFICATION

- A. Refer to Section 40 50 00.

1.09 MAINTENANCE

- A. Refer to Section 40 50 00.

1.10 SPARE PARTS AND TEST EQUIPMENT:

- A. Refer to Section 40 50 00.

1.11 WARRANTY

- A. Refer to Section 40 50 00.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Refer to Section 40 50 00.

2.02 LIGHTNING/SURGE PROTECTION

- A. Refer to Section 40 50 00.

2.03 CONTROL PANEL GENERAL REQUIREMENTS

- A. The dimensions within this Section and on the Contract Drawings are for general reference only. Ensure that final enclosure sizing and panel arrangements accommodate all required equipment for a fully integrated and operational system as specified herein and in the Contract Documents.
- B. Each control panel and terminal cabinet shall bear the UL label. The UL label shall apply to the enclosure, the specific equipment supplied with the enclosure, and the installation and wiring of the equipment within and on the enclosure. If required for UL labeling, provide ground fault protective devices, isolation transformers, fuses and any other equipment necessary to achieve compliance with UL 508 requirement. The Drawings do not detail all UL 508 requirements.
- C. All panel doors shall have a lock installed in the door handle, or a hasp and staple for padlocking. Locks for all panels provided under this Contract shall be keyed alike.
- D. The devices designated for rear-of-panel mounting shall be arranged within the panel according to respective panel drawings and in a manner to allow for ease of maintenance and adjustment. Heat generating devices such as power supplies shall be located at or near the top of the panel.
- E. The panels shall be completely fabricated, instruments and devices installed and wired at the PCSS's facility.
- F. All components shall be mounted in a manner that shall permit servicing, adjustment, testing, and removal without disconnecting, moving, or removing any other component. Components mounted on the inside of panels shall be mounted on removable plates and not directly to the enclosure. Mounting shall be rigid and stable unless shock mounting is required otherwise by the manufacturer to protect equipment from vibration. Component mounting shall be oriented in accordance with manufacturer's recommendations. The internal components shall be identified with suitable plastic or metal engraved nametags mounted adjacent to (not on) each component identifying the component in accordance with the drawing, specifications, and PCSS's data.
- G. All exterior panel mounted equipment shall be installed with suitable gaskets, faceplates, etc. required to maintain the NEMA rating of the panel.

H. Nameplates

1. All panels and panel devices shall be supplied with suitable nameplates, which identify the panel and individual devices as required. Unless otherwise indicated, each device nameplate shall include up to three lines with the first line containing the device tag number as shown on the drawings, the second line containing a functional description (e.g., Recirculation Pump No. 1), and the third line containing a functional control description (e.g., Start).
2. Unless escutcheon plates are specified or unless otherwise noted on the Drawings, nameplates shall be 3/32-inch thick, black and white, Lamicoid with engraved inscriptions. The letters shall be Black [White] against a White [Black] background unless otherwise noted. Edges of the nameplates shall be beveled and smooth. Nameplates with chipped or rough edges will not be acceptable.
3. Nameplate fasteners and mounting shall be epoxy adhesive or stainless steel screws for cabinet mounted nameplates
4. For every panel, provide a panel nameplate with a minimum of 1" high letters. Provide legend plates or 1-in by 3-in engraved nameplates with 1/4-in lettering for identification of door mounted control devices, pilot lights, and meters.
5. Single lamicoid nameplates with multiple legends shall be used for grouping of devices such as selector switches and pilot lights that relate to one function.

I. Mounting Elevations

1. ISA Recommended Practice RP60.3 shall be used as a guide in layout and arrangement of panels and panel mounted components. Dimensions shall account for all housekeeping pads that panels will sit on once they are installed.
2. Centerline of indicators and controllers shall be located no lower than 48-inches or higher than 66-inches above the floor on a panel face.
3. Centerline of lights, selector switches, and pushbuttons shall be located no lower than 32-inches or higher than 70-inches above the floor on a panel face.
4. Tops of annunciators shall be located no higher than 86-inches above the floor on a panel face.
5. Installation of panel components shall conform to component manufacturers' guidelines.

2.04 PANEL MATERIALS AND CONSTRUCTION

A. Structure and Enclosure

1. Panels shall be of continuous welded-steel or FRP construction as shown on the Panel Schedule. Provide angle stiffeners as required on the back of the panel face to prevent panel deflection under instrument loading or operation. Internally the panels shall be supplied with a structural framework for instrument support purposes and panel bracing. The internal framework shall permit panel lifting

without racking or distortion. Provide removable lifting rings designed to facilitate simple, safe rigging, and lifting of the control panels during installation.

2. Each panel shall be provided with full height, fully gasketed access doors where shown. Doors shall be provided with a three-point stainless steel latch and heavy duty stainless steel locking handle. Panel access doors shall be provided with full length, continuous, piano type stainless steel hinges with stainless steel pins. Front access doors with mounted instruments or control devices shall be of sufficient width to permit door opening without interference from flush mounted instruments.
3. The panels, including component parts, shall be free from sharp edges and welding flaws. Wiring shall be free from kinks and sharp bends and shall be routed for easy access to other components for maintenance and inspection purposes.
4. The panel shall be suitable for top and bottom conduit entry as required by the Electrical Drawings. For top mounted conduit entry, the panel top shall be provided with nominal one-foot square removable access plates, which may be drilled to accommodate conduit and cable penetrations. All conduit and cable penetrations shall be provided with ground bushings, hubs, gasketed locknuts, and other accessories as required to maintain the NEMA rating of the panel and electrical rating of the conduit system.
5. All panels in indoor, dry, non-corrosive environments shall be NEMA 12 unless otherwise noted. All panels in outdoor, wet, and non-chemically corrosive environments shall be NEMA 4 unless otherwise noted. Panels in chemically corrosive environments shall be NEMA 4X unless otherwise noted. All panels located in a hazardous location shall be rated for the type of hazard (e.g., NEMA 7 for Class 1, Division 1).

B. Freestanding and Floor-Mounted Vertical Panels

1. Freestanding and floor-mounted vertical panels shall meet the NEMA classification as shown on the drawings or specified herein. The panels shall be constructed of sheet steel, suitably braced internally for structural rigidity and strength. All NEMA 4X rated panels shall be constructed of 316 stainless steel. Front panels or panels containing instruments shall be not less than 10 gauge stretcher leveled sheet steel, reinforced to prevent warping or distortion.

C. Wall and Unistrut Mounted Panels

1. All wall and Unistrut mounted panels shall meet the NEMA classification as shown on the drawings or specified herein. The panels shall be constructed of not strength. All NEMA 4X rated wall mounted panels shall be constructed of 316 stainless steel.

D. Finish Requirements

1. All sections shall be descaled, degreased, filled, ground and finished. The enclosure when fabricated of steel shall be finished with two rust resistant phosphate prime coats and two coats of enamel, polyurethane, or lacquer finish

which shall be applied by either the hot air spray or conventional cold spray methods. Brushed anodized aluminum, stainless steel, and FRP panels will not require a paint finish.

2. The panels shall have edges ground smooth and shall be sandblasted and then cleaned with a solvent. Surface voids shall be filled and ground smooth.
 3. Immediately after cleaning, one coat of a rust-inhibiting primer shall be applied inside and outside, followed by an exterior intermediate and top coat of a two-component type epoxy enamel. A final sanding shall be applied to the intermediate exterior coat before top coating.
 4. Apply a minimum of two coats of flat white lacquer on the panel interior after priming.
 5. Unless otherwise noted, the finish exterior colors shall be ANSI 61 gray with a textured finish.
- E. Print storage pockets shall be provided on the inside of each panel. The storage pockets shall be steel, welded on to the door, and finished to match the interior panel color. The storage pocket shall be sufficient to hold all of the prints required to service the equipment, and to accommodate 8.5 inch by 11 inch documents without folding.
- F. Where specified on the Panel Schedule, a folding shelf shall be provided on the inside of the door on all free-standing and floor-mounted panels. The shelf shall be suitable for a laptop computer and shall be placed such that an open laptop computer does not interfere with any door-mounted devices. The folded shelf shall not interfere with any internal panel components when the door is closed. The folding shelf shall automatically lock in the horizontal position when raised. The folding shelf shall be approximately 18 inches wide by 12 inches deep and shall have a minimum distributed load rating of 100 pounds. All parts shall be made of heavy gauge steel and shall be painted white or finished to match the interior panel color.

2.05 ENVIRONMENTAL CONTROL

- A. All panels shall be provided with louvers, sun shields, heat sinks, forced air ventilation, or air conditioning units as required to prevent temperature buildup inside of panel. The internal temperature of all panels shall be regulated to a range of 45 Deg F to 104 Deg F under all conditions. Under no circumstances shall the panel cooling or heating equipment compromise the NEMA rating of the panel.
- B. PCSS shall submit heat dissipation calculations for every control panel.
- C. Except for panels mounted with their backs directly adjacent to a wall, louvers shall be in the rear of the panels, top and bottom, and shall be stamped sheet metal construction.
- D. For panels mounted with their backs directly adjacent to a wall, louvers shall be on the sides.

- E. Forced air ventilation fans, where used, shall provide a positive internal pressure within the panel, and shall be provided with washable or replaceable filters. Fan motors shall operate on 120-volt, 60-Hz power.
- F. For panels with internal heat that cannot be adequately dissipated with natural convection and heat sinks, or forced air ventilation, an air conditioner shall be provided.
- G. Provide custom fabricated sun shields for all outdoor panels in accordance with the following requirements:
 - 1. Sun shields shall be fabricated from minimum 12 gauge aluminum. Units shall be designed, fabricated, installed, and supported to fully cover and shade the top, sides and back of the enclosure, and to partially shade the front panel of the enclosure, from direct exposure to sunlight from sunrise to sunset.
 - 2. Depending on overall size, sun shields may be fabricated in single or multiple segments for attachment to the enclosure support framing or to separate free standing framing around the enclosure.
 - 3. Sun shields shall not be attached directly to the enclosure by drilling holes through, or welding studs to, the enclosure surfaces, and shall be designed and mounted to provide a minimum 3-inch air gap all around the enclosure for air circulation and heat dissipation.
 - 4. The top section of all sun shields shall be sloped at a minimum angle of 5 degrees from horizontal. For wall mounted enclosures, the top section shall slope downward away from the wall and towards the front of the enclosure. For free standing, floor mounted and frame mounted enclosures the top section shall slope downward towards the back side of the enclosure.
 - 5. The front edge of the top section of all sun shields shall incorporate a narrow and more steeply sloped drip shield segment which sheds water away from the front of the enclosure and prevents it from dripping or running directly onto the front panel of the enclosure.
 - 6. All seam welds used in sun shield fabrication shall be continuous and shall be ground smooth.
 - 7. All exposed corners, edges and projections shall be smooth rounded or chamfered to prevent injury.
- H. All outdoor enclosures and enclosures located in unheated areas indoors or in areas subject to humidity and moisture shall be provided with an integral heater, fan, and adjustable thermostat to reduce condensation and maintain the minimum internal panel temperature. Mount the unit near the bottom of the enclosure with discharge away from heat-sensitive equipment. Heater shall be Hoffman DAH [100] [200] [400] [800] Watts, [115] [230] Volt, 50/60 HZ or equal.

2.06 CONTROL PANEL - INTERNAL CONSTRUCTION

A. Internal Electrical Wiring

1. All interconnecting wiring shall be stranded, type MTW, and shall have 600 volt insulation and be rated for not less than 90 degrees Celsius. Wiring for systems operating at voltages in excess of 120 VAC shall be segregated from other panel wiring either in a separate section of a multi-section panel or behind a removable Plexiglas or similar dielectric barrier. Panel layout shall be developed such that technicians shall have complete access to 120 VAC and lower voltage wiring systems without direct exposure to higher voltages.
2. Power distribution wiring on the line side of fuses or breakers shall be 12 AWG minimum. Control wiring on the secondary side of fuses shall be 16 AWG minimum. Electronic analog circuits shall utilize 18 AWG shielded, twisted pair, cable insulated for not less than 600 volts.
3. Power and low voltage DC wiring systems shall be routed in separate wireways. Crossing of different system wires shall be at right angles. Different system wires routed parallel to each other shall be separated by at least 6-inches. Different wiring systems shall terminate on separate terminal blocks. Wiring troughs shall not be filled to more than 60 percent visible fill.
4. Terminations
 - a. All wiring shall terminate onto single tier terminal blocks, where each terminal is uniquely and sequentially numbered. Direct wiring between field equipment and panel components is not acceptable.
 - b. Multi-level terminal blocks or strips are not acceptable.
 - c. Terminal blocks shall be arranged in vertical rows and separated into groups (power, AC control, DC signal). Each group of terminal blocks shall have a minimum of 25 percent spares.
 - d. Terminal blocks shall be the compression type, fused, unfused, or switched as shown on the Contract Drawings or specified elsewhere in Division 40.
 - e. Discrete inputs and outputs (DI and DO) shall have two terminals per point with adjacent terminal assignments. All active and spare PLC and controller points shall be wired to terminal blocks.
 - f. Analog inputs and outputs (AI and AO) shall have three terminals per shielded pair connection with adjacent terminal assignments for each point. The third terminal is for shielded ground connection for cable pairs. Ground the shielded signal cable at the PLC cabinet. All active and spare PLC and controller points shall be wired to terminal blocks.
 - g. Wire and tube markers shall be the sleeve type with heat impressed letters and numbers.

- h. Only one side of a terminal block row shall be used for internal wiring. The field wiring side of the terminal shall not be within 6-inches of the side panel or adjacent terminal or within 8-inches of the bottom of free standing panels, or within 3-inches of stanchion mounted panels, or 3-inches of adjacent wireway.
 - i. Circuit power from the SCADA cabinet out to field devices (switches, dry contacts etc.) that are used as discrete inputs to the PLC input cards shall be isolated with an isolating switch terminal block with flip cover that is supplied with a dummy fuse. Isolation switch block shall be an Allen Bradley Model 1492-H7 or equal. One isolating switch terminal block per loop numbered piece of equipment and one per spare I/O point is acceptable.
 - j. All PLC discrete outputs to the field shall be isolated with an isolating fuse switch terminal block with a flip cover and a neon blown fuse indicator. The single circuit fusible terminal block shall be an Allen Bradley 1492-H4 or equal.
- 5. All wiring to hand switches and other devices, which are live circuits independent of the panel's normal circuit breaker protection, shall be clearly identified as such.
- 6. All wiring shall be clearly tagged and color coded. All tag numbers and color coding shall correspond to the panel wiring diagrams and loop drawings prepared by the PCSS. All power wiring, control wiring, grounding, and DC wiring shall utilize different color insulation for each wiring system used. The color coding scheme shall be:
 - a. Incoming 120 VAC Hot - Black
 - b. 120 VAC Hot wiring downstream of panel circuit breaker – Red
 - c. 120 VAC Hot wiring derived from a UPS system – Red with Black stripe
 - d. Three phase power – Brown, Orange, Yellow, and Green ground or as specified in Division 26.
 - e. 120 VAC neutral - White
 - f. Ground - Green
 - g. DC power or control wiring – Blue
 - h. DC analog signal wiring – Black (+), White (-)
 - i. Foreign voltage – Yellow
- 7. Provide surge protectors on all incoming power supply lines at each panel per the requirements of Section 40 50 00.
- 8. Each field instrument furnished under Division 40 and shown on the Drawings as deriving input power from the control panel(s) shall have a separate power

distribution circuit with a circuit breaker or fuse and blown fuse indication. All instruments requiring 120VAC power shall be powered from the UPS source in the panel where the instrument signals lands.

9. Provide 24VDC power supplies to power field instruments and panel devices. 24VDC power supplies shall be as specified in this Section.
10. Use of adhesive backed cable tie mounts is not acceptable. Cable ties shall be permanently fixed to the panel structure, as needed for controlling cable routing within the panel.
11. Wiring trough for supporting internal wiring shall be plastic type with snap-on covers. The side walls shall be open top type to permit wire changing without disconnecting. Trough shall be supported to the subpanel by stainless steel screws. Trough shall not be bonded to the panel with glue or adhesives.
12. Each panel shall have a single tube, fluorescent light fixture, 20 Watt in size, mounted internally to the ceiling of the panel. Light fixture shall be switched and shall be complete with the lamp.
13. Each panel shall have a specification grade duplex convenience receptacle with ground fault interrupter, mounted internally within a stamped steel device box with appropriate cover. Convenience receptacle shall not be powered from a UPS and shall be protected by a dedicated fuse or circuit breaker.
14. Each panel shall be provided with an isolated copper grounding bus for all signal and shield ground connections. Shield grounding shall be in accordance with the instrumentation manufacturer's recommendations.
15. Each panel shall be provided with a separate copper power grounding bus (safety) in accordance with the requirements of the National Electrical Code.
16. Each panel shall have control, signal, and communication line surge suppression in accordance with Section 40 50 00.
17. All microprocessor-based electronic devices in the panel that are powered by 120VAC shall be powered by the UPS (refer to appropriate Section in Division 40).
18. Each panel shall be provided with a circuit breaker to interrupt incoming power. Provide a minimum of two (2) spare 20-amp breakers.
19. Additional electrical components including transformers, motor starters, switches, circuit breakers, etc. shall be in compliance with the requirements of Division 26.

B. Pneumatic Tubing

1. Refer to Section 40 50 00.

2. Pneumatic tubing shall be a minimum of 1/4-inch O.D. 316 stainless steel with compression fittings. All tubing shall be rigidly supported and run in horizontal or vertical planes.
 3. All pneumatic equipment shall be provided with separate shut-off valves. Flexible polyethylene tubing shall be used on all devices mounted on hinged doors, etc.
 4. A screened vent shall be provided on all enclosures using pneumatic instruments.
 5. All pneumatic tubing shall be routed in separate bundles or wireways, and shall be separated from all electrical wiring by a minimum of 3-inches.
- C. Relays not provided under Division 26 and required for properly completing the control function specified in Division 40, Division 26, or shown on the Drawings shall be provided under this Section.
- D. The orientation of all devices including PLC and I/O when installed shall be per the manufacturer's recommendations. No vertical orientation of PLC racks shall be allowed unless specifically indicated by the manufacturer as an acceptable mounting alternative and also approved by the engineer.
- E. Purge system for enclosures located in hazardous areas.

2.07 ELECTRICAL COMPONENTS

- A. Refer to Division 26.
- B. The control panel shall be provided with a main power circuit breaker and individual fuses for each 120VAC and 24VDC logical circuit.
- C. All operating control devices and instruments shall be securely mounted on the exterior door. All controls shall be clearly labeled to indicate function and shall be in accordance with the electrical area classification indicated on the Contract Drawings.
- D. The control panel shall be provided with a lightning and surge protection unit on the line side of the main circuit breaker. Unit shall be 600 Volt, 3 Phase, General Electric "Tranquell" Series, or equal.

2.08 GENERAL PURPOSE RELAYS AND TIME DELAYS

- A. Type:
1. General purpose plug-in type.
- B. Functional:
1. Contact arrangement/function shall be as required to meet the specified control function; mechanical life expectancy shall be in excess of 10 million.
 2. Duty cycle shall be rated for continuous operation; Units shall be provided with integral indicating light to indicate if relay is energized.

3. Solid state time delays shall be provided with polarity protection (DC units) and transient protection.
4. Time delay units shall be adjustable and available in ranges from .1 second to 4.5 hours.

C. Physical:

1. For 120 VAC service provide contacts rated 10 amps at 120 VAC, for 24 VDC service provide contacts rated 5 amps at 28 VDC, for electronic (milliamp/millivolt) switching applicator provide gold plated contacts rated for electronic service; relays shall be provided with dust and moisture resistant covers.

D. Options/Accessories Required:

1. Provide mounting sockets with pressure type terminal blocks rated 300 volt and 10 amps.
2. Provide mounting rails/holders as required.

E. Manufacturer(s):

1. IDEC.
2. Allen Bradley.
3. Potter & Brumfield.
4. Equal.

2.09 *SIGNAL RELAY SWITCHES (CURRENT TRIPS)*

A. Type:

1. Solid state, ASIC technology, electronic type.

B. Functional:

1. Input: 4-20 mA.
2. Output: Isolated contact output, double pole double throw, rated 5 amps at 120 VAC.
3. Accuracy: 0.1 percent.
4. Protection: Provide RFI protection.
5. Deadband: Adjustable between 0.1 and 5.0 percent of span.

6. Set point Adjustment: Single Point alarms shall be adjustable to trip on rising or falling input signal, dual point alarms shall be adjustable to trip on rising and falling input signals.
7. Repeatability: Trip point repeatability shall be at least 0.1 percent of span.

C. Physical:

1. Mounting: DIN rail.

D. D. Manufacturer(s):

1. Action Instruments Slim Pak.
2. Acromag.
3. Equal.

2.10 SIGNAL ISOLATORS/BOOSTERS/CONVERTERS

A. Type:

1. Solid state, ASIC technology; electronic type.

B. Functional:

1. Accuracy: 0.15 percent.
2. Inputs: Current, voltage, frequency, temperature, or resistance as required.
3. Outputs: Current or voltage as required.
4. Isolation: There shall be complete isolation between input circuitry, output circuitry, and the power supply.
5. Adjustments: Zero and span adjustment shall be provided.
6. Protection: Provide RFI protection.

C. Physical:

1. Mounting: DIN rail.

D. Manufacturer(s):

1. Action Instruments Slim Pak.
2. Acromag.
3. Equal.

2.11 SIGNAL SELECTORS, COMPUTATION, AND CONDITIONING RELAYS

A. Type:

1. Solid state, ASIC technology, electronic type.

B. Functional:

1. Inputs: 4-20 mA.
2. Outputs: 4-20 mA.
3. Protection: Provide RFI protection.
4. Operation: The relay shall multiply, add, subtract, select, extract the square root, or perform the specified conditioning/ computation function required. All inputs shall be able to be individually rescaled and biased as Required.
5. Isolation: All inputs, outputs, and power supplies shall be completely isolated.
6. Accuracy: 0.35 percent of span.
7. Adjustments: Multi turn potentiometer for zero, span, scaling, and biasing.

C. Physical:

1. Mounting: DIN rail.

D. Manufacturer(s):

1. Action Instruments Slim Pak.
2. Acromag.
3. Equal.

2.12 *INTRINSICALLY SAFE RELAYS*

A. Type:

1. Relays shall be of the solid state electronic type in which the energy level of the sensing or actuation circuit is low enough to allow safe usage in hazardous areas.

B. Options Required:

1. Relays shall match power supply provided.
2. Relays shall be located in non-hazardous areas.

C. Manufacturer(s):

1. Consolidated Electric.

2. Gems Safe-Pak.
3. Warrick Controls.
4. R. Stahl, Inc.
5. Equal.

2.13 *INTRINSIC SAFETY BARRIERS (FOR 2-WIRE TRANSMITTER SYSTEMS)*

- A. Intrinsic safety barriers shall be passive devices requiring no external voltage supply and supplied with series resistors, series fuse and shunt zener diodes to limit the transfer of energy to levels required by intrinsically safe protection between safe and hazardous locations.
- B. Unit shall be Factory Mutual approved and certified for use in accordance with National Fire Protection Association (NFPA 493).
- C. Manufacturer(s):
 1. P&F.
 2. Gems.
 3. Unitech.
 4. Equal.

2.14 *24 VDC POWER SUPPLIES*

- A. Provide a 24 VDC power supply in the control panel to power field instruments, panel devices, etc., as required. Equip the power supply with a power on/off circuit breaker.
- B. The 24 VDC power supply shall meet the following requirements:
 1. Input power: 115 VAC, plus or minus 10 percent, 60 Hz.
 2. Output voltage: 24 VDC.
 3. Output voltage adjustment: 5 percent.
 4. Line regulation: 0.05 percent for 10 volt line change.
 5. Load regulation: 0.15 percent no load to full load.
 6. Ripple: 3 mV RMS.
 7. Operating temperature: 32 to 140 degrees Fahrenheit.
- C. Size the 24 VDC power supply to accommodate the design load plus a minimum 25 percent spare capacity.

- D. If power supply on/off status signal is shown, provide a relay contact (internal to the power supply or external if the power supply is not so equipped) to indicate on/off status of the power supply.
- E. Provide output overvoltage and overcurrent protective devices with the power supply to protect instruments from damage due to power supply failure and to protect the power supply from damage due to external failure.
- F. Mount the 24 VDC power supply such that dissipated heat does not adversely affect other panel components.
- G. Manufacturer(s):
 - 1. Phoenix Contact – Quint Series
 - 2. PULS.
 - 3. Lambda.
 - 4. Equal.

PART 3 -EXECUTION

3.01 INSTALLATION

- A. The panels shall be installed at locations as shown on the Contract Drawings.
- B. Refer to Section 40 50 00.

3.02 TESTS

- A. Refer to Section 40 50 00.

END OF SECTION

SECTION 40 62 14

CONTROL SYSTEMS: PCS COMPUTER EQUIPMENT

GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. PC-based PCS system hardware, including:
 - a. PCS Servers.
 - b. Virtualized HMI Servers.
 - c. SAN Arrays.
 - d. Network Time Servers.
 - e. Keyboard-Video-Mouse (KVM) Switches.
 - f. Network Attached Storage (NAS).
 - g. Tape Backup Devices.
 - h. Operator Workstations (Thick and Thin Clients).
 - i. LCD Monitors.
 - j. Portable Computers.
 - k. Tablets.
 - l. Large Screen Displays.
 - m. Card Readers.
 - n. Industrial Panel Computers.
 - o. Printers.
 - p. Demilitarized Zone Hardware.

1.02 REFERENCES

- A. As specified in Section 40 50 00 - Common Work Results for Process Control and Instrumentation Systems.

1.03 DEFINITIONS

- A. As specified in Section 40 50 00 - Common Work Results for Process Control and Instrumentation Systems.
- B. Specific definitions:
 - 1. CAL: Client access license.
 - 2. RAID: Redundant array of independent disks.
 - 3. SNMP: Simple network management protocol.

1.04 SYSTEM DESCRIPTION

- A. Provide all PCS computer equipment identified in the Contract Documents.
- B. Miscellaneous requirements:
 - 1. All material used in satisfying the equipment requirements shall be new and unused and must be actively marketed by the original equipment manufacturer for new applications at the time of the factory demonstration test. The Contractor shall not use equipment destined for installation or spare parts for the Owner's system for any reason other than development and testing of the system.

1.05 SUBMITTALS

- A. Furnish submittals as specified in Division 01 and 40 50 00.

1.06 QUALITY ASSURANCE

- A. As specified in Section 40 50 00 - Common Work Results for Process Control and Instrumentation Systems.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. As specified in Section 40 50 00 - Common Work Results for Process Control and Instrumentation Systems.

1.08 PROJECT OR SITE CONDITIONS

- A. As specified in Section 40 50 00 - Common Work Results for Process Control and Instrumentation Systems.

1.09 SEQUENCING (NOT USED)

1.10 SCHEDULING (NOT USED)

1.11 WARRANTY

- A. As specified in Section 40 50 00.

1.12 SYSTEM START-UP (NOT USED)

1.13 OWNER'S INSTRUCTIONS (NOT USED)

1.14 COMMISSIONING (NOT USED)

1.15 MAINTENANCE

- A. Servers:
 - 1. Provide a 3-year on-site manufacturer's service plan, with 2-year unlimited phone support.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Commonality:
 - 1. The PCS system shall utilize the same brand and type of computer for like functions throughout the system.
 - 2. Where possible, use the same processor family throughout.
 - 3. Use a single PC computer manufacturer throughout the Project, including those used for diagnostics and maintenance.
- B. Manufacturers:
 - 1. As indicated below.
- C. Systems management architecture:
 - 1. All processors, servers, workstations, network software, bridges, and other manageable objects shall have simple network management protocol (SNMP) agents included.

2.02 EXISTING PRODUCTS (NOT USED)

2.03 MATERIALS (NOT USED)

2.04 MANUFACTURED UNITS

- A. General:

1. The hardware identified in this Section is considered the minimum, acceptable configuration. It is the Contractor's responsibility to upgrade and expand the hardware configuration if necessary to satisfy software and system performance requirements of the Project.
 2. Proposed substitutions must meet or exceed the specifications of the equipment listed.
- B. Industrial panel computer:
1. Industrial panel-mounted monitor with separate PC-architecture computer running the Windows 10 PRO, or newer, operating system.
 - a. Provide a complete set of backup/restore recovery DVD's such that the computer may be restored to factory condition in the event of a catastrophic hard drive failure. Software recovery from a partition on the hard disk drive is not acceptable.
 - b. Provide a complete set of all required cables and software.
 - c. Provide manufacturer's user and maintenance manuals.
 - d. Industrial panel-mounted monitor:
 - 1) Display size: 19.5.
 - 2) Aspect ratio: 16:9.
 - 3) Resolution: 1920x1080.
 - 4) Type: Active Matrix Color TFT LCD display with resistive antiglare touchscreen.
 - 5) Rating: NEMA Type 4X.
 - 6) Faceplate/bezel material: Stainless steel.
 - 7) MTBF: Minimum 50,000 hours.
 - 8) Operating temperature: 0 - 55 Degrees Celsius.
 - 9) Operating relative humidity: 20 - 90 percent non-condensing.
 - 10) Power supply: 120 VAC.
 - 11) Manufacturers: One of the following or equal:
 - a) Advantech TPC series.
 - b) Hope Industrial Systems.

- e. Computer shall meet the following minimum requirements:
 - 1) Processor speed: Intel Core 2 DUO, 2.0 GHz or better.
 - 2) Main memory: 4GB DDR 533 MHz.
 - 3) Hard disk: 320 GB, Serial ATA, 7,200 rpm; buffer cache 8.0 MB minimum.
 - 4) Video card: 64 MB DDR RAM.
 - 5) Serial RS232 port.
 - 6) 2 PCI slots.
 - 7) 4 USB slots.
 - 8) 8X DVD/RW SATA.
 - 9) Network port: 10/100 Base TX, Ethernet LAN.
 - 10) Power supply: 120 VAC.
 - 11) Manufacturers: One of the following or equal:
 - a) Advantech TPC
 - b) Hope Industrial Systems.

C. Printers:

- D. As specified in Section 40 50 00 - Common Work Results for Process Control and Instrumentation Systems.

E. General:

- 1. Each display monitor shall be secured to the console or other work surface.
- 2. Install equipment and cabling so that, in the event of an earthquake, seismic movement will not damage cables. In particular, provide appropriate slack in cables.

- F. Each device with a unique IP address shall be individually labeled with it IP address. The labeling must be printed; handwritten labels will not be accepted.

2.05 ERECTION, INSTALLATION, APPLICATION, CONSTRUCTION (NOT USED)

2.06 REPAIR/RESTORATION (NOT USED)

2.07 RE-INSTALLATION (NOT USED)

2.08 FIELD QUALITY CONTROL

- A. As specified in Section 40_80_01 - Commissioning for Instrumentation and Controls.

2.09 ADJUSTING (NOT USED)

2.10 CLEANING

- A. As specified in Section 40 50 00 - Common Work Results for Process Control and Instrumentation Systems.

2.11 DEMONSTRATION AND TRAINING

- A. As specified in Section 40 50 00 - Common Work Results for Process Control and Instrumentation Systems.
- B. Training:
 - 1. As specified in Section 40 50 00 - Common Work Results for Process Control and Instrumentation Systems.

2.12 PROTECTION (NOT USED)

2.13 SCHEDULES (NOT USED)

END OF SECTION

SECTION 40 64 01

CONTROL SYSTEMS: PROGRAMMABLE LOGIC CONTROLLERS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Programmable logic controller (PLC) based control systems hardware.
 - 2. Development software to be used with the specified PLC hardware.

1.02 REFERENCES

- A. Institute of Electrical and Electronics Engineers (IEEE).
- B. National Electrical Manufacturers Association (NEMA).

1.03 DEFINITIONS

- A. Specific definitions:
 - 1. CPU: Central processing unit.
 - 2. HART: Highway addressable remote transducer. A protocol that allows multiple layers of transmitter process variables and data to be transmitted to the controller.
 - 3. HMI: Human Machine Interface: typically a visual monitor that displays the status and values of the process and equipment.
 - 4. I/O: Input/Output.
 - 5. ICSC: Instrumentation and control system contractor: Subcontractor who specializes in the design, construction, fabrication, software development, installation, testing, and commissioning of industrial instrumentation and control systems.
 - 6. PID: Portional-Integral-Derivative, software based loop controller
 - 7. PC: Personal computer.
 - 8. PLC: Programmable Logic Controller
- B. Specific definitions:

1. Development operating software: The software provided by the PLC manufacturer for use in programming the PLC.
2. Application software: The software that is programmed specifically for the Project.

1.04 SYSTEM DESCRIPTION

- A. Provide all PLC hardware as indicated on the Drawings and as specified in this Section.

1.05 SUBMITTALS

- A. Product data:
 1. CPU:
 - a. Processor type.
 - b. Processor speed.
 - c. Memory.
 - d. Internal processor battery backup time.
 2. I/O modules:
 - a. Type.
 - b. Standard wiring diagram.
- B. Calculations:
 1. Submit calculations or documented estimate to verify that memory requirements of this Section are met, including spare requirements. If possible, use PLC manufacturer's calculation or estimating worksheet.
 2. Submit calculations to verify that spare I/O requirements of this Section are met.
 3. Submit calculations to verify that PLC power supply requirements of this Section are met.
- C. Control logic:
 1. Fully annotated copy of programmed PLC logic.
 2. Cross-referenced index of all PLC registers or points.
- D. Provide application software for the specific Project process requirements.

1. Fully annotated copy of programmed PLC logic in its native format.
2. Cross-referenced index of all PLC registers or points.

1.06 QUALITY ASSURANCE

A. Additional requirements:

1. Provide PLC system components by a single manufacturer:
 - a. Third-party communication modules may be used only for communication or network media functions not provided by the PLC manufacturer.
2. Use PLC manufacturer approved hardware, such as cable, mounting hardware, connectors, enclosures, racks, communication cable, splitters, terminators, and taps.
3. All PLC hardware, CPUs, I/O devices, and communication devices shall be new, free from defects, and produced by manufacturers regularly engaged in the manufacture of these products.

1.07 DELIVERY, STORAGE, AND HANDLING (NOT USED)

1.08 PROJECT OR SITE CONDITIONS (NOT USED)

1.09 SEQUENCING (NOT USED)

1.10 SCHEDULING (NOT USED)

1.11 WARRANTY (NOT USED)

1.12 SYSTEM START-UP (NOT USED)

1.13 OWNER'S INSTRUCTIONS (NOT USED)

1.14 COMMISSIONING (NOT USED)

1.15 MAINTENANCE

A. Furnish the following:

1. CPU: 1 spare for each type of CPU in the system.
2. I/O cards: 3 spares for each type of I/O card in the system.
3. Power supplies: 2 spares for every power supply in the system.
4. Network/communications cards: 1 spare for every network or communications card in the system.

5. Chassis: 1 spare for each chassis size in the system.
 6. Communication cable: 1 spare for each type of cable used in the system.
- B. Installed spare requirements:
1. I/O points:
 - a. Provide total of 25 percent spare I/O capacity for each type of I/O at every PLC.
 - b. Wire all spare I/O points to field terminal blocks in the same enclosure the PLC resides in.
 2. PLC backplane capacity:
 - a. Provide 25-percent or 3 spare backplane slots, whichever is greater, in all racks containing I/O.
 3. PLC memory:
 - a. Provide 50-percent spare program volatile memory.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. The following, no equal:
1. Rockwell Automation:
 - a. CompactLogix Model number 5370, Cat No.1769-L24ERQB1B.
 - b. No equal.
- B. The PLC programming software system shall be manufactured by PLC hardware manufacturer:
1. Rockwell Software:
 - a. RSLogix 5000. Version is to be Determined by client.

2.02 EXISTING PRODUCTS (NOT USED)

2.03 MATERIALS (NOT USED)

2.04 MANUFACTURED UNITS

A. Programmable logic controller:

1. General:

- a. Design the PLC system to function as a standalone unit that performs all of the control functions described in this Section completely independent from the functions of the HMI system PC-based operator interfaces:

- 1) Failure of the HMI system shall not impact data acquisition, control, scaling, alarm checking, or communication functions of the PLC.

2. CPU:

- a. Configure each CPU so that it contains all the software relays, timers, counters, number storage registers, shift registers, sequencers, arithmetic capability, and comparators necessary to perform the specified control functions.
- b. Capable of interfacing with all discrete inputs, analog inputs, discrete outputs, analog outputs, and communication cards to meet the specified requirements.
- c. Capable of supporting and implementing closed-loop floating-point math and PID control that is directly integrated into the CPU control program.

3. Memory:

- a. Non-volatile memory: On-board complementary metal-oxide-semiconductor (CMOS), electrically erasable programmable read-only memory (EEPROM), PCMCIA, compact flash card, or SD card.
- b. Supply with sufficient memory to implement the specified control functions plus a reserve capacity as specified with the requirements of this Section:
 - 1) Reserve capacity:
 - a) Totally free from any system use.
 - 2) Programmed in a multi-mode configuration with multiple series or parallel contacts, function blocks, counters, timers, and arithmetic functions.

4. Programming:

- a. Provide a system where processors are programmed by:
 - 1) Portable laptop computer both locally and via the PLC control network.
- 5. PLC power supply:
 - a. Input: 120 VAC.
 - b. Mounted in the PLC housing or as indicated on the Drawings.
 - c. Sized to power all modules mounted in that housing including an average module load for any empty housing slots plus 50 percent above that total.
- 6. PLC input/output, I/O modules:
 - a. General:
 - 1) Compatible with all of the PLCs being furnished under the contract and by the same manufacturer as the PLCs.
 - 2) Provide I/O modules that:
 - a) Isolate in accordance with IEEE Surge Withstand Standards and NEMA Noise Immunity Standards.
 - b) Provide A/D and D/A converters with optically or galvanically isolated inputs and outputs.
 - c) Accept dual-ended inputs.
 - 3) The use of common grounds between I/O points is not acceptable.
 - 4) Provide at each PLC the I/O modules for the following:
 - a) Designated future I/O points contained in the I/O Lists and/or shown on the P&IDs, control schematics, or described in the control strategies.
 - b) Wire all spares provided to the field terminal strip.
 - 5) Condition, filter, and check input signals for instrument limit conditions.
 - 6) Filter, scale, and linearize the raw signal into an engineering-units-based measurement.
 - 7) Alarm measurements for high, low, rate-of-change limits, and alarm trends.

- 8) Provide external fuses mounted on the field connection terminal block for all discrete input, discrete output, and analog input I/O points.
 - 9) When multiple cards of the same I/O type are provided and parallel equipment, instrumentation, or redundant processes exist, distribute I/O among cards to ensure that a single card failure will not render an entire process unavailable.
- b. Discrete input modules:
- 1) Defined as contact closure inputs from devices external to the input module.
 - 2) Provide inputs that are optically isolated from low-energy common-mode transients to 1,500 volts peak from users wiring or other I/O modules.
 - 3) Individually isolated inputs.
 - 4) With LEDs to indicate status of each discrete input.
 - 1) Input voltage: 120VAC.
 - 5) Provide input module points that are individually fused with blown-fuse indicator lights, mounted external of the module on the output terminal strip:
 - a) Coordinate external fuse size with the protection located on the module, so that the external fuse opens first under a fault condition.
- c. Discrete output modules:
- 1) Defined as contact closure outputs for ON/OFF operation of devices external to the output module:
 - a) Triac outputs may be used, with the permission of the Engineer. Care must be used in applying this type of module to ensure that the leakage current through the output device does not falsely signal or indicate an output condition.
 - 2) Optically isolated from inductively generated, normal mode and low-energy common-mode transients to 1,500 volts peak.
 - 3) LEDs to indicate status of each output point.
 - 4) Output voltage: 24VDC.
 - 5) Individually isolated outputs.

d. Analog input modules:

- 1) Signal type: Provide 4-20 mA for most applications; other levels are acceptable to interface to vendor control panels.
- 2) Analog-to-digital conversion: Minimum 12-bit precision with the digital result entered into the processor.
- 3) The analog-to-digital conversion updated with each scan of the processor.
- 4) Individually isolated each input.
- 5) Coordinate the size of the external fuse with the protection located on the module, so that the external fuse opens first under a fault condition.

e. Analog output modules:

- 1) Signal type: Provide 4-20 mA for most applications; other levels are acceptable to interface to vendor control panels.
- 2) Individual isolated output points each rated for loads of up to 1,000 ohms.
- 3) HART analog input module:
 - a) Channels per module: 4 minimum.
 - b) Signal type: Each channel individually configurable for current (0 to 20 mA DC or 4 to 20 mA DC) or voltage (0 to 5 VDC, 0 to 10 VDC, or -10 to 10 VDC).
 - c) Each channel can individually have HART enabled or disabled.
 - d) Flash-upgradeable firmware.
 - e) Mounts in slot in PLC backplane.
 - f) Modules shall be configured using the specified PLC programming software.
- 4) HART analog output module:
 - a) Channels per module: 4 minimum.
 - b) Signal type: Each channel individually configurable for current (0 to 20 mA DC or 4 to 20 mA DC) or voltage (0 to 5 VDC, 0 to 10 VDC, or -10 to 10 VDC).
 - c) Each channel can individually have HART enabled or disabled.

- d) Flash-upgradeable firmware.
- e) Mounts in slot in PLC backplane.
- f) Modules shall be configured using the specified PLC programming software.

7. Communications modules:

a. Network and Radiocommunications modules:

1) General:

- a) Install communications modules in the PLC backplane.

2) Ethernet:

- a) Ports: 1 RJ-45.
- b) Communication rate: 10 Mbit/s.
- c) Rockwell ControlLogix - 1756-EN2T.

- 3) Provide all network taps, connectors, termination resistors, drop cables, and trunk cables necessary for remote I/O communications.

B. PLC programming software:

Manufacturer: Rockwell Studio 5000

- 1. Licesned to the Owner.
- 2. Contain diagnostics to collect troubleshooting and performance data and display it in easy to understand graphs and tables.
 - a. Monitor devices at each drop on the PLC data network for proper communications.
- 3. Generate a PLC program printout, which is fully documented, through the PLC programming software:
 - a. Fully documented program listings include, as a minimum, appropriate rungs, address, and coils shown with comments to clarify to a reader what that segment of the program accomplishes on an individual line-by-line basis.
 - b. Include a sufficient embedded comment for every rung of the program explaining the control function accomplished in said rung.

- c. Use a mnemonic associated with each contact, coil, etc. that describes its function.
 - d. Utilize the tag and loop identification as contained in the P&IDs:
 - 1) If additional internal coils, timers, etc. are used for a loop, they shall contain the loop number.
 - e. Provide a cross-reference report of program addresses.
- 4. Software functions automatically without operator intervention, except as required to establish file names and similar information:
 - a. Furnish the operating system software that is the standard uncorrupted product of the PLC manufacturer with the following minimum functions:
 - 1) Respond to demands from a program request.
 - 2) Dynamic allocation of the resources available in the PLC. These resources include main memory usage, computation time, peripheral usage, and I/O channel usage.
 - 3) Allotment of system resources based on task priority levels such that a logical allocation of resources and suitable response times are ensured.
 - 4) Queuing of requests in order of priority if one or more requested resources are unavailable.
 - 5) Resolution of contending requests for the same resource in accordance with priority.
 - 6) Service requests for execution of one program by another.
 - 7) Transfer data between programs as requested.
 - 8) Management of all information transfers to and from peripheral devices.
 - 9) Control and recovery from all program fault conditions.
 - 10) Diagnose and report real-time hardware device errors.
- 5. Program execution:
 - a. Application software - program execution scheduled on a priority basis:
 - 1) A multilevel priority interrupt structure is required.
 - 2) Enter into a list of pending programs a program interrupted by a higher priority program:

- a) Resume its execution once it becomes the currently highest priority program.
 - 3) Schedule periodic programs.
 - 4) Base the allocation of resources to a time-scheduled program on its relative priority and the availability of resources.
6. Start-up and restart:
- a. Provide software that initializes and brings a PLC or any microprocessor-based hardware unit from an inactive condition to a state of operational readiness.
 - b. Initialization:
 - 1) Determination of system status before start-up of initializing operating system software and initializing application software.
 - 2) Loading of all memory-resident software, initializing timers, counters, and queues, and initialization of all dynamic database values.
7. Shutdown:
- a. Where possible, provide orderly shutdown capability for shutdowns resulting from equipment failure, including other PLC processor failures, primary power failure, or a manually entered shutdown command.
 - b. Upon loss of primary power, a high-priority hardware interrupt initiates software for an immediate, orderly shutdown.
 - c. Hardware is quickly and automatically commanded to a secure state in response to shutdown command or malfunction.
 - d. Alarm PLC failure at the operator interface level.
8. Diagnostics:
- a. Furnish diagnostic programs with the PLC software package to detect and isolate hardware problems and assist maintenance personnel in discovering the causes for system failures.
 - b. Use the manufacturer's standard diagnostic routines as much as possible.
 - c. Furnish diagnostic software and test programs for each significant component in the control system.
 - d. As a minimum, provide diagnostic routines to test for power supply, central processing unit, memory, communications, and I/O bus failures.

9. Calendar/time program:
 - a. The calendar/time program to update the second, minute, hour, day, month, and year and transfer accurate time and date information to all system-level and application software.
 - b. Variations in the number of days in each month and in leap years must be handled automatically by the program.
 - c. The operator must be able to set or correct the time and date from any operator interface, only at the highest security level.
10. Algorithms:
 - a. Implementation of algorithms for the determinations of control actions and special calculations involving analog and discrete data.
 - b. Algorithms must be capable of outputting positional or incremental control outputs or providing the product of calculations.
 - c. Algorithms must include alarm checks where appropriate.
 - d. Provide, as a minimum, the following types of algorithms:
 - 1) Performs functions such as summing several variables, raising to a power, roots, dividing, multiplying, and subtracting.
 - 2) A switch algorithm, which reads the current and value from its input address and stores it as the value of its output address. 2 types of switches shall be accommodated: 2 outputs with 1 input and 1 output with 2 inputs.
 - 3) A 3-mode proportional-integral-derivative, PID, controller algorithm, with each of the 3 modes independently adjustable, supports both direct and reverse-acting modes.
 - 4) Lead, lag, dead time, and ratio compensators.
 - 5) Integration and totalization of analog process variables.
11. Furnish a comprehensive database for the analog inputs, calculated values, control modules, and outputs:
 - a. In addition, provide spare database points for future expansion.
12. One integrated database can be utilized for all types of analog points or separate databases for each type; in either case, the database for each point must include all specified aspects.
13. All portions of the database must be available for use by the display, report, and other specified software modules.

