

June 15, 2017

**BOARD OF COUNTY COMMISSIONERS
ORANGE COUNTY, FLORIDA
ADDENDUM NO. 3 / IFB NO. Y17-763-PH**

**NORTHWEST WATER RECLAMATION FACILITY REUSE WATER STORAGE
IMPROVEMENTS**

REVISED BID OPENING DATE: June 29, 2017

This addendum is hereby incorporated into the bid documents of the project referenced above. The following items are clarifications, corrections, additions, deletions and/or revisions to and shall take precedence over the original documents. Additions are indicated by underlining, deletions are indicated by ~~strike through~~.

A. The revised Bid Opening is June 29, 2017 at 2:00 P.M.

B. Bidder Questions

Question 1. The Geotechnical Investigation did not provide the 100-year flood elevation for the tank. Please provide the 100-year flood elevation for the project site.

The 100 year flood elevation for the project site is EL.+78.5 feet NGVD 1929 Datum.

Question 2. What elevation do you want the floor of the tank designed for? Does the tank need to be designed for uplift due to groundwater? Drawing Sheet S01, Load Criteria 6, reads Groundwater Elevation...Grade Elevation. Please clarify the intent of the information provided.

The floor of the tank shall be designed for EL. +111.00 feet NGVD 1929 Datum per Drawing M02. Drawing Sheet S01 Structural Chemical Building and Recirculation Pump Pad General Notes does not apply to the ground storage tank. No, the ground storage tank does not need to be designed for uplift due to groundwater. During September 2016 a piezometer was installed on the hill at ground elevation of approximately EL.+124 and groundwater was encountered at 28.2 feet below the existing grade or approximately at EL.+96.

Question 3. The Geotechnical Investigation, page 7, Section 7.2.1 Bearing Pressure, provides a maximum allowable bearing pressure of 3,000 psf for the tank. Specification 13220-9, Section 2.08C, states “Maximum allowable bearing foundation bearing pressure shall be selected as a result of a review of available soils information and tests conducted by the TCC, but in no case shall be greater than 3200 psf”. Drawing Sheet S01, Soil and foundations, #4 provides a 2,500 psf bearing for footings on compacted natural or backfilled subgrade. Please confirm which bearing value is to be used for the design of the tank. Our analysis is the tank only requires 1,700 psf. Please have geotechnical engineer confirm reports and adjust accordingly.

Drawing S01 does not apply to the ground storage tank. The bid shall be based on a foundation design using a maximum allowable soil bearing pressure of 3,000 psf in accordance with the geotechnical investigation. If the tank only bears 1,700 psf on the soil then it is well within the allowable maximum soil bearing pressure of 3,000 psf.

Question 4. The Geotechnical Investigation, page 8, Section 7.2.3 Bearing Depth, requires the foundation should bear at a depth of at least 24 inches below the surrounding final grades to provide confinements to the bearing level soils. Drawing sheet C04, Soil and foundations, shows contours around the tank at elevations of 0' to 1'-0" sloping upwards away from the tank. Please confirm that a minimum of 24" is required for backfill above the tank as this is not typical for our tanks.

The tank bearing elevation is recommended to utilize the in-situ compaction at that elevation. If this cannot be achieved soils should be compacted to an equivalent compaction level as stated in the Geotechnical Investigation (and tested) with the compaction and testing to extend a distance at least 5 feet in all directions of the tank's foundation. This 5' compacted zone buffer area should not slope downward more than 2% from the tank. Areas outward of this should not slope at more than 2H:1V downward for an additional 20'.

Question 5. Specification 13320-4, Section 1.09 A3 requires the clear span dome roof shall include a 16" high parapet wall. Section 4g on page 5, and 2.11E, also mentions 16" high parapet wall. Drawing Sheet M05, Parapet Details, show a 1'-4" high parapet wall with side mounted perimeter handrail. Typically, We provide a 1'-0" high parapet wall which is sufficient for the diversion of water and top mounted perimeter handrail on the parapet. We prefer to use top mounted handrail as opposed to side mounted handrail to reduce costs and more importantly with this project, we need the top mounted handrail for clearance between the parapet and overflow to install either overflow security

device. Please delete all other references and replace with 1'-0" high x 6" wide parapet wall with top mounted handrail.

A 12-inch high by 6-inch wide parapet wall is acceptable. Top mounted handrail is acceptable. Refer to enclosed Specification Section 13320 and Sheet M05 revisions.

Question 6. Specification 13220-5, Section 2.01 A, Elevation of Top of Dome, Feet shall be 143.00. Section 2.11 C, page 10, requires a 1/12th rise dome. In order to provide a 1/12th rise dome, the top of dome elevation would be at 147.63±. Please confirm that a 1/12th rise is desired and that an overall top of dome height to elevation 147.63 is acceptable.

A standard 1/10th dome rise is acceptable. Refer to the enclosed Specification Section 13320 revisions.

Question 7. Specification 13220-6, section 2.01 D, mentions "Each entire tank" and Section 2.02 A1, last sentence mentions "each tank". Section 2.08A and B, mention "Each tank". Section 2.16 A13, mentions "tanks" in the last sentence. Section 3.12 A mentions "tanks". Section 1.01A, requires 1 tank. Please confirm that there is only one (1) tank required for this project.

There is only one (1) prestressed concrete ground storage tank required for this project. Refer to the enclosed Specification Section 13320 revisions.

Question 8. Specification 13220-9, section 2.07 G, requires the TCC to pay all costs associated with shotcrete material testing. Is the TCC also required to pay material testing costs for the floor and dome concrete? Please confirm as we have not been responsible for any material testing on any County projects.

Materials testing will be performed separately by the County. The TCC will not be required to pay for costs associated with the initial testing of shotcrete material, floor or dome concrete testing. The TCC will be responsible for paying all costs associated with re-testing due to failed initial tests or with re-work facilitated by the TCC's failure to meet the requirements of the Contract Documents. Refer to the enclosed Specification Section 13220 revisions.

Question 9. Specification 13320-9, section 2.08 D, requires all below grade piping that falls within the foot print of the tank foundation slab to be encased in reinforced concrete as shown on the drawings. Drawing sheet M02 does not provide any drawing details showing reinforced

concrete encasing the under slab piping. Please delete all mention of reinforced concrete encasement throughout as it is not required.

Reinforcement is not required in the concrete encasement for the under-slab piping. Refer to the enclosed Specification Section 13220 revisions.

Question 10. Specification 13320-10, Section 2.10 A, requires a 26-gauge full height steel tank shell shall complying with ASTM A366 (latest version) for Commercial Quality Cold Rolled Steel. Please update the specifications and replace the language with the following for all tank projects moving forward: “The galvanized steel diaphragm used in the construction of the core wall shall be 26- gauge with a minimum thickness of 0.017 in. conforming to the requirements of ASTM A653/A653M. Weight of zinc coating shall not be less than G 90 of Table 1 of ASTM A653/A653M.” This is an update to our standard tank construction that will enhance the finished product.

The suggested revision is acceptable. Refer to enclosed Specification Section 13320 revisions.