14. All of the data fields and functions specified below must be part of the point definition database at the operator interface. Provide the capability to define new database points through the point display specified below as well as modifying defined points through these displays. This point definition and modification must include all of the features and functions defined below. The analog database software must support the following functions and attributes:
 - a. Analog input signal types:
 - 1) Provide software at the remote terminal units (RTUs) and PLCs to read variable voltage/current signals and pulse duration/frequency type analog input signals.
 - b. Input accuracy:
 - 1) Inputs must be read with an accuracy of within 0.05-percent full-scale or better.
 - 2) Data conversion errors must be less than 0.05-percent full-scale.
 - 3) Pulse accumulation error less than or equal to 1 count of actual input count at a scan rate of once per minute.
 - 4) Maintain for a minimum of 1 year the system accuracy stated above without adjustments.
 - c. Blocking:
 - 1) Provide mechanisms to inhibit or block the scanning and/or processing of any analog input through the operator interface.
 - 2) For any input so blocked, the operator may manually enter a value to be used as the input value.
 - d. Filtering:
 - 1) For each analog input, provide a first order lag digital filter with an adjustable filter factor.
 - e. Linearizing:
 - 1) Where analog inputs require square root extraction or other linearization, provide a mechanism to condition the filtered data before the process of scaling and zero suppression takes place.
 - f. Calculated values:

- 1) Provide means to allow for pseudo-inputs calculated by algebraic and/or Boolean expressions utilizing real inputs, other calculated values, constants, etc.
 - 2) These values must be handled the same as real inputs in terms of record-keeping, alarming, etc.
- g. Scaling and zero suppression:
- 1) Provide a conversion program to convert input values into engineering units in a floating-point format.
- h. Alarms:
- 1) Provide an alarm program to check all analog variables against high-high, high, low, and low-low alarm limits.
 - 2) When an analog value exceeds a set limit, it must be reported as an alarm based on individually set priority level for each alarm point.
 - 3) Provide an adjustable hysteresis band in order to prevent excessive alarms when a variable is hovering around an alarm limit.
 - 4) Must be possible to inhibit alarms based on external events, e.g., lock-out low pump flow alarm when the pump is off.
- i. Averages:
- 1) Provide a program to calculate and store hourly, daily, and monthly averages of analog variables.
 - 2) Continuously compute averages, e.g., the average for the current period to the present point in time must be stored in memory and available for use in displays, etc.
 - 3) Update hourly averages each minute or at the polling interval for the selected variable.
 - 4) Update daily averages at least once each hour and calculate using the results of the hourly averages.
 - 5) Update monthly averages at least once each day and calculate using the results of the daily averages.
 - 6) At the end of each averaging period, store the average values for the period on the hard disk for historical record-keeping and reset the present period average register to the present value of the variable.
 - 7) The active database must include the present period average and previous period average for each variable and averaging period.

j. Totals:

- 1) Provide a program to calculate and store hourly, daily, and monthly totalization of analog variables.
- 2) Assign a scaling factor to each variable to convert to the appropriate units based on a 1-minute totalizing interval.
- 3) Assign a separate factor for each totalizing interval.
- 4) Variables for which totalization is inappropriate must have scaling factors of zero.
- 5) At the end of each totalizing period, store the totalized values for the period on the hard disk for historical record-keeping and reset the present period totalization register to zero.
- 6) The active database must include the present period total and previous period total for each variable and totalizing period.

k. Engineering units:

- 1) Provide software to allow the system and the operator to convert all the measured analog variables to any desired engineering units.
- 2) The operator must be able to view displays and generate reports of any measured variable in one or more engineering units such as flow in gpm, mgd, cfs, and acre-feet per day.
- 3) Pre-program the conversion of the engineering units, and, if not pre-programmed, the operator must be able to program new engineering unit conversions by using simple methods, e.g., multiplication of the database attributes by a constant.
- 4) The programming method must be at a level and compatible with the specified training of the operator and the Owner's personnel.
- 5) New conversions must not require the services of a special programmer and/or special, high-level, programming training.

l. Control modules:

- 1) For each control function configured, whether processed at the RTU, PLC, or operator interface, maintain a file of necessary data including input values, setpoints, constants, intermediate calculated values, output value and limit clamps, etc.
- 2) Input and output assignments, setpoints, and constants must be adjustable by the operator through the operator interface.

- 3) Provide control algorithms for manual control with output values adjustable by the operator.

m. Analog outputs:

- 1) Analog outputs must be maintained as part of the database.
- 2) These outputs must be adjustable manually by the operator through the operator interface or through automatic control algorithms.

15. Some of the above functions may be better accomplished in the data acquisition and graphic display software package; it is the responsibility of the ICSC to optimize the location of the various functions between all software packages.

C. General control functions:

1. Analog control functions:

- a. PID, lead/lag, signal select, alarm, limit, delay, and time base.
- b. Furnish the control system complete with a library of mathematical/calculation software to support averaging, weighted average, addition, subtraction, multiplication, division, square root extraction, exponential, AND, OR, NAND, NOR, XOR, and NXOR functions.
- c. All math utilities must be linkable to process data points or manual inputs via control block configuration.
- d. By linking control blocks to data points, the math library must support system unit conversion and calculation requirements.

2. Discrete control functions:

- a. AND, OR, NOT, EXCLUSIVE OR, comparators, delays, and time base.

3. Software support:

- a. Retain in firmware all control and logic functions at each RTU and PLC and in RAM at the operator interface.
- b. Call each function as required by the configured controls to perform the intended function.

4. Control and status discrepancies:

- a. Generate a discrepancy/fail alarm for any pump, valve, or final control element if a discrepancy exists between a system or operator command and the device status.

- 1) For example, the system commands to start (call), and the pump fails to start (run status report back), within predetermined operator-programmable time delay (time disagree), then a discrepancy (fail) alarm shall be generated.
 - b. Involuntary change in the device's status must also generate an alarm:
 - 1) For example, a pump starts when not commanded to do so, or a pump shuts down while running even though it still has a command to run.
 - c. Each command, status, and alarm must cause the color of the symbol to change.
 - d. Because many discrete final control elements have a cycle time in excess of the scan interval, provide each control output with an associated delay period selected to be longer than the operating period of the control element:
 - 1) Delay periods for each final control element must be adjustable at the operator interface.
 - 2) List all time delays in the final documentation.
 5. Some of the above functions may be better accomplished in the data acquisition and graphic display software package; it is the responsibility of the ICSC to optimize the location of the various functions between all software packages.
- D. Control configuration:
1. Provide software to allow control strategies to be developed, and their operation initiated through the operator interface.
 2. Provide standardized control point displays for defining the control functions including the function type, input/output addresses, setpoints, tuning constants, etc.
 3. Provide a mechanism to link separate control functions together into an integrated control strategy.
 4. Provide a mechanism to download operational/control setpoints developed at any operator interface to any PLC or RTU for operational implementation.
 5. Provide a mechanism to define and implement operational/control setpoints locally at the PLC or RTU, and to upload them to the operator interface for operational record-keeping.
 6. Perform control configurations on-line at the operator interface; the PLC or RTU may be taken off-line when being configured or downloaded.

2.05 EQUIPMENT (NOT USED)

2.06 COMPONENTS (NOT USED)

2.07 ACCESSORIES (NOT USED)

2.08 MIXES (NOT USED)

2.09 FABRICATION (NOT USED)

2.10 FINISHES (NOT USED)

2.11 SOURCE QUALITY CONTROL

- A. As specified in Section 40 61 00 - Common Work Results for Process Control and Instrumentation Systems.

PART 3 EXECUTION

3.01 EXAMINATION (NOT USED)

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION

- A. ~~(NOT APPLICABLE) As specified in Section 40 61 00 - Common Work Results for Process Control and Instrumentation Systems.~~
- B. Utilize personnel to accomplish or supervise the physical installation of all elements, components, accessories, or assemblies:
 - 1. Employ installers who are skilled and experienced in the installation and connection of all elements, components, accessories, and assemblies.
- C. All components of the control system including all data network cables are the installation responsibility of the ICSC unless specifically noted otherwise.
- D. General:
 - 1. The control system logic program shall reside at the PLC level.
- E. Use the tag and loop identifications found on the P&IDs for all tags used and/or assigned as part of the application software work provided by the ICSC.
- F. Program the PLC logic using the following language(s):
 - 1. Ladder Diagram.

3.04 ERECTION, INSTALLATION, APPLICATION, CONSTRUCTION

- A. Provide a minimum of 4 CD/DVD/USB copies of the following:
 - 1. Application software:
 - a. Finalized fully annotated copy of programmed PLC logic in its native format.
 - b. Cross-referenced index of all PLC registers or points.

3.05 REPAIR/RESTORATION (NOT USED)

3.06 RE-INSTALLATION (NOT USED)

3.07 FIELD QUALITY CONTROL

3.08 ADJUSTING (NOT USED)

3.09 CLEANING (NOT USED)

3.10 DEMONSTRATION AND TRAINING

- A. Tailor training specifically for this Project that reflects the entire control system installation and configuration.
- B. Perform training by pre-approved and qualified representatives of the ICSC and/or manufacturer of the PLC hardware and programming software:
 - 1. A representative of the ICSC may perform the PLC hardware training only if the representative has completed the manufacturer's training course for the PLC hardware.
 - 2. A representative of the ICSC may perform the PLC programming software training only if the representative has completed the manufacturer's training course for the PLC programming software.

3.11 PROTECTION (NOT USED)

3.12 SCHEDULES (NOT USED)

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SECTION 406670

CONTROL SYSTEMS: WIRELESS COMMUNICATIONS - RADIO

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PART 1 GENERAL

1.01 SUMMARY

A. Section includes:

1. Radio and antenna product data and submittal requirements.

1.02 REFERENCES

A. American Concrete Institute (ACI):

1. 318 - Building Code Requirements for Structural Concrete.

B. ASTM International (ASTM):

1. A475 - Standard Specification for Zinc-Coated Steel Wire Strand.
2. A586 – Standard Specification for Metallic-Coated Parallel and Helical Steel Wire Structural Strand.

C. Code of Federal Regulations (CFR):

1. Title 47 – Telecommunication.

D. Institute of Electrical and Electronics Engineers (IEEE):

1. 802.11 – Wireless LAN Standards.

E. International Electrotechnical Commission (IEC).

F. International Society of Automation (ISA).

G. National Electrical Code, (NEC).

H. National Electrical Manufacturer's Association Standards, (NEMA).

I. National Fire Protection Association (NFPA):

1. 79 – Electrical Standard for Industrial Machinery.

J. Telecommunications Industry Association (TIA):

1. 222 - Structural Standard for Antenna Supporting Structures and Antennas and Small Wind Turbine Support Structures.
2. 1019 – Installation, Alteration, and Maintenance of Antenna Supporting Structures and Antennas.

1.03 DEFINITIONS

A. Specific definitions:

1. AGL: Above ground level.
2. ASL: Above sea level.
3. Antenna CL: Antenna center line mounting height.
4. BER: Bit error rate, a unitless measure of the number of bit errors that occur in a given number of bit transmissions.
5. CPM: Critical path method.
6. dB: Decibel, a relative expression representing a change in radio frequency power.
7. dBi: A decibel referenced against an isotropic radiator.
8. dBd: A decibel referenced to a dipole antenna.
9. dBm: A decibel referenced to 1 milliwatt (mW).
10. Direct Sequence Spread Spectrum (DSSS): A spread-spectrum technology used in IEEE 802.11 and IEEE 802.11b/g used to achieve data rates up to 2 Mbps.
11. EIRP: Effective isotropic radiated power.
12. Fade margin: The amount of margin left to allow for the natural variations in radio performance, which will occur due to weather, air density, etc.
13. Fade margin: The difference between the received signal level at the input to the receiver and the sensitivity of the receiver.
14. FCC: Federal Communications Commission.
15. Fresnel zone: The area around the line-of-sight that radio waves spread out into after being transmitted by the antenna.
16. FRN: FCC Registration Number.
17. ITS: Institute for Telecommunications Science.
18. LOS: Line of Sight.
19. Radio Path Survey: In-field wireless communication site survey performed by the radio sub-contractor during the preliminary construction phase of the project.

- 20. Receiver Sensitivity: The minimum signal power level with an acceptable Bit Error Rate (in dBm or mW) that is necessary for the receiver to accurately decode a given signal.
- 21. RF: Radio frequency.
- 22. RSSI: Receive signal strength intensity.
- 23. SIM: Subscriber identity module.
- 24. WLAN: Wireless local area network.

1.04 SYSTEM DESCRIPTION

- A. System must be in accordance with the following:
 - 1. Code of Federal Regulations:
 - a. CFR Title 47:
 - 1) Part 15 - Unlicensed Spread Spectrum.
 - 2) Part 90 - UHF Radio Systems – Subpart C and J.
 - 3) Part 101 - Fixed Microwave Services.
 - a) Subpart H – Private Operational Fixed Point-to—Point Microwave Service.
 - b) Subpart O – Multiple Address Systems.
 - 2. NFPA 79, Annex “D” Standards.
 - 3. NEC.
 - 4. NEMA.
 - 5. ISA.
 - 6. IEC.
 - 7. State and Local code requirements.
 - 8. TIA 1019.
- B. Owner will provide a list of aggregation sites and remote sites during construction. For bidding purposes, assume 10 aggregation sites and 80 remote sites.
- C. Provide new radios, antenna, antenna cable and mounting hardware and accessories, surge protection, and any additional components to provide a complete and functioning radio link.

1. Owner will provide the services of a radio consulting firm for installation signal strength testing.

1.05 SUBMITTALS

A. Submit product data for all components of the radio communication system:

1. Radio.
2. SIM card(s).
3. Antenna.
4. Cables between radio and antenna.
5. All other related accessories.
6. Communication port type and quantity.
7. Installation details for each component indicated above.
8. For each type of radio/antenna:
 - a. Provide operating mode setup, encryption, and polling configuration information.
9. Block diagram showing the location of each component of the radio communication system.
10. Radio link map associated with each site.

B. Submit structural calculations demonstrating that the system complies with the design criteria as indicated on the Drawings:

1. Antenna mounting structure.
2. Anchorage of support structure to foundation.
3. Foundation.
4. Antenna mounting structure height.
5. Wind/Seismic requirements.

1.02 QUALITY ASSURANCE (NOT USED)

1.03 DELIVERY, STORAGE, AND HANDLING (NOT USED)

1.04 PROJECT OR SITE CONDITIONS (NOT USED)

1.05 SEQUENCING (NOT USED)

1.06 SCHEDULING (NOT USED)

1.07 WARRANTY

- A. Provide a minimum of 1 year of warranty from substantial completion date for all wireless communication equipment.

1.08 SYSTEM START-UP (NOT USED)

1.09 OWNER'S INSTRUCTIONS (NOT USED)

1.10 COMMISSIONING (NOT USED)

1.11 MAINTENANCE

- A. Furnish all parts, materials and additional components necessary for maintenance and calibration purposes for 1 year:
 - 1. Deliver all supplies before Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Radio:
 - 1. Licensed radio:
 - a. Provide the following, no equal:
 - 1) General Electric, Orbit LN4 Series.
 - a) MCR for aggregation sites
 - b) ECR for remote sites
- B. Transmission cables:
 - a. Manufacturers: One of the following or equal:
 - 1) Phoenix Contact.
 - 2) Teledesign Systems.

- 3) FreeWave.
- 4) Telewave, Inc., ANT Series.
- 5) CommScope:
 - a) HELIAX Cable Products.
- 6) Times Microwave Systems.

C. Surge protectors:

- 1. Manufacturers: One of the following or equal:
 - a. CommScope:
 - 1) T Series Surge Arrestors.
 - 2) Gas Tube Surge Arrestors.
 - b. Phoenix Contact, Trabtech Series.
- 2. As specified in Section 40_67_01 - Control Systems: Panels, Enclosures, and Panel Components.

D. Antennas:

- 1. Radio antennas:
 - a. Manufacturers: One of the following or equal:
 - 1) Phoenix Contact.
 - 2) Teledesign Systems.
 - 3) Telewave, Inc., ANT Series.
 - 4) Kathrein Scala.
 - 5) CommScope.
 - 6) Microwave Data Systems, Clearwave Series.

2.02 MANUFACTURED UNITS

A. Licensed radio system:

- 1. General:
 - a. The radio system comprises the following:

- 1) Wireless radio(s).
 - 2) Antennas.
 - 3) Surge protectors.
 - 4) Transmission cables.
 - 5) Software and other accessories as specified in the Components article.
 - 6) Protocol conversion modules as indicated on the Drawings.
2. Performance requirements:
 - a. Frequency: 400 MHz band
 - b. Ambient temperature range: -20 to 60 degrees Celsius.
 - c. Enclosure protection class:
 - 1) IEC IP20.
3. Bi-directional (2-way) system:
 - a. Transceiver:
 - 1) Carrier power: 0.1 to 5 W, programmable.
 - 2) Power supply: 10.5 - 24 VDC.
- B. Transmission cables characteristics:
 1. 1/2-inch, nominal diameter.
 2. Continuous section without splices or connectors other than at the radio and antenna.
 3. Cable length: As indicated on the Drawings, path study report, or as required to reuse existing conduit path.
 4. Cable characteristics:
 - a. Attenuation: Less than 2.2 dB at 960 MHz per 100 feet.
 - b. Characteristic impedance: 50 ohms.
 - c. Coaxial shield.
 - d. Dielectric: Foam.

C. Antennas:

1. Radio antenna characteristics:

a. Yagi antenna:

- 1) Frequency range: 440-470 MHz.
- 2) Nominal impedance: 50 ohm.
- 3) Connector: N-Type.
- 4) Gain: 9 dB
- 5) Construction material: All welded aluminum.
- 6) Operating temperature:
 - a) Stationary: -40 to 85 degrees Celsius.
 - b) Cyclic: -40 to 55 degrees Celsius.

b. Omni-directional antenna characteristics:

- 1) Frequency range: 440-470 MHz.
- 2) Nominal impedance: 50 ohm.
- 3) Connection: N-type.
- 4) Gain: 6 dB.
- 5) Construction material: All welded aluminum.
- 6) Operating temperature: -40 to 75 degrees Celsius.

2.03 EXISTING PRODUCTS

- A. Mount all new antennas to existing antenna mounting structures.

2.04 MATERIALS (NOT USED)

2.05 EQUIPMENT (NOT USED)

2.06 COMPONENTS (NOT USED)

2.07 ACCESSORIES

A. Antenna accessories:

1. Provide all required mounting accessories required for installation, such as clamps, brackets adapters, and related hardware for a complete installation.

- a. Mounting guidelines shall be provided in the installation details indicated in the Drawings and as recommended by the manufacturer.
2. Provide mounting hardware to meet the wind and seismic requirements at the Project Site.
- B. Provide lightning surge arrestors and data line surge protection for radios or antennas located outdoors.
- C. Provide antenna cables, connectors and related hardware for a complete installation.
- D. Provide din-rail mounting adapters required for installation of radios in control panels/communication cabinets, as needed for each application.
- E. Software:
 1. Provide software package for radio diagnostic testing.
 2. Provide radio configuration via a secured wireless or wired ethernet network.

2.08 MIXES (NOT USED)

2.09 FABRICATION (NOT USED)

2.10 FINISHES (NOT USED)

2.11 SOURCE QUALITY CONTROL (NOT USED)

PART 3 EXECUTION

3.01 EXAMINATION (NOT USED)

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION

- A. Tag and label terminal blocks, radio system components and associated wiring as indicated in the Drawings.

3.04 ERECTION, APPLICATION, AND CONSTRUCTION

- A. Install new antennas, mounting hardware and accessories on existing antenna support structures or as indicated in the Drawings.

- 3.05 REPAIR/RESTORATION (NOT USED)**
- 3.06 RE-INSTALLATION (NOT USED)**
- 3.07 COMMISSIONING (NOT USED)**
- 3.08 FIELD QUALITY CONTROL (NOT USED)**
- 3.09 ADJUSTING (NOT USED)**
- 3.10 CLEANING (NOT USED)**
- 3.11 DEMONSTRATION AND TRAINING (NOT USED)**
- 3.12 PROTECTION (NOT USED)**
- 3.13 SCHEDULES (NOT USED)**

END OF SECTION

SECTION 40_67_01

CONTROL SYSTEMS: PANELS, ENCLOSURES, AND PANEL COMPONENTS

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PART 1 GENERAL

1.01 SUMMARY

A. Section includes:

1. Design, fabrication and assembly of all instrumentation enclosures, control panels and components provided under this contract, including but not limited to:
 - a. Custom built instrumentation and control panels, including all enclosures for hand stations controllers, low voltage power distribution and marshalling panels.
 - b. Control components.
 - c. Control panel installation.

B. Provide all control panels identified in Contract Documents.

1.02 REFERENCES

A. Institute of Electrical and Electronics Engineers (IEEE):

1. C62.41.1 - Guide on the Surge Environment in Low-Voltage (1000 V and less) AC Power Circuits.
2. 802.3af - Standard for Information Technology Telecommunications and Information Exchange Between Systems - Local and Metropolitan Area Networks - Specific Requirements Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications.
3. 802.3at - Standard for Information Technology -- Local and Metropolitan area networks -- Specific requirements -- Part 3: CSMA/CD Access Method and Physical Layer Specifications Amendment 3: Data Terminal Equipment (DTE) Power via the Media Dependent Interface (MDI) Enhancements.

B. International Electrotechnical Commission (IEC):

1. 61643-11 - Low-Voltage Surge Protective Devices - Part 11: Surge Protective Devices Connected to Low-Voltage Power Systems - Requirements and test methods.
2. 61643-21 - Low-Voltage Surge Protective Devices - Part 21: Surge Protective Devices Connected to Telecommunications and Signaling Networks - Performance Requirements and Testing Methods.

C. Underwriters Laboratories Inc. (UL):

1. 248-14 - Low-Voltage Fuses - Part 14: Supplemental Fuses.

2. 497B - Standard for Protectors for Data Communications and Fire-Alarm Circuits.
3. 508 - Standard for Industrial Control Equipment.
4. 508A - Standard for Industrial Control Panel.
5. 698A - Standard for Industrial Control Panels Relating to Hazardous (Classified) Locations.
6. 913 - Standard for Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, III, Division 1, Hazardous (Classified) Locations.
7. 1077 - Standard for Supplementary Protectors for Use in Electrical Equipment.
8. 1283 - Standard for Electromagnetic Interference Filters.
9. 1449 - Standard for Surge Protective Devices.

1.03 DEFINITIONS

A. Specific definitions:

1. The term “panel” in this Section is interchangeable with the term “enclosure.”

1.04 SUBMITTALS

A. Provide a control panel hardware submittal for each control panel and enclosure being provided on this project, including but not limited to:

1. Product data:
 - a. Enclosure construction details and NEMA type.
 - b. Manufacturer's literature and specification data sheets for each type of equipment to be installed within or on the panel or enclosure.
2. Shop drawings:
 - a. Scaled, detailed exterior panel (front and side views) and interior panel layout showing equipment arrangement and dimensional information:
 - 1) Provide draft for review and approval by Engineer. The Engineer has the authority to substantially alter initial panel layouts.
 - b. Complete nameplate engraving schedule.
 - c. Structural details of fabricated panels.
3. Calculations:
 - a. Provide installation details based on calculated shear and tension forces:

- 1) Calculations shall be signed and sealed by a Professional Engineer licensed in the state where the cabinets and panels will be installed.
 - b. For assembled enclosures and other equipment with a weight of 200 pounds or more, provide calculations for:
 - 1) Weight including panel internal components.
 - 2) Seismic forces and overturning moments.
 - 3) Shear and tension forces in connections.
 - c. Cooling calculations, including but not limited to:
 - 1) Highest expected ambient temperature for the enclosure's location.
 - 2) Internal heat load.
 - 3) Exposure to direct sunlight.
 - 4) Dimensions of the enclosure in inches.
 - 5) Maximum allowable temperature inside the enclosure, based on the lowest operating temperature limit of the installed components.
- B. Seismic design:
 1. Seismic panel construction:
 - a. Seismic anchorage: Provide seismic design calculations and installation details for anchorage of all panels, enclosures, consoles, etc. to meet seismic requirements in Section 01_81_02 - Seismic Design Criteria:
 - 1) Stamped by a Professional Engineer registered in the state where the project is being constructed.
 - b. For floor-mounted freestanding panels weighing 200 pounds or more (assembled, including contents), submit calculations, data sheets, and other information to substantiate that panel, base, and framing meet minimum design strength requirements and seismic requirements as specified in Section 01_81_02 - Seismic Design Criteria. Calculations shall be signed and sealed by a Professional Engineer licensed in the state where the cabinets and panels will be installed.

1.05 QUALITY ASSURANCE

- A. Assemble panels, enclosures, and rack systems along with all internal and external devices, wiring, equipment, and materials in a facility that is recognized by UL to assemble and certify UL-labeled control panels:
 1. Provide all components and equipment with UL 508 listing.

2. All control panels shall be UL 508A labeled, unless the equipment in the panel and the design in the contract documents cannot be reasonably modified to meet the requirements for UL 508A labeling:
3. Provide fuses for all equipment that is not UL or UR listed.
4. Install all intrinsically safe circuits and equipment in accordance with UL698A.

1.06 DELIVERY, STORAGE, AND HANDLING (NOT USED)

1.07 PROJECT OR SITE CONDITIONS (NOT USED)

1.08 SEQUENCING (NOT USED)

1.09 SCHEDULING (NOT USED)

1.10 WARRANTY (NOT USED)

1.11 SYSTEM START-UP (NOT USED)

1.12 OWNER'S INSTRUCTIONS (NOT USED)

1.13 COMMISSIONING (NOT USED)

1.14 MAINTENANCE (NOT USED)

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. As listed below in the individual component paragraphs.
- B. Provide instruments and other components performing similar functions of the same type, model, or class, and from 1 manufacturer.

2.02 SYSTEM DESCRIPTION

- A. Panel dimensions:
 1. Minimum dimensions are scalable from or as **indicated on the Drawings** and are based upon manufacturer's non-certified information. It is the responsibility of the Contractor or manufacturer to design and size all panels:
 - a. Size panels to provide space for all equipment, wiring, terminations, and other items in the panel, including space for future build out.
 - b. Panel sizes that substantially deviate (within 3 inches in any dimension) from the sizes **indicated on the Drawings** must be approved by the Engineer.

- c. Maximum panel depth: 30 inches, unless otherwise indicated.

2.03 EXISTING PRODUCTS

- A. Provide labor and materials for complete modifications to existing panels as required.
- B. Field cut and refinish existing panel faces to original condition to accommodate installation of new instruments, removal of existing instruments, and fitting of blanks to suit new layouts. New instrument supports shall be provided as required for complete installation.

2.04 MATERIALS

- A. Construct and finish enclosures using materials capable of withstanding the mechanical, electrical, and thermal stresses, as well as the effects of humidity and corrosion that are likely to be encountered in normal service:
 - 1. Enclosures shall have the following properties:
 - a. NEMA Type 1: Steel.
 - b. NEMA Type 4: Steel with gasketed door, raintight.
 - c. NEMA Type 4X: Type 316 stainless steel (unless Type 304 is **indicated on the Drawings**).
 - d. NEMA Type 4X: Polycarbonate or fiberglass reinforced polyester (FRP) in corrosive areas where stainless steel is incompatible.
 - e. NEMA Type 12: Steel with gasketed door, dusttight.
 - f. NEMA Type 7: Cast aluminum.
- B. Bolting material:
 - 1. Commercial quality 1/2-inch diameter, stainless steel hex-head Grade 5 bolts, nuts, and washers, with unified coarse (UNC) threads.
 - 2. Carriage bolts for attaching end plates.
 - 3. All other bolted joints shall have S.A.E. standard lock washers.

2.05 MANUFACTURED UNITS

- A. Panels/enclosures:
 - 1. Manufacturers: One of the following or equal:
 - a. Rittal.
 - b. nVent/Hoffman.

- c. Saginaw Control & Engineering.
- d. Provide stiffeners for back mounting panels in enclosures larger than 4 feet. In addition, secure the panels in place by collar studs welded to the enclosure.
- e. Door construction:
 - 1) Turned-back edges suitably braced and supported to maintain alignment and rigidity without sagging.
 - 2) Sufficient width to permit door opening without interference with rear projection of flush-mounted instruments.
 - 3) Heavy-gauge stainless steel hinges.
 - 4) For NEMA Type 12, Type 4, and Type 4X, provide oil-resistant neoprene sealing gasket and adhesive to seal cover to enclosure.
 - 5) Gasket installed to seal against roll lip on the enclosure opening.
- f. Latches:
 - 1) For panels, provide each door with a 3-point latching mechanism and locking handle with rollers on the ends of the latch rods. Latch rods shall be connected to a common door handle, hold doors securely, and form a compressed seal between door and gasket, at the top, side, and bottom.
 - a) Provide padlock for each enclosure with padlock provisions.
 - 2) Include an oiltight key-locking, 3-point latching mechanism on each door:
 - a) Provide 2 keys per panel.
 - b) All locks keyed alike.
 - 3) For cabinets not available with 3-point latching hardware, provide multiple clips and padlock hasps.
- g. Panel cut-outs:
 - 1) Cut, punch, or drill cutouts for instruments, devices, and windows. Smoothly finish with rounded edges.
 - 2) Allow a minimum of 3-inch envelope around all displays, controllers, and monitors.
 - 3) Reinforce around cut-outs with steel angles or flat bars for the following:

- a) Large panel cutouts; for example, openings for local operator interfaces.
 - b) Pilot device groupings, where the removed metal exceeds 50 percent of the available metal.
- 2. In addition to the requirements specified above, the following requirements for NEMA Type 4X powder coated stainless steel enclosures apply:
 - a. Minimum 14-gauge, Type 304 stainless steel.
 - b. Captive stainless steel cover screws threaded into sealed wells.
 - c. Inside finish: White polyester powder coating.
 - d. Specifically designed for use with flange-mounted disconnect handles where required or as **indicated on the Drawings**.
 - e. NEMA Type 4X powder-coated stainless steel enclosures are not an acceptable substitute for stainless steel unless **indicated on the Drawings**.
- 3. Outdoor panels. Supplementary requirements for panels located outdoors are as follows:
 - a. All enclosures located outdoors shall be explicitly designed and rated for outdoor service by the manufacturer.
 - b. Door hardware: Stainless steel.
 - c. Provide factory installed rain canopy and sun shield for all enclosures with operator interface panels.
 - d. Bases: Heavy channel, gasketed stainless steel bases, flanges up, for anchoring to pad.
- B. Arrangement of components:
 - 1. Arrange panel internal components for external conduit and piping to enter into panel either from above or below.
 - 2. Arrange panel instruments and control devices in a logical configuration, associating pushbutton and selector switches with related readout devices, or as **indicated on the Drawings**.
 - 3. Mount internal control components on an internal back panel. Devices may be mounted on the side panel only by special permission from the Engineer.
 - 4. All control panel mounted operator interface devices shall be mounted between 3 feet and 5 feet above finished floor.

C. Overcurrent protection:

1. Main overcurrent device:

- a. Where the electrical power supply voltage to the control panel is more than 120 VAC, provide the panel with a flange-mounted disconnect handle operating a molded-case circuit breaker and provide a control power transformer for 120-VAC circuits:

- 1) Door-mounted disconnect handles are not acceptable.
- 2) Mechanically interlock the disconnect switch with the control enclosure doors so that no door can be opened unless the power is disconnected, and the disconnect switch cannot be closed until all doors are closed.
- 3) Provide means to defeat the interlock.
- 4) Lockable in the off position.

- b. Control panels supplied with 120 VAC:

- 1) Provide an internal breaker with the line side terminals covered by a barrier.
- 2) Provide a nameplate prominently positioned on the control panel identifying the location of the power source and a warning statement requiring the source to be disconnected before opening the door to the enclosure.
- 3) Provide a nameplate prominently positioned on the control panel stating "CAUTION Risk of Electric Shock – UPS equipment outputs remain energized with main disconnect in off position" for any panel containing a UPS.

2. Molded Case Circuit Breakers:.

3. Selection and ratings of protective devices:

- a. Interrupting ratings: Not less than the system maximum available fault current at the point of application.
- b. Voltage rating: Not less than the voltage of the application.
- c. Select current rating and trip characteristics to be suitable for:
 - 1) Maximum normal operating current.
 - 2) Inrush characteristics.
 - 3) Coordination of the protective devices to each other and to the source breaker feeding the panel.

- d. Circuit breakers, fuses, and motor overcurrent protection devices used for branch circuit protection must be UL 508A compliant.
 - 1) Circuit breakers listed under UL 1077 Standard for Supplementary Protectors that do not comply with UL 508A requirements are not acceptable.
 - 2) Miscellaneous, miniature, and micro fuses listed under UL 248 Part 14 that do not comply with UL 508A requirements are not acceptable.
 - 3) Manual motor controllers provided with an instantaneous-trip overcurrent mechanism listed under UL 508 that do not comply with UL 508A requirements are not acceptable.
- 4. Provide a separate protective device for each powered electrical device:
 - a. An individual circuit breaker for each 120-VAC instrument installed within its respective control panel and clearly identified for function.
 - b. An individual fuse for each PLC discrete output. Provide with individual blown fuse indication external of the I/O card:
 - 1) Size external fuse to open before any I/O-card-mounted fuses.
 - c. Individual discrete inputs shall use a 1/2-ampere fuse.
 - d. Install protective devices on the back mounting panel and identify by a service nameplate in accordance with the wiring diagrams.
- 5. Fuses for 4 to 20 milliamperes signals:
 - a. Provide durable, readily visible label for each fuse, clearly indicating the correct type, size, and ratings of replacement fuse:
 - 1) Label shall not cover or interfere with equipment manufacturer's instructions.
 - b. An individual 1/2-ampere fuse for each 4-to-20 milliamperes analog loop powered from the control panel.
 - c. Provide fuses rated for the voltage and available short-circuit current at which they are applied.
 - d. Manufacturers: One of the following or equal:
 - 1) Ferraz Shawmut.
 - 2) Littelfuse.
 - 3) Bussmann.
- 6. Fuse holders:

- a. Modular type:
 - 1) DIN rail mounting on 35-millimeter rail.
 - 2) Touch-safe design: All connection terminals to be protected against accidental touch.
 - 3) Incorporates blown-fuse indicator.
 - 4) Plug-in style fuse terminals and fuse plugs are not acceptable.
 - b. Provide nameplate identifying each fuse:
 - c. Manufacturers: One of the following or equal:
 - 1) Phoenix Contact, UT4-HESI Series.
 - 2) Allen-Bradley, 1492-FB Series B.
7. Control circuit breakers:
- a. DIN rail mounting on 35-millimeter rail.
 - b. Manual OPEN-CLOSE toggle switch.
 - c. Rated for 250 VAC.
 - d. Interrupting rating: 10 kiloampere (kA) or available fault current at the line terminal, whichever is higher.
 - e. Current ratings: As required for the application.
 - f. Provide nameplate identifying each circuit breaker:
 - g. Manufacturers: One of the following or equal:
 - 1) Phoenix Contact, TMC Series.
 - 2) ABB.
 - 3) Allen-Bradley.
 - 4) Square D.
8. Electronic circuit protectors:
- a. Used where a NEC Class 2 power circuit is required to protect devices with NEC Class 2 power supplies.

- b. DIN rail mounting on 35-millimeter rail.
- c. Rated for 24 VDC.
- d. 4 channels to feed 4 independent power feeds to separate devices.
- e. Output current ratings: As required for the application.
- f. LED input status indication.
- g. LED failure status of each channel indication.
- h. Fail contacts.
- i. Provide nameplate identifying each circuit electronic circuit protector module:
- j. Manufacturers: One of the following or equal:
 - 1) Rockwell Automation 1692-TD014.
 - 2) Puls PISA11 series.

D. Conductors and cables:

- 1. Power and control wiring:
 - a. Materials: Stranded, soft annealed copper.
 - b. Insulation: 600 volts type MTW.
 - c. Minimum sizes:
 - 1) Primary power distribution: 12 AWG.
 - 2) Secondary power distribution: 14 AWG.
 - 3) Control: 16 AWG.
 - d. Color:
 - 1) AC power (line and load): Black.
 - 2) AC power (neutral): White.
 - 3) AC control: Red.
 - 4) AC control: Orange for foreign voltages.
 - 5) DC power and control (ungrounded): Blue.
 - 6) DC power and control (grounded): White with Blue stripe.

7) Ground: Green.

2. Signal cables:

- a. Materials: Stranded, soft annealed copper.
- b. Insulation: 600 volts, PVC outer jacket.
- c. Minimum size: 18 AWG paired triad.
- d. Overall aluminum shield (tape).
- e. Copper drain wire.
- f. Color:

1) 2-Conductor:

- a) Positive (+): Black.
- b) Negative (-): White and red.

2) 3-Conductor:

- a) Positive (+): Black.
- b) Negative (-): Red.
- c) Signal: White.

- g. Insulate the foil shielding and exposed drain wire for each signal cable with heat-shrink tubing.

E. Conductor identification:

- 1. Identify each conductor and cable with unique wire numbers
- 2. Readily identified without twisting the conductor.

F. General wiring requirements:

- 1. Wiring methods: Wiring methods and materials for panels shall be in accordance with the NEC requirements for General Purpose (no open wiring) unless otherwise specified.
- 2. Install all components in accordance with the manufacturer's instructions included in the listing and labeling.
- 3. Provide a nameplate on the cover of the control panel identifying all sources of power supply and foreign voltages within the control panel.

4. Provide transformers, protective devices, and power supplies required to convert the supply voltage to the needed utilization voltage.
5. Provide power surge protection for all control panels.
6. Provide signal surge protection within control panels for each analog I/O, discrete I/O, and data line (Copper Ethernet, Coax, Fieldbus signals) that originates from outdoor devices.
7. Provide non-metallic ducts for routing and organization of conductors and cables:
 - a. Provide wiring separation plan.
 - b. Size ducts for ultimate build-out of the panel, or for 20-percent spare, whichever is greater.
 - c. Provide separate ducts for signal and low-voltage wiring from power and 120-VAC control wiring:
 - 1) 120 VAC: Grey colored ducts.
 - 2) 24 VDC: White colored ducts.
8. Cables shall be fastened with cable-mounting clamps or with cable ties supported by any of the following methods:
 - a. Screw-on cable tie mounts.
 - b. Hammer-on cable-tie mounting clips.
 - c. Fingers of the nonmetallic duct.
9. Wire ties:
 - a. No wire ties inside wire duct.
 - b. Use Panduit Cable tie installation tool, with tension control/cutoff.
 - c. Verify cut ends are cut flush filed smooth after installed.
10. Provide supports at the ends of cables to prevent mechanical stresses at the termination of conductors.
11. Support panel conductors where necessary to keep them in place.
12. Wiring to rear terminals on panel-mount instruments shall be run in nonmetallic duct secured to horizontal brackets run adjacent to the instruments.
13. Conductors and cables shall be run from terminal to terminal without splice or joints. Exceptions:

- a. Factory-applied connectors molded onto cables shall be permitted. Such connectors shall not be considered as splices or joints.
- 14. The control panel shall be the source of power for all 120-VAC devices interconnected with the control panel including, but not limited to:
 - a. Solenoid valves.
 - b. Instruments both mounted in the control panel and remotely connected to the control panel.
- G. Provide power circuits for all Contractor and Vendor-furnished PLC cabinets in accordance with the PLC and Instrument Power wiring diagrams **Indicated on the Drawings** or as specified.

2.06 EQUIPMENT (NOT USED)

2.07 COMPONENTS

- A. Thermal management:
 - 1. Provide heating, cooling, and dehumidifying devices in order to maintain all instrumentation and control devices to within a range of the most temperature and humidity sensitive component.
 - 2. Air conditioner:
 - a. Provide solid-state cabinet coolers or air conditioning units on all outdoor panels containing electronic components such as local operator interfaces, panel instruments, programmable logic controllers, or remote I/O.
 - b. Provide filters on intake and exhaust openings.
 - c. Increase panel sizes as needed to accommodate cooling units.
 - d. Enclosure rating: NEMA Type 4X.
 - e. Power supply: 120 VAC.
 - f. Manufacturers: The following or equal:
 - 1) Kooltronic, Guardian DP Series.
 - 2) ICEcube, Blade series or IECEx/ATEX for Zone 1 & 2.
 - 3. Heating:
 - a. Provide all panels located in areas that are not climate controlled with thermostatically controlled strip heaters, except where all of the following conditions apply:

- 1) The panel is not supplied with 120 VAC power.
 - 2) There are no electronics or moisture-sensitive devices in the enclosure.
 - 3) The panel is smaller than 38 inches high.
4. Heat exchanger:
 - a. Closed-loop design ensuring separation of ambient air and clean air inside the cabinet.
 - b. Filterless design to facilitate easy cleaning of the core.
 - c. Mounting: As **indicated on the Drawings**.
 - d. Manufacturers: The following or equal:
 - 1) Noren, CC Series.
 - 2) ICEcube, Blade series.
5. Enclosure temperature sensor as indicated on the Drawings:
 - a. Provide wall-mounted RTD transmitter (to measure internal cabinet temperature) in all enclosures containing electrical components such as PLCs, RTUs, RIO, and VFDs.
 - b. Platinum RTD.
 - c. 4-20 mA DC output.
 - d. Sensor and electronic enclosure.
 - e. Accuracy: Within 2 degrees Fahrenheit.
 - f. Manufacturers: One of the following or equal:
 - 1) Omega, EWS Series.
 - 2) TCS Basys Controls, TS Series as indicated on the Drawings.
6. Enclosure temperature switch:
 - a. Provide wall-mounted bimetallic switch transmitter (to measure internal cabinet temperature in all enclosures) containing electrical components such as PLCs, RTUs, RIO, and VFDs.
 - b. Sensor and electronic enclosure.
 - c. Accuracy: Within 2 degrees Fahrenheit.

- d. Single contact:
 - 1) Manufacturers: One of the following or equal:
 - a) nVent/Hoffman ATEMNC.
 - b) Pfannenbergl FLZ.
- e. Dual contact:
 - 1) Manufacturers: The following or equal:
 - a) nVent/Hoffman ADLTEMP.
- 7. Status relays and discrete inputs for switches, power supplies, and fieldbus devices (if applicable):
 - a. Provide as **indicated on the Drawings** or as specified.
- 8. Fan ventilation:
 - a. Provide nVent/Hoffman fan speed control:
 - 1) Provide 2 door/cabinet-mounted vent fans for every 72 inches of cabinet width.
 - 2) Provide finger-guard kit.
 - 3) Filter kit with 2 spare filters for each intake fan.
 - 4) Provide bezel and gasket kit.
 - 5) Provide fan shroud.
 - 6) Automatically adjust fan speed depending on remote temperature sensor input.
 - 7) 120 VAC, 60 hertz.
 - 8) NEMA Type 5-15R cord connections.

B. Panel meters:

- 1. Pointer type:
 - a. Suitable for panel mounting.
 - b. Minimum scale length: 3 inches.
 - c. Calibrated in engineering units.
 - d. Accuracy: Within 2 percent of span.

- e. NEMA Type 4/IP65 sealed front metal bezel.
 - f. Manufacturers: One of the following or equal:
 - 1) Yokogawa.
 - 2) Red Lion.
2. Digital process indicators:
- a. General:
 - 1) Integral provisions for scaling.
 - 2) Scale to process engineering units.
 - 3) Switch-programmable decimal points.
 - 4) NEMA Type 4/IP65 sealed front bezel.
 - b. Current and voltage indicators:
 - 1) 3-1/2-digit minimum.
 - 2) Minimum character height: 0.5 inches.
 - 3) Accuracy:
 - a) AC/DC volts: Within 0.1 percent of reading plus 2 digits.
 - b) DC current: 4-to-20 milliamperes; within 0.1 percent of reading plus 1 digit.
 - c) DC voltage: 0 to 10 volts; within 0.1 percent of reading plus 1 digit.
 - c. Operating voltage: 120 VAC.
 - d. Operating temperature: 32 degrees to 140 degrees Fahrenheit.
 - 1) Manufacturers: One of the following or equal:
 - a) Red Lion, PAX
 - b) Action Instruments, Visipak.
- C. Pilot devices:
- 1. General:
 - a. Provide operator pushbuttons, switches, and pilot lights, from a single manufacturer.

- b. Size:
 - 1) 30.5 millimeters.
- c. Heavy duty.
- d. Pushbuttons:
 - 1) Contacts rated:
 - a) NEMA Type A600.
 - 2) Furnish 1 spare normally open contact and normally closed contact with each switch.
- e. Selector switches:
 - 1) Contacts rated:
 - a) NEMA Type A600.
 - b) Knob type.
 - 2) Furnish 1 spare normally open contact and normally closed contact with each switch.
 - 3) Provisions for locking in the OFF position where lockout provisions are **indicated on the Drawings**.
- f. Pilot lights:
 - 1) Type:
 - a) LED for interior installations.
 - 2) Push to test.
 - 3) Lamp color:
 - a) On/Running/Start: Red.
 - b) Off/Stop: Green.
 - c) Power: White.
 - d) Alarm: Amber.
 - e) Status or normal condition: White.
 - f) Opened: Red.
 - g) Closed: Green.

- h) Failure: Red.
- 2. Indoor and outdoor areas:
 - a. NEMA Type 4/13.
 - b. Manufacturers: One of the following or equal:
 - 1) Allen-Bradley, Type 800T.
 - 2) Schneider Electric, Class 9001, Type K.
 - 3) General Electric, Type CR104P.
 - 4) IDEC, TWTD Series.
- 3. Corrosive areas:
 - a. NEMA Type 4X.
 - b. Corrosion resistant.
 - c. Exterior parts of high-impact strength fiberglass-reinforced polyester or multiple-layer epoxy-coated zinc.
 - d. Manufacturers: One of the following or equal:
 - 1) Cutler Hammer, Type E34.
 - 2) Schneider Electric, Class 9001, Type SK.
 - 3) Allen-Bradley Type 800H.
 - 4) IDEC, TWTD Series.
- 4. Hazardous (Classified) Areas/Class I Division 2:
 - a. NEMA Type 4X.
 - b. Corrosion resistant.
 - c. Exterior parts of high-impact strength fiberglass-reinforced polyester or multiple-layer epoxy-coated zinc:
 - 1) All contacts contained within a hermetically sealed chamber:
 - a) Pushbuttons.
 - b) Selector switches.
 - c) Push-to-test contacts on pilot lights.

- 2) UL listed and labeled for Class I Division 2 areas.
 - d. Manufacturers: One of the following or equal:
 - 1) Cutler Hammer, Type E34.
 - 2) Allen-Bradley, Type 800H.
- D. Potentiometer and slidewire transmitters:
 - 1. Provide a DC output in proportion to a potentiometer input.
 - 2. Potentiometer input:
 - a. 100 ohms to 100 K ohms.
 - b. Impedance Greater or equal to 1 M ohms.
 - c. Zero turn-up: 80 percent of full-scale input.
 - d. Span turn-down: 80 percent of full-scale input.
 - 3. Field-configurable output:
 - a. Voltage and current: All conventional current loops and voltage control signals.
 - 4. Accuracy including linearity and hysteresis within 0.1 percent maximum at 77 degrees Fahrenheit.
 - 5. Operating temperature: 32 degrees to 131 degrees Fahrenheit.
 - 6. Supply power: 9 to 30 VDC.
 - 7. Manufacturers: The following or equal:
 - a. Phoenix Contact, Mini Analog Pro.
- E. Signal isolators and converters:
 - 1. Furnish signal isolators that provide complete isolation of input, output, and power input:
 - a. Minimum isolation level: 1.0 kilovolts AC/50 hertz for at least 1 minute.
 - b. Adjustable span and zero.
 - c. Accuracy: Within 1.0 percent of span.
 - d. Ambient temperature range: -4 degrees to 149 degrees Fahrenheit.

2. Manufacturers: One of the following or equal:
 - a. Phoenix Contact, Mini Analog Pro.
 - b. Acromag, 1500, 600T, 800T, Flat Pack, or ACR Series.
 - c. Action Instruments, Q500 Series or Ultra SlimPakII.
 - d. AGM Electronics, Model TA-4000.
 - e. Moore Industries, MIT 4-Channel.

F. Relays:

1. General:
 - a. For all types of 120-VAC relays, provide surge protection across the coil of each relay.
 - b. For all types of 24-VDC relays, provide a free-wheeling diode across the coil of each relay.
 - c. For plug in type relays, provide a relay base from the same manufacturer as the relay manufacturer.
2. General purpose:
 - a. Magnetic control relays.
 - b. NEMA ratings:
 - 1) 300 volts.
 - 2) 10 Amps thermal continuous test current.
 - 3) 60 Amps make.
 - 4) 6 Amps break.
 - c. Plug-in type.
 - d. LED indication for energization status.
 - e. Coil voltages: As required for the application.
 - f. Minimum poles: DPDT.

- g. Touch-safe design: All connection terminals to be protected against accidental touch.
 - h. Enclose each relay in a clear plastic heat and shock-resistant dust cover.
 - i. Quantity and type of contact shall be as **indicated on the Drawings** or as needed for system compatibility.
 - j. Relays with screw-type socket terminals.
 - k. Provide additional (slave/interposing) relays when the following occurs:
 - 1) The number or type of contacts shown exceeds the contact capacity of the specified relays.
 - 2) Higher contact rating is required in order to interface with starter circuits or other equipment.
 - l. DIN rail mounting on 35-millimeter rail.
 - m. Ice-cube-type relays with retainer clips to secure relay in socket.
 - n. Integrated label holder for device labeling.
 - o. Manufacturers: One of the following or equal:
 - 1) Potter and Brumfield: Type KRP or KUP.
 - 2) IDEC: R* Series (* = H, J, R, S, U).
 - 3) Allen-Bradley: Type 700 HC.
 - 4) Square D: Type K.
3. Terminal block relays:
- a. Magnetic control relays.
 - b. For use as an interposing relay for PLC based discrete I/O signals.
 - c. NEMA ratings:
 - 1) 250 volts.
 - 2) 6 Amps continuous.
 - 3) 1,500 volt-amperes make.
 - d. Plug-in type.
 - e. LED indication for energization status.

- f. Coil voltages: As required for the application.
 - g. Minimum poles: SPDT.
 - h. Touch-safe design: All connection terminals to be protected against accidental touch.
 - i. Quantity and type of contact shall be as indicated on the Drawings or as needed for system compatibility.
 - j. Relays with screw-type socket terminals.
 - k. DIN rail mounting on 35-millimeter rail.
 - l. Integrated label holder for device labeling.
 - m. Manufacturer: One of the following or equal:
 - 1) Phoenix Contact PLC Series.
 - 2) Eaton XR TBR Series.
 - 3) IDEC RV8H Series.
 - 4) Allen-Bradley Type 700 HL TBR Series.
4. Latching:
- a. Magnetic-latching control relays.
 - b. NEMA ratings:
 - 1) 300 volts.
 - 2) 5 Amps continuous.
 - 3) 360 volt-amperes make.
 - 4) 320 volt-amperes break.
 - c. Plug-in type.
 - d. DIN rail mounting on 35-millimeter rail.
 - e. Coil voltage: As required for the application.
 - f. Minimum poles: 2 PDT; as required for the application. Plus 1 spare pole.
 - g. Touch-safe design: All connection terminals to be protected against accidental touch.
 - h. Clear cover for visual inspection.

- i. Provide retainer clip to secure relay in socket.
 - j. Manufacturers: One of the following or equal:
 - 1) Square D, 8501, Type K.
 - 2) IDEC, RR2KP Series.
5. Time delay:
- a. Provide time-delay relays to control contact transition time.
 - b. Contact rating:
 - 1) 240 volts.
 - 2) 10 Amps continuous.
 - 3) 3,600 volt-amperes make.
 - 4) 360 volt-amperes break.
 - c. Coil voltage: As required for the application.
 - d. Provide pneumatic or electronic type with on-delay, off-delay, and on/off-delay:
 - 1) For off-delay, use true power-off time-delay relays. Where the required timing range exceeds capability of the off-delay relay use, signal off-delay where power loss will not cause undesirable operation or pneumatic time-delay relays.
 - e. Minimum poles: 2 PDT.
 - f. Units include adjustable dial with graduated scale covering the time range in each case.
 - g. Minimum timing range: 0.1 seconds to 10 minutes, or as required for the application.
 - h. Manufacturers: One of the following or equal:
 - 1) IDEC, RTE Series.
 - 2) Tyco Electronics, Agastat 7000 Series (pneumatic).
 - 3) Allen-Bradley, Type 700-HR.
- G. Terminal blocks:
- 1. DIN rail mounting on 35-millimeter rail.

2. Rated for 15 amperes at 600 volts.
 3. Screw terminal type.
 4. Provide mechanism to prevent wire connection from loosening in environments where vibration is present. This mechanism shall not cause permanent deformation to the metal body.
 5. Finger-safe protection for all terminals for conductors.
 6. Construction: Polyamide insulation material capable of withstanding temperature extremes from -40 degrees to 221 degrees Fahrenheit.
 7. Terminals: Plainly identified to correspond with markings on the diagrams:
 - a. Permanent machine-printed terminal identification.
 8. Disconnect-type field signal conductor terminals with socket/screw for testing.
 9. Identify terminals suitable for use with more than 1 conductor.
 10. Position:
 - a. So that the internal and external wiring does not cross.
 - b. To provide unobstructed access to the terminals and their conductors.
 11. Provide minimum 25-percent spare terminals.
 12. Manufacturers: One of the following or equal:
 - a. Phoenix Contact, UT4 Series.
 - b. Allen-Bradley, 1492 Series.
- H. DIN rail grounding:
1. Grounding terminal blocks used exclusively for bonding each DIN rail section to panel grounding busbar shall:
 - a. Mount to DIN rail via grounding foot with mounting screw.
 - b. Connect to the panel grounding busbar shall be via a green insulated conductor sized in accordance with NEC.
 - c. Not be used for grounding signal cable shields.
 2. Screw terminal type.
 3. DIN rail mounting on 35-millimeter rail.

4. Provide mechanism to prevent wire connection from loosening in environments where vibration is present. This mechanism shall not cause permanent deformation to the metal body.
5. Finger-safe protection for all terminals for conductors.
6. Terminals: Plainly identified to correspond with markings on the diagrams:
 - a. Permanent machine-printed terminal identification.
7. Manufacturers: One of the following or equal:
 - a. Phoenix Contact, USKLG Series.
 - b. Allen-Bradley, 1492-JG Series.

I. Wire duct:

1. Provide flame retardant plastic wiring duct, slotted with dust cover.
2. Type:
 - a. Wide slot.
 - b. Narrow slot.
 - c. Round hole.
3. Manufacturers: The following or equal:
 - a. Panduit.
 - b. Phoenix Contact.
 - c. Thomas & Betts.
 - d. Iboco.

J. DIN rail:

1. Perforated steel.
2. 35 mm width.
3. 15 mm deep.
4. Provide 2-inch offset using one of the following:
 - a. Offset brackets.
 - b. Preformed standoff DIN Rail Channel.

K. Surge protection devices (SPD):

1. 120 VAC control panel power SPD:
 - a. Provide SPD for panel 120 VAC power entrances:
 - 1) Non-faulting and non-interrupting design.
 - 2) Provide line to neutral and neutral to ground surge protection.
 - b. Provide surge protection at secondary of main circuit breaker:
 - 1) Surge protection is not required for 120 VAC circuits that are only used for panel lights and receptacles.
 - 2) For panels receiving power at 480 VAC, provide surge protection on the 120 VAC control power transformer secondary.
 - c. DIN rail mounting.
 - d. Attach wiring to the SPD by means of a screw-type cable-clamping terminal block:
 - 1) Gastight connections.
 - 2) Visual status indication of MOV status on the input and output circuits.
 - 3) Dry contact rated for remote status indication.
 - e. Approvals:
 - 1) Tested in accordance with IEC 61643-11.
 - 2) Tested in accordance with UL 1283.
 - 3) Tested in accordance with UL 1449.
 - 4) Surge protection minimum requirements: Withstand a minimum 10-kA test current of an 8/20 μ s waveform in accordance with IEEE C62.41.1 Category C Area.
 - f. Manufacturers: One of the following or equal:
 - 1) Phoenix Contact, Type SFP Filter.
 - 2) ASCO, Model 277.
2. 24 VDC control panel power SPD:
 - a. Provide SPD for 24VDC power circuits.
 - b. Provide surge protection at DC power supply output.

- c. DIN rail mounting.
 - d. Attach wiring to the SPD by means of a screw-type cable clamping terminal block:
 - 1) Optical status indicator.
 - 2) Dry contact rated for remote status indication.
 - e. Approvals:
 - 1) Tested in accordance with IEC 61643-11.
 - f. Manufacturers: One of the following or equal:
 - 1) Phoenix Contact, Plugtrab PLT-SEC-T3-24-FM-UT.
3. Panel mounted control, signal, and data line SPD:
- a. General:
 - 1) This section applies to SPD located in a control panel, field panel, network junction box, or marshalling panel.
 - 2) Approvals:
 - a) Tested in accordance with IEC 61643-21.
 - b) Tested in accordance with UL 497B.
 - 3) SPD shall consist of 2 parts:
 - a) Base module:
 - (1) DIN rail mounting.
 - (a) Grounded to DIN rail via mounting rail foot.
 - b) Plug protection module:
 - (1) Replacing a plug shall not require the removal of any wires nor interrupt the signal.
 - 4) Provide indirect shield ground style SPD unless otherwise noted.
 - 5) Provide ability to locally identify and indicate SPD health.

- 6) SPD shall be provided with controller module with dry contact for remote status monitoring of SPD device health.
 - 7) SPD modules shall be compatible with signal, communication bus type, data type, or control power being protected.
 - 8) Provide dedicated SPD for each signal, communication bus type, or data line being protected.
 - b. Manufacturers: One of the following or equal:
 - 1) Phoenix Contact, Plugtrab PT-IQ Series.
 - 2) Dehn, Blitzductor XTU Series.
4. Copper Ethernet SPD:
 - a. Protects network equipment from lightning or other surge events.
 - b. Suitable for Gigabit networks.
 - c. Compatible with shielded Cat 6 cabling with shielded RJ-45 ports.
 - d. Compliant with PoE standards IEEE 802.3af and 802.3at.
 - e. Nominal discharge surge current: 10 kA.
 - f. Approvals:
 - 1) Tested in accordance with IEC 61643-21.
 - 2) Tested in accordance with UL 497B.
 - g. Manufacturers: One of the following or equal:
 - 1) Phoenix Contact, DT-LAN-CAT6+.
 - 2) Weidmuller, VDATA CAT6.
 - 3) Eaton/MTL, ZoneBarrier.
5. Field device mounted SPD:
 - a. Conduit entry mounting.
 - 1) Provide parallel or through wiring configurations as required by the application.
 - a) Use parallel wiring configuration if there is an available cable gland at the device.

- b) Use through wiring configuration if there is no available cable gland at the device.
- 2) Provide Screw connections compatible with field device.
- b. NEMA 4X stainless steel material housing.
- c. Approvals:
 - 1) Tested in accordance with IEC 61643-21.
- d. 4-wire field device:
 - 1) Module shall provide simultaneous protection of signal cable, communication bus, or data line, and power supply line.
 - a) Maximum continuous voltage:
 - (1) DC:
 - (a) Signal: 32 VDC.
 - (b) Power supply: 255 VDC.
 - (2) AC:
 - (a) Signal: 22.6 VAC.
 - (b) Power supply: 255 VAC.
 - 2) Manufacturers: The following, engineer knows of no equal:
 - a) Endress+Hauser, HAW569-CB2C.
- e. 2-wire or 3-wire field device:
 - 1) Module shall provide protection for the signal cable, communication bus or data line.
 - 2) Manufacturers: One of the following or equal:
 - a) Endress+Hauser, HAW569 Series.
 - b) Phoenix Contact, Surgetrab S-PT Series.
 - c) Eaton/MTL, TP Series.

L. Horns and beacons:

- 1. Beacons/horn combination units:
 - a. Manufacturers: The following or equal:

- 1) Edwards, Multi-Status LED 108i with tone module.
 - b. LED Colors: Red, Green, and Amber.
 - c. Power: 120VAC.
 - d. Provide accessories such as pipe mount flange, pipe extensions, corner mount brackets, or wall mount brackets as needed.
 - e. Horn rated 80 dB minimum at 10 feet.
 2. Dedicated beacon unit:
 - a. Manufacturers: One of the following or equal:
 - 1) Federal Signal Corp., Starfire Series.
 - 2) Allen-Bradley, 855 B *-* 10 Series.
 - 3) Edwards, 102 Series.
 3. Dedicated horn unit:
 - a. Electromechanical:
 - 1) Manufacturers: One of the following or equal:
 - a) Federal Signal, 350 or 31X Series.
 - b) Edwards, 878EX or 879EX Series.
 - b. Electronic:
 - 1) Manufacturers: One of the following or equal:
 - a) Federal Signal, 300GCX or 300X Series.
 - b) Allen-Bradley, 855H or 855XH Series.
 - c) Edwards, 5530M or 5533MD Series.
 - c. Rated for 80 dB minimum at 10 feet.
- M. Power supplies:
1. Design power supply system so that either the primary or backup supply can be removed, repaired or replaced, and returned to service without disrupting the system operation.
 2. Convert 120 VAC to 24-volt DC or other DC voltages required or as required for the application.

3. Provide redundant backup 24 VDC power supply units to automatically supply the load upon failure of the primary supply.
4. Provide power supply arrangement that is configured with several modules to supply adequate power in the event of a single module failure in either a 1+1 or N+1 configuration as required:
 - a. Provide automatic switchover upon module failure.
 - b. Alarm contacts monitored by the PLC.
5. Provide protective isolation between power supply units either by means of Diodes, Diode Modules, MOSFET Modules, or use power supplies with built in redundancy. Power supplies with built in redundancy must actively isolate each power supply and be designed as such.
6. Sized to provide 40-percent excess rated capacity.
7. UL 508C listed to allow full-rated output without de-rating.
8. Provide fuse or short-circuit protection.
9. Provide a minimum of 1 set of dry contacts for each power supply configured to change state on failure for monitoring and signaling purposes.
10. Output regulation: Within 0.05 percent for a 10-percent line change or a 50-percent load change.
11. Operating temperature range: 32 degrees to 140 degrees Fahrenheit.
12. Touch-safe design: All connection terminals to be protected against accidental touch.
13. DIN rail mounting on 35-millimeter rail:
 - a. Mount the power supply in the proper orientation as recommended by the manufacturer to ensure adequate thermal dispersion without derating the power supply.
14. Provide self-protecting power supplies with a means of limiting DC current in case of short circuit.
15. Manufacturers: One of the following or equal:
 - a. Fully redundant:
 - 1) Phoenix Contact, Quint Power Supply with SFB technology.
 - a) Phoenix Contact, Quint.
 - 2) IDEC, PS5R Series:

3) Sola.

4) PULS.

b. Redundancy module:

1) Phoenix contact, o-ring redundancy module.

N. Limit switches:

1. NEMA Type 4X.
2. AC contact rating 120 volts, 10 A.
3. DC contact rating 125 volts, 0.4 A.
4. Provide robust actuation mechanism not prone to degradation.
5. Provide complete actuator mechanism with all required hardware.
6. Allows for contact opening even during contact weld condition.
7. UL approved.
8. Operating temperature range: 0 degrees to 230 degrees Fahrenheit).
9. Manufacturers: One of the following or equal:
 - a. Allen-Bradley, 802 Series.
 - b. Honeywell, HDLS Series.
 - c. Omron, D4 Series.
 - d. Eaton, E47, E49, E50.
 - e. ABB.

O. Current switches:

1. Operate from 120-VAC supply voltage.
2. 1 normally open and normally closed contacts.
3. Adjustable current setting.
4. Manufacturers: The following or equal:
 - a. Zelio, RM35.
 - b. Phoenix Contact, EMD Series.

P. Current transmitters:

1. Input current range: As indicated on Drawings.
2. Output: 4-20 mA.
3. Operate from 24 VDC supply voltage.
4. Output overload protected.
5. Accuracy: Within 0.5 percent Full-Scale.
6. Ripple and Noise: 1 percent Max., peak to peak.
7. Frequency: 50/60 hertz.
8. Manufacturer:
 - a. Phoenix Contact: Mini Analog Pro Series.
 - b. CR Magnetics: CR4320 series.
 - c. American Aerospace: 1070 Series.

Q. Panel mount quick connector:

1. Keyed insertion plug.
2. Threaded cap to protect connection when not in use.
3. Material: Stainless steel.
4. Pre-wired pigtails.
5. Indoor/Outdoor:
 - a. Rating: Meets or exceeds panel rating.
 - b. Manufacturers: One of the following or equal:
 - 1) Amphenol.
 - 2) Sealcon.
6. Hazardous (Classified) Areas:
 - a. UL listed and labeled for area as **indicated on the Drawings**.
 - b. Manufacturers: The following or equal:
 - 1) Amphenol HDE Series.

2.08 ACCESSORIES

- A. Provide panels with an inside protective pocket to hold the panel drawings. Ship panels with 1 copy of accepted Shop Drawings including, but not limited to, schematic diagram, connection diagram, and layout drawing of control wiring and components in a sealed plastic bag stored in the panel drawing pocket.
- B. Provide floor stands or legs with a minimum height of 12 inches where needed or as **indicated on the Drawings**.
- C. Provide a folding shelf for enclosures that contain programmable controllers. The shelf shall be mounted on the inside surface of the door, capable of supporting a laptop computer.
- D. Provide nameplate to each panel as **indicated on the Drawings**:
 - 1. Provide as specified in Section 26_05_53 - Identification for Electrical Systems on all internal and external instruments and devices.
 - 2. Provide a nameplate with the following markings that is plainly visible after installation:
 - a. Manufacturer's name, trademark, or other descriptive marking by which the organization responsible for the panel can be identified.
 - b. Supply voltage, phase, frequency, and full-load current.
 - c. Power source or circuit ID.
 - d. Short-circuit current rating of the panel based on one of the following:
 - 1) Short-circuit current rating of a listed and labeled assembly.
 - 2) Short-circuit current rating established utilizing an approved method.
- E. Provide a window kit where **indicated on the Drawings** or where a transmitter with display is mounted inside a control panel. The window shall meet the following requirements:
 - 1. Safety plate glass.
 - 2. Secured by rubber locking seal.
 - 3. Allow full viewing of devices issuing visual process data or diagnostics.
- F. Lighting:
 - 1. Provide 1 luminaire for each section, on the interior of the panel, spaced evenly along the top-front of the enclosure door opening(s):
 - a. Covered or guarded.

- b. Provide On-Off door-activated switches where **indicated on the Drawings**.
- c. 120-volt, single-phase, 15-amp style plug.
- d. Provide 4,000 K, 900 Lumens - LED fixture.
 - 1) Provide additional fixtures for every 36 inches of width.

G. Receptacles:

- 1. Provide 1 duplex receptacle located every 6 feet of enclosure width, spaced evenly along the back mounting panels.
- 2. GFCI, 120-volt, single-phase, 15-amp style plug.
- 3. Provide circuit breaker or fuse to limit receptacle draw to 5 amperes.

H. Grounding:

- 1. Provide the following:
 - a. Grounding strap between enclosure doors and the enclosure.
 - b. Equipment grounding conductor terminals.
 - c. Provide equipment grounding busbar with lugs for connection of all equipment grounding wires.
 - d. Bond multi-section panels together with an equipment grounding conductor or an equivalent grounding busbar.
- 2. Identify equipment grounding conductor terminals with the word "GROUND," the letters "GND," the letter "G," or the color green.
- 3. Signal cable shields shall only be grounded at a single point in the loop. Unless otherwise noted, ground signal cable shields at control panel.
- 4. Ensure the continuity of the equipment grounding system by effective connections through conductors or structural members.
- 5. Design so that removing a device does not interrupt the continuity of the equipment-grounding circuit.
- 6. Provide an equipment-grounding terminal for each incoming power circuit, near the phase conductor terminal.
- 7. Size ground wires in accordance with NEC and UL Standards, unless noted otherwise.
- 8. Unless otherwise noted, connect all exposed, noncurrent-carrying conductive parts, devices, and equipment to the equipment-grounding circuit.

9. Connect the door stud on the enclosures to an equipment-grounding terminal within the enclosure using an equipment-bonding jumper.
- I. Provide sunshades and insulation for all outdoor installations.

2.09 MIXES (NOT USED)

2.10 FABRICATION (NOT USED)

2.11 FINISHES

A. Finishes:

1. Metallic (non-stainless):
 - a. Metal surfaces of panels shall be prepared by chemical cleaning and mechanical abrasion in accordance with the finish manufacturer's recommendations to achieve a smooth, well-finished surface.
 - b. Scratches or blemishes shall be filled before finishing. One coat of zinc phosphate shall be applied per the manufacturer's recommended dry-film thickness and allowed to dry before applying the finish coat.
 - c. Finish coat shall be a baked polyester-urethane powder, aliphatic air-dry polyurethane, or epoxy enamel to meet NEMA rating specified application.
 - d. Exterior of enclosures located outdoors shall be UV-resistant polyester powder coating. Total dry film thickness shall be 3 mils, minimum.
2. Stainless steel:
 - a. Stainless enclosures shall be provided with a Number 4 brushed finish - not painted.

B. Colors:

1. Exterior color of panels mounted indoors shall be manufacturer's standard light gray.
2. Exterior of panels mounted outdoors shall be manufacturer's standard white.
3. Panel interiors shall be manufacturer's standard white.

2.12 SOURCE QUALITY CONTROL

- A. As specified in Section 40_61_00 - Common Work Results for Process Control and Instrumentation Systems.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine the installation location for the instrument and verify that the instrument will work properly when installed.
 - 1. Notify the Engineer promptly if any installation condition does not meet the instrument manufacturer's recommendations or specifications.

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION

- A. Install enclosures so that their surfaces are plumb and level within 1/8-inch over the entire surface of the panel; anchor securely to wall and structural supports at each corner, minimum. Direct attachment to drywall is not permitted.
- B. Install the enclosure per guidelines and submitted installation instructions to meet the seismic requirements at the project site.
- C. Provide floor stand kits for wall-mounted enclosures larger than 48 inches high.
- D. Provide concrete housekeeping pads for freestanding enclosures.
 - 1. Refer to the structural typical details.
- E. Install gasket and sealing material under panels with floor slab cutouts for conduit:
 - 1. Undercoat floor-mounted panels.
- F. Provide a full-size equipment-grounding conductor in accordance with NEC included with the power feeder. Terminate to the incoming power circuit-grounding terminal.
- G. All holes for field conduits, etc. shall be cut in the field. There shall be no additional holes, factory cut holes, or hole closers allowed. Incorrect holes, additional holes, or miscut holes shall require that the entire enclosure be replaced.
- H. Protect all wiring from sharp edges and corners.
- I. Control panels that are adjacent to motor control centers shall be fully wired to the motor control centers using wireways integral to the motor control center or additional conduits as needed. These interconnections are not shown or reflected on the Conduit Schedule but shall be shown on the Loop Drawings prepared by the Contractor.
- J. Provide individually fused analog input module points with blown-fuse indicator lights, mounted external of the module on the output terminal strip.
- K. Side panels:

1. Side panels shall be kept free off all control equipment and devices. Any deviation must be sent to the engineer in writing asking for a deviation.

3.04 ERECTION, INSTALLATION, APPLICATION, AND CONSTRUCTION (NOT USED)

3.05 REPAIRS/RESTORATION (NOT USED)

3.06 RE-INSTALLATION (NOT USED)

3.07 FIELD QUALITY CONTROL (NOT USED)

3.08 ADJUSTING (NOT USED)

3.09 CLEANING (NOT USED)

3.10 DEMONSTRATION AND TRAINING (NOT USED)

3.11 PROTECTION (NOT USED)

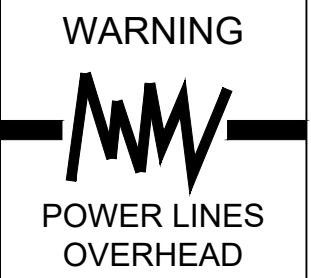
3.12 SCHEDULES (NOT USED)

END OF SECTION

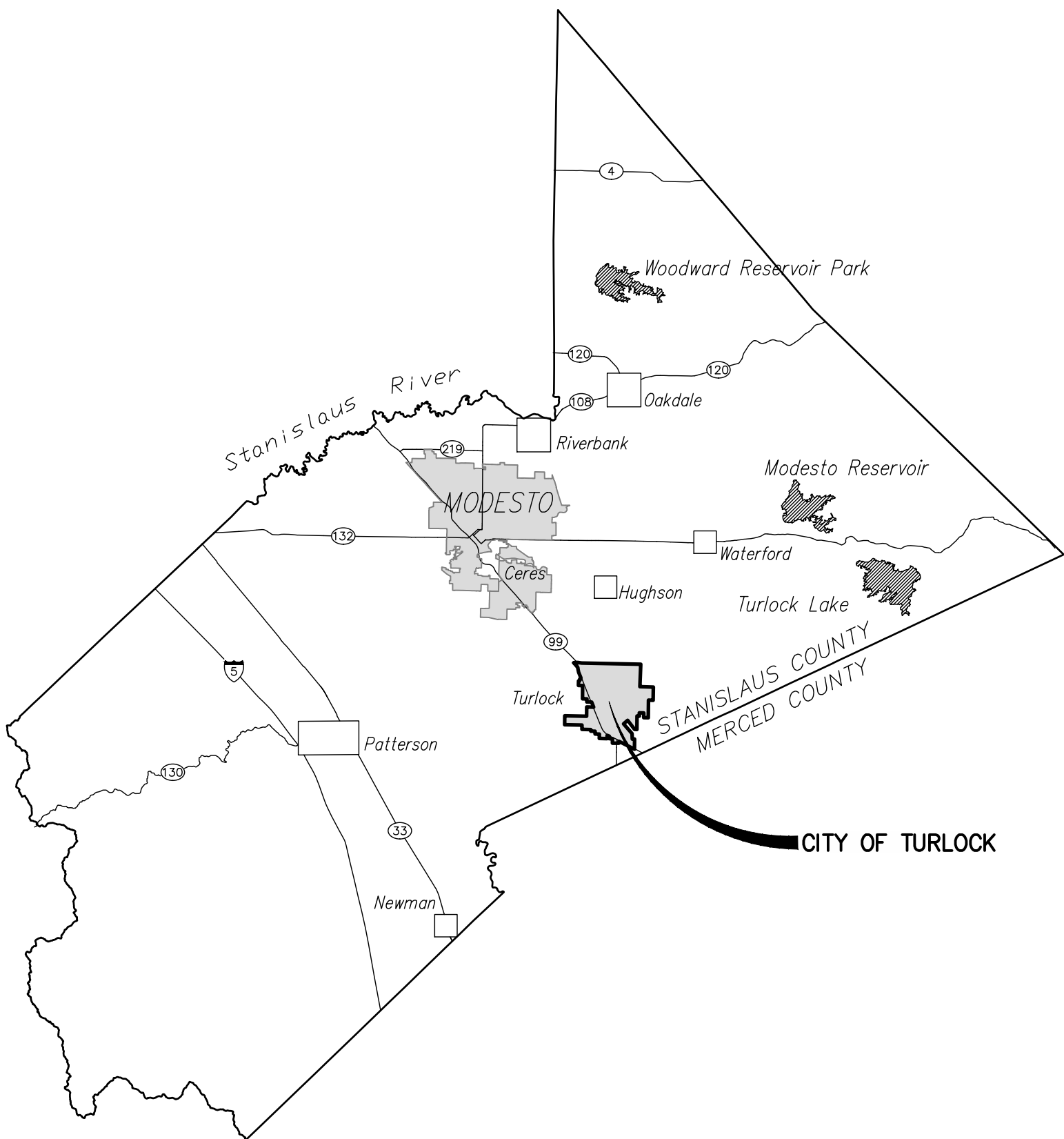
CITY OF TURLOCK

CITY PROJECT NO. 2020-79

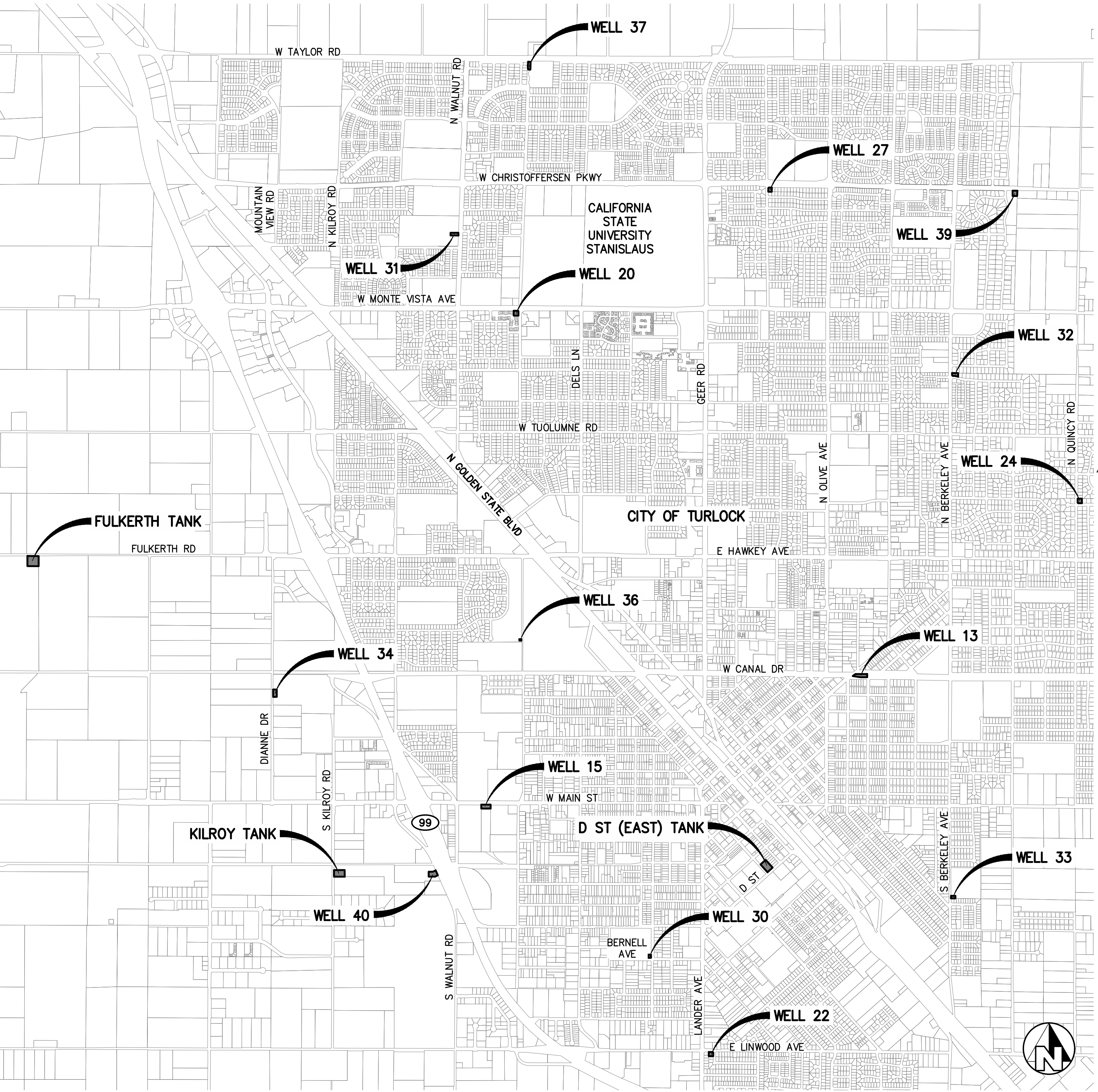
CITY WIDE CHLORINATION



Know what's below.
Call before you dig.



VICINITY MAP
NOT TO SCALE

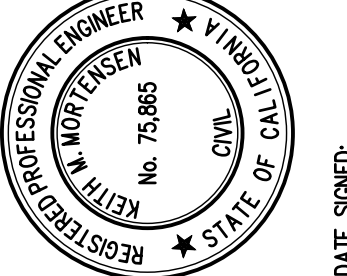


SITE MAP
NOT TO SCALE

SHEET INDEX		
SHEET NO.	SEQ. SHEET NO.	DESCRIPTION
GENERAL		
G-1	1	COVER SHEET
G-2	2	LEGENDS AND ABBREVIATIONS
G-3	3	GENERAL NOTES
G-4	4	GENERAL NOTES
G-5	5	DESIGN CRITERIA
G-6	6	CHEMICAL INJECTION PROCESS FLOW
G-7	7	SURVEY NOTES
CIVIL		
C-1	8	D STREET (EAST) TANK SITE PLAN
C-2	9	FULKERTH ROAD TANK SITE PLAN
C-3	10	KILROY ROAD TANK SITE PLAN
C-13	11	WELL 13 SITE PLAN
C-15	12	WELL 15 SITE PLAN
C-20	13	WELL 20 SITE PLAN
C-22	14	WELL 22 SITE PLAN
C-24	15	WELL 24 SITE PLAN
C-27	16	WELL 27 SITE PLAN
C-30	17	WELL 30 SITE PLAN
C-31	18	WELL 31 SITE PLAN
C-32	19	WELL 32 SITE PLAN
C-33	20	WELL 33 SITE PLAN
C-34	21	WELL 34 SITE PLAN
C-36	22	WELL 36 SITE PLAN
C-37	23	WELL 37 SITE PLAN
C-39	24	WELL 39 SITE PLAN
C-40	25	WELL 40 SITE PLAN
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D-1	26	CHLORINATION ENCLOSURE DETAILS
D-2	27	CHLORINATION ENCLOSURE DETAILS
D-3	28	CHLORINATION DETAILS
D-4	29	CHLORINATION DETAILS
D-5	30	CHLORINATION DETAILS
D-6	31	SAMPLING STATION DETAILS
D-7	32	STRUCTURAL DETAILS
D-8	33	STRUCTURAL DETAILS
D-8B	34	STRUCTURAL DETAILS
D-8C	35	FENCING DETAILS
D-9	36	CITY STANDARD DETAILS
D-10	37	CITY STANDARD DETAILS
ELECTRICAL		
EG-1	38	GENERAL NOTES AND ABBREVIATIONS
E-1	39	PARTIAL SITE PLAN - DST TANK
E-2	40	PARTIAL SITE PLAN - FULKERTH TANK
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E-31	49	PARTIAL SITE PLAN - WELL 31
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E-34	52	PARTIAL SITE PLAN - WELL 34
E-36	53	PARTIAL SITE PLAN - WELL 36
E-37	54	PARTIAL SITE PLAN - WELL 37
E-39	55	PARTIAL SITE PLAN - WELL 39
E-40	56	PARTIAL SITE PLAN - WELL 40
ED-1	57	INSTRUMENTATION TITLE SHEET
ED-2	58	INSTRUMENTATION CONTROLS
ED-3	59	ELECTRICAL DETAILS

APPROVALS	
NATHAN BRAY, P.E., INTERIM DEVELOPMENT SERVICES DIRECTOR/CITY ENGINEER	DATE
MARK GOMEZ, FIRE MARSHAL/DIVISION FIRE CHIEF	DATE

95% DESIGN SUBMITTAL
NOT FOR CONSTRUCTION
10/16/2020



CITY WIDE CHLORINATION
CITY OF TURLOCK
CITY PROJECT NO. 2020-79
GENERAL
COVER SHEET

EST. 1968
PROVOST & PRITCHARD
CONSULTING GROUP
An Employee Owned Company
288 WEST CROWLEY AVENUE
FRESNO, CALIFORNIA 93711-6162
559/449-2700 FAX 559/449-2715
www.ppgrp.com

DESIGN ENGINEER:
KEITH MORTENSEN
LICENSE NO:
75865

DRAFTED BY: JMN
CHECKED BY: RKB
DATE: NOV 2020
JOB NO: 229220006

PROJECT NO:
PHASE: CD

ORIGINAL SCALE SHOWN IS ONE INCH. ADJUST SCALE FOR REDUCED OR ENLARGED PLANS.

SHEET
G-1
1 OF 57

1. DISTANCES AND MEASUREMENTS ARE GIVEN AND WILL BE MADE IN HORIZONTAL PLANE. GRADES ARE GIVEN FROM THE TOP OF STAKES OR NAILS UNLESS OTHERWISE NOTED. THE CONTRACTOR SHALL PRESERVE ALL STAKES AND POINTS SET FOR LINES, GRADES OR MEASUREMENTS OF THE WORK IN THEIR PROPER PLACES. ALL EXPENSES INCURRED IN REPLACING STAKES THAT HAVE BEEN REMOVED WITHOUT PROPER AUTHORITY SHALL BE PAID FOR BY THE GENERAL CONTRACTOR.
2. ALL WORK TO BE DONE IN ACCORDANCE WITH CITY OF TURLOCK STANDARDS.
3. CONTRACTOR SHALL COMPLY WITH ALL APPLICABLE STATE AND FEDERAL SAFETY AND LABOR CODES.
4. CONTRACTOR SHALL OBTAIN ENCROACHMENT PERMIT FROM THE CITY OF TURLOCK PRIOR TO BEGINNING WORK (NO FEE).
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PRESERVATION AND PROTECTION OF ALL UNDERGROUND PIPES, CONDUITS AND OTHER IMPROVEMENTS WHETHER SHOWN ON THE PLANS OR NOT. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO NOTIFY ALL UTILITY COMPANIES AT LEAST 48 HOURS PRIOR TO COMMENCEMENT OF WORK. CONTRACTOR SHALL NOTIFY:
 - A. UNDERGROUND SERVICE ALERT (USA) AT 1-800-227-2600 TO LOCATE EXACT POSITION OF UNDERGROUND TELEPHONE CABLE, GAS LINES, SEWER LINES AND WATER LINES.
 - B. TURLOCK IRRIGATION DISTRICT AT (209) 883-8464 TO LOCATE UNDERGROUND ELECTRICAL CONDUIT.
 - C. CHARTER CABLE AT (209) 656-2124 TO LOCATE UNDERGROUND CABLE T.V.
 - D. FIRE DEPARTMENT AT (209) 668-5580, POLICE DEPT. AT (209) 668-5550 AND AMBULANCE AT (209) 632-2271.
6. ANY UTILITY TO BE RELOCATED OR REMOVED SHALL BE COORDINATED WITH THE APPROPRIATE UTILITY COMPANY.
7. WHERE EXISTING PAVEMENT IS SCHEDULED TO BE REMOVED ADJACENT TO EXISTING PAVEMENT TO REMAIN IN PLACE, THE CONTRACTOR SHALL SAWCUT THE EXISTING PAVEMENT TO INSURE CLEAN VERTICAL EDGE TO PAVE AGAINST.
8. LOCATION AND DEPTH OF EXISTING SUB-SURFACE STRUCTURE ARE NOT GUARANTEED. CONTRACTOR SHALL VERIFY THE HORIZONTAL AND VERTICAL LOCATION OF EXISTING BURIED UTILITIES SHOWN ON THE PLANS PRIOR TO DIGGING NEAR EXISTING BURIED UTILITIES.
9. ALL REFERENCES AND WRITTEN DIMENSIONS SHALL TAKE PREFERENCE OVER SCALED DIMENSIONS AND SHALL BE VERIFIED ON THE SITE. ANY DISCREPANCY SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER PRIOR TO THE COMMENCEMENT OF ANY WORK.

1. UNLESS NOTED OTHERWISE ON THE PLANS, ALL DEMOLISHED MATERIALS AND DEBRIS SHALL BE DISPOSED OF BY THE CONTRACTOR

1. THE CONTRACTOR SHALL REPLACE ALL LANDSCAPE IRRIGATION COMPONENTS (E.G. IRRIGATION PIPE, VALVES, CONTROLS, CONTROL WIRING, SPRAY HEADS, ETC.) DISTURBED DURING CONSTRUCTION.
2. REPLACEMENT SPRAY HEADS SHALL BE OF A TYPE SUITABLE FOR PROVIDING FULL COVERAGE OF LANDSCAPING ACCOUNTING FOR CHANGES IN SPRAY HEAD AND PLANT LOCATIONS IF REQUIRED.

1. BEFORE COMMENCING EXCAVATION, THE CONTRACTOR SHALL NOTIFY ALL UTILITY AUTHORITIES OR UTILITY COMPANIES HAVING INTEREST IN THE WORK OF THE CONTRACTOR'S INTENTION TO EXCAVATE PROXIMATE TO EXISTING FACILITIES AND THE CONTRACTOR SHALL VERIFY THE LOCATION, DEPTH, AND SIZE OF ALL UTILITIES IN THE WORK AREA. THE WORK SHALL NOT BE COMMENCED UNTIL THE CONTRACTOR HAS FIRST BEEN PROVIDED AN INQUIRY IDENTIFICATION NUMBER FOR SUB-SURFACE INSTALLATIONS AS SPECIFIED IN SECTION 4216 OF THE GOVERNMENT CODE.
2. CONTRACTOR SHALL NOTIFY AND COORDINATE ALL RELATED WORK WITH THE FOLLOWING AGENCIES:
 1. CITY OF TURLOCK
 2. CITY OF TURLOCK PUBLIC WORKS DEPARTMENT
 3. CITY OF TURLOCK PARKS DEPARTMENT
 4. PACIFIC GAS AND ELECTRIC COMPANY
 5. AT&T
 6. TURLOCK IRRIGATION DISTRICT
3. ALL WATER DISTRIBUTION SYSTEM MAINS AND SERVICE CONNECTIONS SHALL BE KEPT IN CONSTANT SERVICE DURING THE WORK.
4. THE CONTRACTOR SHALL PROVIDE RECORD DRAWINGS FOR ALL PROJECT IMPROVEMENTS.
5. DETAILS AND NOTES ON TYPICAL SHEETS SHALL APPLY UNLESS SPECIFICALLY SHOWN OTHERWISE. DETAILS OF CONSTRUCTION NOT FULLY SHOWN SHALL BE OF THE SAME NATURE AS SHOWN FOR SIMILAR CONDITIONS.
6. ALL DIMENSIONS ARE TO BE FIELD VERIFIED BY THE CONTRACTOR PRIOR TO COMMENCING WORK OR FABRICATION. IF ANY CONDITION EXISTS THAT IS NOT AS SHOWN ON THE DRAWINGS THE ENGINEER SHALL BE NOTIFIED IMMEDIATELY.
7. DO NOT SCALE DRAWINGS. WRITTEN DIMENSIONS SHALL HAVE PRECEDENCE OVER SCALED DRAWINGS.
8. ALL WORK SHALL BE PERFORMED BY LICENSED CONTRACTOR(S) USING MATERIALS AND METHODS IN ACCORDANCE WITH APPLICABLE SECTIONS OF THE 2019 CALIFORNIA BUILDING CODE (CBC), LOCAL CODES AND ORDINANCES.
9. ANY CHANGES TO THE APPROVED SET OF PLANS WITHOUT NOTIFYING THE ENGINEER PRIOR TO SUCH CHANGES ABSOLVES SAID ENGINEER FROM ANY AND ALL RESPONSIBILITY WITH RESPECT TO THE LIABILITY, DAMAGE OR EXTRA WORK RESULTING FROM SAID CHANGES.
10. ALL WORK SHALL CONFORM TO THE LATEST APPLICABLE CONSTRUCTION SAFETY REQUIREMENTS OF OSHA AND ANY OTHER GOVERNMENTAL ENTITY HAVING JURISDICTION.
11. THE DUTY OF THE ENGINEER TO CONDUCT CONSTRUCTION REVIEW OF THE CONTRACTOR'S PERFORMANCE IS NOT INTENDED TO INCLUDE REVIEW OF THE ADEQUACY OF THE CONTRACTOR'S SAFETY MEASURES IN, ON, OR NEAR THE CONSTRUCTION SITE.
12. ANY SUPPORT SERVICES PERFORMED BY THE ENGINEER OR FIELD REPRESENTATIVES DURING CONSTRUCTION SHALL BE DISTINGUISHED FROM CONTINUOUS AND DETAILED INSPECTION SERVICES WHICH ARE FURNISHED BY OTHERS. THESE SUPPORT SERVICES PERFORMED BY THE ENGINEER WHETHER PERFORMED PRIOR TO, DURING, OR AFTER COMPLETION OF CONSTRUCTION ARE PERFORMED SOLELY FOR THE PURPOSE OF ASSISTING IN QUALITY CONTROL AND IN ACHIEVING CONFORMANCE WITH CONTRACT DRAWINGS AND SPECIFICATIONS, BUT THEY DO NOT GUARANTEE CONTRACTOR'S PERFORMANCE AND SHALL NOT BE CONSTRUED AS SUPERVISION OF CONSTRUCTION.