Question 11. Specification 13320-10, section 2.11 D, requires the tank dome overflows to be sized with an overflow area of at least three times the largest pipe. Drawing sheet M05 shows detailing of the parapet with callouts for the overflows to be #675 with a minimum of 6 required. Drawing sheet M02 shows 4 dome overflows. Please delete “4” and replace with “5”.

Drawing M02 and M05 are revised to show typical of 5 dome overflows.

Question 12. Specification 13320-12, Section 2.16 A6, requires the dome overflows to have fiberglass “eyelid” covers over the overflow openings. Drawing sheet M04, Detail 7, shows a stainless steel security cover device. Both of these devices cannot be used together and is not required. Please remove all devices as the rain water must enter the tank freely and there is no concern for security on tanks of this type. Please reference Sand Lake Road – Two 10-MG GST’s recently constructed to confirm.

Refer to enclosed Specification 13320-12 Part 2.16 A6 revision.

On Drawing Sheet M04, DELETE Detail 7 in its entirety.

Question 13. Specification 13320-12, Section 2.16 A13, requires a Fall Protection System with the basis of the system shall be perimeter cable

system mounted along the roof of the tank at the parapet wall. A double rail perimeter handrail is also required to be mounted to the parapet wall. Please delete all reference to the Fall Protection System as the handrail fulfills the safety issues.

The fall protection system is deleted. DELETE paragraph 13320-12 Part 2.16 A.13 in its entirety.

Question 14. Specification 03350-3, Section 3.02A, provides slab and floor finishes. Please delete Type “D” – Steel Troweled finish and that Type “E” is required as standard. Specification 13320-16, Section 3.11 B, states that the standard finish and colors shall be determined by the Owner. We provide a light broom finish on the tank floor, interior tank wall, dome and exterior tank wall. Prior to broom finish on exterior wall, the covercoat is trowel sliced.

Specification Section 03350 applies to more than just the ground storage tank. A light broom finish on the ground storage tank floor, interior wall, dome and exterior tank wall is acceptable. Trowel sliced covercoat prior to broom finish is acceptable on the exterior wall. Refer to the enclosed Specification Section 13320 revisions.

Question 15. Specification 07190-1, Section 2.01 I, requires the vapor barrier shall be 10 mil thick. Drawing Sheet S01, Slab on Grade #4, requires an 8 mil vapor barrier thickness. Please delete all other references and replace with “6 mil” vapor barrier is standard for all our Tanks.

Drawing Sheet 01 does not apply to the ground storage tank. A 6 mil vapor barrier is acceptable for the ground storage tank. Refer to the enclosed Specification Section 07190 revisions.

Question 16. Specification 09900-12, Section 2.01A, requires a three coat system of Thoroseal, Tneme-Cryl Series 6, and Tufcryl Series 29 for the exterior surfaces of the prestressed concrete tank. Please delete all references above as this is an old spec and not a recommended system. Orange County has changed to the following in accordance with our recent project on Sand Lake Road which included - two coats system of Tnemec Series 156 Modified Waterborne Acrylate on the tank wall, one coat of Tnemec series 151 and one coat of Tnemec series 158 on the dome for protection and beautification of the tank.

In Specification 09900-12 Part 3.03 G 1. REPLACE

<u>Application</u>	<u>No.</u>	<u>Description</u>	<u>DFT</u>
First—1 coat		Theroseal/Acryl 60*	
Second—1 coat		Tneme Cryl Series 6	2.0—3.0
Finish—1 coat		Tufcryl Series 29	1.5—2.0

**Spray Applied*

With

<u>Application</u>	<u>No.</u>	<u>Description</u>	<u>DFT</u>
<u>First 1 coat</u>	<u>111</u>	<u>Modified Waterborne Acrylate Series 156</u>	<u>4.0 – 8.0</u>
<u>Second 1 coat</u>	<u>111</u>	<u>Modified Waterborne Acrylate Series 156</u>	<u>4.0 – 8.0</u>
		<u>Min. Total</u>	<u>8 – 16 Mils</u>

Question 17. Specification 09900-13, Section 3.03 H1, requires the interior concrete surfaces of the prestressed concrete tank to be coated including bottom floor slab, walls, and underside of dome up to the overflow/vents. Please delete “bottom floor slab” as this is not coated. The interior coating system will include two coats of Tnemec Series N140 Pota-Pox, standard for Orange County tanks.

In Specification 09900-13 Part 3.03.H.1 DELETE the words “bottom floor slab” from the first sentence. Tnemec Series N140 Pota-Pox is acceptable as specified in 09900-13 Part 3.03 H.1.a.

Question 18. Specification 16450 provides information for grounding. Specification 16670-2 provides information for lightning protection. Drawing Sheet E-07 provides information regarding grounding and bonding to tank grounding grid, access ladder, and to the handrail. Also shown is lightning protection bare copper conductor around perimeter of dome connecting to air terminals. Bonding to any concrete encased tank steel is not recommended and shall not be allowed per the tank manufacturer. All bonding shall be done by using air terminals on the top of the tank dome with PVC conduit adhered to the exterior tank wall.

Please use a PVC or UV resistant sleeve if bare copper wire on the tank is used as the bare copper will “Black” streak the tank and will negatively

affect the appearance following the first rain event. We recommend using “Aluminum” cable if required as this doesn’t affect the appearance if left “bare”. Or please DELETE all lightning protection as it is not required or recommended on Prestressed Concrete Tanks. Please provide calculations that provide proof that the prestressed concrete tank require lightning protection for us to review.

Electrical grounding to the reinforcing of a prestressed concrete tank is prohibited by AWWA D110- 13 per Section 5.16. Items requiring grounding, such as lightning protection, are required to be a separate system with its own ground connections. Excerpts of the referenced sections are provided below.

- AWWA D110-13, Sec. 5.16 – Electrical grounding to non-prestressed reinforcing steel or prestressed reinforcement for any equipment or electrical service shall be strictly prohibited.
- AWWA D110-13 Sec. 5.17 – Lightning protection, if required, shall be a separate system with its own ground connections.

Lightning Protection is typical on all Orange County Ground Storage Tanks. Add down conductors are to be installed in 1” PVC sleeves to avoid “staining” on the exterior of the tank. All connections between the lightning protection system and the counterpoise are to be completed by the electrical subcontractor.

Question 19. Drawing Sheet M04, Detail 1, shows a 20" DIP drain for the vortex baffle. 20" pipe is not shown on any drawings, however, the 16" outlet is shown with a vortex baffle. Please confirm that the vortex baffle is for the 16" outlet pipe or the pipe is 20”.

The outlet pipe is 16-inches diameter. On Drawing M04, Detail 1, REPLACE the “20” with “16”.

Question 20. Drawing Sheet M04, Note 2, requires the tank manufacturer to provide brackets for the 12" stand pipe. Per Detail B, Sheet M02, the 12" Inlet pipe extends above the floor 12". Please confirm the height or elevation of the 12” pipe.

Brackets are not required for the 12” inlet pipe. Sheet M02, Detail B is correct, the inlet pipe extends 12-inches above the floor. On Sheet M04, DELETE Note 2 in its entirety.

Question 21. Please confirm that this project is not subject to “Buy American” requirements.

This project is not subject to "Buy American" requirements.

Question 22. Please confirm Davis-Bacon prevailing wages are not required.

Davis-Bacon prevailing wages are not required.

Question 23. Section 01510 requires the Contractor to bring project power from the furthest point on McCormick Rd. Will this require coordination from the power utility or is this an on-site connection? Additionally, can this line be installed on poles above grade or will it need to be buried and concrete encased?

Yes. Coordination with the power utility is required. Temporary construction power shall be in accordance with specification section 01510 and shall be coordinated with the plant staff. Installation of temporary power shall not impact plant operations or truck access. Concrete encasement is not required for temporary power.

Question 24. Section 01510 also requires night time security lighting. Can you also provide a boundary description of the night lighting required? Will we need to provide lighting for the entirety of pipe routes, haul roads, stockpiles, and work areas?

In Specification Section 01510 Part 1.01 F.7, DELETE the entire paragraph F7 and renumber paragraphs 8 and 9 to 7 and 8 accordingly.

Question 25. Will the Contractor be able to use site reclaimed water for all pressure and static testing? Will there be a charge for said use? If so, how much?

Yes, the Contractor will be able to use site reclaimed water for pressure and static testing. There will be no charge for reclaimed water used for testing. However, the reclaimed water will be metered to account for the water usage.

Question 26. Sheet E03 existing conduit removal. Please advise how many conduits are there which requires feeders and Fiber optic cable removal. Please provide the conduit sizes.

There is no fiber optic cable in this run. The conduit and wire consists of 3#10, 1#10Gnd-1" and 2#2/0, 1#6Gnd-2 as shown on sheet E-05.

Question 27. Please advise how many and what size conduits are required in the new duct bank. Single line diagram shows 1-2" and 1-1" with the feeders.(per note on sheet 03). Please furnish the quantity and size of the conduits and feeders to be rerouted in the new duct bank.

The conduit and wire consists of 3#10, 1#10Gnd-1" and 2#2/0, 1#6Gnd-2 as shown on sheet E-05.

Question 28. The project consisting of a New Reuse Water Storage tank has recently been brought to my attention. Engineering America is the Largest provider in Above Ground Factory Coated tanks. Our Standard Tank Systems include Stainless Steel, Glass-Fused-To-Steel and Epoxy coated. I see that you have a Concrete structure currently spec'd out for this project and would like the opportunity to bid our Glass-Fused-To-Steel option. This would give your client the option for the highest quality product in today's ground storage applications at a very aggressive price. I've attached our company brochure and below is all my contact information. Please feel free to contact me with any questions or direction to proceed. I'd like the opportunity to show you why Engineering America is Nationally recognized throughout the US as the preferred tank vender.

For this project the ground storage tank shall be prestressed concrete construction as specified in Specification Section 13320 Prestressed Concrete Tanks. Alternative tank types are not acceptable.

Questions 29 through 31 are in reference to Specification Section 11107 Horizontal Non-Clog Pumps:

Question 29. We request that Section 1.02 "Minimum Suction Diameter (in.)" allow an 8 (in.) to accommodate the 8MF13C pump selected for this project. Selection information included.

An 8-inch suction is acceptable. Refer to enclosed Specification Section 11107 Horizontal Non-Clog Pumps revisions. If an 8-inch suction is used, the 10-inch single arch rubber expansion joint attached to the pump suction flange must be changed to a 10"x8" concentric reducing rubber expansion joint.

Question 30. We request that Section 1.02 "Minimum Discharge Diameter (in.)" allow an 8 (in.) to accommodate the 8MF13C pump selected for this project. Selection information included.

An 8-inch discharge is acceptable. Refer to enclosed Specification Section

11107 Horizontal Non-Clog Pumps revisions. If an 8-inch pump discharge is used, the 10-inch single arch rubber expansion joint attached to the pump discharge flange must be changed to a 10"x8" concentric reducing rubber expansion joint.

Question 31. We requests that Section 2.02, I., remove acceptable materials and require 316SS Shaft sleeve in lieu of the hardened sleeve. This request is based on the principle that, "Hardened sleeves can lead to difficulty with the mechanical seal set screw biting into the sleeve and can result in relative rotation and sliding"

Type 316 stainless steel shaft sleeves are acceptable. Refer to the enclosed revisions to Specification Section 11107.

Question 32. The following questions pertain to Specification Section 11103 "Magnetic Drive Centrifugal Pumps":

We request review and confirmation of the attached selection for approval. We request that Section 2.02, A & B, Include Ductile Iron casings lined with Ethylene-Tetrafluoroethylene, as well as impeller that are Carbon Fiber reinforced Ethylene-Tetrafluoroethylene. We request acceptance for 2.03, A, "Horsepower" to allow a 2.0 HP motor. We request confirmation on 2.03, B, Controls to be provided by others.

No. Substitute equipment may be considered after execution of the contract in accordance with Part C-Instructions to Bidders, Paragraph 7.

Question 33. Please confirm the existing Chlorine Control Panel on drawing I-03 has sufficient I/O for the replacement chemical metering skid. Please confirm programming modifications will not be required for the Chlorine Control Panel.

See revised drawings E-09 and I-04. Contractor to include programming modifications;

The existing system includes the following signals for each pump:

- *Run Command*
- *Speed Control*
- *Speed Feedback*

The new system includes the following signals for each pump:

- *Run Command*
- *Speed Control*

- *Speed Feedback*
- *Pump Fail*

Question 34. Sheet E10 Effluent valve station building location is not clear on site plan. Please advise how far is 80- MCC-2 from effluent valve station. Please furnish the location of LCP-4-RIO.

The effluent valve is located on the north side of the chlorine contact chamber. 80-MCC-2 is located in the existing Air compressor building. LCP-4-RIO is located in the air compressor building. See revised drawing E-02.

Question 35. Addendum 1 piping schedule call for “Thd” joints on SS Sample pipe. Section 15013 requires “SW”. Please confirm joint type.

The Type 316 stainless steel sample line shall be socket welded above grade in accordance with Section 15013. Refer to Specification Section 15390 Schedules revisions.

Question 36. Will the newly installed section of the 30” effluent line require flushing?

In this case it is not practical to flush the new 30” effluent line in advance of pressure testing and making final connections. The Contractor shall take measures to keep the new segment of 30” effluent piping as clean as possible during installation. Refer to enclosed revisions to Specification Section 15995 Pipeline Testing and Disinfection.

Question 37. Once tied in, will the entire 30” effluent line require flushing?