1. PIPE MATERIALS
 - a) ALL BURIED PRESSURE PIPING WITHIN THE SITE PROPERTY LINES SHALL BE DUCTILE IRON PIPE CONFORMING TO SPECIFICATION 40 05 00 UNLESS OTHERWISE NOTED.
 - b) ALL ABOVE GRADE PIPING 4 INCHES AND LARGER SHALL BE FBELC WELDED STEEL PIPE WITH FLANGED OR GROOVED CONNECTIONS CONFORMING TO SPECIFICATION 40 05 00 UNLESS OTHERWISE NOTED
 - c) ALL CHEMICAL PIPING SHALL BE 1/2-INCH POLYETHYLENE TUBING INSIDE OF EPVC CONDUIT CONFORMING TO SPECIFICATION 40 20 90 OR DOUBLE CONTAINED PIPING UNLESS OTHERWISE NOTED.
 - d) DRAIN PIPING 4 INCHES AND SMALLER SHALL BE ASTM D 3034, SDR 35, UNLESS NOTED OTHERWISE.
2. RESTRAIN ALL ON-SITE PRESSURE PIPING IN ACCORDANCE WITH SPECIFICATION 40 05 00. THRUST BLOCKS WILL NOT BE ACCEPTABLE.
3. THE WORK CONTAINED HEREIN SHALL COMPLY WITH TITLE 22 SECTION 64572 OF THE CALIFORNIA CODE OF REGULATIONS. REFER TO WATER MAIN SEPARATION REQUIREMENTS DETAIL.
4. ALL HARDWARE FOR BURIED PIPE CONNECTIONS SHALL BE STAINLESS STEEL REGARDLESS OF TYPE (RESTRAINED MJ, FLANGE, ETC.).
5. NEW WATER MAINS, TANKS, AND TREATMENT EQUIPMENT SHALL BE DISINFECTED AND TESTED IN ACCORDANCE WITH THE SPECIFICATIONS PRIOR TO BEING PLACED INTO SERVICE.

1. THE WORK EMBRACED HEREIN SHALL BE DONE IN ACCORDANCE WITH THE APPROPRIATE PROVISIONS OF CHAPTER 33 OF 2019 CALIFORNIA BUILDING CODE AS ADOPTED.
2. THE CONTRACTOR SHALL OBTAIN WRITTEN AUTHORIZATION FROM ANY PROPERTY OWNER GIVING HIM PERMISSION TO ENTER HIS PROPERTY FOR THE PURPOSES OF CONSTRUCTING THE IMPROVEMENTS DELINEATED ON THE PLANS AND TRANSITIONS THERETO OR STAGING MATERIALS AND EQUIPMENT TO SUPPORT CONSTRUCTION. CONTRACTOR SHALL SUBMIT A LETTER SIGNED BY THE PROPERTY OWNER THAT THE PROPERTY HAS BEEN PROPERLY RESTORED TO ITS PRE-CONSTRUCTION CONDITION.
3. ANY DIRT OR DEBRIS TRACKED ONTO ANY EXISTING ROAD FROM THIS PROJECT SHALL BE CLEANED OFF AT THE END OF EACH WORKING DAY TO THE SATISFACTION OF THE CITY.
4. BEFORE COMMENCING WORK, THE CONTRACTOR SHALL NOTIFY ALL UTILITY AUTHORITIES OR UTILITY COMPANIES HAVING POSSIBLE INTEREST IN THE WORK OF THE CONTRACTOR'S INTENTION TO EXCAVATE PROXIMATE TO EXISTING FACILITIES AND THE CONTRACTOR SHALL VERIFY THE LOCATION OF ANY UTILITIES IN THE WORK AREA. THE CONTRACTOR SHALL NOTIFY U.S.A. TWO (2) DAYS PRIOR TO BEGINNING ANY EXCAVATION.
5. PROVIDE THE CITY OF TURLOCK WITH "AS BUILT" PLANS UPON COMPLETION OF GRADING
6. ANY VERTICAL CUT OR FILL DIFFERENTIAL EQUAL TO OR GREATER THAN TWELVE (12) INCHES BETWEEN ADJACENT PROPERTIES SHALL BE SUPPORTED BY AN APPROVED RETAINING WALL.
7. DIFFERENTIALS LESS THAN TWELVE (12) INCHES ARE TO HAVE A MAXIMUM SLOPE OF ONE (1) VERTICAL TO TWO (2) HORIZONTAL.
8. GRADING CONTRACTOR SHALL REMOVE ALL ORGANIC MATTER, DEBRIS, AND OTHER DELETERIOUS OR EXCESS MATERIAL FROM THE SITE AND DISPOSE OF AT AN APPROVED LOCATION. SUBSURFACE DEBRIS NOT VISIBLE FROM THE SURFACE THAT IS NOT SUITABLE TO REMAIN ONSITE OR USED AS BACKFILL MATERIAL SHALL BE REMOVED AT ENGINEER'S DIRECTION AS EXTRA WORK.
9. CONTRACTOR SHALL PRESERVE SURVEY MONUMENTS TO THE EXTENT POSSIBLE. CONTRACTOR SHALL NOTIFY ENGINEER OF ANY SURVEY MONUMENTS THAT WILL BE DISTURBED AS A RESULT OF CONSTRUCTION. MONUMENTS THAT MAY BE DISTURBED BY CONSTRUCTION WILL BE RESET BY A LICENSED LAND SURVEYOR RETAINED BY THE OWNER OR ENGINEER.
10. THE CONTRACTOR SHALL MAKE ADEQUATE PROVISION FOR DUST CONTROL FOR THE DURATION OF THE WORK. DUST CONTROL MEASURES SHALL BE FULLY AND ADEQUATELY CARRIED OUT ON WEEKDAYS, WEEKENDS AND HOLIDAYS, AND WHEN NECESSARY, BEFORE OR AFTER NORMAL WORKING HOURS.
11. PRIOR TO THE LAYING OF THE SUB BASE OR BASE ON THE ROADWAY, THE CITY'S ENGINEER SHALL CERTIFY THAT THE SUB GRADE ELEVATIONS ARE IN CONFORMANCE WITH THE APPROVED PLANS.
12. ALL SEWER, STORM DRAIN AND UTILITY MANHOLES AFFECTED BY THIS PROJECT SHALL BE ADJUSTED TO GRADE AS NECESSARY BY THE CONTRACTOR AND INCLUDED IN THIS WORK. ALL WATER MAIN VALVES (CAP AND LID) SHALL BE ADJUSTED TO GRADE AS NECESSARY BY THE CONTRACTOR AND INCLUDED IN THIS WORK.
13. THE COSTS OF ALL REPEAT TESTING REQUIRED FOR ACCEPTANCE OF WORK SHALL BE FULLY BORNE BY THE CONTRACTOR.
14. PERMANENT TRENCH RESURFACING TO BE PER CITY STANDARD, OR AS DETAILED.
15. TEMPORARY TRENCH RESURFACING TO BE A MINIMUM 4" THICK COLD MIX.
16. TRENCH CUTS IN EXISTING STREETS THAT ARE NOT TO BE RECONSTRUCTED OR OVERLAID SHALL HAVE PERMANENT TRENCH RESURFACING INSTALLED WITHIN SEVEN (7) DAYS AFTER INITIAL STREET CUT.

C900	AWWA C900 STANDARD	FLG	FLANGE	BSC	BITUMINOUS SEAL COATED PER AWWA C105	FBE	FUSION BONDED EPOXY 40 05 00
DIP	DUCTILE IRON PIPE	GE	GROOVED END	CM	CEMENT MORTAR PER AWWA C104	PEE	POLYETHYLENE ENCASEMENT 40 05 00 PER AWWA
PVCG	POLYVINYL CHLORIDE GRAVITY	MJ	MECHANICAL JOINT				
WSP	WELDED STEEL PIPE	PO	PUSH ON JOINT	EP	EPOXY POLYURETHANE 40 05 00 SYSTEM 2		

EST. 1968 PROVOST & PRITCHARD CONSULTING GROUP <i>An Employee Owned Company</i> 286 WEST CROMWELL AVENUE SUITE 200, COVINGTON, LA 70429 559/449-2700 FAX 559/449-2715 www.fsg.com	DESIGN ENGINEER: KEITH MORTENSEN	
	LICENSE NO: 75865	
	DRAFTED BY: JMN	CHECKED BY: RKB
	DATE: NOV 20 2020	
	JOB NO: 229220006	
	PROJECT NO:	
	PHASE: CD	
	0' 3"	
	ORIGINAL SCALE, SHOWN IS ONE INCH, ADJUST SCALE FOR REDUCED OR ENLARGED PLANS.	
	SHEET G-3	
3	OF	57

LOADING CRITERIA

RISK CATEGORY OF BUILDING:		III
1. WIND LOAD:	ULTIMATE DESIGN WIND SPEED	110 MPH
	EXPOSURE	C
	INTERNAL PRESSURE COEFFICIENT	0.8
2. SEISMIC LOAD:	COMPONENTS & CLADDING	0.9
	DESIGN WIND PRESSURE	
	ROOF	25 PSF
3. WATER LOAD:	WALL	25 PSF
	DESIGN HIGH WATER LEVEL	N/A

SPECIAL INSPECTION NOTES

- THE CONTRACTOR SHALL NOTIFY THE OWNER'S REPRESENTATIVE 48 HOURS BEFORE PLACEMENT OF REINFORCING STEEL AND CONCRETE SO THAT THE SUBGRADE OF EXCAVATIONS MAY BE INSPECTED BY THE GEOTECHNICAL ENGINEER. THE GEOTECHNICAL ENGINEER SHALL VERIFY BACKFILL MATERIAL, BACKFILLING PROCEDURES AND SOIL COMPACTION TESTS.
- STRUCTURAL OBSERVATION SHALL BE PROVIDED BY THE DESIGN ENGINEER(S) OF RECORD OR THEIR AUTHORIZED REPRESENTATIVES IN ACCORDANCE WITH CBC 2019, SECTION 1704. STRUCTURAL OBSERVATION SHALL CONSIST OF SITE VISITS AT INTERVALS APPROPRIATE TO THE STAGE OF CONSTRUCTION TO OBSERVE CONSTRUCTION IN PROGRESS AND REVIEW OF TESTING AND INSPECTION REPORTS FOR GENERAL COMPLIANCE WITH THE CONSTRUCTION DOCUMENTS RELATING TO THE STRUCTURAL WORK AND THE NONSTRUCTURAL COMPONENTS AND EQUIPMENT ANCHORAGE.
- SPECIAL INSPECTION IN ACCORDANCE WITH CBC 2019 SECTIONS 1704 & 1705, SHALL BE REQUIRED AS INDICATED IN THE SPECIAL INSPECTION AND TESTING SCHEDULE ON THIS SHEET.
- ALL SPECIAL INSPECTIONS REQUIRED MUST BE BY APPROVED INDEPENDENT INSPECTORS WHO SHALL BE RETAINED BY THE OWNER. INSPECTORS SHALL SUBMIT THEIR REPORTS DIRECTLY TO THE BUILDING OFFICIAL AND THE REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE. THESE INSPECTORS ARE IN ADDITION TO ANY REQUIRED OWNER INSPECTIONS. CONTRACTOR SHALL COORDINATE INSPECTIONS AND ALLOW ACCESS FOR THE SPECIAL INSPECTOR TO PERFORM REQUIRED INSPECTIONS.
- SPECIAL INSPECTION FOR STUCTURAL STEEL SHALL BE IN ACCORDANCE WITH AISC 360.
- MASONRY SHALL REQUIRE LEVEL B FREQUENCY INSPECTIONS.

REQUIRED VERIFICATION AND INSPECTION OF CONCRETE CONSTRUCTION (CBC TABLE 1705.3)				
VERIFICATION AND INSPECTION	CONTINUOUS	PERIODIC	COMMENTS	REFERENCES
1. INSPECTION OF REINFORCING STEEL, INCLUDING PRESTRESSING TENDONS AND PLACEMENT		X		ACI 318, 5.5, 7.1-7.7 CBC 1910.4
3. INSPECTION OF ANCHORS CAST IN CONCRETE WHERE ALLOWABLE LOADS HAVE BEEN INCREASED OR WHERE STRENGTH DESIGN IS USED		X		ACI 318, 8.1.3, 21.2.8 CBC 1908.5, 1909.1
4. INSPECTION OF ANCHORS POST-INSTALLED IN HARDENED CONCRETE MEMBERS		X		ACI 318, 8.1.3, 21.2.8 CBC 1908.5, 1909.1
5. VERIFYING USE OF REQUIRED DESIGN MIX		X		ACI 318, CH.4, 3.2-5.4 CBC 1904.2, 1910.2, 1910.3
6. AT THE TIME FRESH CONCRETE IS SAMPLED TO FABRICATE SPECIMENS FOR STRENGTH TESTS, PERFORM SLUMP AND AIR CONTENT TESTS, AND DETERMINE THE TEMPERATURE OF THE CONCRETE	X			ASTM C172 ASTM C81 ACI 318, 5.6, 5.8 CBC 1910.10
7. INSPECTION OF CONCRETE AND SHOTCRETE PLACEMENT FOR PROPER APPLICATION TECHNIQUES		X		ACI 318, 5.9, 5.10 CBC 1705.3.4, 1705.5.5, 1705.5.6, 1910.6, 1910.7, 1910.8
8. INSPECTION FOR MAINTENANCE OF SPECIFIED CURING TEMPERATURE AND TECHNIQUES		X		ACI 318, 5.11-5.13 CBC 1910.9
12. INSPECT FORMWORK FOR SHAPE, LOCATION AND DIMENSIONS OF THE CONCRETE MEMBER BEING FORMED		X		ACI 318, 6.11
13. MATERIAL VERIFICATION OF REINFORCEMENT STEEL			MANUFACTURER SHALL PROVIDE MILL TEST REPORTS--SEE CBC FOR EXCEPTIONS	CBC 1705.12.1

REQUIRED VERIFICATION AND INSPECTION OF ANCHORS				
VERIFICATION AND INSPECTION	CONTINUOUS	PERIODIC	COMMENTS	REFERENCES
1. INSPECTION OF ANCHORS POST-INSTALLED IN HARDENED CONCRETE MEMBERS		X		ACI 318, 3.8.6, 8.1.5, 21.2.8 CBC 1909.1

REQUIRED VERIFICATION AND INSPECTION OF SOILS (CBC TABLE 1705.6)				
VERIFICATION AND INSPECTION	CONTINUOUS	PERIODIC	COMMENTS	REFERENCES
1. VERIFY MATERIALS BELOW SHALLOW FOUNDATIONS ARE ADEQUATE TO ACHIEVE THE DESIGN BEARING CAPACITY		X		CBC 1705.6 CBC 1804
2. VERIFY EXCAVATIONS ARE EXTENDED TO PROPER DEPTH AND HAVE REACHED PROPER MATERIAL		X		
3. PERFORM CLASSIFICATION AND TESTING OF COMPACTED FILL MATERIALS		X		
4. VERIFY USE OF PROPER MATERIALS, DENSITIES AND LIFT THICKNESSES DURING PLACEMENT AND COMPACTION OF COMPACTED FILL	X			
5. PRIOR TO PLACEMENT OF COMPACTED FILL, OBSERVE SUBGRADE AND VERIFY THAT SITE HAS BEEN PREPARED PROPERLY		X		

STEEL NOTES

- ALL EXPOSED STEEL SHALL BE HOT DIP GALVANIZED.
- STRUCTURAL STEEL SHALL CONFORM TO THE FOLLOWING, UNLESS SPECIFIED OTHERWISE:
 - STRUCTURAL SHAPES M, S, HP, C, MC, L, AS PER AISC MANUAL 13th EDITION, TO COMPLY WITH ASTM A36 (Fy=36 ksi) UNLESS NOTED OTHERWISE.
 - STRUCTURAL SHAPES W, AISC MANUAL 13th EDITION, TO COMPLY WITH ASTM A992 (Fy=50 ksi) UNLESS NOTED OTHERWISE.
 - STRUCTURAL STEEL TUBING, AS PER AISC MANUAL 13th EDITION, TO COMPLY WITH ASTM A500 GRADE B (Fy=46 ksi) UNLESS NOTED OTHERWISE.
 - STRUCTURAL STEEL PIPE, AS PER AISC MANUAL 13th EDITION, TO COMPLY WITH ASTM A53 GRADE B (Fy=35 ksi) UNLESS NOTED OTHERWISE.
- ANY MATERIAL REQUEST WITH DIFFERENT SPECIFICATIONS THAN NOTED ABOVE ARE TO BE DIRECTED TO THE DESIGNER, IN A TIMELY MANNER, PRIOR TO CONSTRUCTION AND/OR INSTALLATION. ANY ITEM OF A DIFFERENT SPECIFICATION INSTALLED, WITHOUT SPECIFIC PRIOR WRITTEN APPROVAL MAY NOT MEET THE PROJECT ENGINEERING REQUIREMENTS NECESSITATING A REMOVAL AND/OR SIGNIFICANT REVISION TO ITEMS INSTALLED.
- STRUCTURAL STEEL DETAILING, FABRICATION AND ERECTION SHALL BE IN ACCORDANCE WITH THE 13th EDITION OF THE AISC MANUAL AND THE LATEST EDITION OF STRUCTURAL STEEL DETAILING BY THE AISC.
- A STEEL BUILDING IS STRUCTURALLY STABLE WHEN ALL ASPECTS OF THE DESIGN SHOWN ON THESE DRAWINGS ARE COMPLETED. THE CONTRACTOR SHALL DETERMINE WHEN AND WHERE TEMPORARY BRACING IS NEEDED.
- WELDS SHALL BE MADE WITH WIRE OR ELECTRODE HAVING A MINIMUM TENSILE STRENGTH OF 70,000 PSI, UNLESS NOTED OTHERWISE.

CONCRETE REINFORCEMENT COVER	
SIZE	COVER (IN)
CONCRETE CAST AGAINST AND PERMANENTLY EXPOSED TO EARTH	
ALL SIZES	3
CONCRETE EXPOSED TO EARTH OR WEATHER	
#6 - #18 BAR	2
#5 BAR, W31 OR D31 WIRE, AND SMALLER	1 1/2
CONCRETE NOT EXPOSED TO WEATHER OR IN CONTACT WITH GROUND	
#14 & #18 BARS	1 1/2
#11 BAR & SMALLER	3/4

CONCRETE NOTES

- ALL CONCRETE SHALL BE NORMAL WEIGHT CONSISTING OF TYPE II/V PORTLAND CEMENT, FINE AGGREGATE, COARSE AGGREGATE, AND WATER (WATER:CEMENT RATIO SHALL NOT EXCEED 0.45 ABSOLUTE BY WEIGHT, AND SLUMP SHALL NOT EXCEED 4 INCHES ±1 INCH). THE CONCRETE SHALL BE PLACED WITHIN ONE AND ONE-HALF HOURS FROM THE TIME WATER IS INTRODUCED. TO YIELD AT 28 DAYS A MINIMUM COMPRESSIVE STRENGTH AS FOLLOWS:

PAVING, SLABS, AND SIDEWALKS	3,000 PSI
STRUCTURAL FOOTINGS	4,000 PSI
ALL OTHER STRUCTURAL CONCRETE	4,000 PSI
- CONCRETE CONSTRUCTION SHALL CONFORM TO ACI 318 (LATEST EDITION).
- CONCRETE MIXING SHALL COMPLY WITH ASTM C94.
- SUBMIT CONCRETE LIFT DRAWINGS SHOWING THE LOCATION OF CONSTRUCTION JOINTS AND OTHER TYPES OF JOINTS OTHER THAN SPECIFIED OR SHOWN ON THE DRAWINGS FOR FAVORABLE REVIEW BY THE ENGINEER BEFORE START OF WORK ON FORMS, REINFORCING STEEL OR PLACING CONCRETE. ANY ADDITIONAL VERTICAL OR HORIZONTAL CONSTRUCTION JOINTS SHALL HAVE A STANDARD KEYWAY AND SHALL BE REVIEWED BY THE ENGINEER. REFER TO SPECIFICATIONS AND TYPICAL DETAILS FOR ADDITIONAL INFORMATION. CONSTRUCTION JOINTS SHALL BE ROUGHENED TO 1/4" AMPLITUDE.
- OPENINGS, PIPE SLEEVES, CONDUITS, INSERTS, AND OTHER EMBEDDED ITEMS SHALL BE IN PLACE BEFORE CONCRETE IS PLACED. IT IS THE CONTRACTOR'S RESPONSIBILITY TO COORDINATE ARCHITECTURAL, CIVIL, MECHANICAL, ELECTRICAL, LANDSCAPING, HVAC, PLUMBING, INSTRUMENTATION, AND OTHER PLANS FOR ITEMS REQUIRING SLEEVES AND EMBEDMENTS IN CONCRETE WHICH ARE NOT INDICATED OR SHOWN ON STRUCTURAL DRAWINGS. NO PIPES OR SLEEVES SHALL PASS THROUGH STRUCTURAL MEMBERS UNLESS SHOWN ON STRUCTURAL DRAWINGS. COORDINATE WITH EQUIPMENT MANUFACTURER'S DRAWINGS FOR ANCHORING DEVICES.
- CONCRETE SHALL BE PREVENTED FROM PREMATURE DRYING FOR A CURING PERIOD OF AT LEAST SEVEN DAYS AFTER IT IS PLACED. EXPOSED SURFACES SHALL BE KEPT CONTINUOUSLY MOIST FOR THE ENTIRE PERIOD. IN LIEU OF WATER CURING, THE CONCRETE SHALL BE PROTECTED BY SPRAYING WITH AN APPROVED CURING COMPOUND. ALL SURFACES SHALL BE KEPT MOIST UNTIL THE COMPOUND IS APPLIED.
- CONTROL JOINTS SHALL BE PLACED NO GREATER THAN 20 FEET APART IN BOTH DIRECTIONS WITHIN 8 HOURS OF THE CONCRETE PLACEMENT ON ALL CONCRETE SLABS. PROVIDE CONTROL JOINTS IN UNREINFORCED SLABS PER PCA GUIDELINES. NO CONTROL JOINTS REQUIRED IN VESSEL PADS.
- ALL EXTERIOR SLABS SHALL BE SLOPED TO ALLOW DRAINAGE OF RUNOFF WATER TO PREVENT PONDING.
- UNLESS NOTED OTHERWISE, ALL EXPOSED EDGES AND CORNERS SHALL BE CHAMFERED 3/4 INCH. INTERIOR FLOORS AND EXTERIOR SIDEWALKS SHALL HAVE TOOLED 3/8 INCH RADIUS CONSTRUCTION JOINTS.

CONCRETE MASONRY

- FURNISH AND INSTALL MASONRY MATERIALS IN CONFORMANCE WITH TMS 602, SPECIFICATION FOR MASONRY STRUCTURES.
- CMU: ASTM C90 LIGHTWEIGHT.
- MORTAR: ASTM C270, TYPE S BY PROPORTION
- COARSE GROUT: ASTM C476, MINIMUM COMPRESSIVE STRENGTH OF 2,000 PSI OR MASONRY DESIGN STRENGTH, F'M, WHICHEVER IS GREATER.
- IF PLACEMENT OF GROUT IS STOPPED FOR ONE HOUR OR LONGER, PROVIDE HORIZONTAL CONSTRUCTION JOINTS BY STOPPING THE GROUP A MINIMUM OF 1 1/2 INCHES BELOW THE TOP OF THE BLOCK.
- HORIZONTAL CONTRACTION JOINTS: AS INDICATED ON DRAWINGS WITH MAXIMUM SPACING OF 25 FT OR 1.5 TIMES MASONRY PANEL HEIGHT.
- SUBMIT WRITTEN PROCEDURES FOR GROUTING PRIOR TO THE START OF CONSTRUCTION.

REQUIRED VERIFICATION AND INSPECTION OF MASONRY CONSTRUCTION (LEVEL B)		
VERIFICATION AND INSPECTION	CONTINUOUS	PERIODIC
MATERIALS AND PROCEDURES WITH THE APPROVED SUBMITTALS		X
PLACEMENT OF MASONRY UNITS AND MORTAR JOINT CONSTRUCTION		X
SIZE AND LOCATION OF STRUCTURAL MEMBERS		X
TYPE, SIZE, AND LOCATION OF ANCHORS, INCLUDING OTHER DETAILS OF ANCHORAGE OF MASONRY TO STRUCTURAL MEMBERS, FRAMES, OR OTHER CONSTRUCTION		X
WELDING OF REINFORCEMENT	X	

SOIL AND FOUNDATION NOTES

- ALL CONCRETE FOOTINGS AND SLABS SHALL BEAR UPON AND/OR PENETRATE INTO PROPERLY COMPACTED FILL WHICH SHALL HAVE A MINIMUM IN-PLACE DENSITY OF 90% OF MAXIMUM DENSITY AT OPTIMUM MOISTURE CONTENT AT THE PROJECT SITE. IN CASE OF EXPANSIVE CLAY SOIL CONDITIONS, THE OWNER MUST CONSULT WITH A GEOTECHNICAL ENGINEER AND THE FOUNDATION PLAN MUST BE APPROVED BY THE GEOTECHNICAL ENGINEER.
- FOUNDATION WORK TO BE DONE PER 2019 CBC, CHAPTER 18.
- ENGINEERING DESIGN OF FOUNDATION IS AS FOLLOWS:
 - ASSUMED ALLOWABLE SOIL BEARING CAPACITYCONTINUOUS FOOTING 1500 PSF INCLUDING WIND OR SEISMIC 1500 PSF
- SHOULD THE ACTUAL SOIL CONDITIONS NOT BE EQUAL TO OR BETTER THAN THE MINIMUM REQUIREMENTS SHOWN ABOVE, NOTIFY THE ENGINEER OF RECORD IMMEDIATELY.
- SOIL SHALL BE EXCAVATED TO THE ELEVATIONS INDICATED ON THE DRAWINGS FOR STRUCTURE FOUNDATIONS.
- ALL FOUNDATION EXCAVATIONS MUST BE REVIEWED AND APPROVED PRIOR TO PLACEMENT OF CONCRETE.
- CONCRETE SLABS-ON-GRADE IN THE MAINTENANCE AND CHEMICAL STORAGE BUILDINGS SHALL HAVE A 6" THICK AGGREGATE BASE LAYER ON TOP OF THE PREPARED SUBGRADE. SEE THE FOUNDATION PLANS AND DETAILS FOR THE SAND AND VAPOR BARRIER LAYERS OVER THE SUBBASE.

EST. 1968

PROVOST & PRITCHARD

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AN Employee Owned Company

288 WEST CROWMELL AVENUE
FRESNO, CALIFORNIA 93711-6162
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www.pprg.com

DESIGN ENGINEER:
KEITH MORTENSEN
LICENSE NO:
75865
DRAFTED BY:
JMN
CHECKED BY:
RKB
DATE: NOV 2020
JOB NO: 229220006
PROJECT NO:
PHASE: CD
ORIGINAL SCALE SHOWN IS
ONE INCH. ADJUST SCALE FOR
REDUCED OR ENLARGED PLANS.
SHEET
G-4
4 OF 57

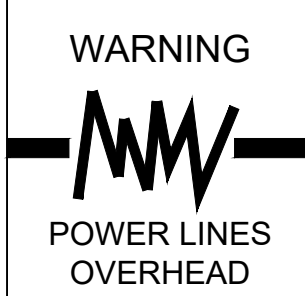
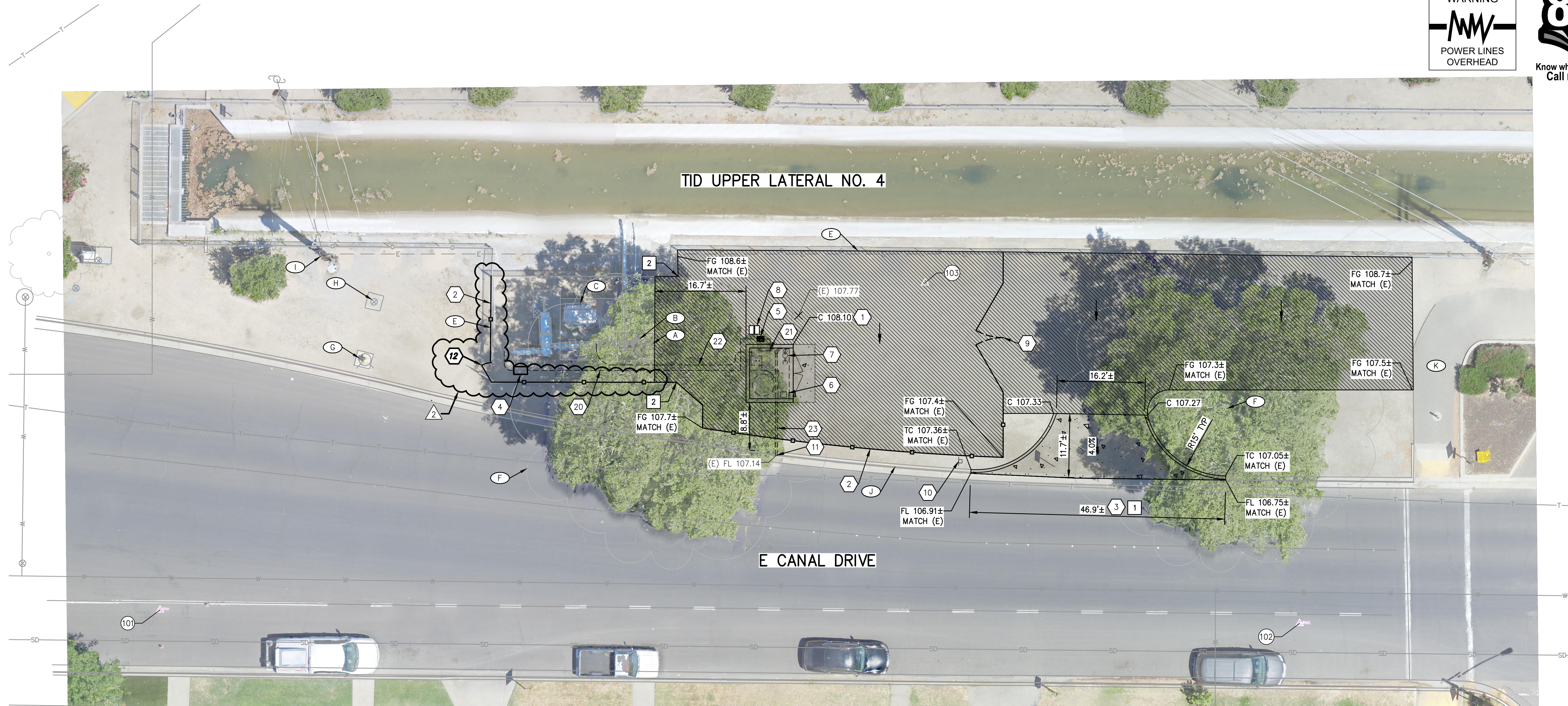
95% DESIGN SUBMITTAL
NOT FOR CONSTRUCTION
10/16/2020

REVISION
ADDENDUM 2
NO.
BY
DATE
11-12-2020
KWM

DATE SIGNED: _____
PROFESSIONAL ENGINEER
KEITH MORTENSEN
No. 75865
CIVIL
STATE OF CALIFORNIA
RES. FID. NO. 100000000

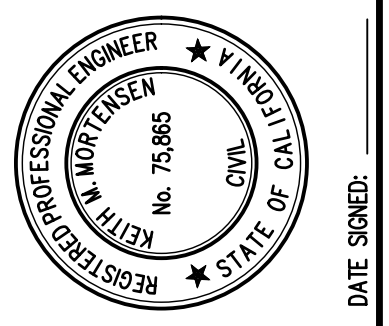
CITY WIDE CHLORINATION
CITY OF TURLOCK
CITY PROJECT NO. 2020-79
GENERAL
GENERAL NOTES

11/12/2020 4:16 PM G:\Turlock_City of-2292\229220006-City-Wide Chlorination\300-CA0\340-Sheet Sets\01_General NOTES.dwg -Jordan Noel



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CITY WIDE CHLORINATION
CITY OF TURLOCK
CITY PROJECT NO. 2020-79
CIVIL
WELL 13 SITE PLAN

EST. 1968
PROVEST & PRITCHARD
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DESIGN ENGINEER:
KEITH MORTENSEN
LICENSE NO: 75865

DRAFTED BY: JMN
CHECKED BY: RKB

DATE: NOV 2020
JOB NO: 229220006

PROJECT NO:
PHASE: CD

ORIGINAL SCALE SHOWN IS
ONE INCH. ADJUST SCALE FOR
REDUCED OR ENLARGED PLANS.

SHEET **C-13**
11 OF 57

EXISTING SITE LEGEND

- (A) (E) WELL PUMP SHED
- (B) (E) WELL 13
- (C) (E) ELECTRIC CABINET
- (D) (E) UNUSED
- (E) (E) CHAINLINK FENCE
- (F) (E) TREE
- (G) (E) FIRE HYDRANT
- (H) ~~(E) DRYWELL~~
(E) WATER VALVE
- (I) (E) POWER POLE
- (J) (E) CURB AND GUTTER
- (K) (E) PEDESTRIAN PATH

DEMOLITION SITE LEGEND

- 1 SAWCUT, REMOVE AND DISPOSE OF (E) CURB (SEE NOTE 5) (SEE DETAIL 4 SHEET D-8)
- 2 REMOVE AND DISPOSE OF (E) CHAINLINK FENCE AND GATE, LOCATED BETWEEN CALLOUTS AND WHERE REPLACED WITH METAL SECURITY FENCE

CONSTRUCTION SITE LEGEND

- 1 CHEMICAL STORAGE BUILDING PAD (SEE SHEET D-1)
- 2 PROPOSED SITE FENCING WITH BARBED WIRE (SEE CITY OF TURLOCK STANDARD DETAIL M-6 SHEET D-9) METAL SECURITY FENCE WITH MONSTRIP (SEE DETAILS SHEET D-8C)
- 3 COMMERCIAL/INDUSTRIAL DRIVE APPROACH (SEE CITY OF TURLOCK STANDARD DETAIL C-8 SHEET D-9)
- 4 1" WATER SERVICE ASSEMBLY (SEE CITY OF TURLOCK STANDARD DETAILS W-10 & W-11 SHEET D-10)
- 5 1" REDUCED PRESSURE PRINCIPLE BACKFLOW ASSEMBLY (SEE CITY OF TURLOCK STANDARD DETAIL W-13 SHEET D-10)
- 6 HOSE BIBB & RACK (SEE DETAILS 2 & 3 SHEET D-4)
- 7 EMERGENCY EYEWASH STATION (SEE DETAIL 1 SHEET D-4)
- 8 ELECTRICAL PULL BOX, REFER TO ELECTRICAL SHEETS
- 9 20' DOUBLE SWING GATE (SEE CITY OF TURLOCK STANDARD DETAIL M-6 SHEET D-9) (SEE DETAIL 4 SHEET D-8C)
- 10 RELOCATE (E) SPEED LIMIT SIGN FROM DRIVE APPROACH LOCATION PER CITY
- 11 OUTLET TO (E) CURB & GUTTER FLOWLINE ELEVATION
- 12 4' PEDESTRIAN GATE (SEE DETAIL 2 SHEET D-8C)

GRADING SITE LEGEND

- DIRECTION OF SURFACE FLOW
- CONSTRUCT AC PAVING DRIVE (SEE DETAIL 8 SHEET D-7)
- CONCRETE IMPROVEMENTS

HORIZONTAL CONTROL LEGEND

- # POINT # (SEE SHEET G-7)

PIPING LEGEND

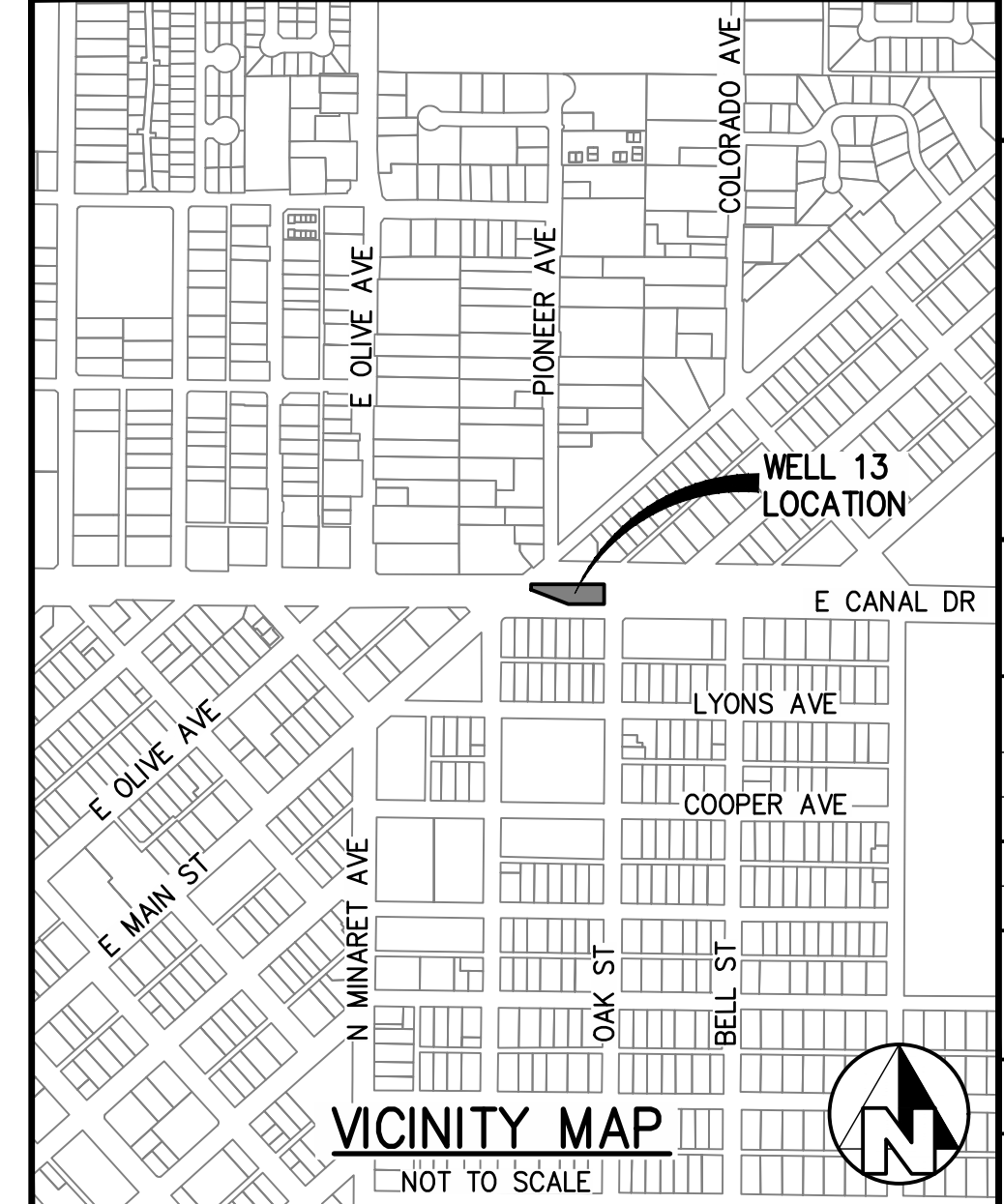
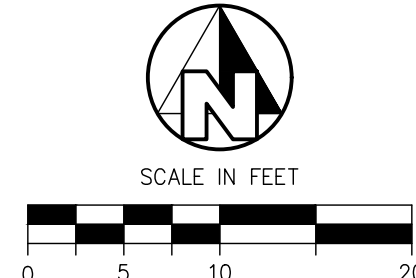
NO.	PIPE	MATERIAL	COMMENT
20	1"	HDPE	SITE UTILITY WATER
21	1"	HDPE	ANALYZER SAMPLE LINE
22	2"	PVC ELECTRICAL CONDUIT	SODIUM HYPOCHLORITE FEED WITH 1/2" OD TUBING (SEE DETAIL 1 SHEET D-3)
23	4"	SDR 35	ANALYZER DRAIN LINE (SEE NOTE 3)

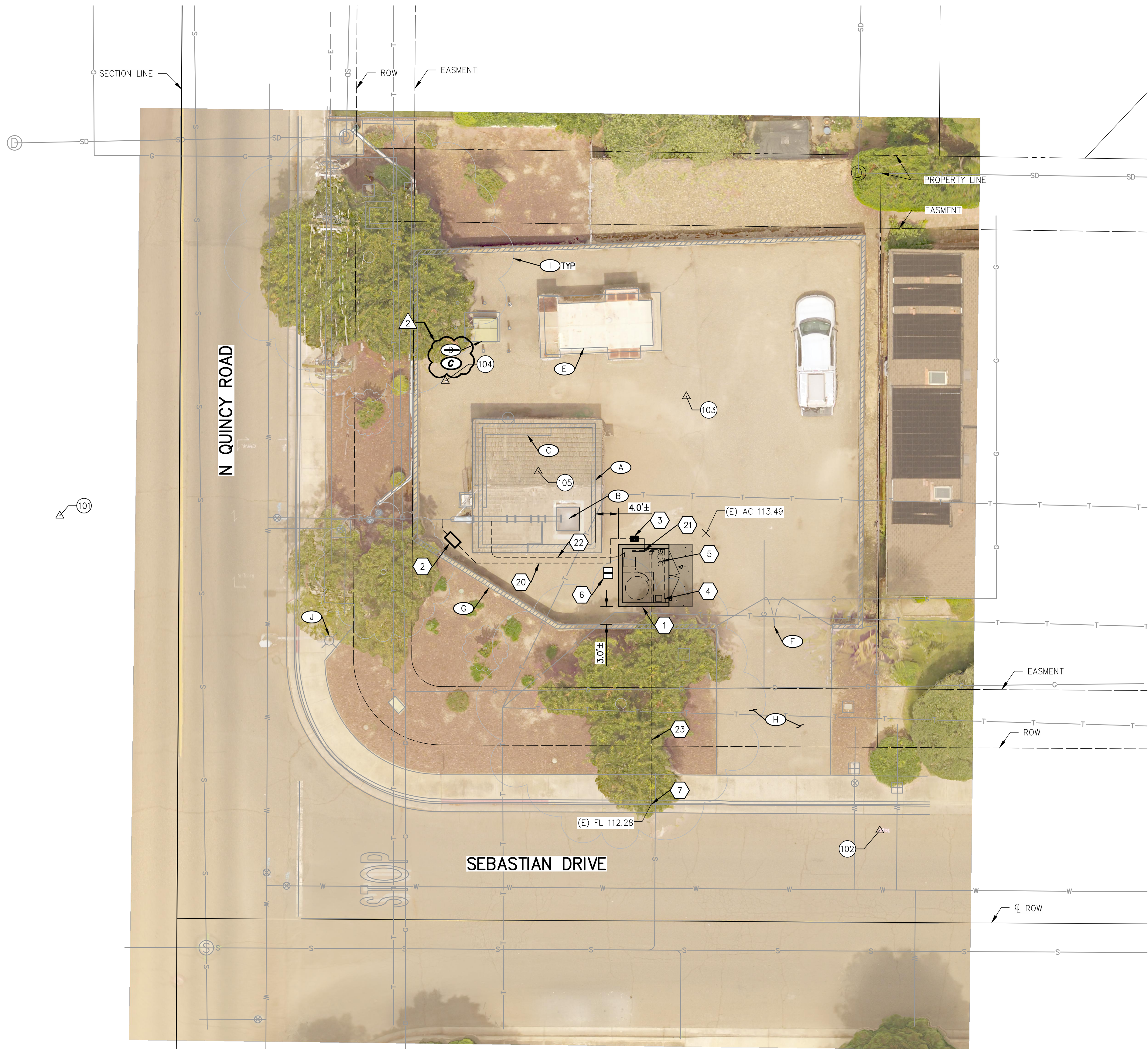
STREET ADDRESS

1261 E CANAL DR
TURLOCK, CA 95380

NOTES

- SITE PIPING LINEWORK IS SCHEMATIC.
- CONTRACTOR SHALL FIELD VERIFY ALL MEASUREMENTS AND UNDERGROUND UTILITY LOCATIONS PRIOR TO CONSTRUCTION.
- DRAINAGE PIPING TO HAVE MINIMUM SLOPE OF 0.5% ESTIMATED ELEVATION DROP = 0.09 FT
- CONTRACTOR SHALL REPLACE IN-KIND ALL EXISTING SURFACING OR LANDSCAPING DAMAGED DURING CONSTRUCTION.
- SAWCUT AND REMOVE EXISTING PAVEMENT IN CLEAN STRAIGHT LINES.





STREET ADDRESS
2423 SEBASTIAN
TURLOCK, CA 95382

- NOTES**
1. SITE PIPING LINEWORK IS SCHEMATIC.
 2. CONTRACTOR SHALL FIELD VERIFY ALL MEASUREMENTS AND UNDERGROUND UTILITY LOCATIONS PRIOR TO CONSTRUCTION.
 3. DRAINAGE PIPING TO HAVE MINIMUM SLOPE OF 0.5%. ESTIMATED ELEVATION DROP = 0.22 FT
 4. CONTRACTOR SHALL REPLACE IN-KIND ALL EXISTING SURFACING OR LANDSCAPING DAMAGED DURING CONSTRUCTION.