Yes. The Contractor will need to coordinate the tie-in and flushing activities with the County RPR. Once the new segment of 30” effluent pipe has been tied in, the County will operate the effluent pumping system in a manner that diverts the effluent flow to RIB sites 14 and 15 for flushing. Depending on how many effluent pumps the County decides to operate the time for flushing out the new and existing effluent piping all the way to RIBs 14 and 15 will be approximately 30 to 60 minutes. The Contractor will be responsible for cleaning out flushing debris from the RIB sites to restore the RIB sites to pre-flushing condition. Pre and post flush photographs of the RIBs will be used to determine the extent of cleaning required following flushing. Refer to enclosed Specification Section 15995 Pipeline Testing and Disinfection revisions.

Question 38. Will MJ fittings be allowed on all buried piping? MJ fittings are on Orange County's approved materials list. RJ fittings will require additional lead time as all pipe must be pre-measured and field verification completed prior to order. 30" DIP can have a 90 lead time. The 300 day schedule will not allow for this delay.

MJ fittings are acceptable on buried piping. Refer to the enclosed Specification Sections 15000, 15006 and 15390 Schedules revisions.

Question 39. Please verify pipe type for existing 30" effluent line.

The existing 30-inch effluent pipe is ductile iron pipe.

Question 40. Detail 4 on sheet M09 appears to be for a flanged coupling. Are mega-flanges required for this below-grade connection?

No. Mega-flanges are not required for this below grade connection. MJ solid sleeves or EBAA Iron Mega-Coupling Series 3800 are acceptable for making the final effluent piping connections. Refer to the enclosed Specification Section 15000 revisions. Refer to the revised Sheets C03 and M09 Detail 4.

Question 41. Series 1100 Tandem Mega-Lugs will add considerable cost to the project. 1100 Series Single Gland Mega Lugs will meet pipe/fitting design pressures and are on Orange County's approved product list. Will Tandem Mega Lugs be required?

No, tandem Mega-Lugs will not be required. Refer to the enclosed Specification Sections 15000 and 15006 revisions.

Question 42. Will MJ Solid Sleeves be allowed for final effluent line connections in lieu of Harnessed Flexible Couplings?

Yes. MJ solid sleeves or EBAA Iron Mega-Coupling Series 3800 are acceptable for making final effluent line connections. Refer to the enclosed Specification Section 15000, Sheets C03 and M09, Detail 4 revisions.

Question 43. Section 15006 calls for Class 51 30" pipe, addendum 1 references PC300. Please confirm Class requirement.

The 30-inch pipe shall be Pressure Class 250. Refer to Specification Section 15006 and 15390 revisions.

Question 44. In Spec Section O 1590 list calls out for all the items to be included in the RPR Field Office, is everything on that list necessary?

Yes.

Question 45. Drawing Co 4, Note 2 tells us to prepare existing soil, cement road and overlay in accordance with Spec. Section 02513, are you asking us to remove and replace the soil cement base, sub base and then pave per detail 9 on drawing Co. 7?

No. Make minor repairs to existing soil cement road as necessary to provide suitable base prior to overlaying with asphaltic cement pavement.

Question 46. Spec Section 01516-J calls for a temporary 6 chain link fence with visual fabric barrier to be installed completely around the construction site, will this be necessary for the project?

No. DELETE Specification Section 01510 Part J. in its entirety. Renumber letter K. to letter J. accordingly. Refer to the enclosed specification revisions.

Question 47. Will we be required to purchase reused water if we use it for construction or water sod? If so how much is reused water?

No. The County will not charge for reuse water. The County will meter the reuse water to account for usage.

Question 48. In Appendix A – Geotechnical Reports – one report talks about a Ground Penetrating Radar (GRR) Survey was conducted in section 2. The GRR Report is mentioned again in section 6.3, but not until section 7.2, does it talk about excavation and backfill of 20 to 22 feet based on the GPR Report and the anomaly that was discovered. Can you please give us the limits of this anticipated excavation and backfill? Would this excavation be 20-22 feet deep from existing ground level or from the tank dirt grade of 110.67?

Subsequent to the issuance of the Geotechnical report, the ground storage tank was shifted further north such that the tank foundation will be approximately 10 feet outside the north corner of the GPR anomaly area at the closest point. The anomaly area is likely to be encountered by the Contractor along the outside half of the 20 feet wide tank construction work zone for a length of approximately 30 feet. The Contractor should compact this area in the work zone to a minimum of 95% of the modified proctor dry density value prior to installing pre-stressing wires (wrapping the tank). - This area should be monitored during construction. Compaction efforts that

appear to exceed the norm, soil subsidence, or any other abnormalities should be reported to the engineer of record immediately. Refer to Drawing C04 revisions which show the area of the GPR anomaly.

Question 49. Will the County accept Unitron Controls (a division of Barney's Pumps) as an alternate supplier for control panels?

No, Contractor to bid per 13300, Part 1, 1.01, D.

Question 50. According to Part 1.01.F, it is the responsibility of the Contractor to ensure the System supplier coordinates with suppliers of specialty equipment. This suggests components of the electrical system could be supplied separately.

The System Supplier is responsible for coordinating with all equipment as defined in the contract documents. Electrical contractor shall be responsible for supplying the electrical equipment defined in Division 16.

Question 51. It is our desire to offer to supply the Recirculation Pump Control Panel (RPCP), as specified in Spec Section 13315.

The System Supplier shall furnish the control panel as defined in Division 13.

Question 52. The general section for the pumps refers to them coming with a pressure gauge with a diaphragm seal. The section then directs you to division 17 (17650 and 17698) for the specs on those gauges, however, those sections don't exist in the specs. There is only (1) gauge shown and it is located on the inlet to the Chlorine Booster Pump. The only detail for a pressure gauge in the drawings shows it as a side mounted gauge, and call for 316SS construction which is not consistent with the location or service for this gauge. Please provide clarification on the pressure gauge?

Drawing M06 calls for a side mounted pressure gauge to be located on the discharge side of each recirculation pump upstream from the check valve. The pressure gauges for both the recirculation pump station and chlorine booster pump are specified in Section 13650 Pressure Gauges. Refer to revised Section 11100 Pumps General.

Question 53. As per Appendix A, the Geotechnical Report, Part 7.2 & 8.1, the tank subbase is to be excavated to "20-22 feet below grade" and "extending 5 feet outward" of the tank foundation area. Since the tank will

be installed on a hill, i.e. the existing elevation difference from the East side of the tank to the West side of the tank is nearly 20 feet, we will need clarification as to where the 20-22 foot below "grade" is measured from. Therefore, providing a bottom of excavation "elevation" would add clarification the depth of the excavation. This important due to the possible undermining impacts of the existing 2.0 MG and surrounding buildings when proper sloping techniques are used.

Refer to the replies to Questions Nos. 2 and 48 and the following: The nominal elevation of the ground storage tank top of floor is EL. +111.00. The excavation depth may be based on an elevation of approximately +110.67± depending on the ground storage tank foundation design. The 20-22 feet below grade is in reference to the existing top of the hill elevations and potential worse case excavation depths. The excavation will need to include the approximately 20 feet wide working area around the ground storage tank perimeter to facilitate construction of the tank. It will be the responsibility of the Contractor to use proper sloping techniques and/or temporary shoring to facilitate tank construction.

Question 54. Pertaining to our first question and the 01025, 1.03, A.2, the payment description for the 20,000 CY Hauling and Placement of Excess Soil Material, please confirm the following; 1.) confirm the material cut from the hill (i.e. the GST finish floor elevation) and trucked to the onsite location is included in this allowance, 2.) confirm the material cut for tank subbase (i.e. the 20-22 foot depth and extending 5 feet outward of the tank) and trucked to the onsite location is included in this allowance, 3.) confirm the imported compacted in place fill material for the tank subbase (i.e. the 20-22 foot depth and extending 5 feet outward of the tank) is to be included in the base bid.

The volume of excess excavated material (20,000 CY) that is to be hauled to the on-site location is an estimate of the difference between the pre-construction grades and the final post construction grades shown on the drawings. 1) The material cut from the hill that remains as excess material following final grading is included in the allowance. 2) The material cut for the tank subbase to approximate EL. 110.67 that remains as excess material following final grading is included in this allowance. 3) The need to import structural fill material from off-site is not anticipated because there should not be any over-excavation of in-situ soils below approximate EL. +110.67 except for the purpose of constructing buried piping and electrical conduits/ductbanks. In-situ soils should be compacted as specified to form the tank subbase. The County's RPR and project Engineer should be notified if the specified compaction of in-situ soils cannot be achieved at approximate EL. +110.67.

Question 55. Pertaining to our first question and Appendix A of the Geotechnical Report, Part 2.2 & 6.3 - Ground Penetrating radar (GPR), please provide the GPR Survey?

The limits of the GPR anomaly are provided in revised Drawing Sheet C04. Also refer to the reply to Question No. 48. The GPR survey is provided with this addendum for informational purposes.

Question 56. C01 shows existing Turtle Caves. Please confirm this project does not require any relocation of monitoring services for the turtles?

Gopher tortoise relocation will not be the responsibility of the Contractor. The County will have the gopher tortoises relocated by others prior to construction.

C. PART H SPECIFICATIONS

1. Section 01510 Temporary Utilities

DELETE paragraph 1.01 F.7 in its entirety and renumber paragraphs 8 and 9 to 7 and 8 accordingly.

~~7. The CONTRACTOR shall provide a separate temporary night lighting circuit for construction security. This system shall be energized at the end of each normal working day and de-energized at the start of each normal working day by the CONTRACTOR. The system is to be left energized over Saturdays, Sundays, and all holidays. Lighting intensities shall be not less than 2 foot candles.~~

78. Electrical welders provided by each trade used in the erection and fabrication of the buildings, structures and equipment shall be provided with an independent grounding cable connected directly to the structure on which the weld is being made rather than adjacent conduit piping, etc.

Electricians and other tradesmen necessary for the required connections and operation of welding equipment and generator, standby generators and similar equipment shall be furnished by the individual CONTRACTORS. All costs for such labor and equipment shall be borne by the individual CONTRACTORS.

89. Upon completion of the work, but prior to acceptance by the OWNER, the CONTRACTOR shall remove all temporary services, security lighting systems, temporary general lighting systems and all

temporary electrical work from the premises.

2. Section 07190 Vapor Barrier

In paragraph 2.01 A. ADD "**Except for the ground storage tank,**" to the beginning of the sentence.

ADD paragraph 2.01 D. in its entirety. "**D. The vapor barrier for the ground storage tank foundation shall be 6 mil thick polyethylene sheet meeting the requirements of ASTM E 1745 Class A.**"

3. Section 09900 Painting

In paragraph 2.01 A. Table 09900-1 Product Listing, ADD a row to the table and ADD coating system Ref. No. 130 as follows:

<u>130</u>	<u>Polyamidoamine Epoxy</u>	<u>N140 Pota-Pox Plus</u>	<u>Carboguard 891</u>	<u>Tank Clad Epoxy</u>
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In paragraph 3.03 G. REPLACE:

<u>Application</u>	<u>No.</u>	<u>Description</u>	<u>DFT</u>
First — 1 coat ---		Thoroseal/Acryl 60*	----
Second — 1 coat		Tneme-Cryl Series 6	2.0 - 3.0
Finish — 1 coat --		Tufcryl Series 29	1.5 - 2.0

with:

<u>First - 1 coat</u>	<u>111</u>	<u>Modified Waterborne Acrylate Series 156</u>	<u>4.0 - 8.0</u>
<u>Second - 1 coat</u>	<u>111</u>	<u>Modified Waterborne Acrylate Series 156</u>	<u>4.0 - 8.0</u>
		<u>Min. Total</u>	<u>8 - 16 Mils</u>

4. Section 11100 Pumps General

In paragraph 2.03 A. 1. DELETE the entire paragraph 1 and renumber paragraphs 2 through 4 to 1 through 3 accordingly. ~~1. The CONTRACTOR shall furnish and install pressure gauges on the can of each pump using a factory drilled connection. Bosses shall be provided where appropriate to stabilize the pressure gauge. The pressure gauge shall not be installed on the same tap as the air release valve.~~

In renumbered paragraph 2.03 A. 1, REPLACE the words “vertical turbine” with the words “**horizontal non-clog**”.

In renumbered paragraph 2.03.A.2, REPLACE “17650” with “**13650**”.

In renumbered paragraph 2.03.A.3, REPLACE “17698 Instrumentation and Control System Accessories” with “**13650 Pressure Gauges**”.

5. **Section 11107 Horizontal Non-Clog Pumps**

In paragraph 1.02, in the Operating Conditions and Performance Requirements table, in the row for Minimum Suction Diameter (in.), REPLACE 40 with “**8**”.

In paragraph 1.02, in the Operating Conditions and Performance Requirements table, in the row for Minimum Discharge Diameter (in.), REPLACE 40 with “**8**”.

In paragraph 2.02.I. REPLACE ~~420 series stainless steel hardened to 450 Brinell or better or corrosion resistant bronze,~~ with “**Type 316 stainless steel**”

6. **Section 13320 Prestressed Concrete Tanks**

In paragraph 2.01 D. REPLACE ~~Each~~ with “**The**”.

In paragraph 2.02 A.1. REPLACE each with “**the**”.

In paragraph 2.07 G. REPLACE ~~acceptable to the Engineer~~ with “**provided by the OWNER**”.

In paragraph 2.08 A. and B. REPLACE ~~Each~~ with “**The**”.

In paragraph 2.08 C. REPLACE ~~3200~~ with **3000** psf.

In paragraph 2.08 D. DELETE ~~reinforced~~.

In paragraph 2.10 A. REPLACE ~~A 26-gauge full height steel tank shell shall, complying with ASTM A 366 (latest revision) for Commercial Quality Cold-Rolled Steel~~ with “**The galvanized steel diaphragm used in the construction of the core wall shall be 26-gauge with a minimum thickness of 0.017 in. conforming to the requirements of ASTM A653/A653M. Weight of zinc coating shall not be less than G 90 of Table 1 of ASTM A653/A653M. The galvanized steel diaphragm**”

In paragraph 2.16 A.6, REPLACE four with “**five**” and DELETE complete with fiber glass “eyelid” covers and polyester, removable insect screens.