HORIZONTAL CONTROL LEGEND

POINT # (SEE SHEET G-7)

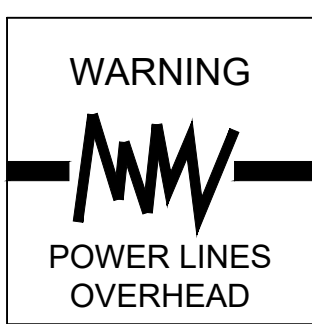
PIPING LEGEND			
No.	PIPE	MATERIAL	COMMENT
20	1"	HDPE	SITE UTILITY WATER
21	1"	HDPE	ANALYZER SAMPLE LINE
22	2"	PVC ELECTRICAL CONDUIT	SODIUM HYPOCHLORITE FEED WITH 1/2" OD TUBING (SEE DETAIL 1 SHEET D-3)
23	4"	SDR 35	ANALYZER DRAIN LINE (SEE NOTE 3)

EXISTING SITE LEGEND

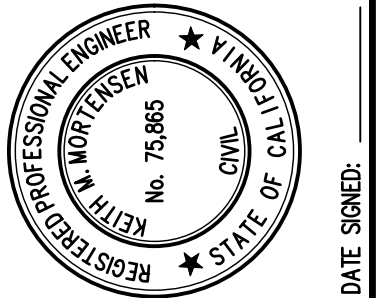
- (A) (E) WELL PUMP BUILDING
(B) (E) WELL 24
(C) (E) ELECTRIC CABINET
(D) **NOT USED**
(E) (E) GENERATOR
(F) (E) CHAINLINK FENCE GATE
(G) (E) CONCRETE BLOCK WALL
(H) (E) DRIVE APPROACH
(I) (E) TREE
(J) (E) LIGHT POLE
(K) (E) SUMP

CONSTRUCTION SITE LEGEND

- 1 CHEMICAL STORAGE BUILDING PAD (SEE SHEET D-1)
2 1" WATER SERVICE ASSEMBLY (SEE CITY OF TURLOCK STANDARD DETAILS W-10 & W-11 SHEET D-10)
3 1" REDUCED PRESSURE PRINCIPLE BACKFLOW ASSEMBLY (SEE CITY OF TURLOCK STANDARD DETAIL W-13 SHEET D-10)
4 HOSE BIBB & RACK (SEE DETAILS 2 & 3 SHEET D-4)
5 EMERGENCY EYEWASH STATION (SEE DETAIL 1 SHEET D-4)
6 ELECTRICAL PULL BOX, REFER TO ELECTRICAL SHEETS
7 OUTLET TO (E) CURB & GUTTER FLOWLINE ELEVATION



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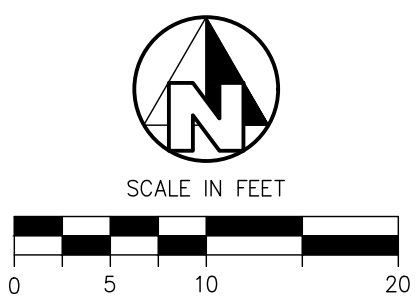


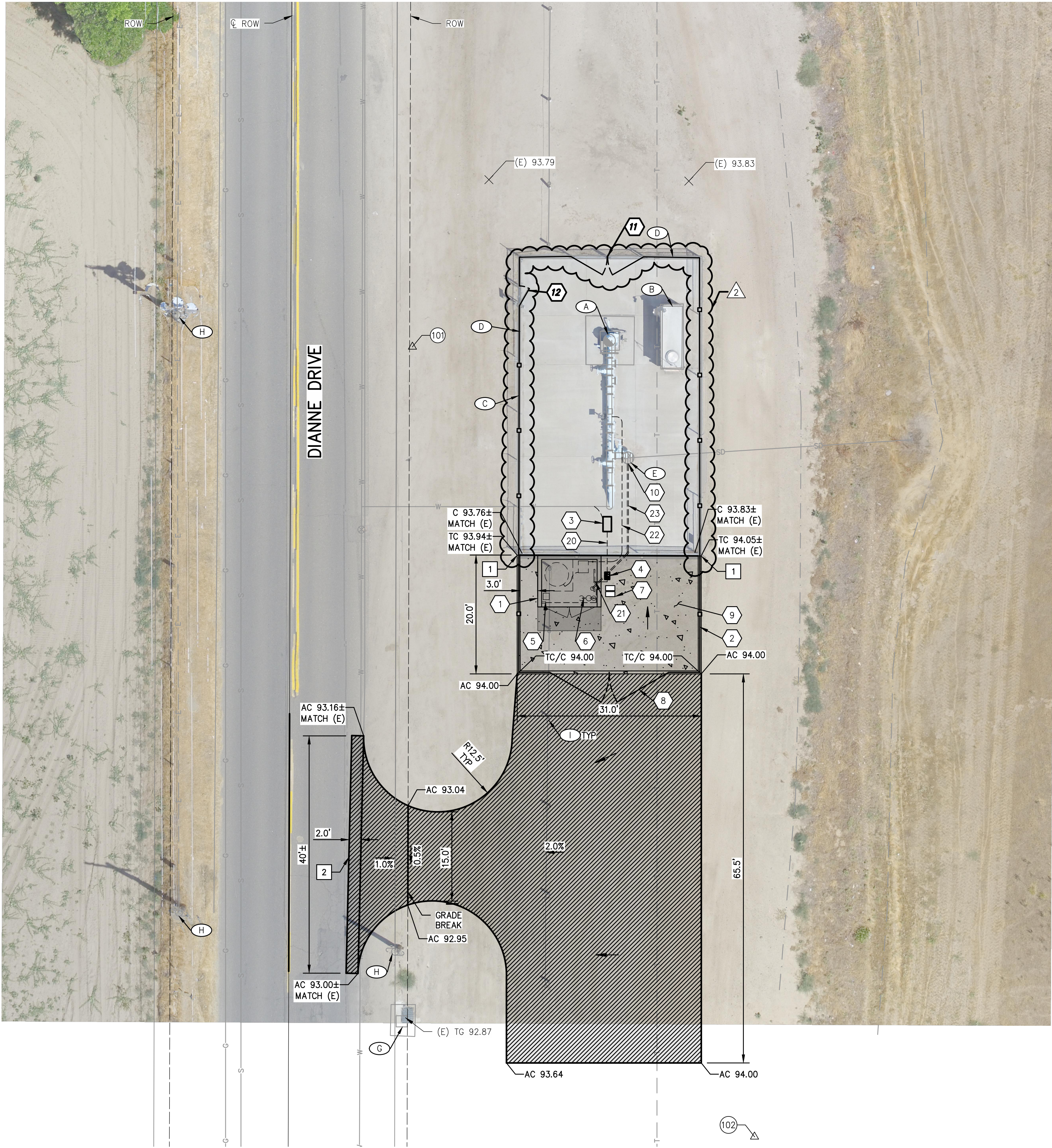
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DESIGN ENGINEER:
KEITH MORTENSEN
LICENSE NO:
75865
DRAFTED BY:
JMN
CHECKED BY:
RKB
DATE: NOV 2020
JOB NO: 229220006
PROJECT NO:
PHASE: CD
ORIGINAL SCALE SHOWN IS
ONE INCH. ADJUST SCALE FOR
REDUCED OR ENLARGED PLANS.
SHEET
C-24

15 OF 57





PIPING LEGEND			
No.	PIPE	MATERIAL	COMMENT
20	1"	HDPE	SITE UTILITY WATER
21	1"	HDPE	ANALYZER SAMPLE LINE
22	2"	PVC ELECTRICAL CONDUIT	SODIUM HYPOCHLORITE FEED WITH 1/2" OD TUBING (SEE DETAIL 1 SHEET D-3)
23	4"	SDR 35	ANALYZER DRAIN LINE (SEE NOTE 3)

EXISTING SITE LEGEND

- (A) (E) WELL 34
- (B) (E) ELECTRIC CABINET
- (C) (E) CHAINLINK FENCE
- (D) (E) GATE
- (E) (E) STORM DRAIN MANHOLE
- (F) (E) UTILITY VAULT
- (G) (E) DROP INLET
- (H) (E) ELECTRIC POLE
- (I) (E) WIRE FENCE POST

CONSTRUCTION SITE LEGEND

- 1 CHEMICAL STORAGE BUILDING PAD (SEE SHEET D-1)
- 2 VERTICAL CURB (SEE CITY OF TURLOCK STANDARD DETAIL C-1 SHEET D-9) AND PROPOSED SITE FENCING WITH BARBED WIRE (SEE CITY OF TURLOCK STANDARD DETAIL M-6 SHEET D-9) METAL SECURITY FENCE (SEE DETAILS SHEET D-BC)
- 3 1" WATER SERVICE ASSEMBLY (SEE CITY OF TURLOCK STANDARD DETAILS W-10 & W-11 SHEET D-10)
- 4 1" REDUCED PRESSURE PRINCIPLE BACKFLOW ASSEMBLY (SEE CITY OF TURLOCK STANDARD DETAIL W-13 SHEET D-10)
- 5 HOSE BIBB & RACK (SEE DETAILS 2 & 3 SHEET D-4)
- 6 EMERGENCY EYEWASH STATION (SEE DETAIL 1 SHEET D-4)
- 7 ELECTRICAL PULL BOX, REFER TO ELECTRICAL SHEETS
- 8 20' DOUBLE SWING GATE (SEE CITY OF TURLOCK STANDARD DETAIL M-6 SHEET D-9) (SEE DETAIL 4 SHEET D-BC)
- 9 CONCRETE SLAB, SLOPE TO DRAIN TO STORM DRAIN "E" (SEE DETAIL 2 SHEET D-8)
- 10 CONNECTION TO (E) STAND PIPE (SEE DETAIL 6 SHEET D-3)

DEMOLITION SITE LEGEND

- 1 REMOVE AND DISPOSE OF (E) CONCRETE CURB, CHAINLINK FENCE AND GATE, LOCATED BETWEEN CALLOUTS AND WHERE REPLACED WITH METAL SECURITY FENCE
- 2 SAWCUT AROUND FRONTAGE OF NEW AC DRIVE ENTRANCE, REMOVE AND DISPOSE OF (E) AC (SEE NOTE 5)

- 11 12' DOUBLE SWING GATE (SEE DETAIL 4 SHEET D-BC)
- 12 4' PEDESTRIAN GATE (SEE DETAIL 2 SHEET D-BC)

STREET ADDRESS

1527 DIANNE DR
TURLOCK, CA 95380

NOTES

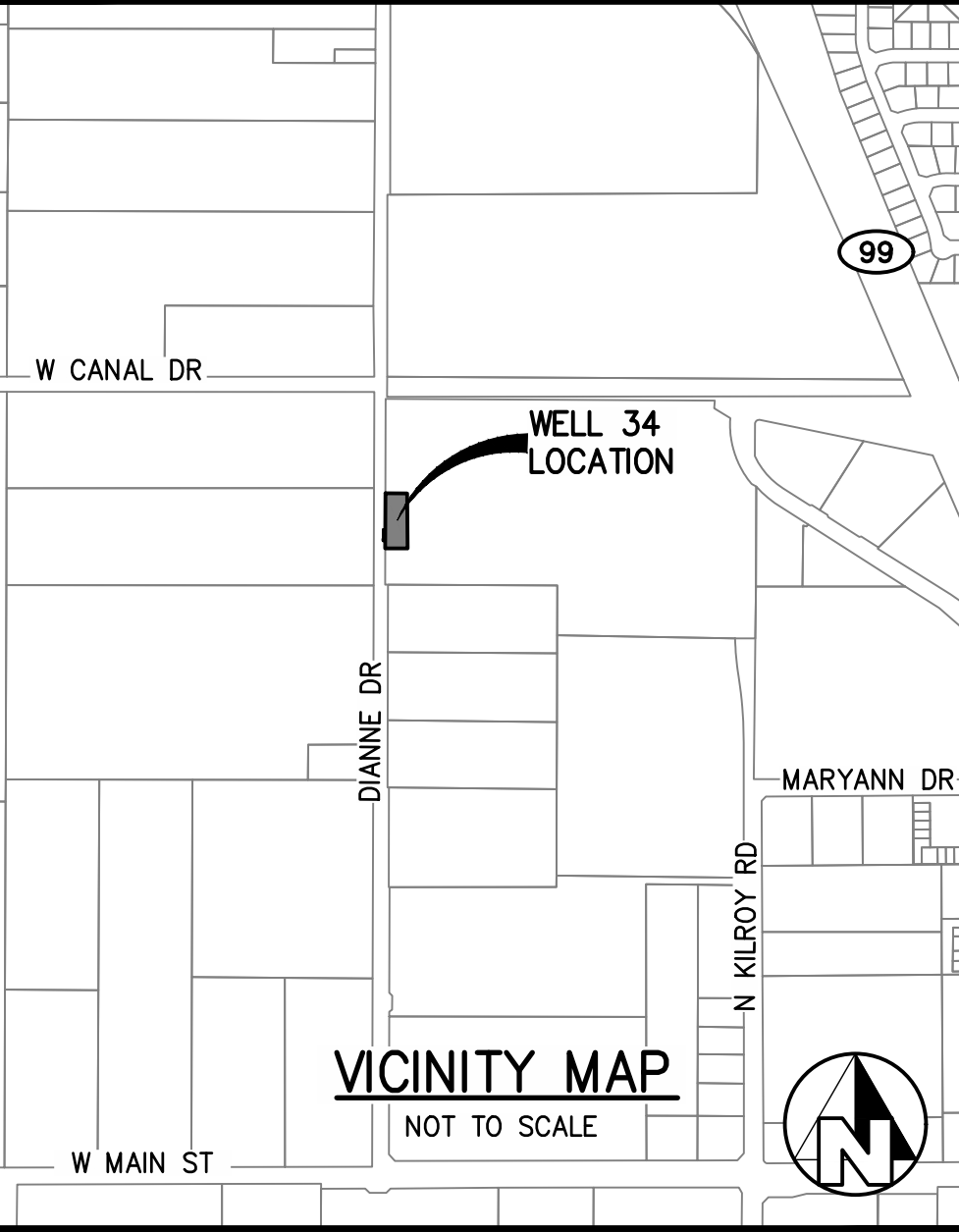
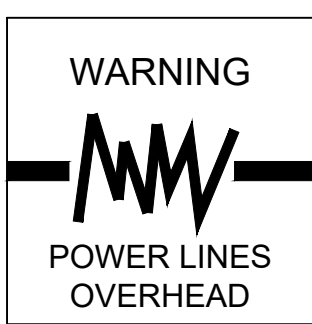
- SITE PIPING LINEWORK IS SCHEMATIC.
- CONTRACTOR SHALL FIELD VERIFY ALL MEASUREMENTS AND UNDERGROUND UTILITY LOCATIONS PRIOR TO CONSTRUCTION.
- DRAINAGE PIPING TO HAVE MINIMUM SLOPE OF 0.5% ESTIMATED ELEVATION DROP = 0.12 FT
- CONTRACTOR SHALL REPLACE IN-KIND ALL EXISTING SURFACING OR LANDSCAPING DAMAGED DURING CONSTRUCTION.
- SAWCUT AND REMOVE EXISTING PAVEMENT IN CLEAN STRAIGHT LINES.

HORIZONTAL CONTROL LEGEND

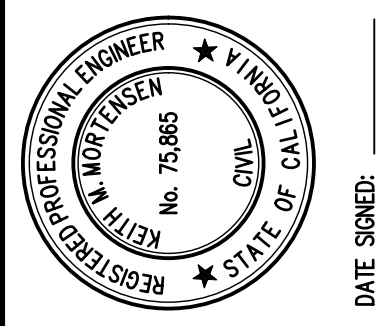
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GRADING SITE LEGEND

- DIRECTION OF SURFACE FLOW
- CONSTRUCT AC PAVING DRIVE (SEE DETAIL 8 SHEET D-7)
- CONCRETE IMPROVEMENTS



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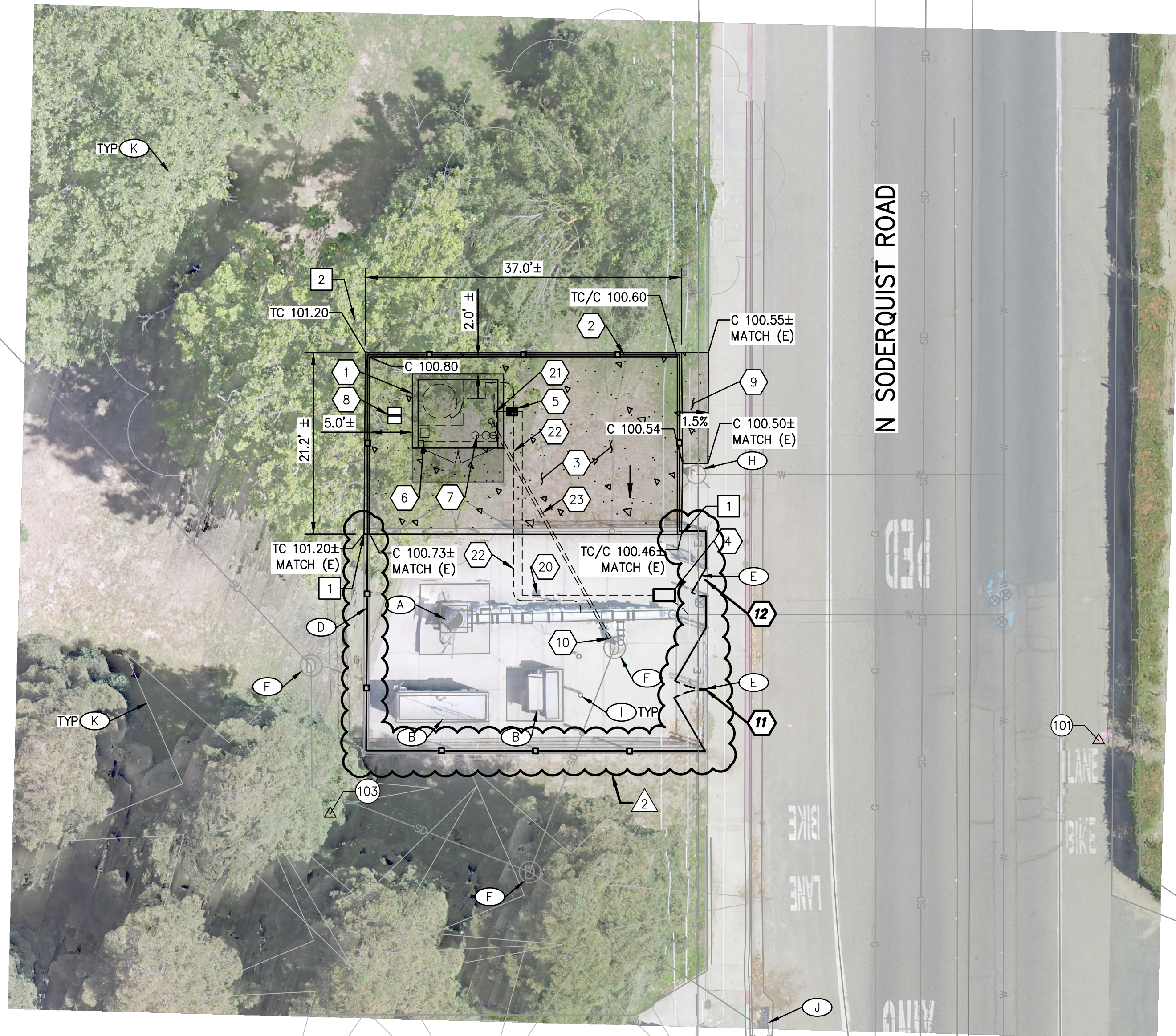


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PROJECT NO:
PHASE: CD
ORIGINAL SCALE SHOWN IS
ONE INCH. ADJUST SCALE FOR
REDUCED OR ENLARGED PLANS.
SHEET
C-34

21 OF 57



PIPING LEGEND			
No.	PIPE	MATERIAL	COMMENT
20	1"	HDPE	SITE UTILITY WATER
21	1"	HDPE	ANALYZER SAMPLE LINE
22	2"	PVC ELECTRICAL CONDUIT	SODIUM HYPOCHLORITE FEED WITH 1/2" OD TUBING (SEE DETAIL 1 SHEET D-3)
23	4"	SDR 35	ANALYZER DRAIN LINE (SEE NOTE 3)

- ### EXISTING SITE LEGEND

- (A) (E) WELL 36
- (B) (E) ELECTRIC CABINET
- (C) NOT USED
- (D) (E) CHAINLINK FENCE
- (E) (E) GATE
- (F) (E) STORM DRAIN MANHOLE
- (G) (E) ELECTRIC/LIGHT POLE
- (H) (E) FIRE HYDRANT
- (I) (E) BOLLARD
- (J) (E) DROP INLET
- (K) (E) TREE


DEMOLITION SITE LEGEND

- 1 REMOVE AND DISPOSE OF (E) CONCRETE CURB, CHAINLINK FENCE AND GATE. LOCATED BETWEEN CALLOUTS **AND WHERE REPLACED WITH METAL SECURITY FENCE**
- 2 REMOVE AND DISPOSE OF (E) TREE

CONSTRUCTION SITE LEGEND

- 1 CHEMICAL STORAGE BUILDING PAD
(SEE SHEET D-1)
- 2 VERTICAL CURB (SEE CITY OF TURLOCK STANDARD
DETAIL C-1 SHEET D-9)
~~AND PROPOSED SITE FENCING WITH BARBED
WIRE (SEE CITY OF TURLOCK STANDARD
DETAIL W-6 SHEET D-9).~~
**METAL SECURITY FENCE
(SEE DETAILS SHEET D-8C)**
- 3 CONCRETE SLAB, SLOPE TO DRAIN TO STORM
DRAIN "F" (SEE DETAIL 2 SHEET D-8)
- 4 1" WATER SERVICE ASSEMBLY
(SEE CITY OF TURLOCK STANDARD DETAILS
W-10 & W-11 SHEET D-10)
- 5 1" REDUCED PRESSURE PRINCIPLE BACKFLOW
ASSEMBLY (SEE CITY OF TURLOCK STANDARD
DETAIL W-13 SHEET D-10)
- 6 HOSE BIBB & RACK
(SEE DETAILS 2 & 3 SHEET D-4)
- 7 EMERGENCY EYEWASH STATION
(SEE DETAIL 1 SHEET D-4)
- 8 ELECTRICAL PUL BOX,
REFER TO ELECTRICAL SHEETS
- 9 SIDEWALK (SEE CITY OF TURLOCK STANDARD
DETAIL C-3 SHEET D-9)
- 10 CONNECTION TO (E) STAND PIPE
(SEE DETAIL 6 SHEET D-3)

GRADING SITE LEGEND

- DIRECTION OF SURFACE FLOW
 CONCRETE IMPROVEMENTS

STREET ADDRESS

1548 N SODERQUIST
TURLOCK, CA 95380

HORIZONTAL CONTROL LEGEND

- POINT # (SEE SHEET G-7)

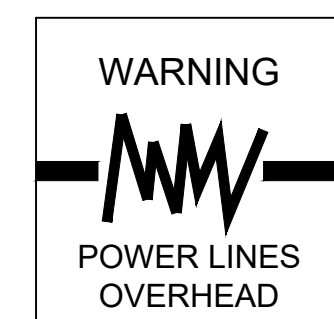
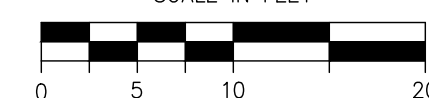
NOTES

1. SITE PIPING LINEWORK IS SCHEMATIC.
2. CONTRACTOR SHALL FIELD VERIFY ALL MEASUREMENTS AND UNDERGROUND UTILITY LOCATIONS PRIOR TO CONSTRUCTION.
3. DRAINAGE PIPING TO HAVE MINIMUM SLOPE OF 0.5%. ESTIMATED ELEVATION DROP = 0.14 FT
4. CONTRACTOR SHALL REPLACE IN-KIND ALL EXISTING SURFACING OR LANDSCAPING DAMAGED DURING CONSTRUCTION.

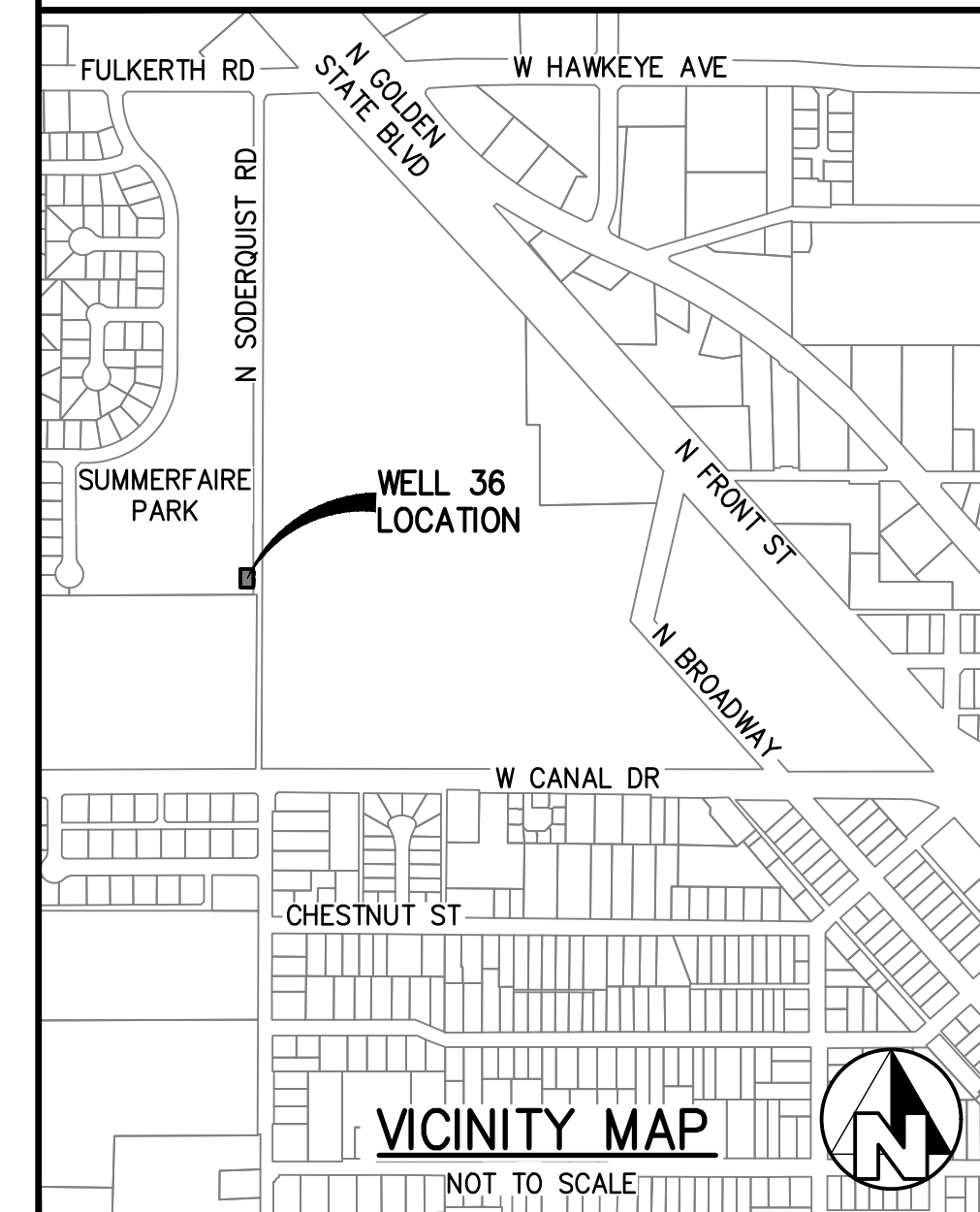
- 11 14' DOUBLE SWING GATE
(SEE DETAIL 4 SHEET D-8C)
- 12 4' PEDESTRIAN GATE
(SEE DETAIL 2 SHEET D-8C)



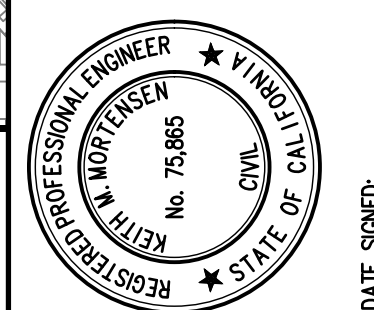
SCALE IN FFF



Know what's below.
Call before you dig



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10/16/2020



DATE SIGNED:

CITY WIDE CHLORINATION

CITY OF TURLOCK

CIVIL PROJECT NO. 2020-73

WELL 36 SITE PLAN

EST. 1968
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An Employee Owned Company
286 WEST CROMWELL AVENUE
FRESNO, CALIFORNIA 93711-6162
559/449-2700 FAX 559/449-2715
www.ppeng.com

DESIGN ENGINEER:
KEITH MORTENSEN
LICENSE NO:
75865

DRAFTED BY: JMN	CHECKED BY: RKB
--------------------	--------------------

DATE: NOV 2020
JOB NO: 220220006

JOB NO.
PROJECT NO.

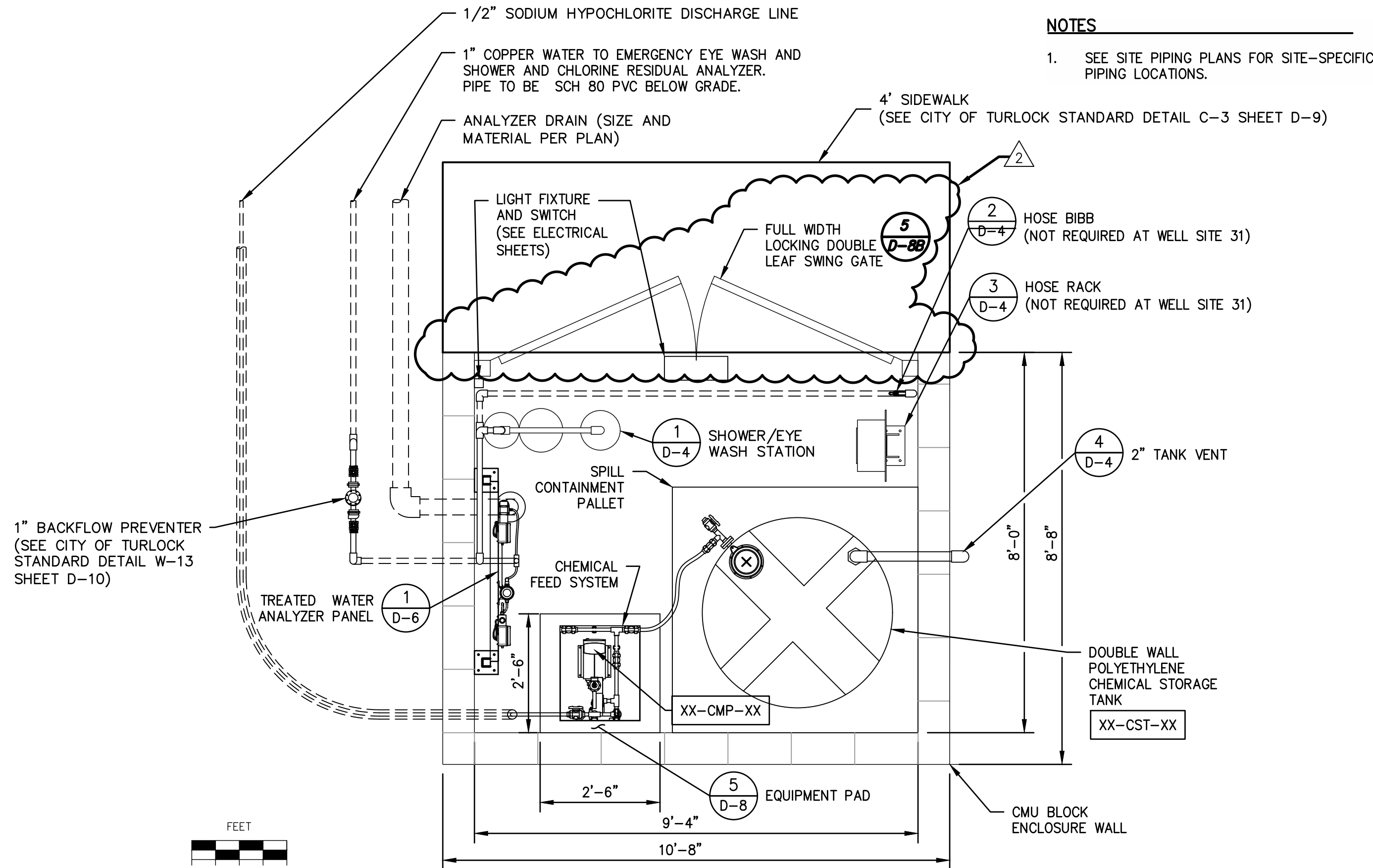
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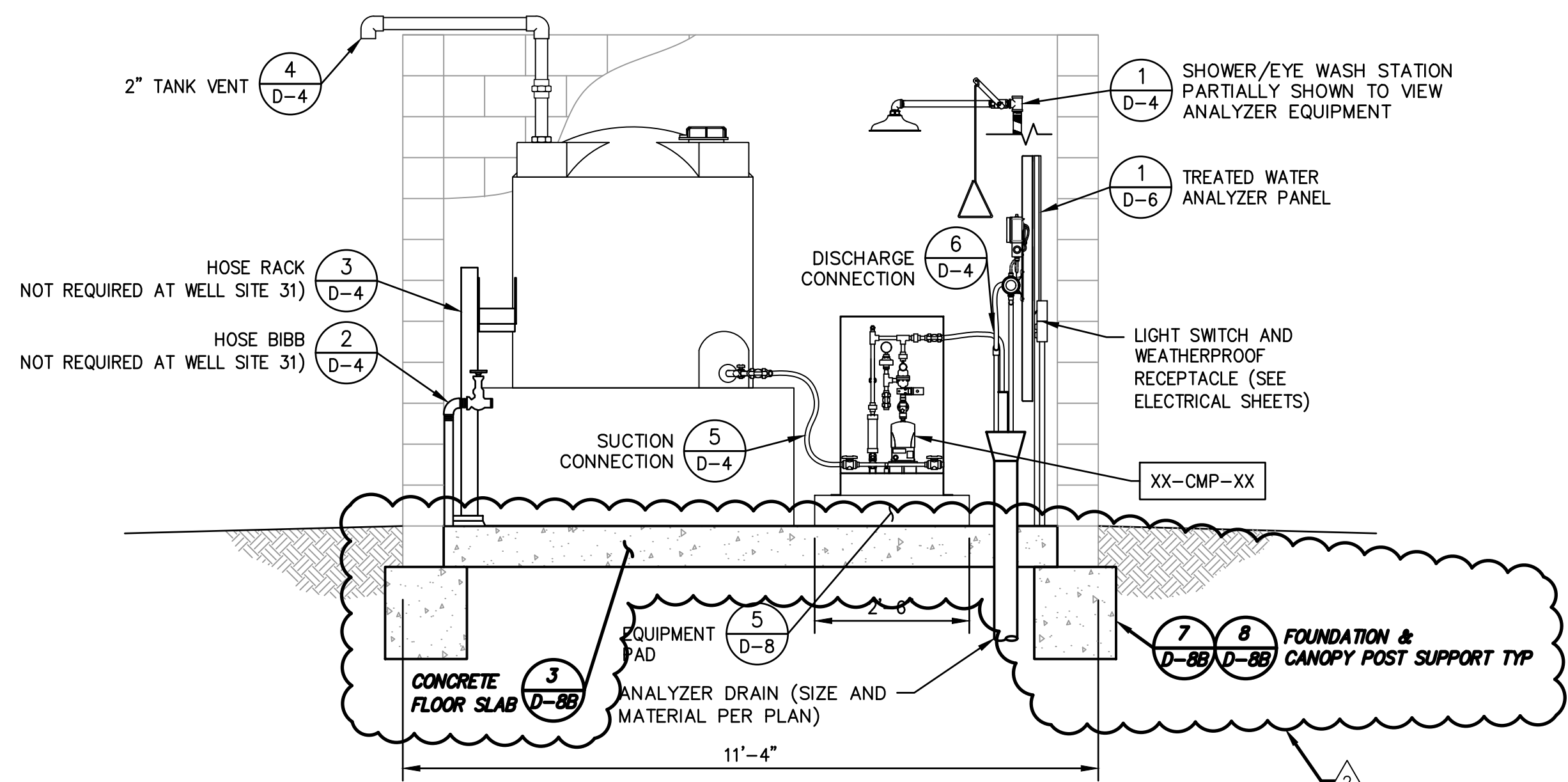
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REDUCED OR ENLARGED PLANS.

SHEET C-36

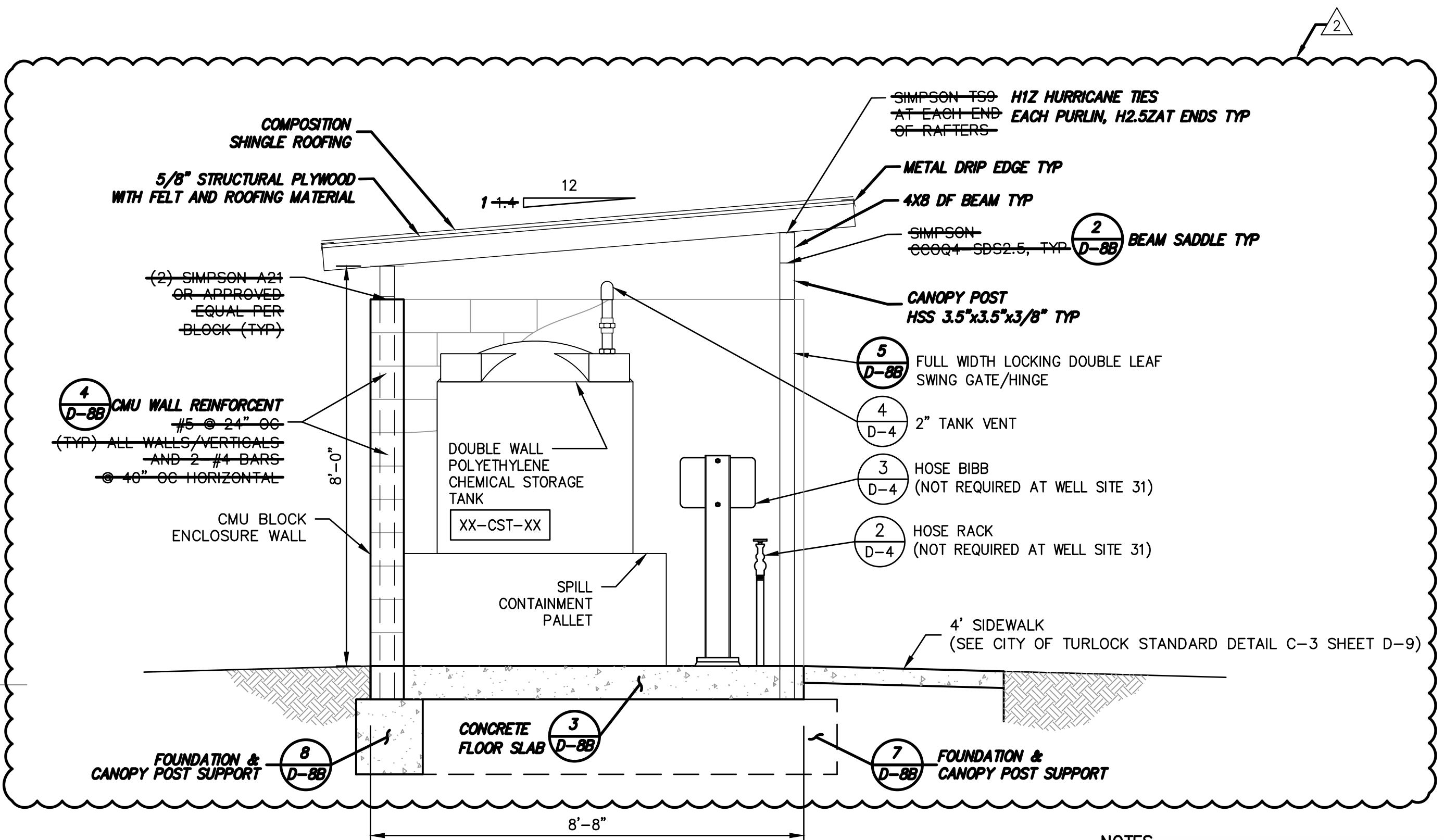
22 OF 57



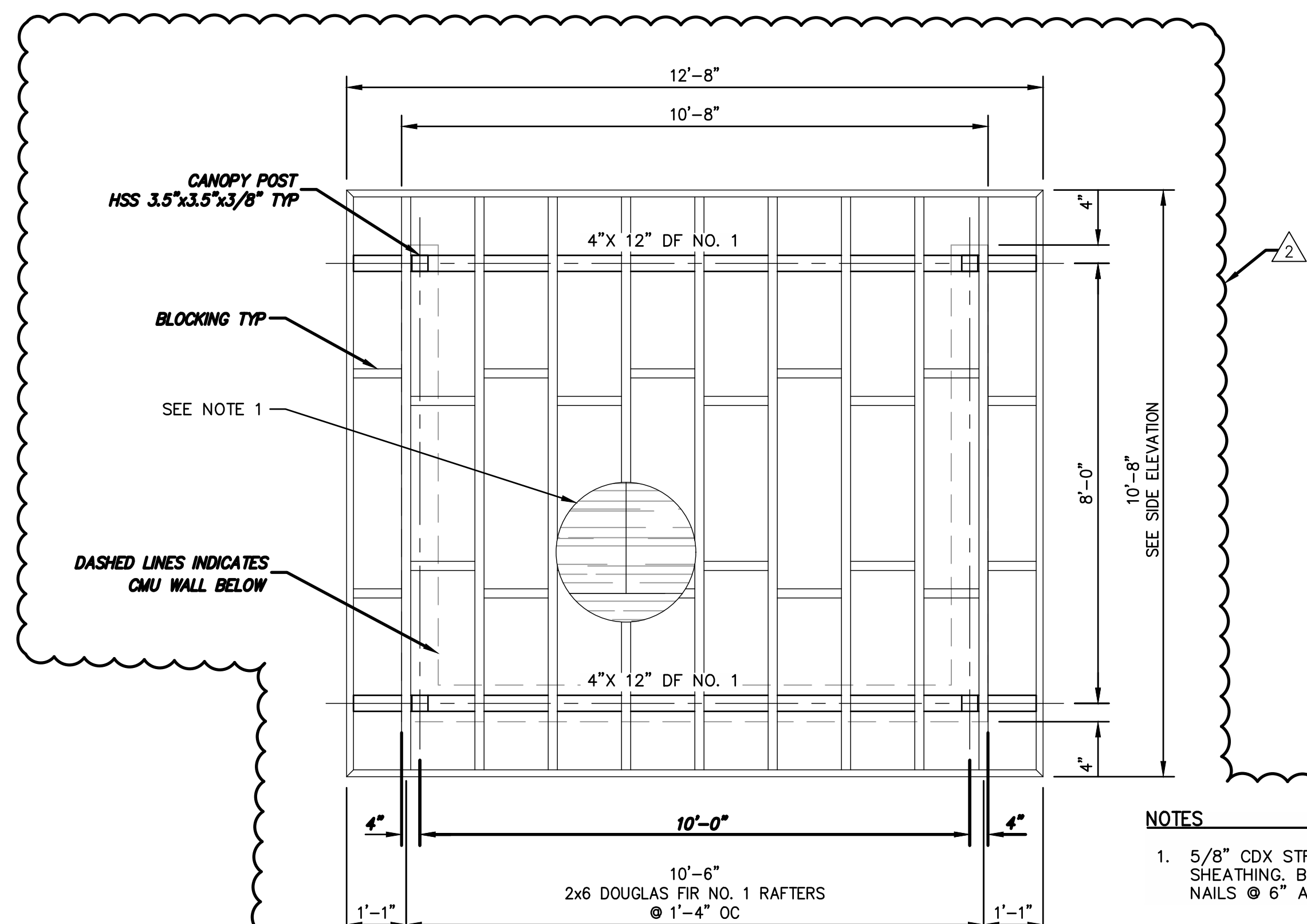
CHEMICAL STORAGE ENCLOSURE PLAN



CHEMICAL ENCLOSURE FRONT ELEVATION



CHEMICAL ENCLOSURE SIDE SECTION



CHEMICAL ENCLOSURE ROOFING PLAN

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ADDENDUM 2

NO. 11-12-2020

BY KWM

DATE

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10/16/2020

PROFESSIONAL ENGINEER
KEITH MORTENSEN
No. 75,865
CIVIL
STATE OF CALIFORNIA

DATE SIGNED

CITY WIDE CHLORINATION
CITY OF TURLOCK
CITY PROJECT NO. 2020-79
DETAILS

CHLORINATION ENCLOSURE DETAILS

EST. 1968
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CONSULTING GROUP
An Employee Owned Company
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FRESNO, CALIFORNIA 93711-6162
559/449-2700 FAX 559/449-2715
www.peng.com