In paragraph 2.16 A.13, in the last sentence REPLACE tanks with “**tank**”.

In paragraph 3.12 A. in the last sentence REPLACE tanks with “**tank**”.

ADD paragraph **3.13 Concrete Surface Finishes** in its entirety.

3.13 CONCRETE SURFACE FINISHES

A. Concrete surfaces shall be finished as follows:

- 1. Tank floor, interior wall, and dome shall have a light broom finish.**
- 2. Tank exterior wall covercoat shall be trowel sliced with a light broom finish.**

ADD paragraph **3.14 MATERIAL TESTING** in its entirety.

3.14 MATERIAL TESTING

A. Prepare and test the number of cylinder sets shown in the following schedule using ASTM C 39.

	At 7 Days	At 28 Days	Hold	Total Sets
Concrete Floor (per quarter area)	1	2	1	4
Shotcrete (per quarter area)				
Inside Core Wall	1	2	1	4
Outside Core Wall	2	2	2	6
Dome	1	2	1	4
Exterior Covercoat	1	2	1	4
Concrete Wall (per quarter area)				
Each pour of wall	1	2	1	4
Dome	1	2	1	4
Exterior (Overcoat)	1	2	1	4

The OWNER will pay for the initial sets of tests as described in the table above. The TCC shall pay for all re-tests above and beyond the tests shown in the table above due to failed test results or re-work facilitated by the TCC's failure to meet the requirements of the Contract Documents.

RENUMBER paragraph 3.13-WARRANTY to 3.15 WARRANTY.

7. Section 15000 General Mechanical

In paragraph 2.06 A. in the first sentence, REPLACE “shall” with “**may**”

In paragraph 2.06 A. DELETE the second sentence in its entirety. “~~Use of megaflange joints shall be limited to High Service Pump suction piping only in locations shown on the Drawings.~~”

In paragraph 2.06 E. DELETE the entire paragraph in its entirety. “~~E. The megaflange joint shall have a minimum safety factor of 2:1 and renumber letter F. to E.~~”

In renumbered paragraph 2.06 E. replace the number “2” with the number “1” such that it reads “**E**F. The megaflange joint shall be EBAA Iron, Inc. Series **2**1100.”

INSERT paragraph 2.11 in its entirety as follows:

2.11 MEGA-COUPLINGS

A. Joint Restraint to prevent axial separation shall be incorporated into the design of the sleeve or coupling used to connect two plain pipe ends. The restraint mechanism shall consist of a plurality of individually actuated gripping surfaces to maximize restraint capability. Torque limiting twist off nuts shall be used to insure proper actuating of the restraint devices. The restraint devices shall be coated using a corrosion resistant coating system intended for buried use, such as EBBA Iron MEGABOND™. Ductile Iron components shall be of a minimum of 65- 45-12 ductile iron meeting the requirements of ASTM A536 of the latest revision and shall be tested in accordance with the stated standard. The restrained joining system shall meet the applicable requirements of AWWA C219, ANSI/AWWA C111/A21.11, and ASTM D2000. The restrained joining system shall be the EBAA Iron Series 3800.

8. Section 15006 Ductile Iron Pipe

In paragraph 2.01 B.1. for Buried Pipe Size 14” – 54”, REPLACE “54” with “**Pressure Class 250**”

In paragraph 2.02 D.1. INSERT the words “**and fittings**” following the words “Restrained joint pipe” and before the words “shall be Flex-Ring ...”

In 2.02 D. ADD paragraphs 2. And 3. in their entirety as follows:

2. Mechanical Joints: Mechanical pipe joints shall conform to the requirements of ANSI A21.11/AWWA C111. Joints shall be made employing a tapered rubber gasket forced into a tapered groove with a ductile iron follower ring. If required by installation conditions, pipe and fittings shall have cast on lugs for adequately tying the pipe and fittings together. These shall be in conformance with standard practice and as outlined under the appropriate AWWA Specifications. Bolts for mechanical joints shall be high strength corrosion resistant low-alloy steel tee-head bolts with hexagonal nuts.
3. Mechanical joint valves shall be restrained by manufacturer MJ coupled glands where installed in new pipe. New pipe being connected to existing mechanical joints and pipe being connected to fittings for which restrained joints named in paragraph 1 above are not available, shall be restrained by MJ coupled glands or follower ring and wedge type MJ restraints.

In 2.02 D. RENUMBER paragraph 2. to paragraph 4 and REPLACE “Restrained Mechanical Joint Fittings” with “Follower Ring and Wedge Type Mechanical Joint Restraints”. Also, REPLACE:

~~“All mechanical joint fittings, valves and appurtenances shall be restrained as described herein. The restraint rings shall be manufactured of ductile iron conforming to ASTM A536 and incorporate a plurality of individually-actuating gripping surfaces to grip the pipe. The restraint device shall be coated in MEGA BOND® Restraint Coating System. The restraint system shall consist of two series 1100 MEGALUGS® mechanical joint restraint follower glands with the second follower gland having the mechanical joint lip removed at the factory to seat properly behind the first. The restraint system shall have a sufficient number of fastening bolts to connect the rings to the mechanical joint. The restraint system shall have a minimum safety factor of 2 to 1. The restraint system shall be the Series 1100TDM Tandem MEGALUG Mechanical Joint Restraint manufactured by EBAA Iron, Inc., or approved equal.”~~

with:

“Follower ring and wedge type mechanical joint restraints may be used in lieu of MJ coupled gland AWWA C111 mechanical joints unless specified otherwise such as with mechanical joint valves. The restraining mechanism shall consist of a follower gland having a seal gasket and individually actuated wedges that increase their resistance to pullout as pressure or external forces increase. The system manufacturer shall provide all the components (follower ring, wedges, and gaskets) for the restraining device. The device shall be capable of

full mechanical joint deflection during assembly, and the flexibility of the joint shall be maintained after burial. The joint restraint ring and its wedging components shall be constructed of ductile iron conforming to ASTM A536, Grade 60-42-10. The wedges shall be ductile iron, heat-treated to a minimum hardness of 370 BHN. Dimensions of the gland shall be such that it can be used with mechanical joint bells conforming to AWWA C111 and AWWA C153. The design shall use torque limiting twist-off nuts to provide actuation of the restraining wedges. The mechanical joint restraint shall be available in the size range of 3 through 48 inches. Minimum rated pressure shall be 350 psi for sizes 16 inches and smaller and 250 psi in sizes 18 inches and larger. Products: Megalug Series 1100 as manufactured by EBAA Iron, Inc., Stargrip by Star Pipe Systems, ONE LOK by Sigma, or Grip Ring by Romac.”

In 2.02 E.1. REPLACE “Fittings shall be manufactured in accordance with AWWA C110 or AWWA C153 or the manufacturer’s standard. Fittings shall be either AWWA C110 unless AWWA C153 as identified in the Piping Schedule in Specification Section 15390 entitled “Schedules” with “Flanged fittings shall be manufactured in accordance with ANSI A21.10/AWWA C110. Mechanical and restrained joint fittings shall be manufactured in accordance with ANSI A21.10/AWWA C110 or ANSI A21.53/AWWA C153.”

In 2.02 E. 6. REPLACE “Unless otherwise indicated on the Drawings or specified herein, all below ground fittings 30 inches in diameter and greater shall be provided with manufacturer proprietary restrained joints” with “Manufacturer proprietary restrained joint fittings may be used for below ground ductile iron pipe sizes 14 to 36 inches. Field Flex-Ring joint pipe ends and gaskets may be used to connect to manufacturer proprietary restrained joints where field cuts are necessary to make adjustments.

In 2.02 E. 7. REPLACE “Underground ductile iron fittings 24 inches in diameter and less shall be restrained mechanical joint fittings” with “Mechanical joint fittings using MJ coupled glands conforming to ANSI A21.11/AWWA C111 or follower ring and wedge type mechanical joint restraints may be used for all below grade piping”.

9. Section 15106 Ball Valves

In paragraph 2.01 C. ADD “4. Spears Manufacturing”.

10. Section 15390 Schedules

In paragraph 1.02 B. in the table, for Pipe Size 30-in and greater under the column “Class/Design”, REPLACE “300” with “250”.

In paragraph 1.03 D. REPLACE “Grv” with “**Weld**” and “Grooved Coupling” with “**Socket Welded**”

In paragraph 1.04 Piping Schedule, under the column “Type of Joints”, and in the row “Sample Lines Above Ground” REPLACE ~~Thd~~ with “**Weld**”

In paragraph 1.04 Piping Schedule, under the column “Type of Joints”, and in the row “RW Piping Below Ground” and “Nominal Pipe Diameter 4 inch to 24 inch” ADD “**MJ or**” before “RJ”.

In paragraph 1.04 Piping Schedule, under the column “Type of Joints”, and in the row “RW Piping Below Ground” and “Nominal Pipe Diameter Greater than 24 inch” ADD “**MJ or**” before “RJ”.

11. Section 15995 Pipeline Testing and Disinfection

In paragraph 3.02 B. after the first sentence ADD “**It will not be practical to flush the new segment of 30-inch effluent pipeline prior to pressure testing, disinfection and making final connections. The CONTRACTOR shall take other measures to minimize the amount of sand and other debris that enter the pipe during installation, pressure testing, disinfection and tie-ins.**”

In Section 3.02 ADD the entire paragraph “**E. Following successful pressure testing and disinfection, the CONTRACTOR shall be responsible for coordinating tie-ins of the new segment of 30-inch effluent piping with the COUNTY’s RPR. Once the new segment of 30-inch effluent pipeline has been tied-in and the COUNTY has deemed that the pipeline is ready to be placed back into service, the COUNTY will operate the effluent pumping system to divert effluent flow to RIBs 14 and 15 to facilitate flushing of the pipeline. It is anticipated that the flushing will take approximately 30 to 60 minutes to get the water from the new segment of 30-inch pipe into RIBs 14 and 15. The CONTRACTOR shall be responsible for cleaning out undesirable sand and other debris that are deposited into RIBs 14 and 15 during flushing. Within 24 hours of flushing and in the presence of the COUNTY RPR, the CONTRACTOR shall observe and photograph the pre-flushing condition of RIBs 14 and 15. The photographs will be used to compare pre and post flushing conditions to determine the extent of cleaning the CONTRACTOR needs to do in the RIBs. The intent is for the CONTRACTOR to minimize the amount of sand and other debris that enters the new segment of 30-inch effluent pipeline during installation, pressure testing, disinfection and tie-in activities such that there will be minimal cleaning required in the RIBs following flushing.**”

In Paragraph 3.03 A. in the first sentence INSERT “**reuse and potable**” between the words “new” and “water mains”.

In Paragraph 3.03 D. in the first sentence INSERT “**reuse and potable**” following the words “Disinfection of” and before the words “water mains shall be considered ...installation.”

D. DRAWINGS

1. Drawing No. C03

REPLACE Drawing C03 with revised Drawing C03. Pipeline tie-in connections are revised from harnessed flexible couplings to mega-couplings or MJ solid sleeves.

2. Drawing No. C04

REPLACE Drawing C04 with revised Drawing C04. Approximate location of the ground penetrating radar (GPR) anomaly is added.

3. Drawing No. M02

REPLACE Drawing M02 with revised Drawing M02. The number and locations of storage tank concrete overflows are revised.

4. Drawing No. M04

REPLACE Drawing M04 with revised Drawing M04. Note 2 is deleted. Detail 4 is revised. Detail 7 is deleted.

5. Drawing No. M05

REPLACE Drawing M05 with revised Drawing M05. The height of the parapet wall is revised from 1'-4" to 1'-0" in three places. The elevation of the top of the parapet wall is revised from EL. +138.08 to EL. +137.75 in three places. The handrail is relocated from side mounted to top mounted on the parapet wall in two places.

6. Drawing No. M06

REPLACE Drawing M06 with revised Drawing M06. The pump suction and discharge pipe fittings and valves, Item No. 4 is revised to include 10"x8" reducing single arch expansion joints for 8" pump size.

7. Drawing No. M09

REPLACE Drawing M09 with revised Drawing M09. Detail 4 is revised to show a Mega-Coupling in lieu of a harnessed flexible coupling.

8. Drawing No. I-03

REPLACE Drawing I-03 with revised Drawing I-03. The number of control signals from pump skid control panel to the CCP are revised from 8 to 4 per pump.

9. Drawing No. E-02

REPLACE Drawing E-02 with revised Drawing E-02. The locations of the effluent valve and Air Compressor Building which houses 80 MCC-2 and LCP-4-RIO are identified.

10. Drawing No. E-09

REPLACE Drawing E-09 with revised Drawing E-09. Wiring from pump skid control panel to CCP is revised from ~~64~~#14 to 16#14.

E. ACKNOWLEDGEMENT OF ADDENDA

- a. The Proposer shall acknowledge receipt of this addendum by completing the applicable section in the solicitation or by completion of the acknowledgement information on the addendum. Either form of acknowledgement must be completed and returned not later than the date and time for receipt of proposal.
All other terms, conditions and specifications remain the same.