DESIGN ENGINEER:
KEITH MORTENSEN
LICENSE NO: 75865

DRAFTED BY: JMN
CHECKED BY: RKB

DATE: NOV 2020
JOB NO: 229220006

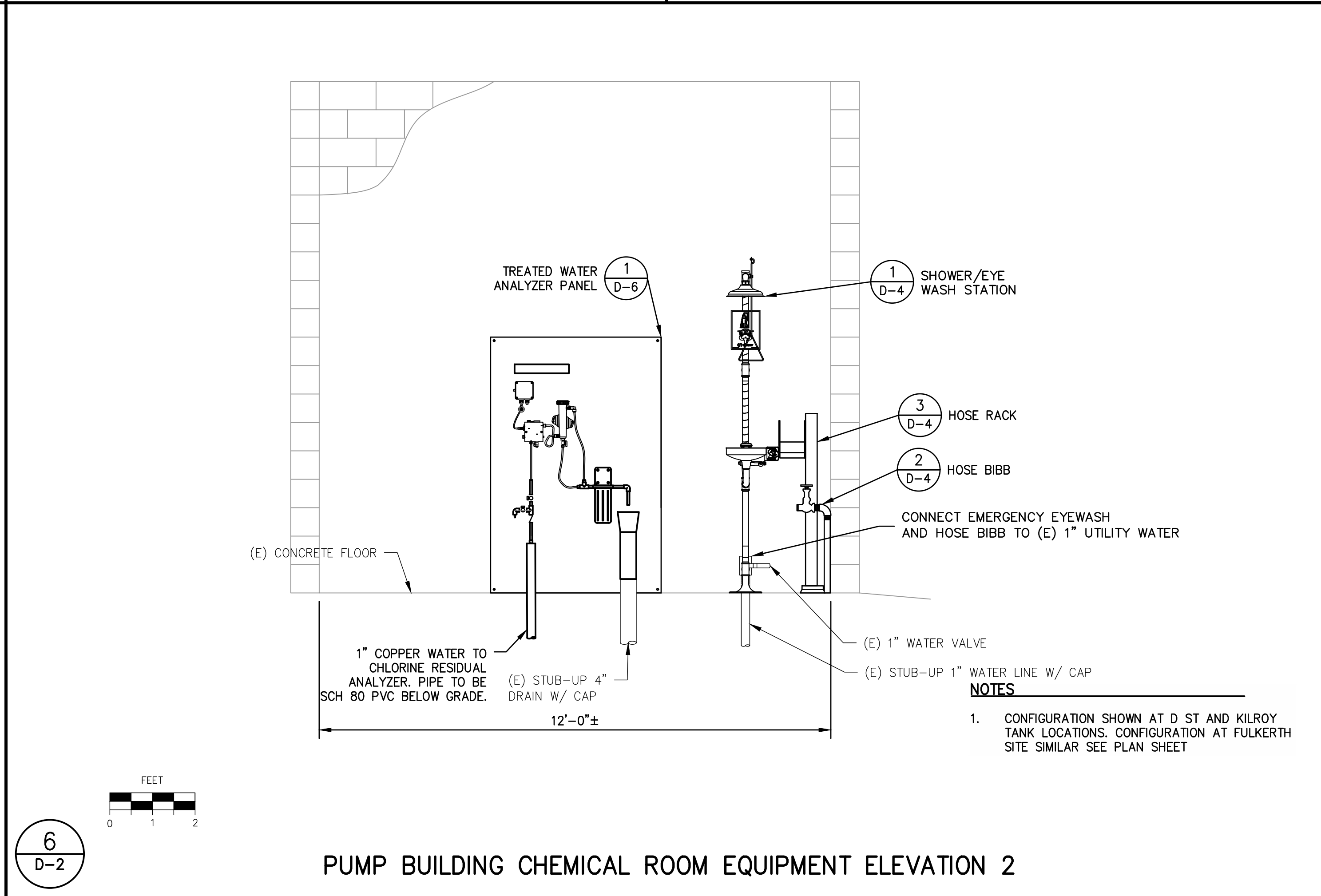
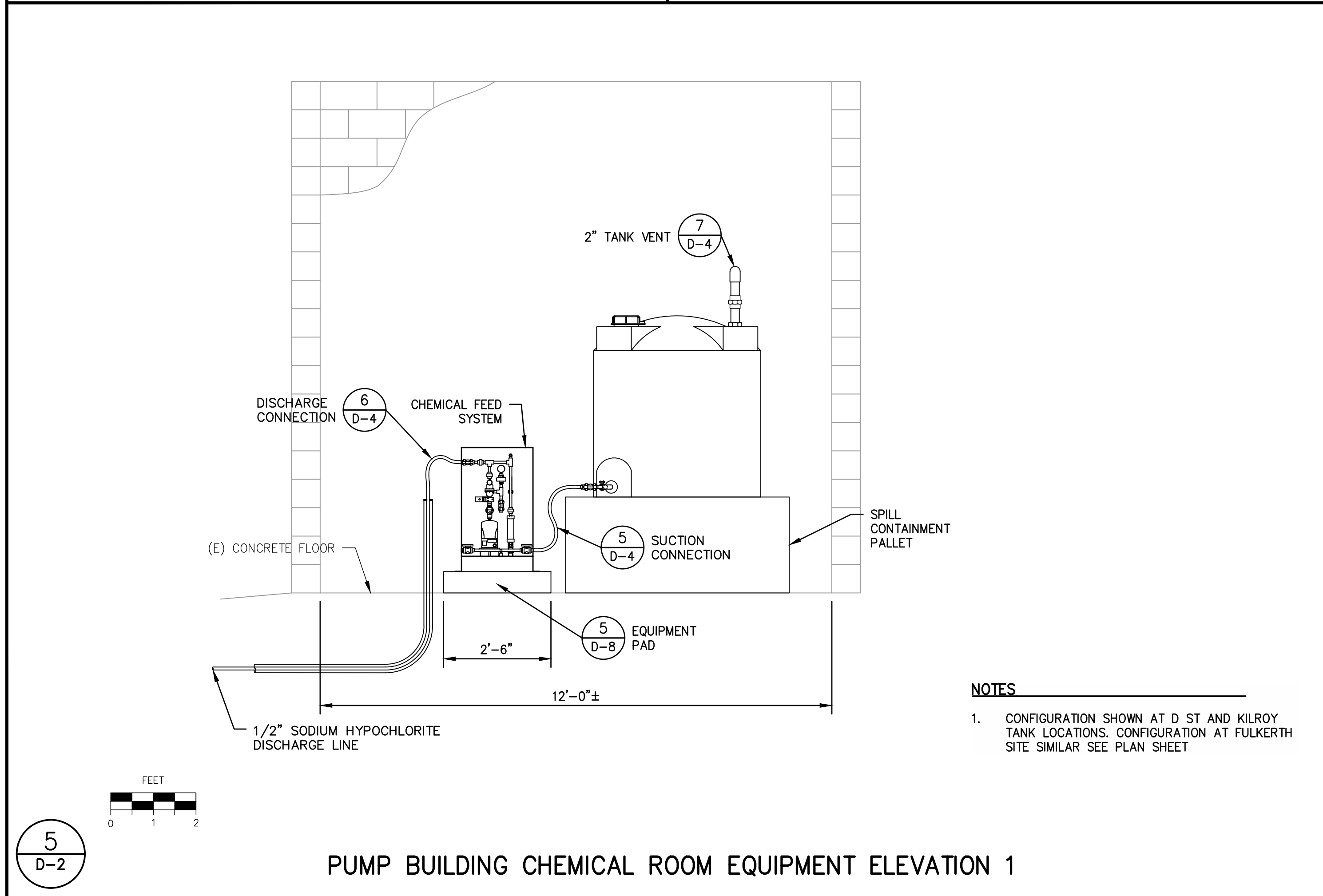
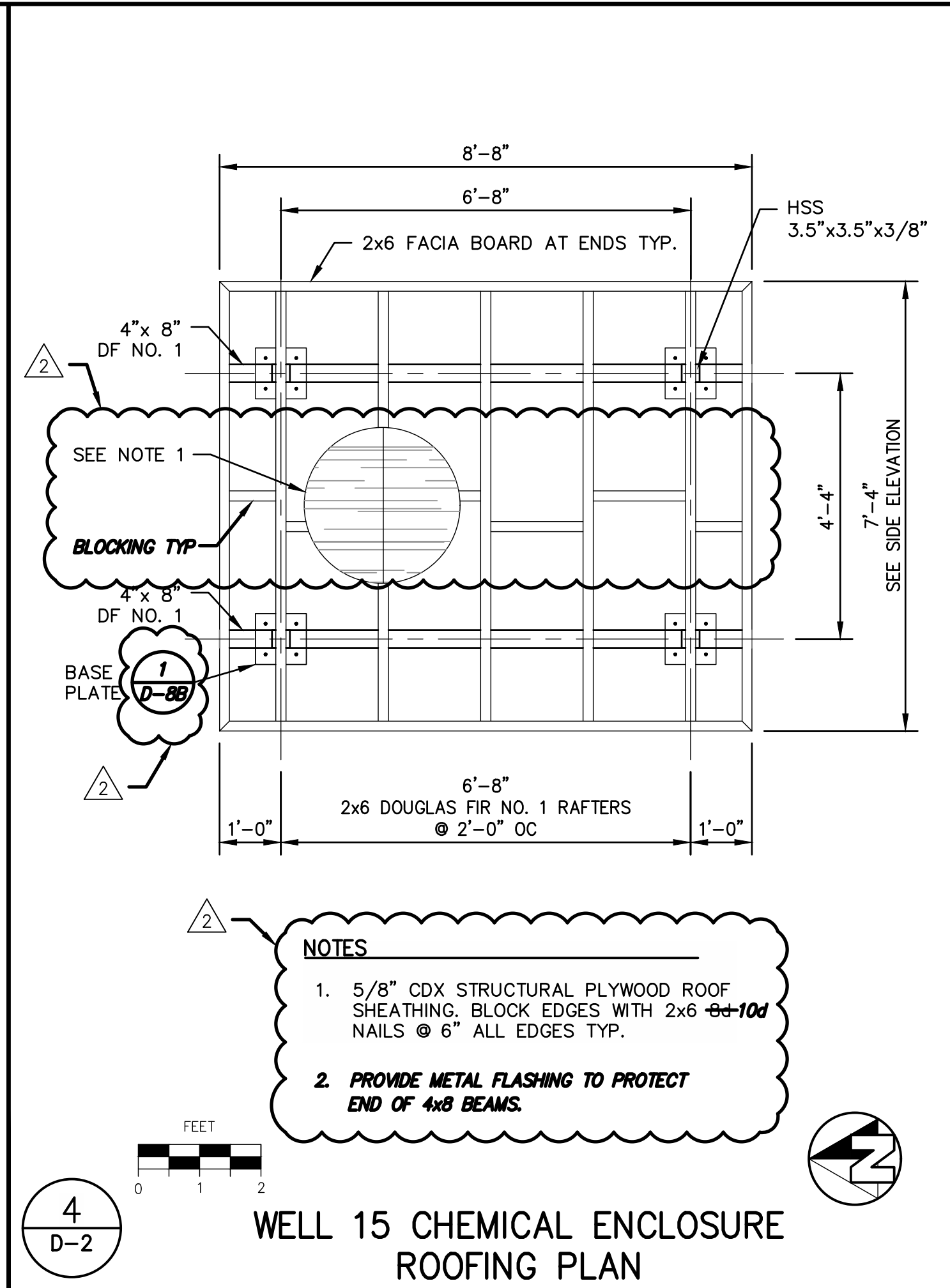
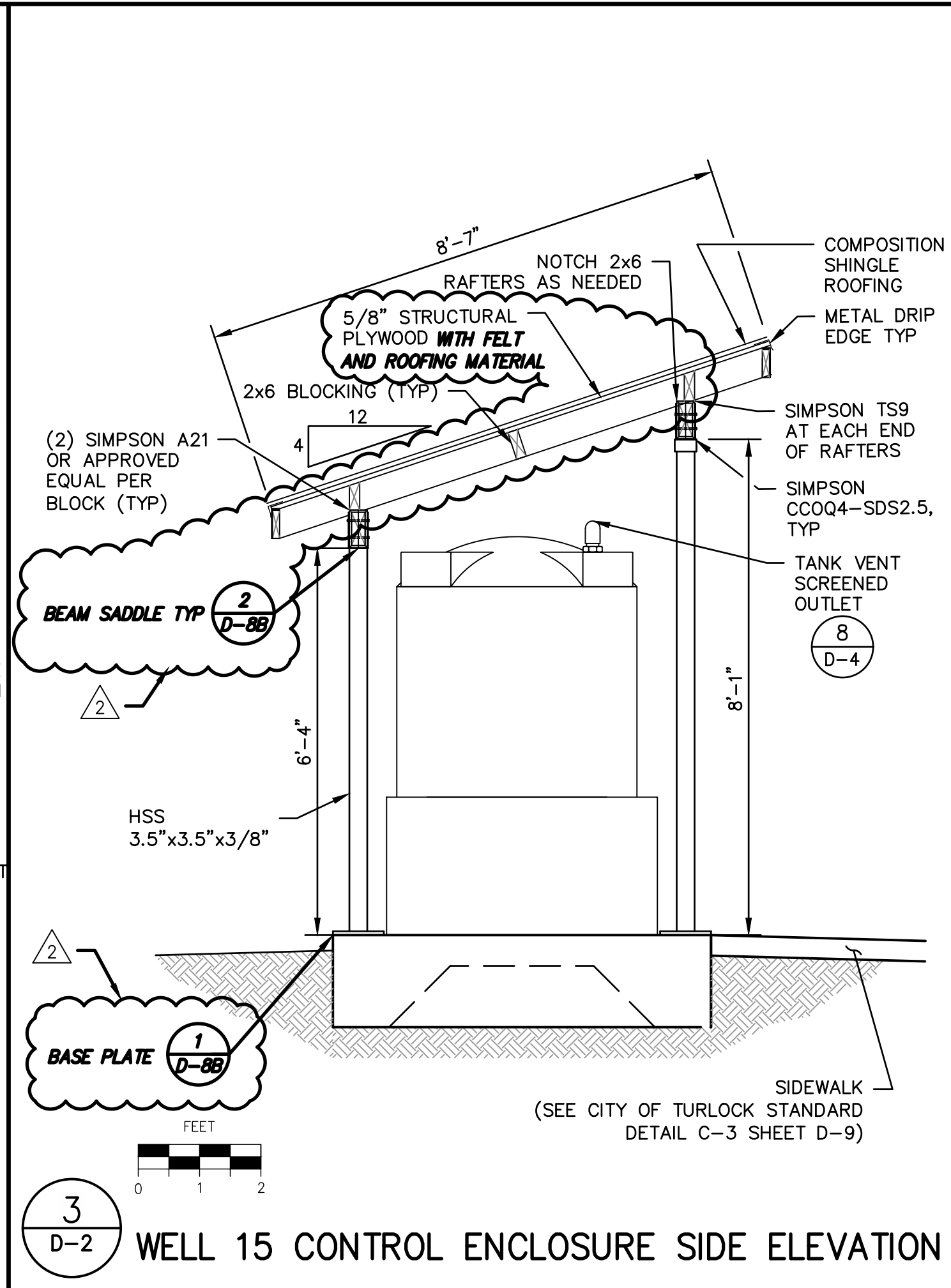
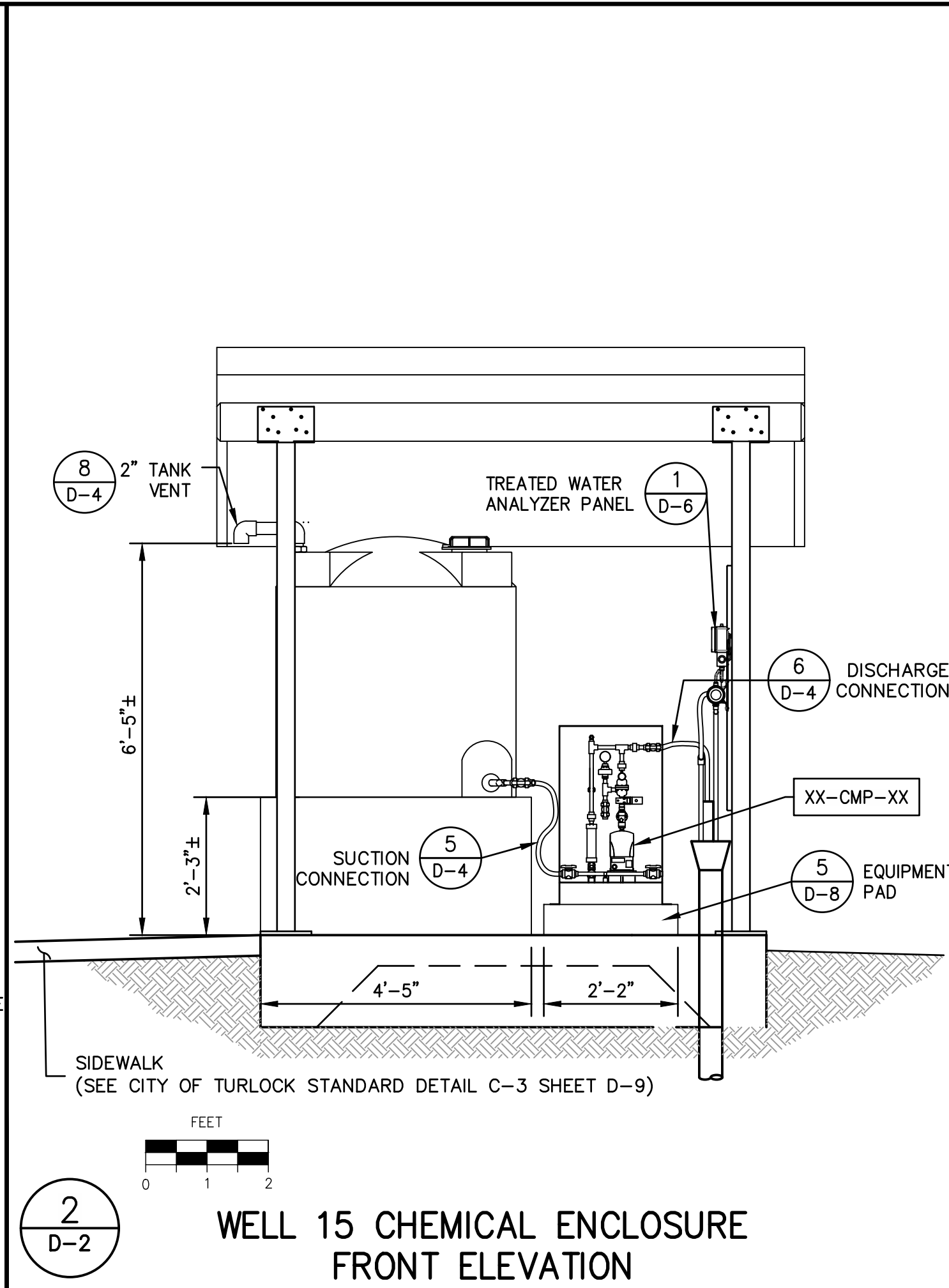
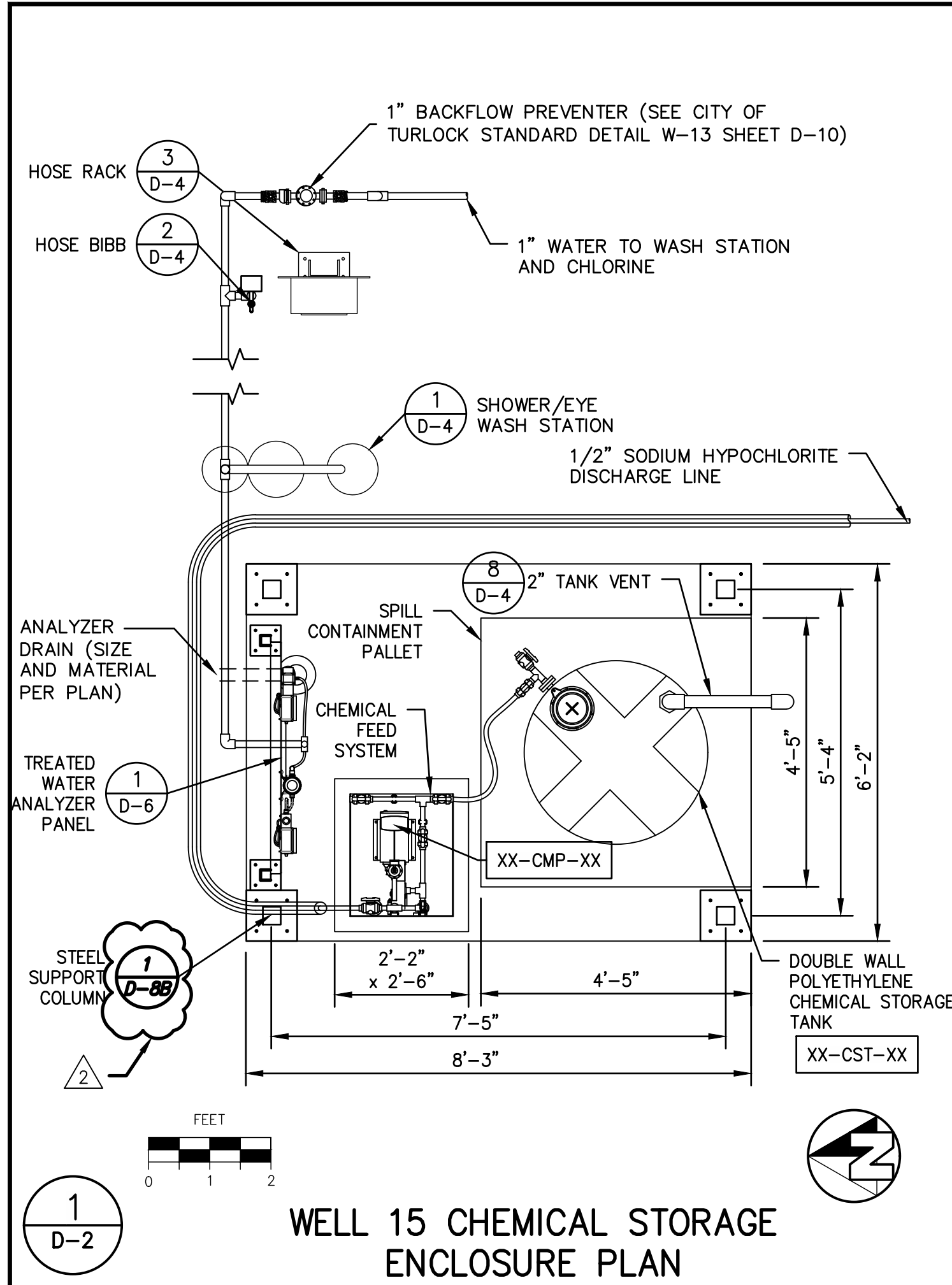
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SHEET D-1

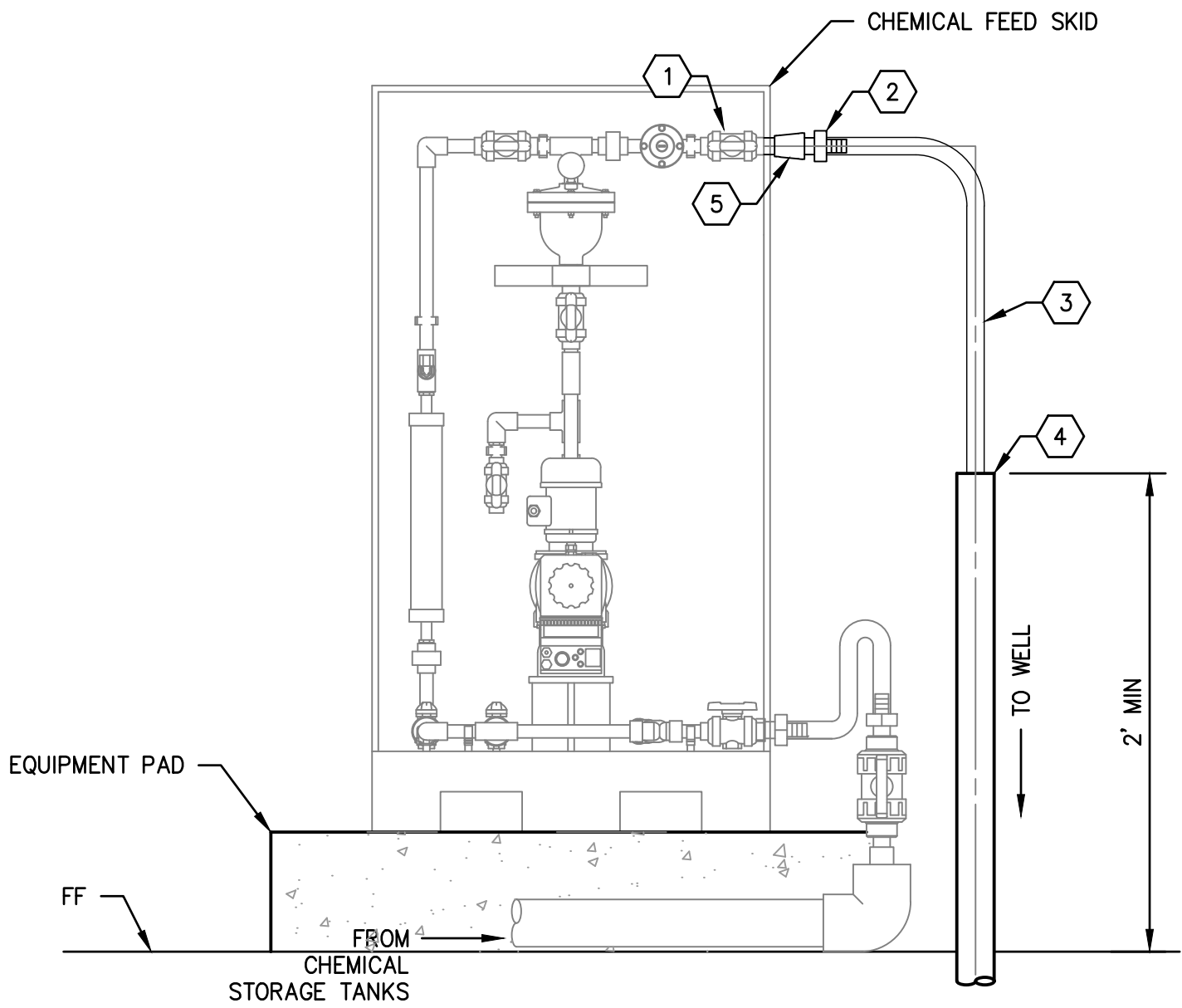
26 OF 57

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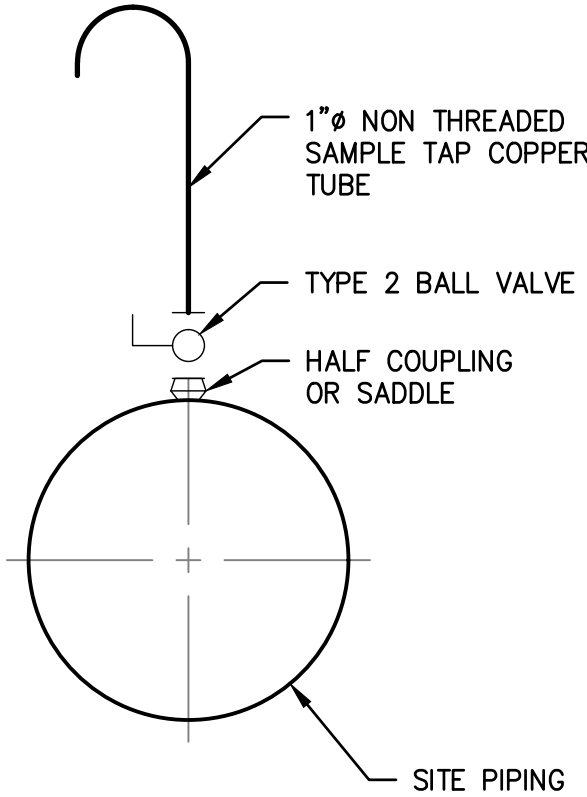
CITY WIDE CHLORINATION CITY OF TURLOCK CITY PROJECT NO. 2020-79 DETAILS				CHLORINATION ENCLOSURE DETAILS			
EST. 1968 PROVOST & PRITCHARD CONSULTING GROUP An Employee Owned Company 288 WEST CROWLEY AVENUE FRESNO, CALIFORNIA 93711-6162 559/449-2700 FAX 559/449-2715 www.pprg.com				DESIGN ENGINEER: KEITH MORTENSEN LICENSE NO: 75865			
DRAFTED BY: JMN				CHECKED BY: RKB			
DATE: NOV 2020				JOB NO: 229220006			
PHASE: CD				PROJECT NO:			
ORIGINAL SCALE SHOWN IS ONE INCH. ADJUST SCALE FOR REDUCED OR ENLARGED PLANS.				SHEET D-2			
27				OF 57			

MATERIAL LIST	
ID	DESCRIPTION
①	1/2" TYPE 6 BALL VALVE
②	3/4 HOSE BARB W/ WORM GEAR HOSE CLAMP
③	CHEMICAL TUBING
④	1-1/2"Ø SCH 40 PVC PIPE
⑤	3/4" x 1/2" REDUCER



1
D-5

TYPICAL CHEMICAL FEED SKID DISCHARGE CONNECTION DETAIL



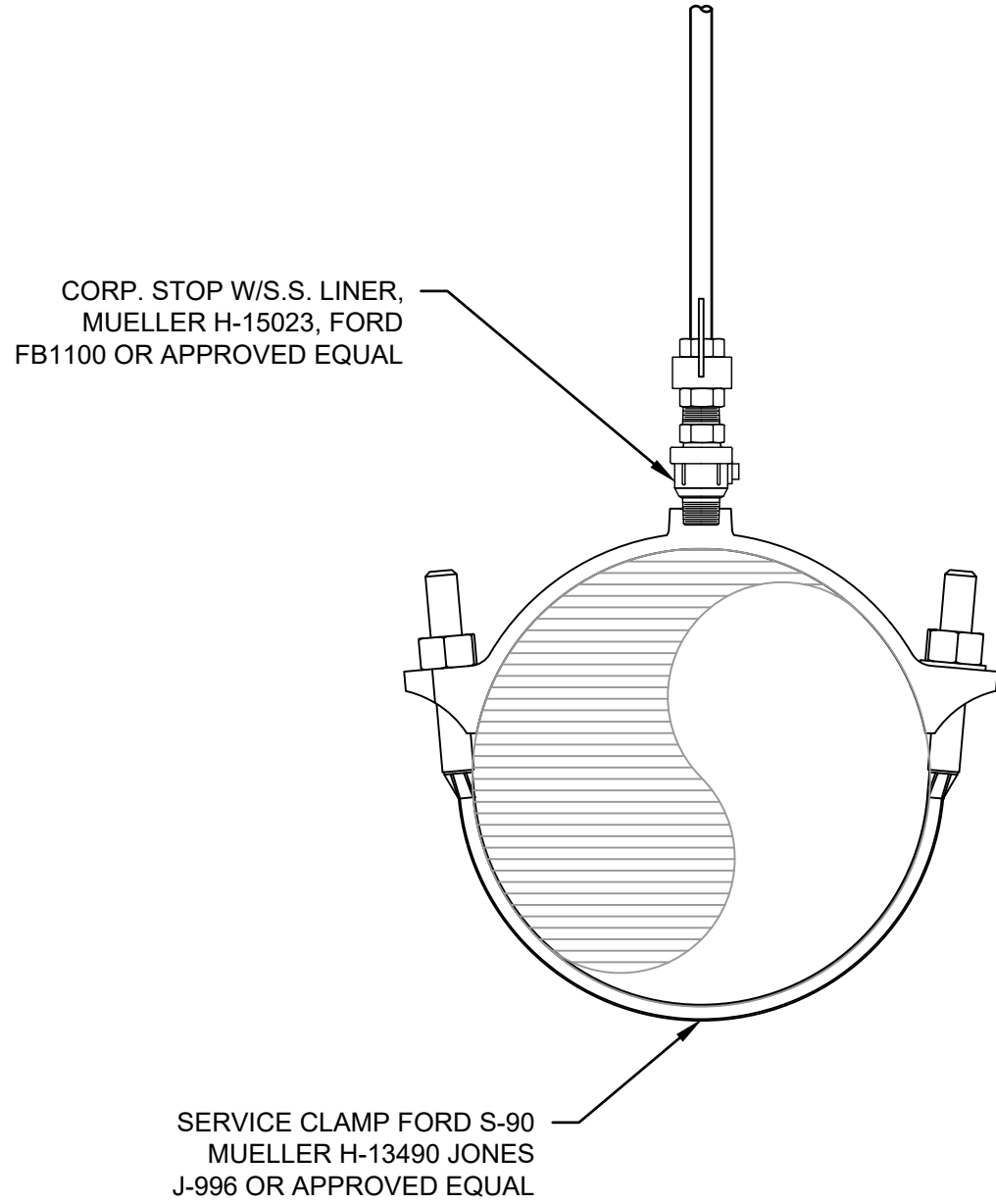
NOTES

1. DIRECT TAP FOR DIP OR WELD DIRECTLY TO WSP

NOT TO SCALE

2
D-5

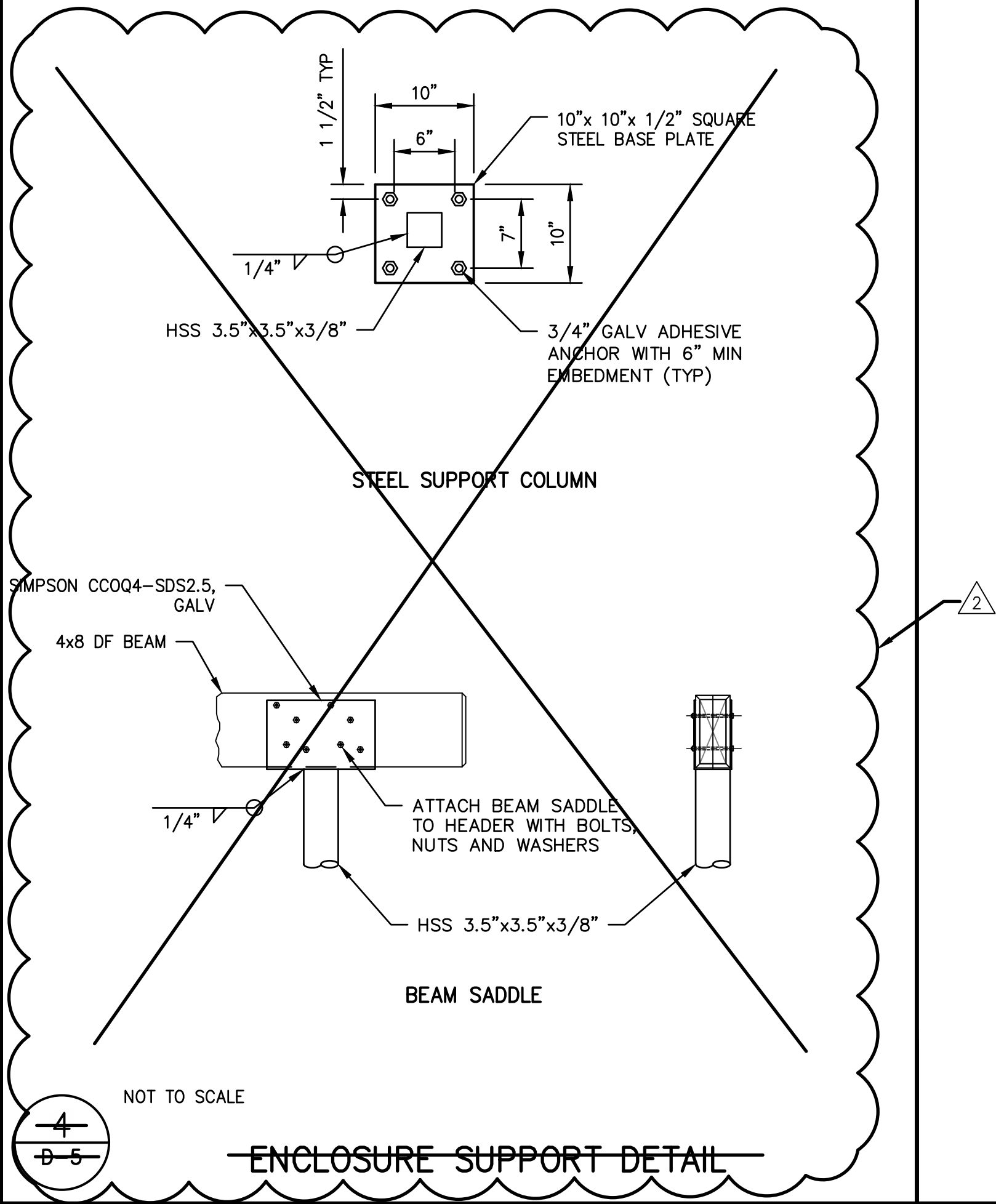
TYPE 1 SAMPLE TAP



NOT TO SCALE

3
D-5

SAMPLE TAP SADDLE

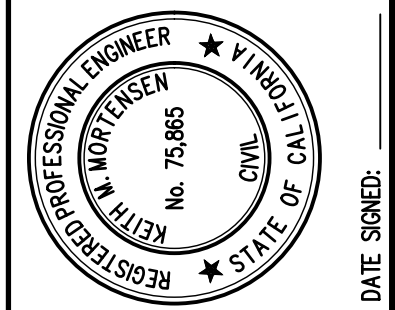


4
D-5

ENCLOSURE SUPPORT DETAIL

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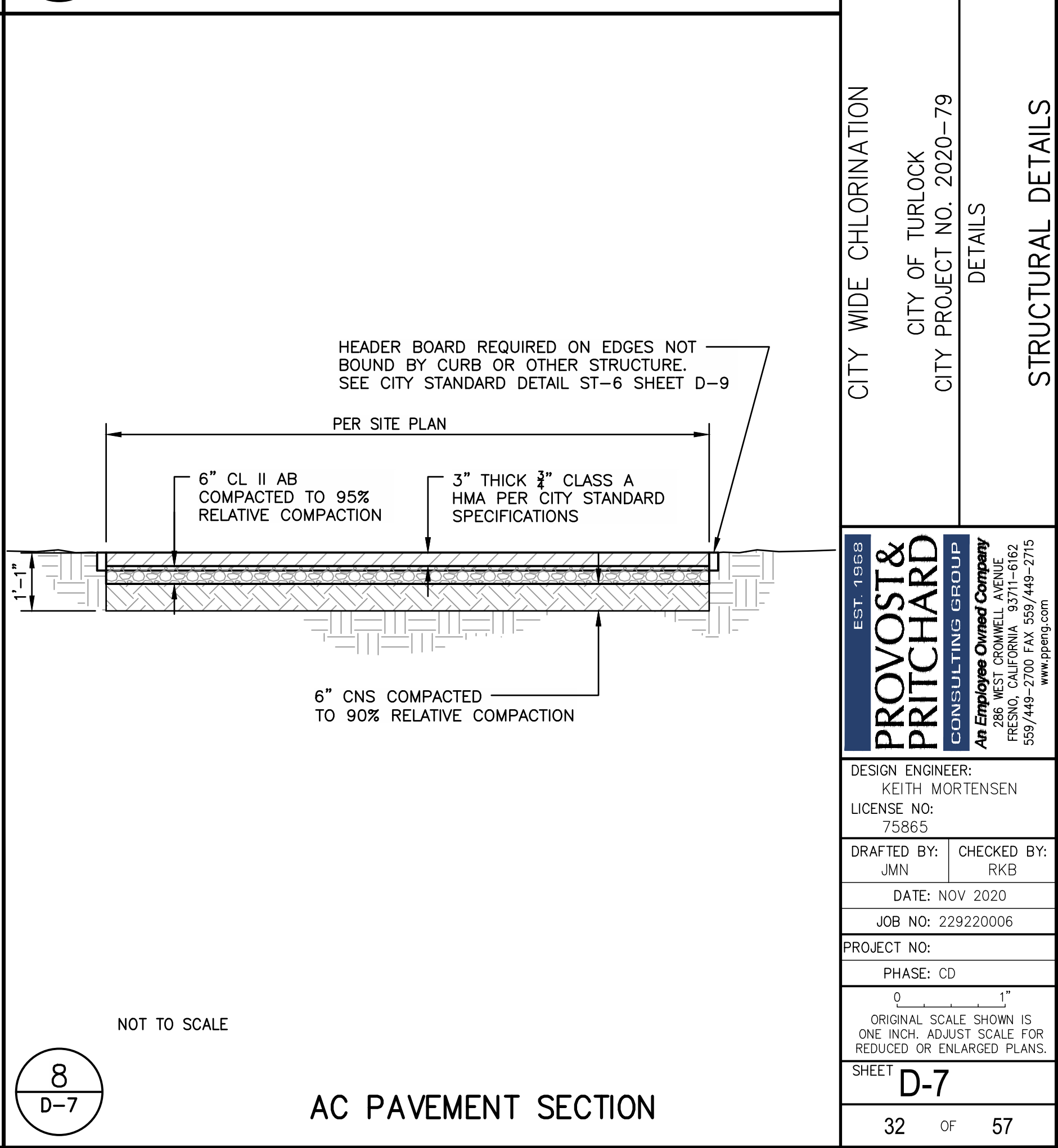
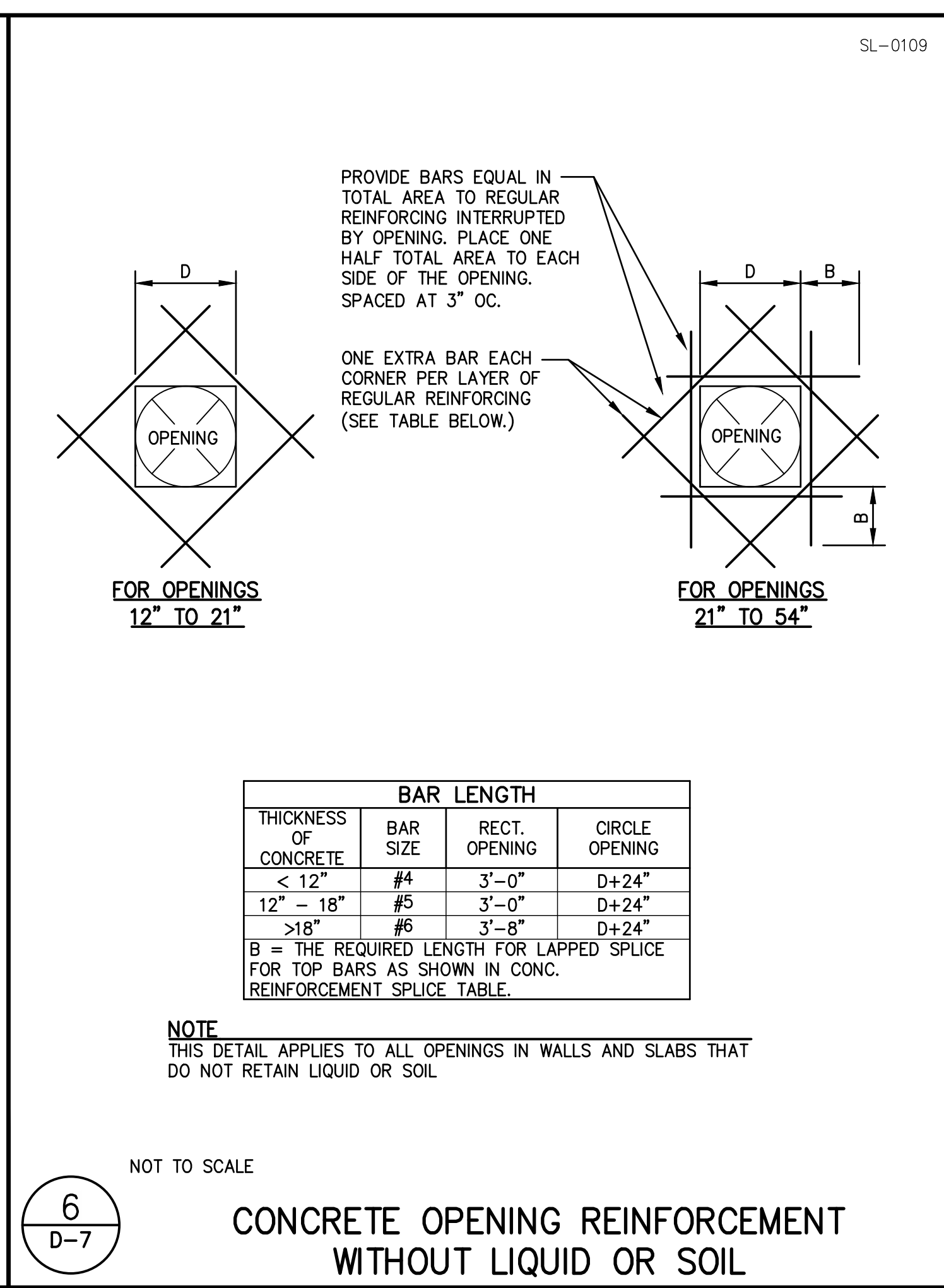
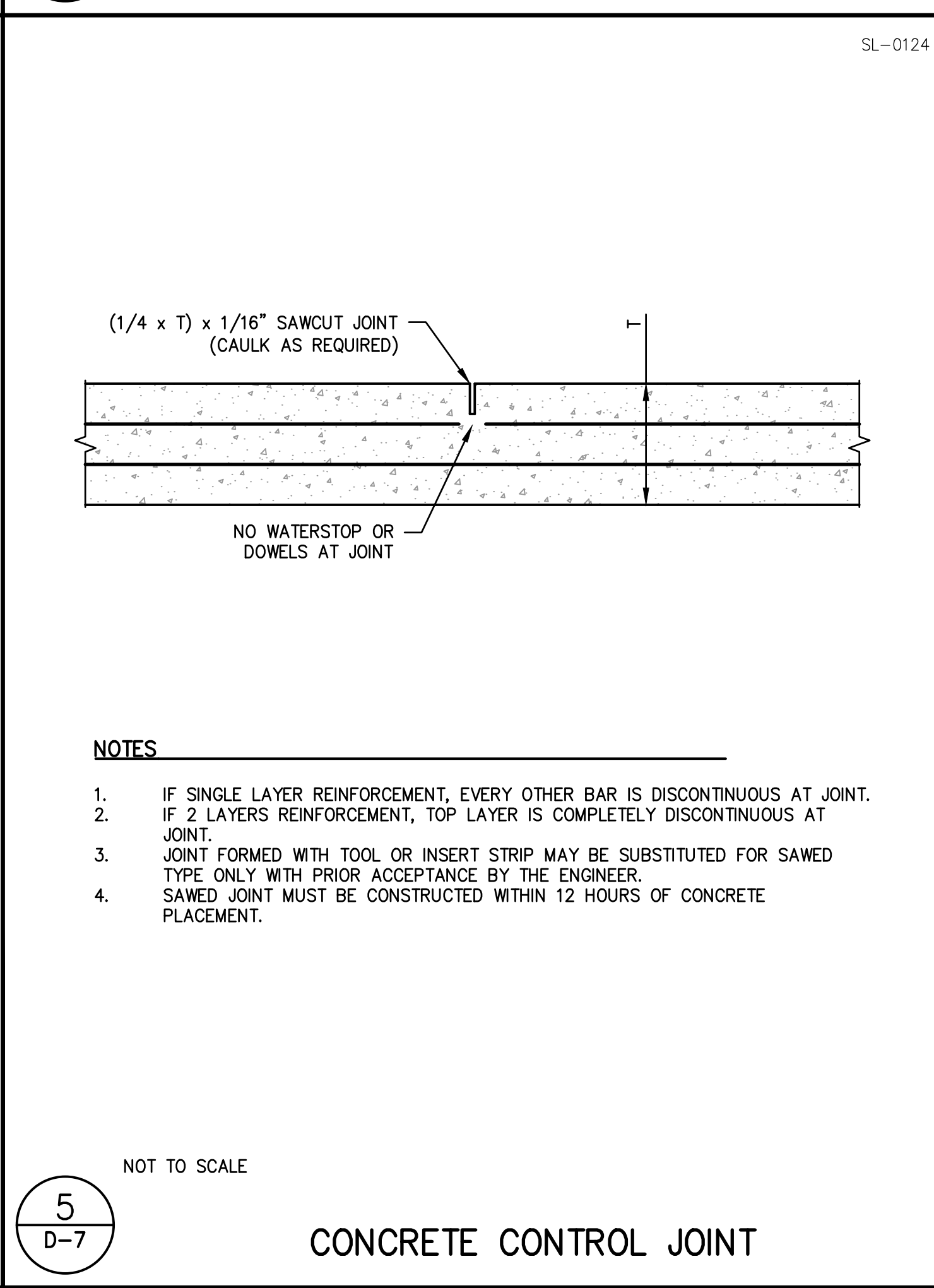
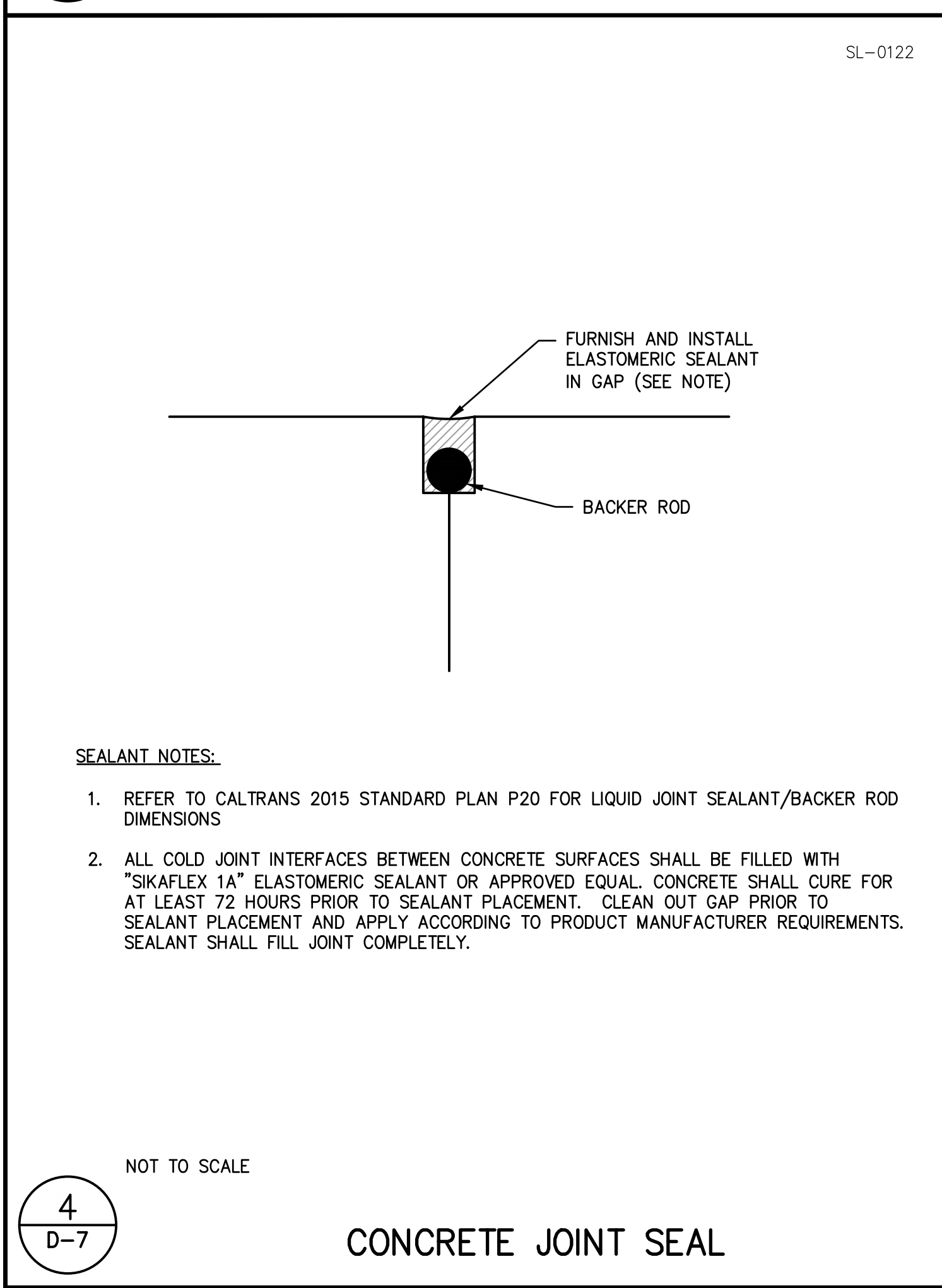
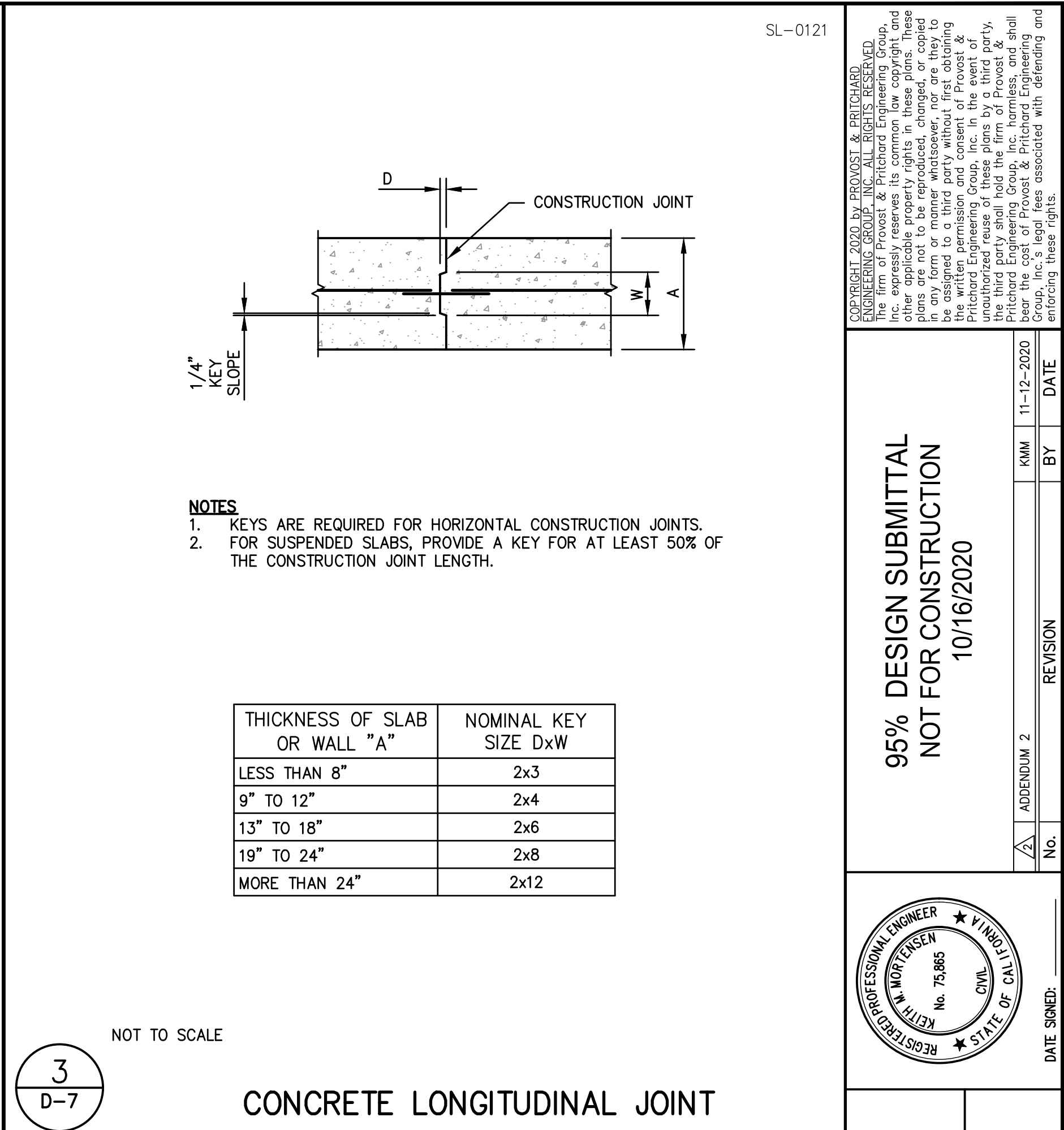
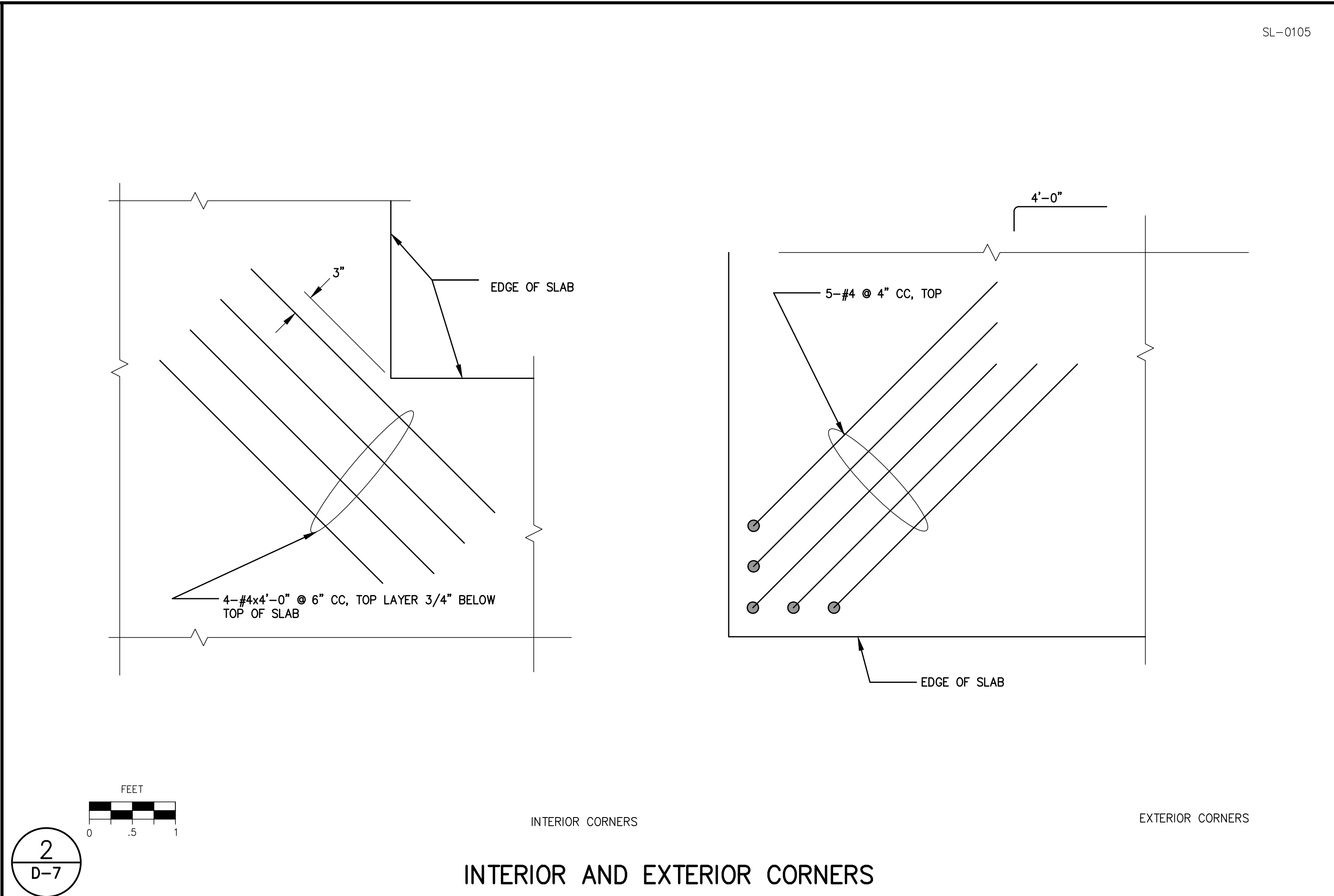
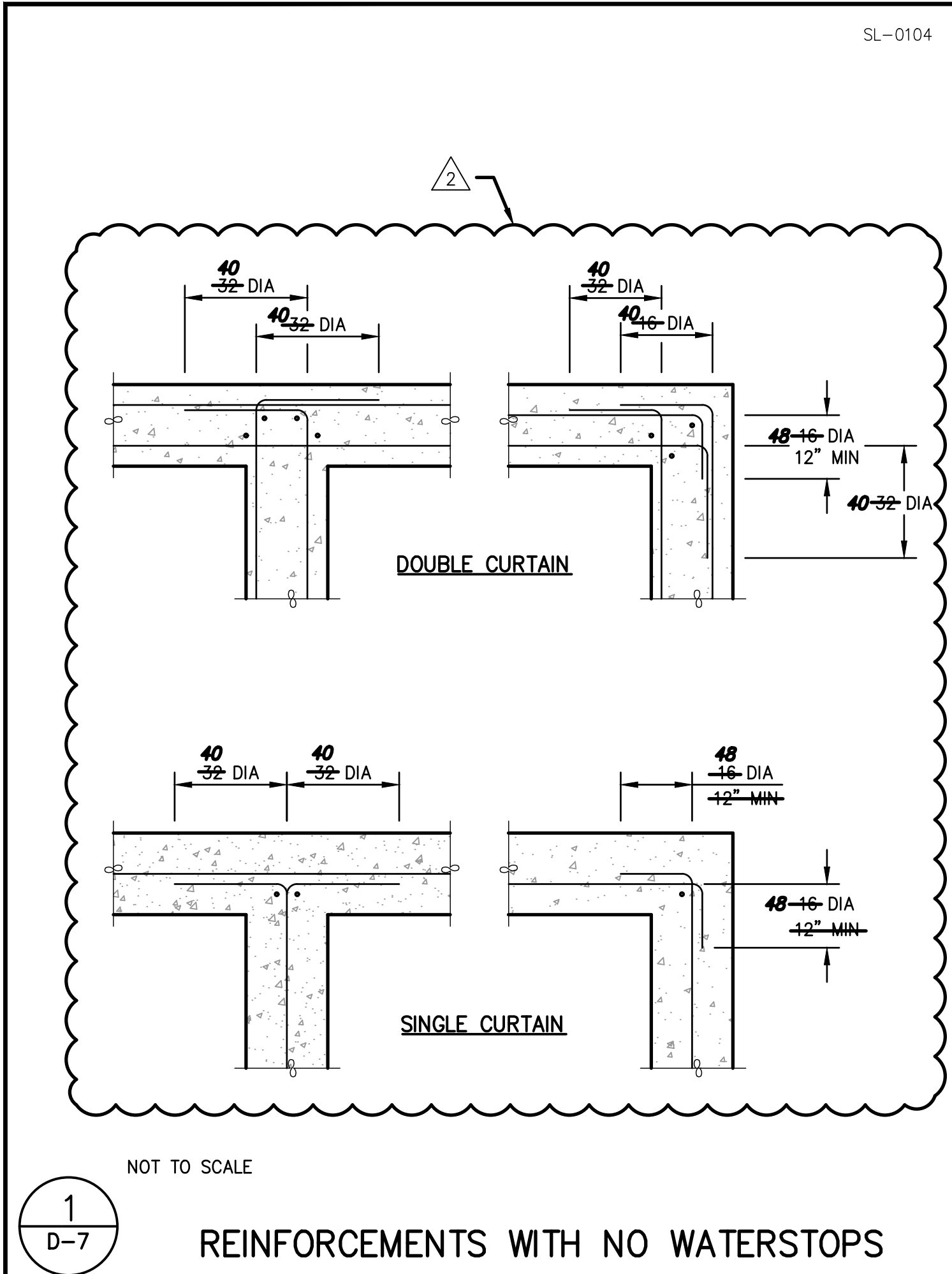
95% DESIGN SUBMITTAL NOT FOR CONSTRUCTION 10/16/2020		NO.	BY	DATE
ADDENDUM 2			KWM	11-12-2020
REVISION				



CITY WIDE CHLORINATION		DATE SIGNED
CITY OF TURLOCK		
CITY PROJECT NO. 2020-79		
DETAILS		
CHLORINATION DETAILS		

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--	--

DESIGN ENGINEER: KEITH MORTENSEN LICENSE NO: 75865	
DRAFTED BY: JMN	CHECKED BY: RKB
DATE: NOV 2020	
JOB NO: 229220006	
PROJECT NO:	
PHASE: CD	
ORIGINAL SCALE SHOWN IS ONE INCH. ADJUST SCALE FOR REDUCED OR ENLARGED PLANS.	
SHEET D-5	
30	OF 57



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NOT FOR CONSTRUCTION
10/16/2020

ADDENDUM 2

REVISION

BY

DATE

NO.

DATE SIGNED

CITY WIDE CHLORINATION

CITY OF TURLOCK

CITY PROJECT NO. 2020-79

DETAILS

STRUCTURAL DETAILS

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CONSULTING GROUP

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FRESNO, CALIFORNIA 93711-6162
559/449-2700 FAX 559/449-2715
www.ppeng.com

DESIGN ENGINEER:
KEITH MORTENSEN

LICENSE NO:
75865

DRAFTED BY:
JMN

CHECKED BY:
RKB

DATE: NOV 2020

JOB NO: 229220006

PROJECT NO:

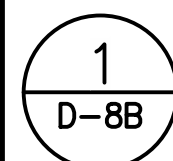
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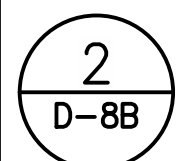
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D-7

32 OF 57

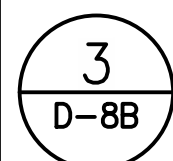
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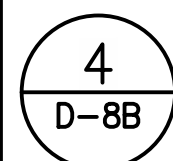
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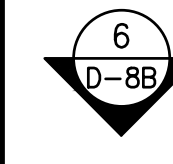
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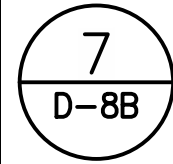


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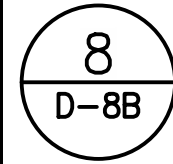


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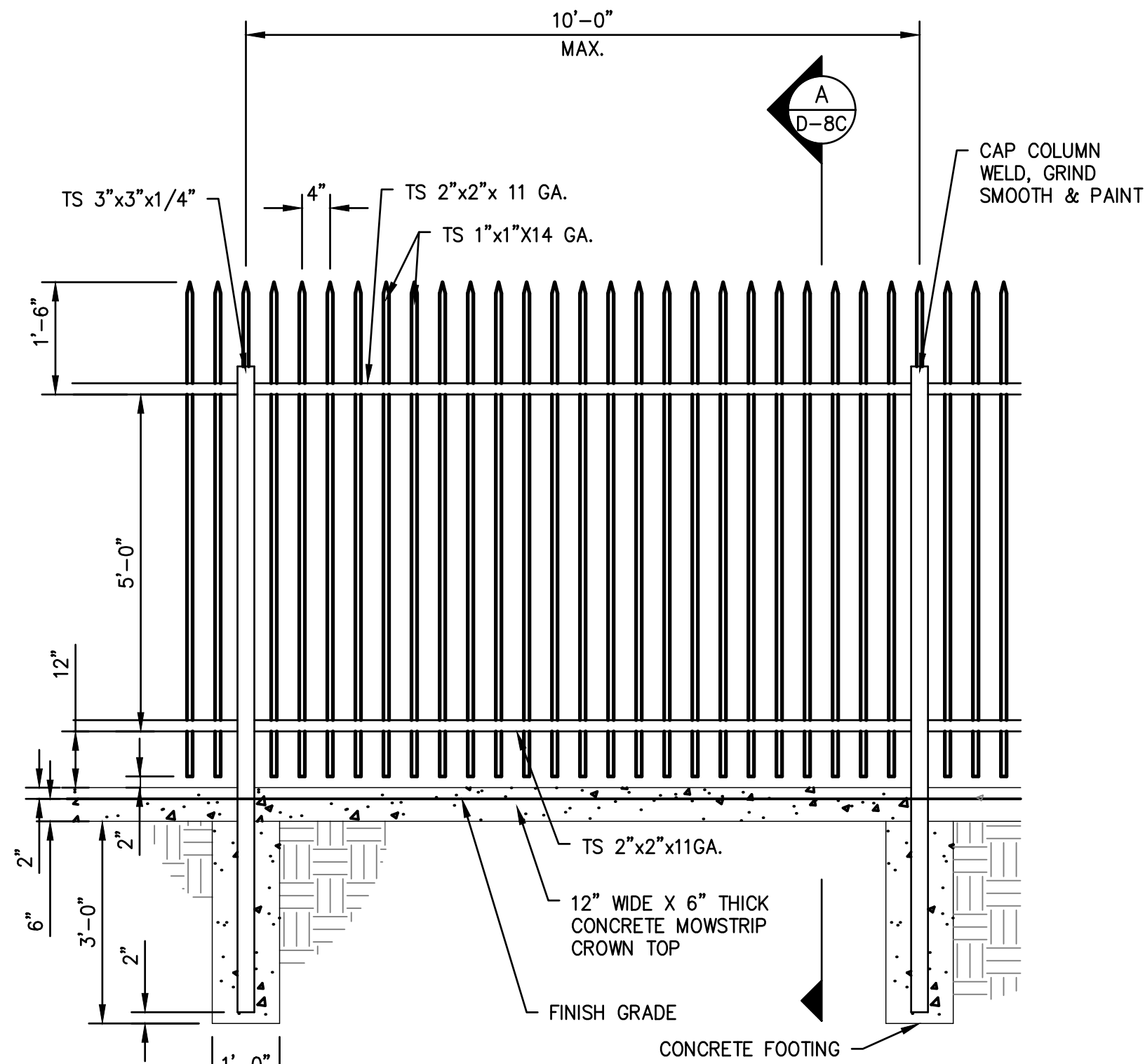


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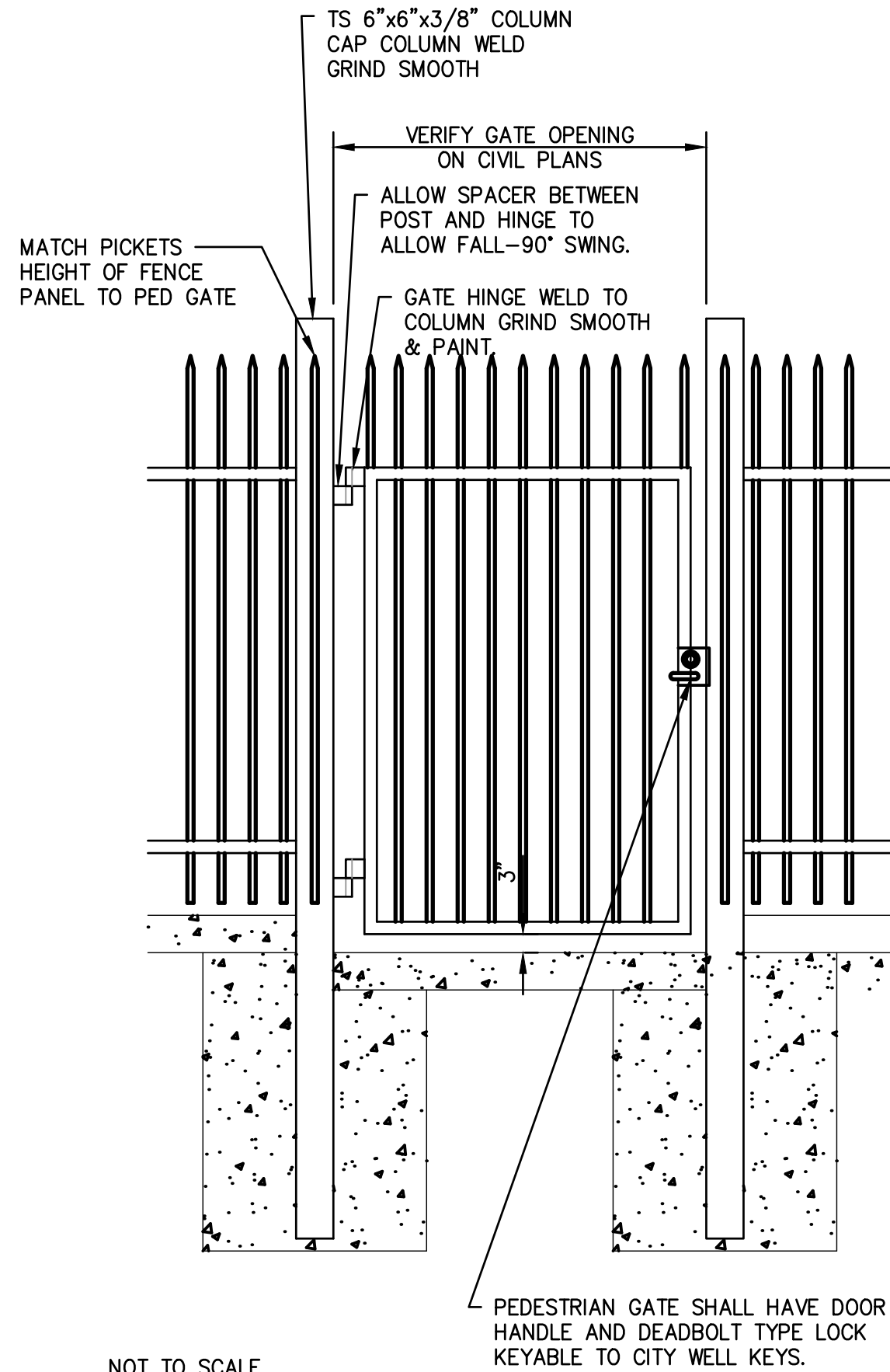
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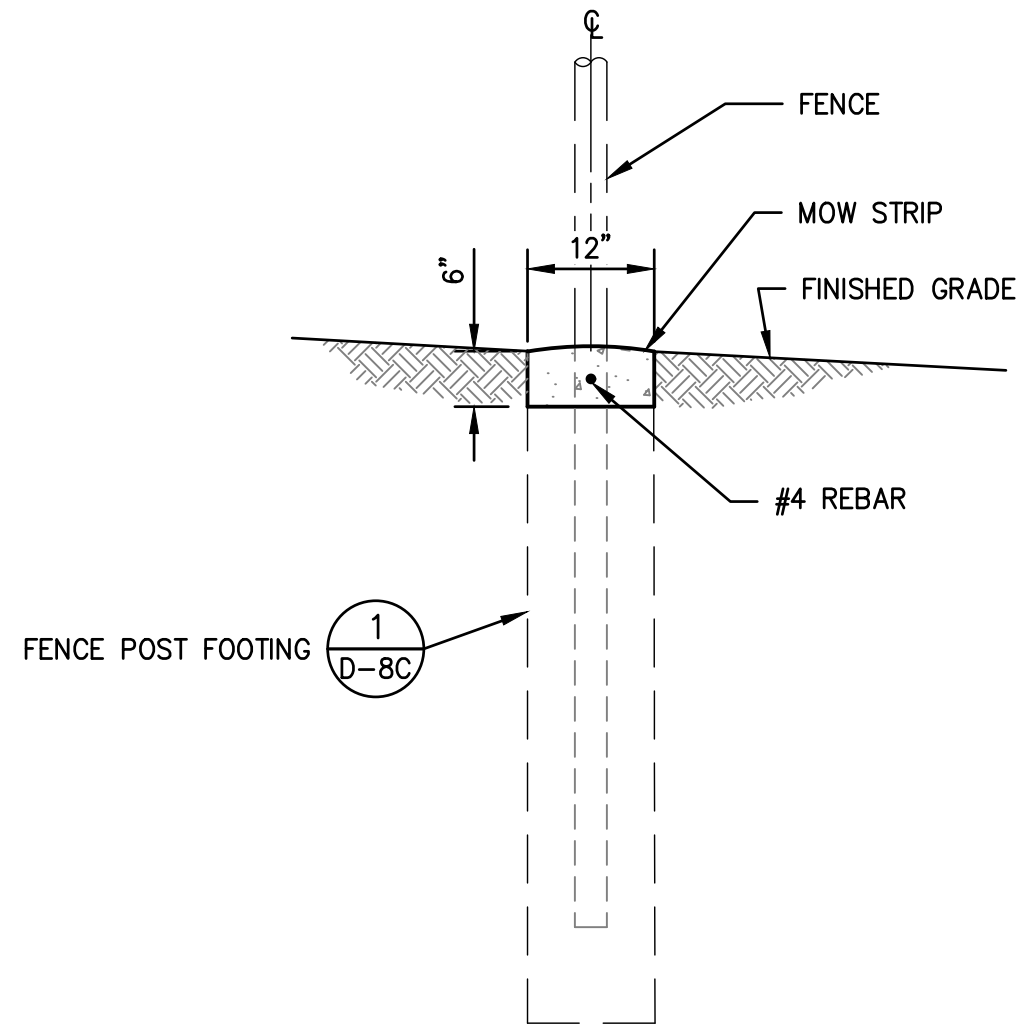
NOTES

1. ALL METAL FENCING, GATES, AND ACCESSORIES TO BE POWDER COATED BLACK.

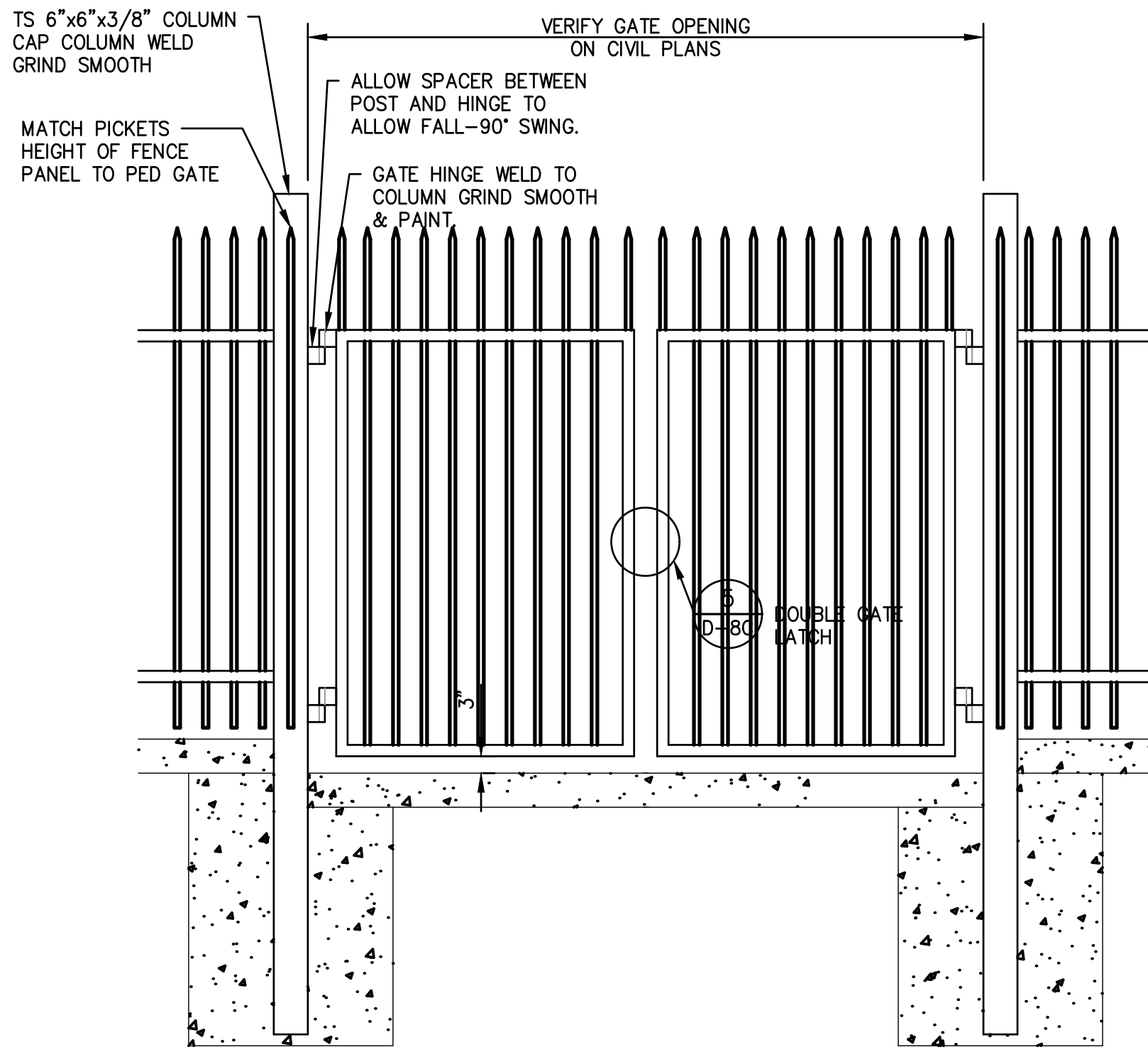
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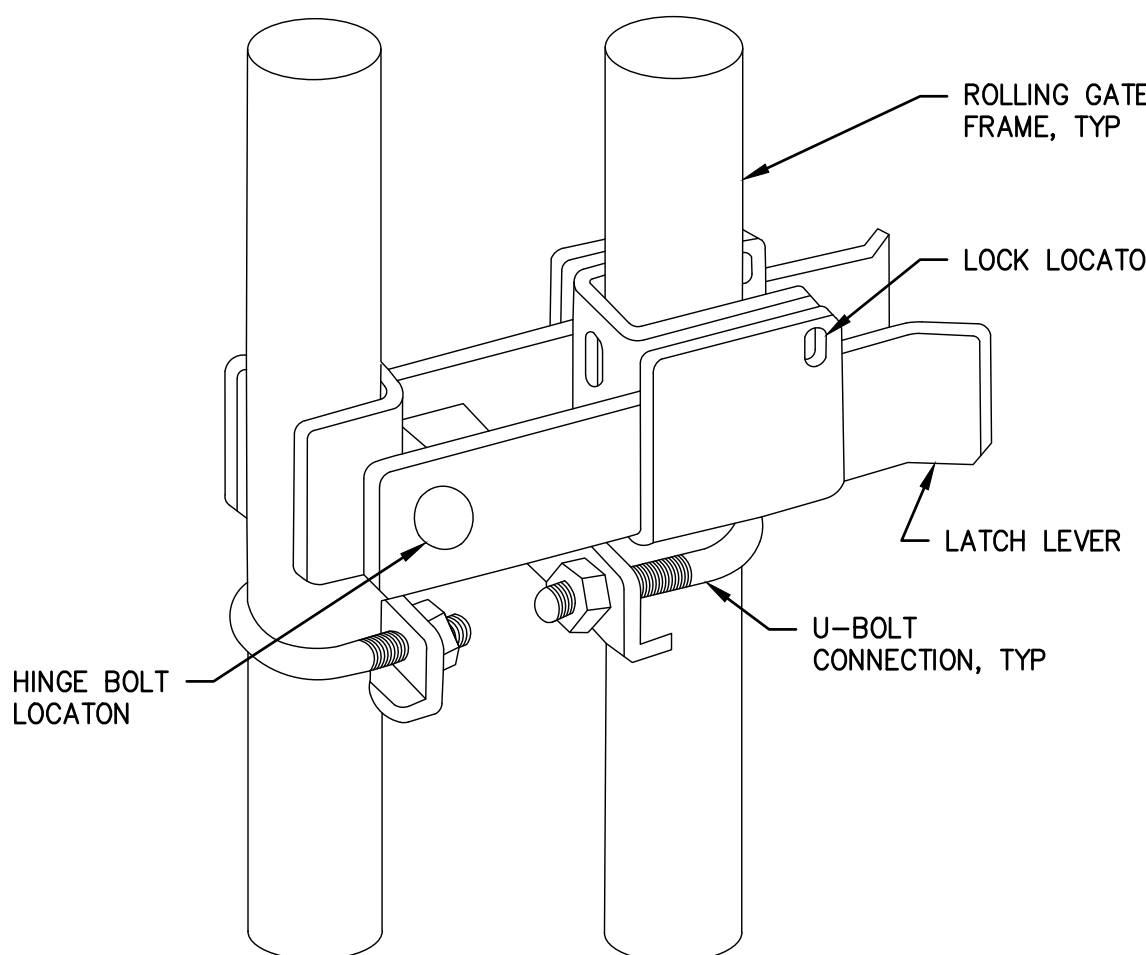
PEDESTRIAN GATE



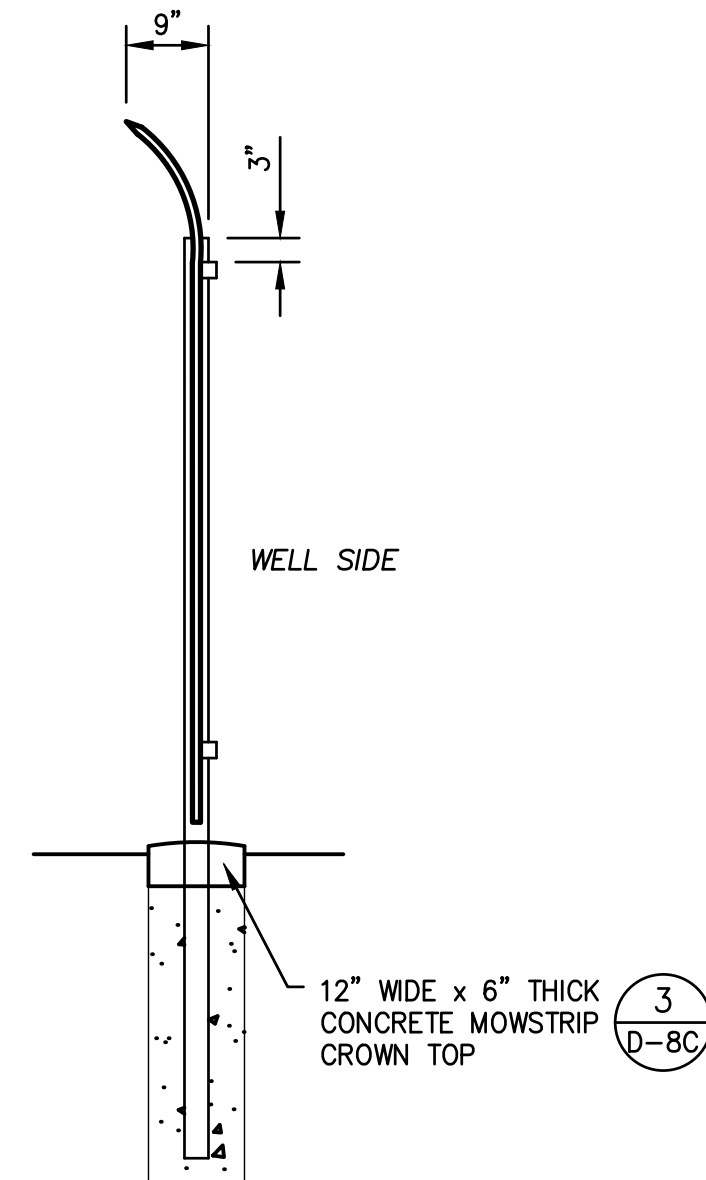
MOW STRIP



DOUBLE GATE



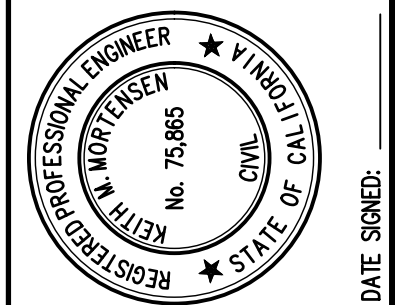
DOUBLE GATE LATCH



SECTION A

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CITY WIDE CHLORINATION
CITY OF TURLOCK
CITY PROJECT NO. 2020-79
DETAILS
FENCING DETAILS

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559/449-2700 FAX 559/449-2715
www.pjeng.com

DESIGN ENGINEER:
KEITH MORTENSEN
LICENSE NO:
75865

DRAFTED BY: JMN
CHECKED BY: RKB

DATE: NOV 2020
JOB NO: 229220006

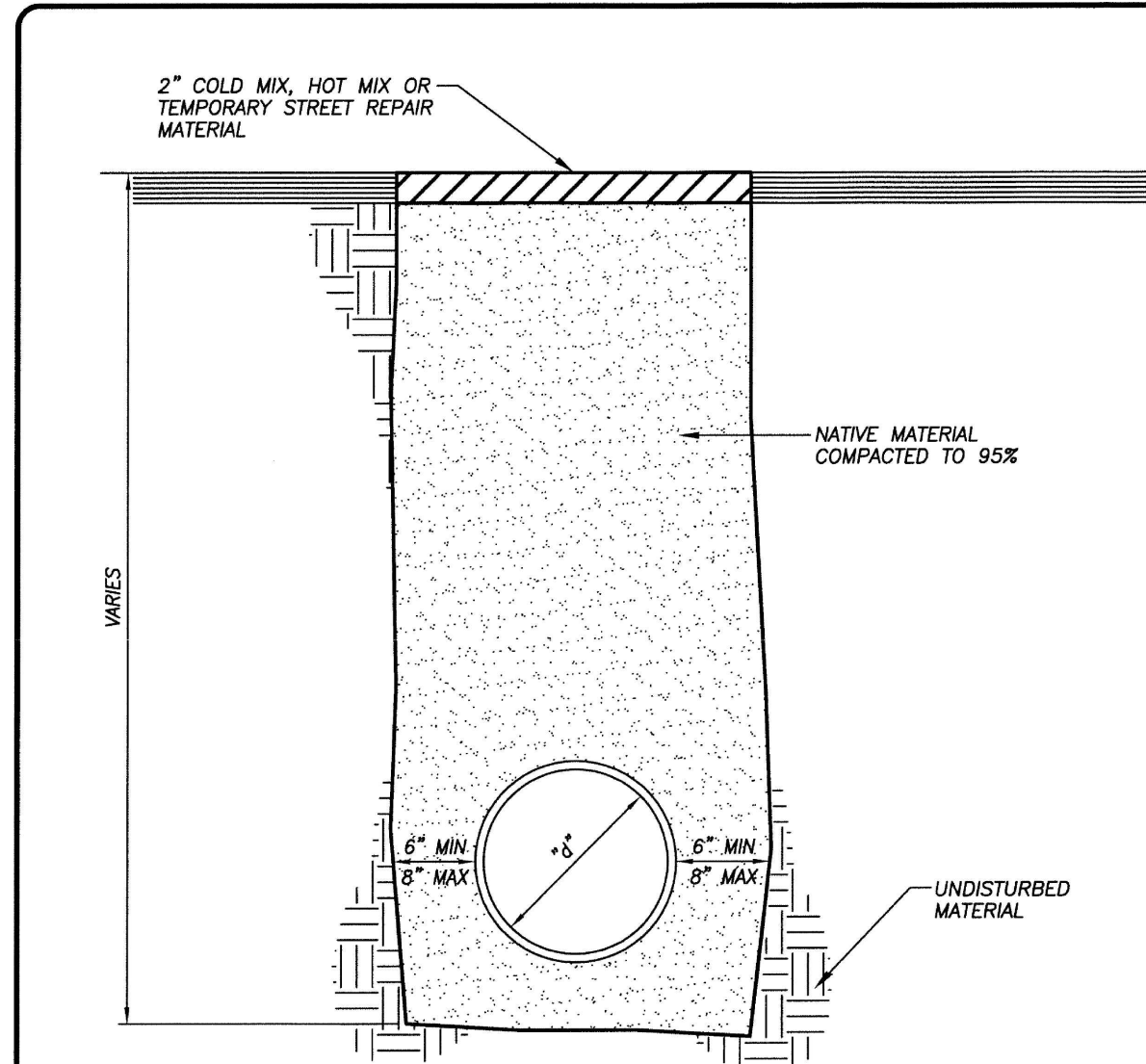
PROJECT NO:
PHASE: CD

0 1"
ORIGINAL SCALE SHOWN IS
ONE INCH. ADJUST SCALE FOR
REDUCED OR ENLARGED PLANS.

SHEET
D-8C

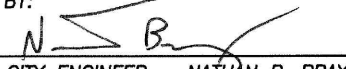
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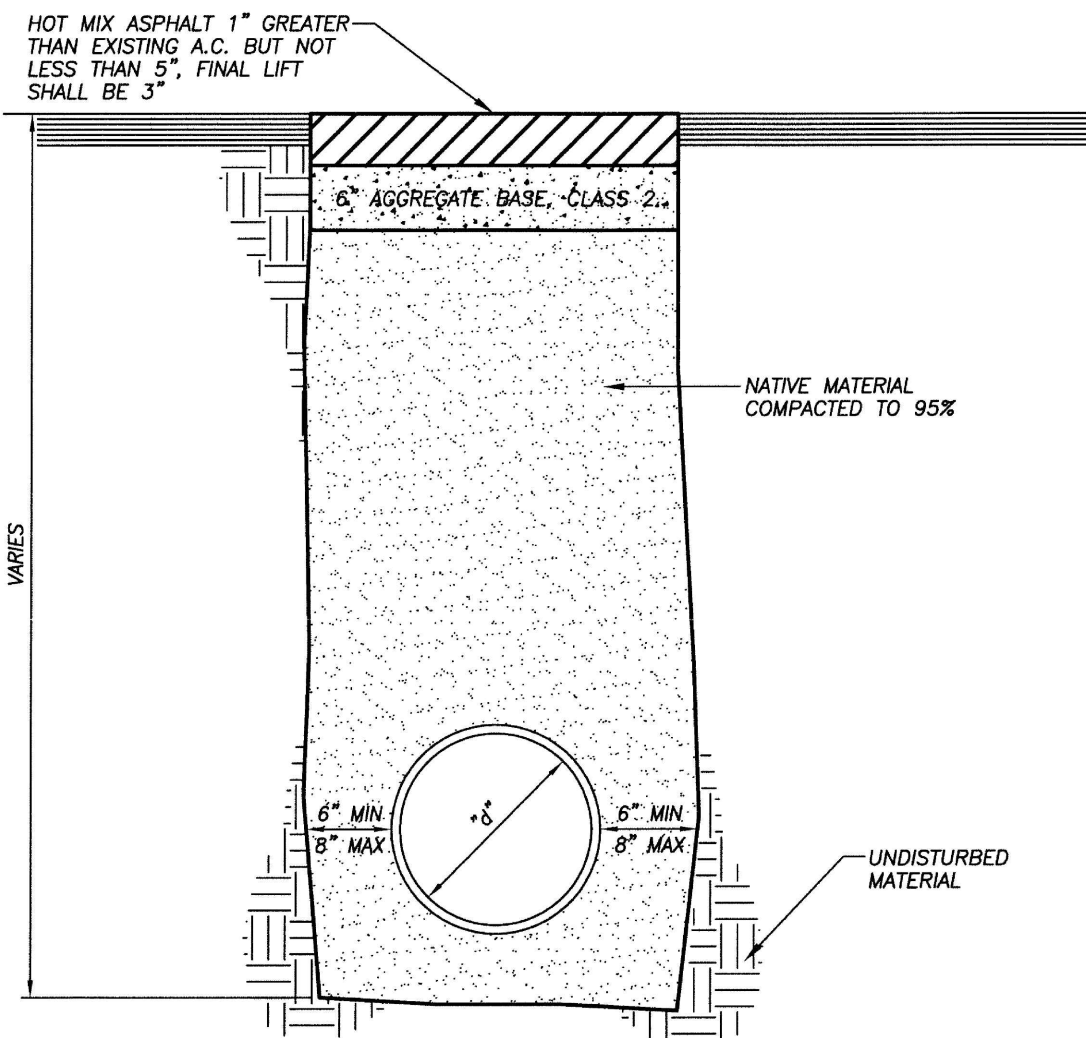
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- NOTES:
1. COMPACTION TESTS SHALL BE APPROVED BY THE CITY BEFORE PAVING.
 2. TRENCHES 5 FEET OR MORE IN DEPTH SHALL BE SHORED.
 3. MAXIMUM LIFT THICKNESS FOR BEDDING AND BACKFILL SHALL BE 12" BEFORE COMPACTION.
 4. TRENCHES WHICH ARE LESS THAN 30" IN DEPTH OR LESS THAN 18" IN WIDTH SHALL BE BACKFILLED WITH TWO SACK CEMENT SLURRY.
 5. ALL STEPS OF TRENCHING SHALL BE REPEATED WHEN REPAIRING A SECTION OF PIPE.

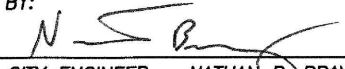
3 STEP TRENCH REPAIR ~ STEP 1
CITY OF TURLOCK

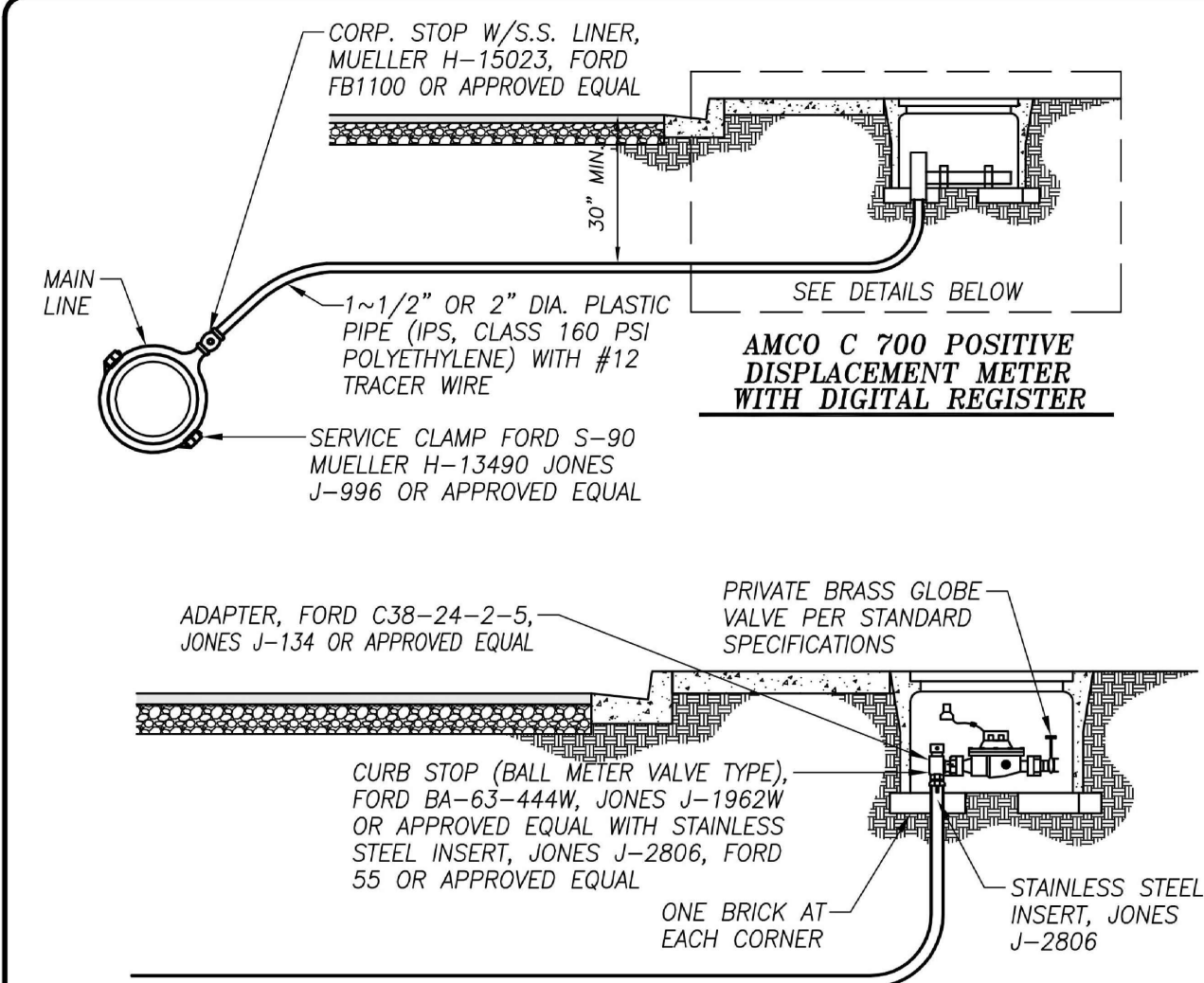
DRAWN BY: JSH	APPROVED BY: 	DRAWING NO. T-1
CHECK BY: NBB	INTERIM CITY ENGINEER - NATHAN B. BRAY - RCE 76642	COUNCIL APPROVAL FEB, 2019
SCALE: NONE		



- NOTES:
1. STEP 1 MAY BE OMITTED IF STEP 2 IS PERFORMED SAME DAY AS TRENCH EXCAVATION
 2. COMPACTION TESTS SHALL BE APPROVED BY THE CITY BEFORE PAVING.
 3. TRENCHES 5 FEET OR MORE IN DEPTH SHALL BE SHORED.
 4. MAXIMUM LIFT THICKNESS FOR BEDDING AND BACKFILL SHALL BE 12" BEFORE COMPACTION.
 5. TRENCHES WHICH ARE LESS THAN 30" IN DEPTH OR LESS THAN 18" IN WIDTH SHALL BE BACKFILLED WITH TWO SACK CEMENT SLURRY.
 6. ALL STEPS OF TRENCHING SHALL BE REPEATED WHEN REPAIRING A SECTION OF PIPE.
 7. HMA SHALL BE PG 64-10, TYPE A


3 STEP TRENCH REPAIR ~ STEP 2
CITY OF TURLOCK

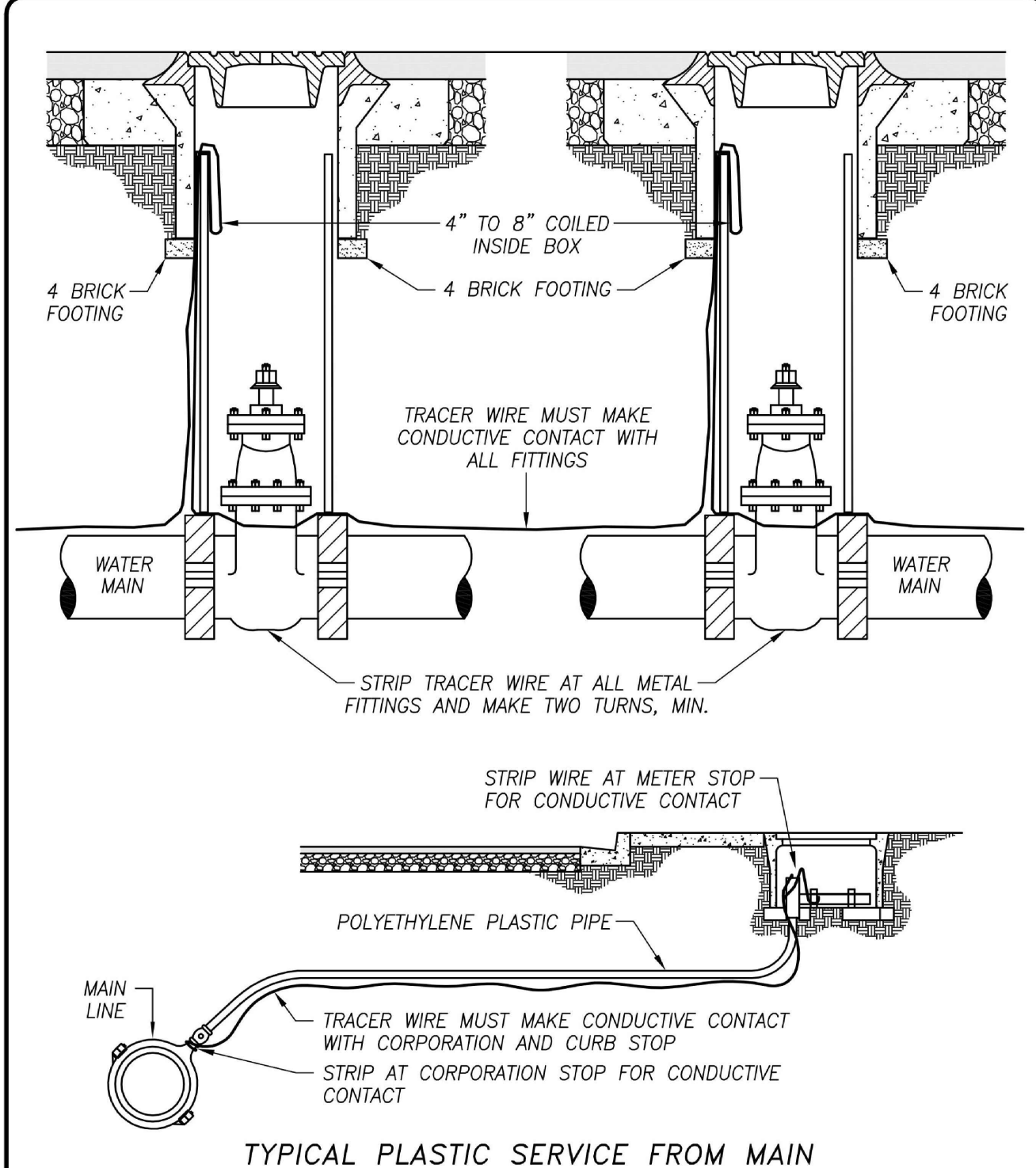
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CHECK BY: NBB	INTERIM CITY ENGINEER - NATHAN B. BRAY - RCE 76642	COUNCIL APPROVAL FEB, 2019
SCALE: NONE		



- *BFA 43-777W
- NOTES:
1. ALL BOX COVERS SHALL BE SET TO GRADE AND SHALL NOT BE SITUATED IN DRIVEWAYS.
 2. METER STOP SHALL VARY BETWEEN 6" AND 10" FROM BOTTOM OF LID.
 3. POLYETHYLENE PLASTIC OR PLOYMER CONCRETE VALVE BOX AND LID SHALL BE USED.
 4. A "W", 3" HIGH, SHALL BE STAMPED OR CHISELED ON THE CURB FACE OVER SERVICE LINES.
 5. PLACE A #12 TRACER WIRE IN THE SERVICE TRENCH TO MAKE CONDUCTIVE CONTACT WITH THE CORPORATION AND CURB (METER) STOP.

1~1/2" OR 2" PLASTIC WATER SERVICE CONNECTION
CITY OF TURLOCK

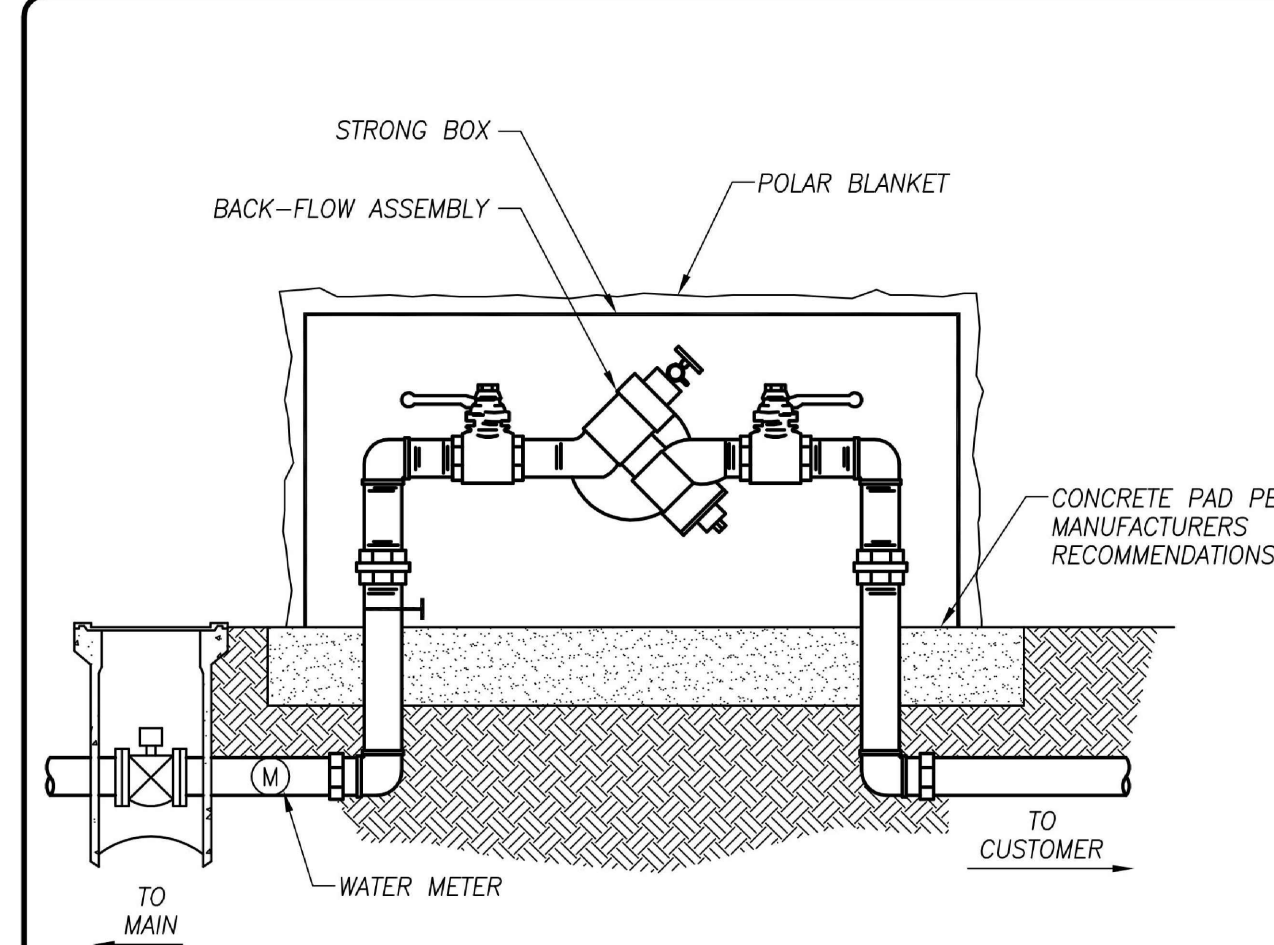
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CHECK BY: NBB	CITY ENGINEER - MICHAEL G. PITCOCK - RCE 52694	COUNCIL APPROVAL DEC, 2015
SCALE: NONE		



TYPICAL PLASTIC SERVICE FROM MAIN

TYPICAL TRACER WIRE INSTALLATION
CITY OF TURLOCK

DRAWN BY: JSH	APPROVED BY: 	DRAWING NO. W-11
CHECK BY: NBB	CITY ENGINEER - MICHAEL G. PITCOCK - RCE 52694	COUNCIL APPROVAL DEC, 2015
SCALE: NONE		



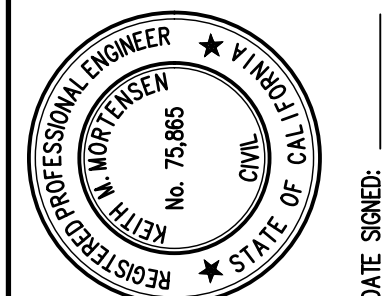
- NOTES:
1. FOR INSTALLATIONS LESS THAN 3"
 2. EQUIPMENT TO BE INSTALLED AT A MINIMUM OF 24" FROM ANY STRUCTURES OR HARDSCAPING.
 3. COVER BACKFLOW ASSEMBLY WITH POLAR BLANKET TO PREVENT FREEZE DAMAGE.
 4. ENCLOSE ENTIRE BACKFLOW DEVICE WITH STRONG BOX BC-45-CR OR APPROVED EQUAL WHEN UNIT IS NEXT TO A STRUCTURE (I.E. WALL, BUILDING, ETC.) MOUNT TEST COCKS ON OPEN OR NON STRUCTURE SIDE.
 5. ALL FITTINGS SHALL COMPLY WITH CALIFORNIA HEALTH AND SAFETY CODE, 116875 (NO LEAD BRASS)

BACKFLOW PREVENTER ASSEMBLY DETAIL
CITY OF TURLOCK

DRAWN BY: JSH	APPROVED BY: 	DRAWING NO. W-13
CHECK BY: NBB	CITY ENGINEER - MICHAEL G. PITCOCK - RCE 52694	COUNCIL APPROVAL DEC, 2015
SCALE: NONE		

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CITY WIDE CHLORINATION
CITY OF TURLOCK
CITY PROJECT NO. 2020-79
DETAILS
CITY STANDARD DETAILS

PROVOST & PRITCHARD
EST. 1968
CONSULTING GROUP
An Employee Owned Company
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FRESNO, CALIFORNIA 93711-6162
559/449-2700 FAX 559/449-2715
www.peng.com

DESIGN ENGINEER:
KEITH MORTENSEN
LICENSE NO:
75865

DRAFTED BY: JMN
CHECKED BY: RKB

DATE: NOV 2020
JOB NO: 229220006

PROJECT NO:
PHASE: CD

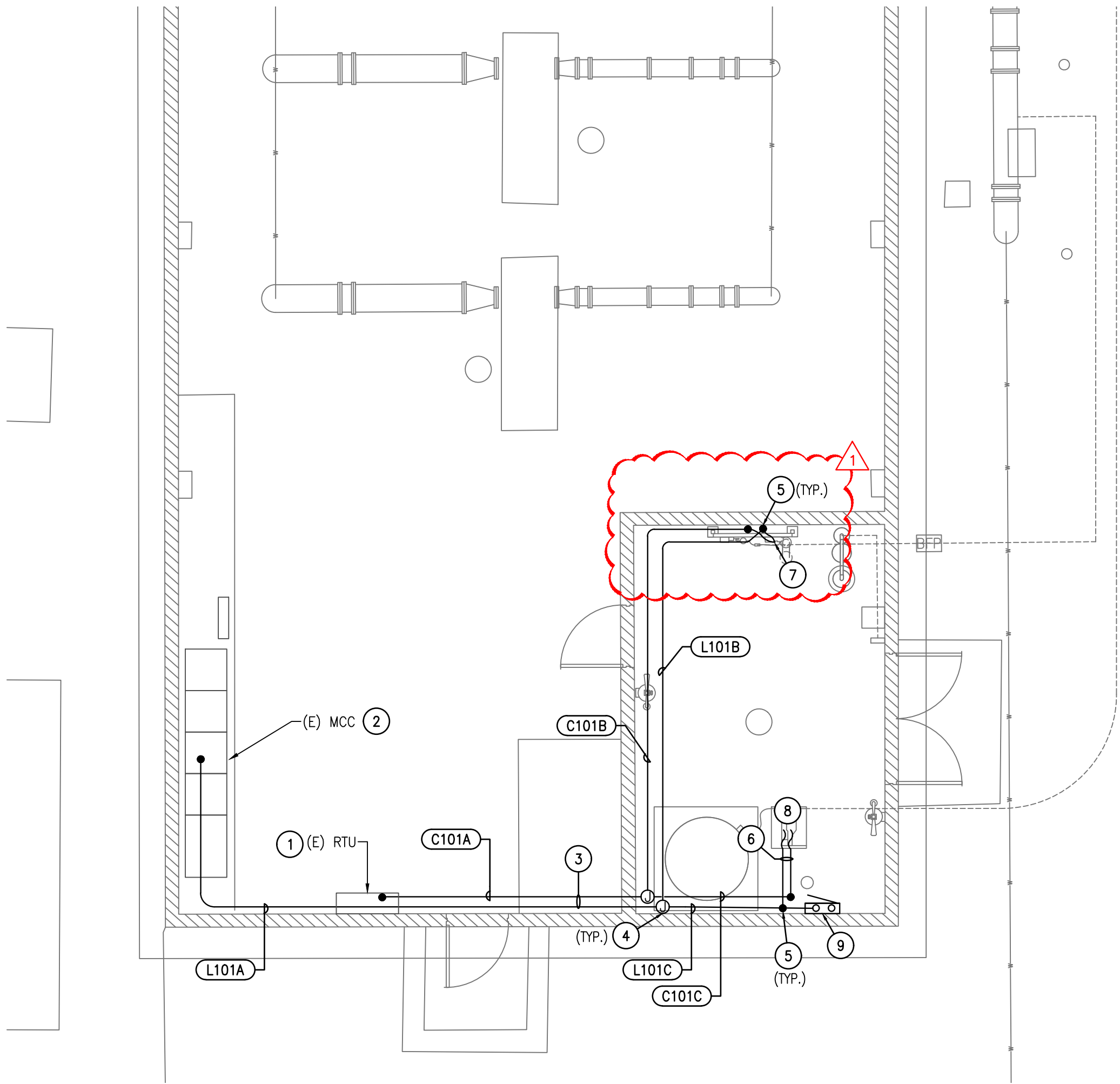
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SHEET **D-10**

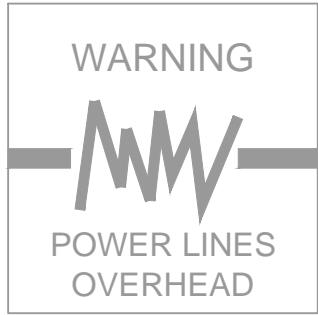
35 OF 57

CONDUIT & CABLE SCHEDULE -DST PUMP STATION										
CONDUIT ID#	FROM		TO		CONDUIT			CONDUCTOR		
					QNTY	SIZE	TYPE	QNTY	SIZE	GND
L 101 A	(E) 120V PANEL		(N) J-BOX		1	3/4"	RMC	2	#12	#12
L 101 B	(N) J-BOX		DT-AE/AIT-001		1	3/4"	CRMC	2	#12	#12
L 101 C	(N) J-BOX		CMP-001		1	3/4"	CRMC	2	#12	#12
C 101 A	(E) PLC		(N) J-BOX		1	1 1/2"	RMC	10	#14	#14
C 101 B	(N) J-BOX		DT-AE/AIT-001		1	1"	CRMC	1	2C/16AWG STP	
C 101 C	(N) J-BOX		CMP-001		1	1 1/4"	CRMC	10	#14	#14
								2	2C/16AWG STP	

NOTES:
[1] = PROVIDE CONDUCTOR/CABLES IN ALL CONDUITS
[2] = CONDUIT BELOW GRADE MAYBE PVC SCH40
[3] = ROUTE (N) CABLE/CONDUCTOR(S) THROUGH (E) RACEWAYS WHERE POSSIBLE
[4] = PROVIDE SS CONNECTORS & TYPE LFMC FLEX TO EQUIPMENT



1 PARTIAL SITE PLAN - DST TANK
SCALE: 1"=5'-0"



SYMBOL (#) PLAN NOTES:

- STUB (N) CONDUIT INTO (E) PLC ENCLOSURE & TERMINATE (N) I/O ONTO (E) PLC.
- STUB (N) CONDUIT INTO (E) 120V PANEL SECTION -CONNECT ONTO (E) SPARE 20A-1P BREAKER & LABEL AS "CL2 PUMP & ANALYZER".
- ROUTE CONDUITS HIGH ALONG EXTERIOR WALL AT (E) TRUSSES.
- INSTALL (N) NEMA-1 J-BOXES ABOVE FINISHED CLG WITHIN CHLORINATION ROOM -ALL CONDUIT EXTERIOR TO ROOM CAN BE RMC.
- PENETRATE (E) FINISHED CLG & SEAL TIGHT -ROUTE (NO CONDUITS ALONG CMU WALL.
- ROUTE ALONG EDGE OF CONTAINMENT PALLET TO DOSING PUMP -FASTEN TO FLOOR ON SS304 B-LINE B22 OR EQUAL STRUT W/HILT KB-TZ 3/8"X2"EMBED.
- CONNECT (N) ANALYZER DT-AE/AIT-001 -COORDINATE W/SHEET D-6.
- CONNECT (N) DOSING PUMP -COORDINATE W/SHEET D-4.
- (E) EF CONTROL PANEL TO REMAIN.

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CITY WIDE CHLORINATION
CITY OF TURLOCK
CITY PROJECT NO.2020-79
ELECTRICAL
PARTIAL SITE PLAN - DST TANK

EST. 1988
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CONSULTING GROUP
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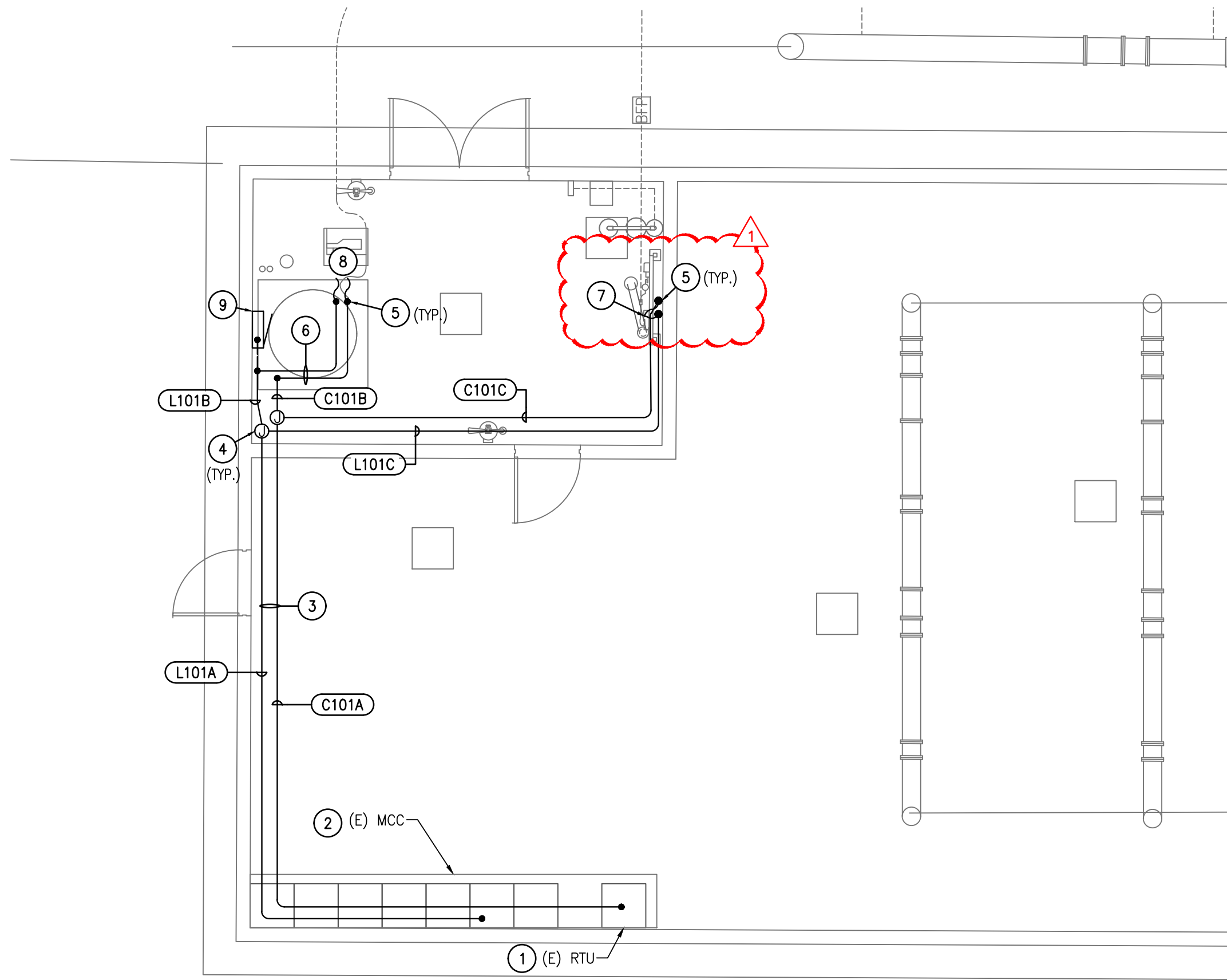
DESIGN ENGINEER:
KEVIN PEZZONI
LICENSE NO:
16269
DRAFTED BY:
CCM
CHECKED BY:
KP
DATE: OCTOBER 2020
JOB NO: 229220006
PROJECT NO: 20-501
PHASE: CD



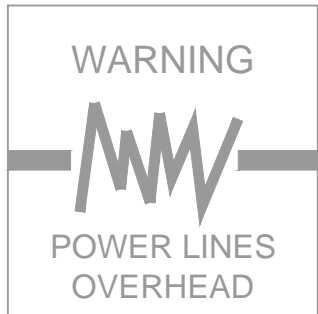
ORIGINAL SCALE SHOWN IS
ONE INCH. ADJUST SCALE FOR
REDUCED OR ENLARGED PLANS.
SHEET **E-1**
37 OF 57

CONDUIT & CABLE SCHEDULE - FULKERTH PUMP STATION										
CONDUIT ID#	FROM		TO	CONDUIT			CONDUCTOR			CABLE
				QNTY	SIZE	TYPE	QNTY	SIZE	GND	TYPE
L 201 A	(E) 120V PANEL	(N) J-BOX		1	3/4"	RMC	2	#12	#12	
L 201 B	(N) J-BOX	DT-AE/AIT-001		1	3/4"	CRMC	2	#12	#12	
L 201 C	(N) J-BOX	CMP-001		1	3/4"	CRMC	2	#12	#12	
C 201 A	(E) PLC	(N) J-BOX		1	1 1/2"	RMC	10	#14	#14	3 2C/16AWG STP
C 201 B	(N) J-BOX	DT-AE/AIT-001		1	1"	CRMC	1			2C/16AWG STP
C 201 C	(N) J-BOX	CMP-001		1	1 1/4"	CRMC	10	#14	#14	2 2C/16AWG STP

NOTES:
[1] = PROVIDE CONDUCTOR/CABLES IN ALL CONDUITS
[2] = CONDUIT BELOW GRADE MAYBE PVC SCH40
[3] = ROUTE (N) CABLE/CONDUCTOR(S) THROUGH (E) RACEWAYS WHERE POSSIBLE
[4] = PROVIDE SS CONNECTORS & TYPE LFMC FLEX TO EQUIPMENT



1 PARTIAL SITE PLAN - FULKERTH TANK
SCALE: 1"=10'-0"



SYMBOL ## PLAN NOTES:

- STUB (N) CONDUIT INTO (E) PLC ENCLOSURE & TERMINATE (N) I/O ONTO (E) PLC.
- STUB (N) CONDUIT INTO (E) 120V PANEL SECTION -CONNECT ONTO (E) SPARE 20A-1P BREAKER & LABEL AS "CL2 PUMP & ANALYZER".
- ROUTE CONDUITS HIGH ALONG EXTERIOR WALL AT (E) TRUSSES.
- INSTALL (N) NEMA-1 J-BOXES ABOVE FINISHED CLG WITHIN CHLORINATION ROOM -ALL CONDUIT EXTERIOR TO ROOM CAN BE RMC.
- PENETRATE (E) FINISHED CLG & SEAL TIGHT -ROUTE (NO CONDUITS ALONG CMU WALL.
- ROUTE ALONG EDGE OF CONTAINMENT PALLET TO DOSING PUMP -FASTEN TO FLOOR ON SS304 B-LINE B22 OR EQUAL STRUT W/HILTI KB-TZ 3/8"X2"EMBED.
- CONNECT (N) ANALYZER DT-AE/AIT-001 -COORDINATE W/SHEET D-6.
- CONNECT (N) DOSING PUMP -COORDINATE W/SHEET D-4.
- (E) EF CONTROL PANEL TO REMAIN.

CITY WIDE CHLORINATION
CITY OF TURLOCK
CITY PROJECT NO.2020-79

ELECTRICAL
PARTIAL SITE PLAN - FULKERTH TANK

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286 WEST GRIMMEL AVENUE
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www.ppeng.com

DESIGN ENGINEER:
KEVIN PEZZONI
LICENSE NO:
16269

DRAFTED BY: CCM
CHECKED BY: KP

DATE: OCTOBER 2020
JOB NO: 229220006

PROJECT NO: 20-501
PHASE: CD

0 1"
ORIGINAL SCALE SHOWN IS
ONE INCH. ADJUST SCALE FOR
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SHEET **E-2**

38 OF 57



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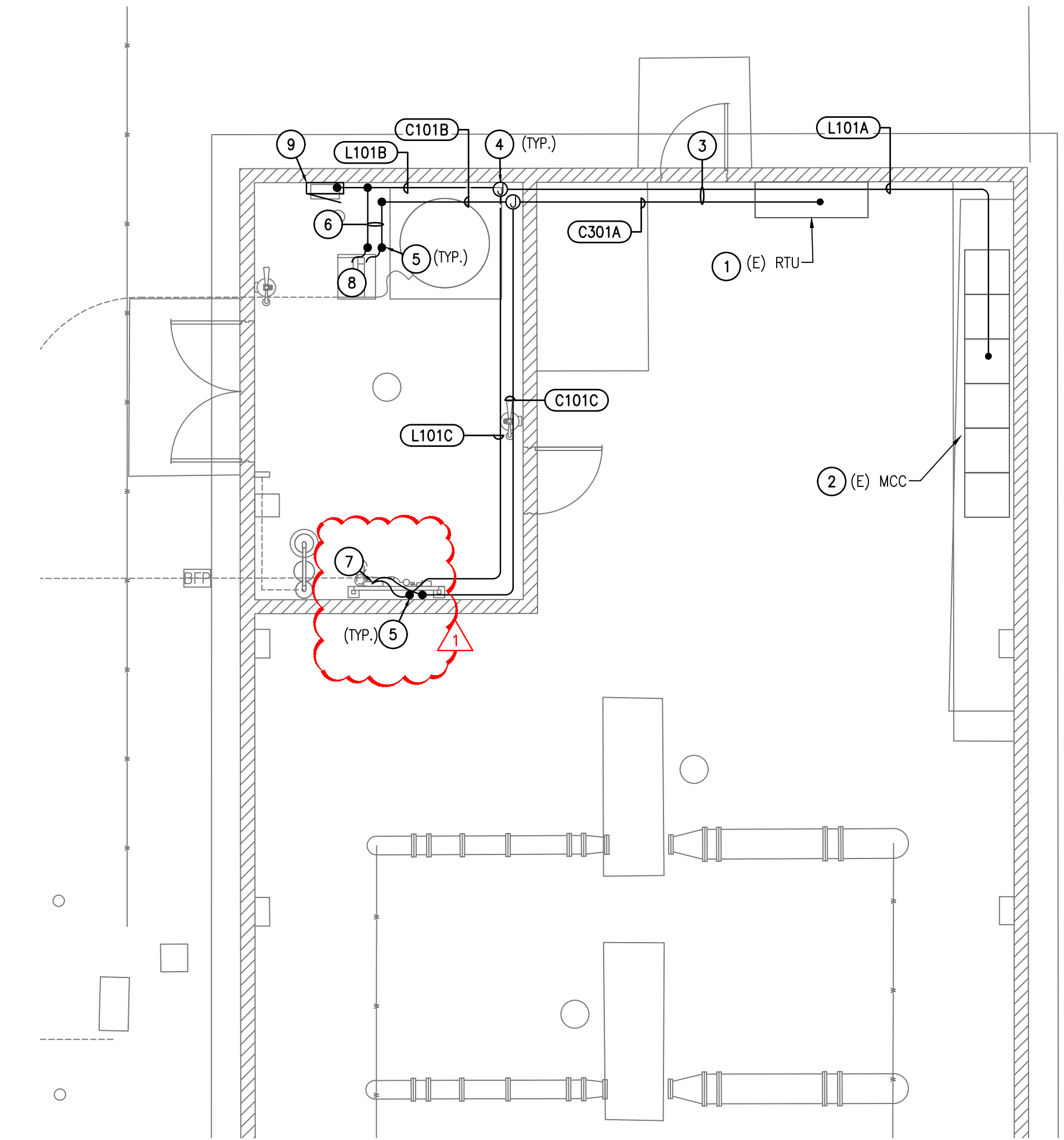


1	ADDENDUM #2	CM/KP	BY	DATE
				11/12/20

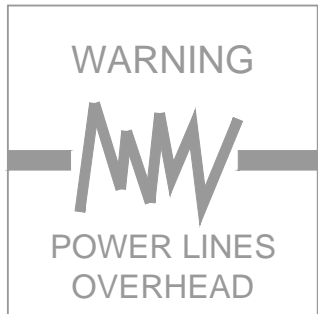
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CONDUIT & CABLE SCHEDULE –KILROY PUMP STATION										
CONDUIT ID#	FROM		TO	CONDUIT			CONDUCTOR			CABLE
				QNTY	SIZE	TYPE	QNTY	SIZE	GND	TYPE
L 301 A	(E)	120V PANEL	(N) J–BOX	1	3/4"	RMC	2	#12	#12	
L 301 B	(N)	J–BOX	DT–AE/AIT–001	1	3/4"	CRMC	2	#12	#12	
L 301 C	(N)	J–BOX	CMP–001	1	3/4"	CRMC	2	#12	#12	
C 301 A	(E)	PLC	(N) J–BOX	1	1 1/2"	RMC	10	#14	#14	3 2C/16AWG STP
C 101 B	(N)	J–BOX	DT–AE/AIT–001	1	1"	CRMC	1	2C/16AWG STP		
C 101 C	(N)	J–BOX	CMP–001	1	1 1/4"	CRMC	10	#14	#14	2 2C/16AWG STP

NOTES:
[1] = PROVIDE CONDUCTOR/CABLES IN ALL CONDUITS
[2] = CONDUIT BELOW GRADE MAYBE PVC SCH40
[3] = ROUTE (N) CABLE/CONDUCTOR(S) THROUGH (E) RACEWAYS WHERE POSSIBLE
[4] = PROVIDE SS CONNECTORS & TYPE LFMC FLEX TO EQUIPMENT



1 PARTIAL SITE PLAN – KILROY TANK
SCALE: 1"=10'-0"



SYMBOL ## PLAN NOTES:

1. STUB (N) CONDUIT INTO (E) PLC ENCLOSURE & TERMINATE (N) I/O ONTO (E) PLC.
2. STUB (N) CONDUIT INTO (E) 120V PANEL SECTION –CONNECT ONTO (E) SPARE 20A–1P BREAKER & LABEL AS “CL2 PUMP & ANALYZER”.
3. ROUTE CONDUITS HIGH ALONG EXTERIOR WALL AT (E) TRUSSES.
4. INSTALL (N) NEMA–1 J–BOXES ABOVE FINISHED CEILING WITHIN CHLORINATION ROOM –ALL CONDUIT EXTERIOR TO ROOM CAN BE RMC.
5. PENETRATE (E) FINISHED CEILING & SEAL TIGHT –ROUTE (NO CONDUITS ALONG CMU WALL.
6. ROUTE ALONG EDGE OF CONTAINMENT PALLET TO DOSING PUMP –FASTEN TO FLOOR ON SS304 B–LINE B22 OR EQUAL STRUT W/HILTI KB–TZ 3/8"X2"EMBED.
7. CONNECT (N) ANALYZER DT–AE/AIT–001 –COORDINATE W/SHEET D–6.
8. CONNECT (N) DOSING PUMP –COORDINATE W/SHEET D–4.
9. (E) EF CONTROL PANEL TO REMAIN.

CITY WIDE CHLORINATION
CITY OF TURLOCK
CITY PROJECT NO.2020–79
ELECTRICAL
PARTIAL SITE PLAN – KILROY TANK

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An Employee Owned Company
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www.ppeng.com

DESIGN ENGINEER:
KEVIN PEZZONI
LICENSE NO:
16269
DRAFTED BY:
CCM
CHECKED BY:
KP
DATE: OCTOBER 2020
JOB NO: 229220006
PROJECT NO: 20–501
PHASE: CD

0 1"
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ONE INCH. ADJUST SCALE FOR
REDUCED OR ENLARGED PLANS.
SHEET
E–3

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ENGINEERING, INC.
CONSULTING ELECTRICAL ENGINEERS
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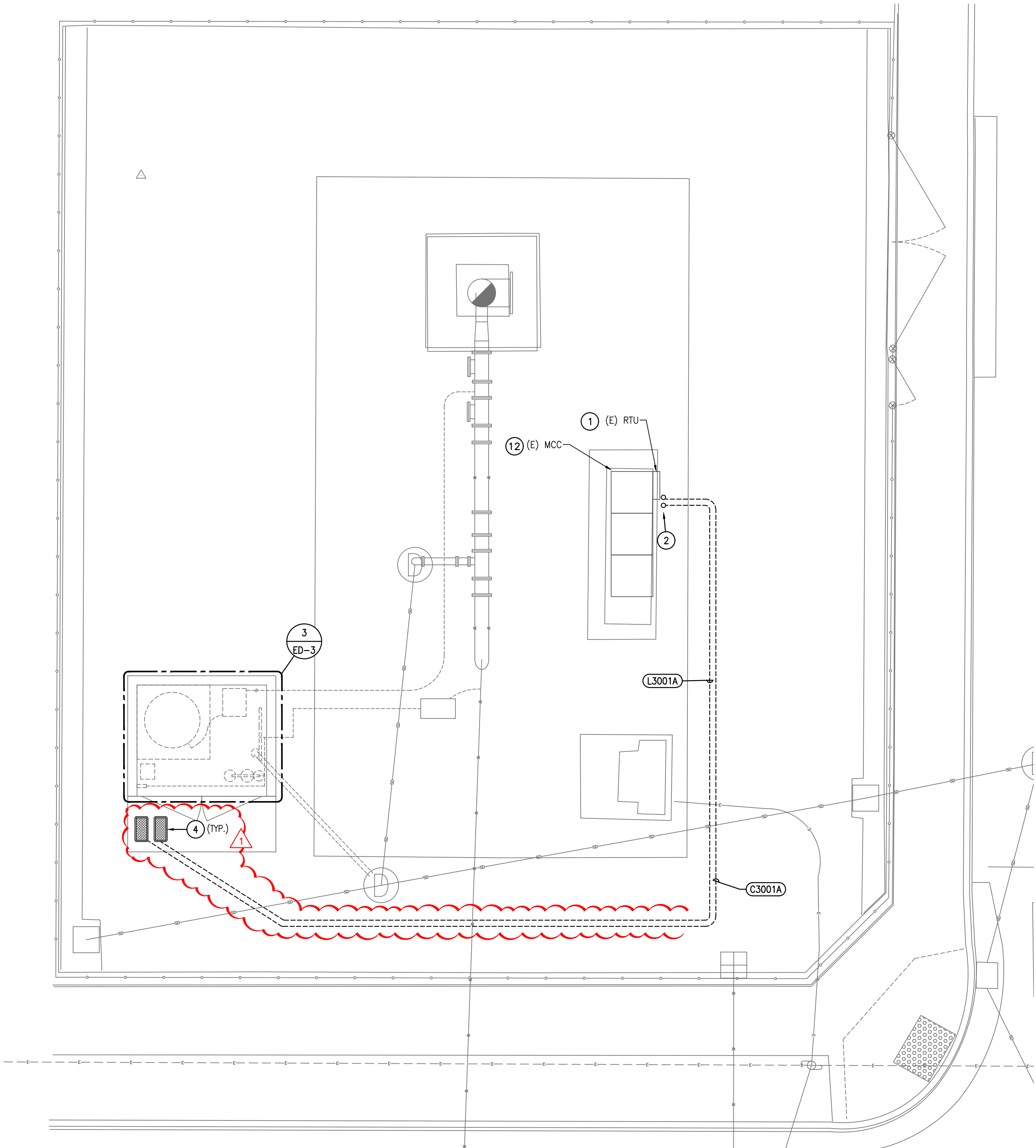
1	ADDENDUM #2	CM/KP	11/12/20	BY	DATE

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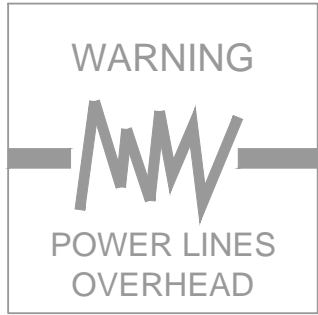
11/11/20 8:42:37 AM F:\20\501 CITY OF TURLOCK CHLORINATION AT VARIOUS SITES\ENGR\SHEETS\501_E-30 PLOT PLAN - WELL 30.DWG crenandez

CONDUIT & CABLE SCHEDULE --WELL #30									
CONDUIT ID#	FROM	TO	CONDUIT QNTY	SIZE	TYPE	CONDUCTOR QNTY	SIZE	GND	NOTES
L 3001 A	(E) PANEL	(N) PULLBOX	1	1 1/4"	RMC	4	#10	#10	[2]
C 3001 A	(E) PANEL	(N) PULLBOX	1	1 1/2"	RMC	10	#14	#14	[2]

NOTES:
[1] = PROVIDE CONDUCTOR/CABLES IN ALL CONDUITS
[2] = CONDUIT BELOW GRADE MAYBE PVC SCH40
[3] = ROUTE (N) CABLE/CONDUCTOR(S) THROUGH (E) RACEWAYS WHERE POSSIBLE
[4] = PROVIDE SS CONNECTORS & TYPE LFMC FLEX TO EQUIPMENT



1 PARTIAL SITE PLAN - WELL 30
SCALE: 1"=5'-0"



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SYMBOL ## PLAN NOTES:

• ALL NOTES SHOWN MAY NOT BE USED IN THE SHEET

- (N) RMC RISER INTO PLC CABINET.
- LB INTO MCC +8"AFG NEAR EDGE OF HOUSEKEEPING PAD.
- REPLACE (E) LOADCENTER W/SQUARE-D OR EQUAL LOADCENTER #006-12L100F/S W/(3) 20A-1P TANDOM BREAKERS -RECONNECT (E) 120V CIRCUITS & INSTALL (N) (2) 120V CIRCUITS -LABEL AS "RECP/LT -CL2 ENCLOSURE" & "CL2 PUMP & ANALYZER" -ADJUST MOUNTING OF (E) SECURITY PANEL TO ACCOMMODATE (N) LOADCENTER.
- (N) N16 PULLBOXES FOR POWER & SIGNAL -SEE DETAIL 2/ED-3.
- REPLACE (E) LOADCENTER W/SQUARE-D OR EQUAL LOADCENTER #006-12L100F/S W/(2) 20A-1P TANDOM BREAKERS -RECONNECT (E) 120V CIRCUITS & INSTALL (N) (2) 120V CIRCUITS- LABEL AS "RECP/LT -CL2 ENCLOSURE" & "CL2 PUMP & ANALYZER" .
- ROUTE (N) CONDUITS HIGH ALONG WALL.
- (N) RMC RISERS W/LBS ALONG WEST SIDE OF MANDOOR -ROUTE SURFACE MOUNTED ON CONCRETE TIGHT ALONG FENCE LINE TO (N) CL2 ENCLOSURE.
- (N) 12"X12"X4" NEMA-4X J-BOXES, +6" A.F.F.
- INSTALL (N) 2 20A-1P BREAKERS IN (E) PANEL & INSTALL (N) CIRCUITS AS SHOWN -LABEL (N) CIRCUITS AS "RECP/LT -CL2 ENCLOSURE" & "CL2 PUMP & ANALYZER".
- (N) RMC RISERS W/LBS.
- INSTALL (N) 20A-1P TANDOM BREAKER IN (E) PANEL & INSTALL (N) CIRCUITS AS SHOWN -LABEL (N) CIRCUITS AS "RECP/LT -CL2 ENCLOSURE" & "CL2 PUMP & ANALYZER".
- REPLACE (2) (E) 20A-1P BREAKERS W/(N) 20A-1P TANDOM BREAKERS -RECONNECT (E) CKTS & INSTALL (N) (2) 120V CIRCUITS -LABEL AS "RECP/LT -CL2 ENCLOSURE" & "CL2 PUMP & ANALYZER".
- CONNECT (N) 120V CIRCUITS ONTO (E) SPARE 20A-1P BREAKERS -LABEL AS "RECP/LT -CL2 ENCLOSURE" & "CL2 PUMP & ANALYZER".

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CITY WIDE CHLORINATION
CITY OF TURLOCK
CITY PROJECT NO.2020-79
ELECTRICAL
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PHASE: CD



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SHEET **E-30**

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