Receipt acknowledged by:

Authorized Signature

Date Signed

Title

Name of Firm

SECTION 01510

TEMPORARY UTILITIES

PART 1 -- GENERAL

1.01 THE REQUIREMENT

- A. The CONTRACTOR shall provide temporary telephone, light and power, heating and air conditioning, potable water service and sanitary facilities for their operations and for the construction operations of the other subcontractors of this Project at the site. The temporary services shall be provided for use throughout the construction period.
- B. The CONTRACTOR shall coordinate and install all temporary services in accordance with the requirements of the utility companies having jurisdiction and as required by applicable codes and regulations.
- C. At the completion of the work, or when the temporary services are no longer required, the facilities shall be restored to their original conditions.
- D. All costs in connection with the temporary services including, but not limited to, installation, utility company service charges, maintenance, relocation and removal shall be borne by the CONTRACTOR at no additional cost to the OWNER. The CONTRACTOR shall plan to bring temporary power into the NWRf site from the furthest point along McCormick Road and shall include all costs for doing so in the bid price.
- E. Some temporary facilities that may be required may be indicated on the Drawings; however, the Drawings do not necessarily show any or all of the temporary facilities that the CONTRACTOR ultimately uses to complete the work.
- F. Temporary Light and Power
 - 1. The temporary general lighting and small power requirements shall be serviced by 120/240 V, 1 phase, 3 wire temporary systems furnished and installed by the CONTRACTOR. This service shall be furnished complete with step down transformer, main disconnect, overcurrent protection, branch circuit breakers, and wiring as required; including branch circuit breakers and wiring as required for furnishing temporary power to the various connections required by the CONTRACTOR, all in accordance with the requirements of the servicing power company and applicable standards and codes. Connection to the plant emergency power system is prohibited. OWNER shall not be responsible for CONTRACTOR loss of power in the event of a power interruption caused by the power company or any other event which may cause an interruption in service to the temporary light and power system. Any CONTRACTOR with a need for power other than the 120/240 V, 1 phase, 3 wire shall provide such power at their own expense.
 - 2. The CONTRACTOR shall make all necessary arrangements, and pay for all permits, inspections, and other charges for all temporary service installations. All temporary systems shall comply with and meet the approval of the ENGINEER, OWNER and the local authorities having jurisdiction. All temporary electrical

systems shall consist of wiring, switches, necessary insulated supports, poles, fixtures, sockets, receptacles, lamps, guards, cutouts, and fuses as required to complete such installations. The CONTRACTOR shall furnish lamps and fuses for all temporary systems furnished by him and shall replace broken and burned out lamps, blown fuses, damaged wiring and as required to maintain these systems in adequate and safe operating condition. All such temporary light and power system shall be installed without interfering with the work of the other CONTRACTORS.

When it is necessary during the progress of construction that a temporary electrical facility installed under this Division interferes with construction operations, the CONTRACTOR shall relocate the temporary electrical facilities to maintain temporary power as required at no additional cost to the OWNER. The CONTRACTOR shall be responsible at all times for any damage or injury to equipment, materials, or personnel caused by improperly protected or installed temporary installations and equipment.

3. The various CONTRACTORS doing the work at the site shall be permitted to connect into the temporary general lighting system small hand tools, such as drills, hammers, and grinders, provided that:
 - a. Equipment and tools are suitable for 120 V, single phase, 60 Hz operation and operating input does not exceed 1,500 volt-amperes.
 - b. Tools are connected to outlets of the system with only one (1) unit connected to a single outlet.
 - c. In case of overloading of circuits, the CONTRACTOR will restrict use of equipment and tools as required for correct loading.
4. The CONTRACTOR shall keep the temporary general lighting systems energized 15 minutes before the time that the earliest trade starts in the morning and de-energized 15 minutes after the time the latest trade stops. This applies to all weekdays, Monday through Friday, inclusive, which are established as regular working days.

Any CONTRACTOR requiring temporary light and power before or after the hours set forth hereinbefore, or on a Saturday, Sunday, or holiday, shall pay for the additional cost of keeping the system energized and repaired. If more than one CONTRACTOR is involved, the charges shall be prorated, such amounts to be determined from the meter readings or other acceptable means previously agreed upon by the CONTRACTORS involved. If it is necessary for any CONTRACTOR or his employees to be in any structure after regular working hours and the temporary general lighting system is not required for illumination, that CONTRACTOR shall provide such illumination required by means of flashlights, electric lanterns, or other devices not requiring use of electricity from the temporary general lighting system.

5. Each CONTRACTOR requiring additional power and lighting other than that specified herein (including power for temporary heating equipment to be provided by the CONTRACTOR) shall furnish his own service complete with all fuses, cutouts, wiring and other material and equipment necessary for a complete system

between the service point and the additional power consumers and shall install his own metering equipment in accordance with the requirements of the servicing power company.

6. The temporary general lighting system shall be installed progressively in structures as the various areas are enclosed or as lighting becomes necessary because of partial enclosure. Lighting intensities shall be not less than 10 foot candles.
- ~~7. The CONTRACTOR shall provide a separate temporary night lighting circuit for construction security. This system shall be energized at the end of each normal working day and de-energized at the start of each normal working day by the CONTRACTOR. The system is to be left energized over Saturdays, Sundays, and all holidays. Lighting intensities shall be not less than 2 foot candles.~~
78. Electrical welders provided by each trade used in the erection and fabrication of the buildings, structures and equipment shall be provided with an independent grounding cable connected directly to the structure on which the weld is being made rather than adjacent conduit piping, etc.

Electricians and other tradesmen necessary for the required connections and operation of welding equipment and generator, standby generators and similar equipment shall be furnished by the individual CONTRACTORS. All costs for such labor and equipment shall be borne by the individual CONTRACTORS.

89. Upon completion of the work, but prior to acceptance by the OWNER, the CONTRACTOR shall remove all temporary services, security lighting systems, temporary general lighting systems and all temporary electrical work from the premises.

G. Temporary Heating and Air Conditioning

1. The CONTRACTOR shall provide temporary heating, air conditioning, ventilation coverings and enclosures necessary to properly protect all work and materials against damage by dampness, heat and/or cold, to dry out the work and to facilitate work in all structures.
2. The equipment, fuel, materials, operating personnel and methods used shall be at all times satisfactory and adequate to maintain critical installation temperatures and ventilation for all work in those areas where the same is required.
3. After any structure is enclosed, the minimum temperature to be maintained is 50 degrees Fahrenheit, unless otherwise specified, where work is actually being performed.
4. Before and during the application of interior finishing, painting, etc., the CONTRACTOR shall provide sufficient heat to maintain a temperature of not less than 65 degrees Fahrenheit or greater than 85 degrees Fahrenheit.
5. Any work damaged by dampness or insufficient or abnormal heating shall be replaced by the CONTRACTOR at no additional cost to the Owner.

H. Temporary Sanitary Service

1. Sanitary conveniences, in sufficient numbers, for the use of all persons employed on the work and properly screened from public observation, shall be provided and maintained at suitable locations by the CONTRACTOR, all as prescribed by State Labor Regulations and local ordinances. The contents of same shall be removed and disposed of in a manner consistent with local and state regulations, as the occasion requires. Each CONTRACTOR shall rigorously prohibit the committing of nuisances within, on, or about the work. Sanitary facilities shall be removed from the site when no longer required.

I. Temporary Water

1. The CONTRACTOR shall provide temporary potable water service for construction purposes, sanitary facilities, fire protection, field offices and for cleaning. The CONTRACTOR shall make all arrangements for connections to the potable water at the plant site.
2. The CONTRACTOR shall pay all charges associated with the potable water connection. The CONTRACTOR shall pay all charges for potable water used under this Contract.
3. Each CONTRACTOR shall supply potable water for his employees either by portable containers or drinking fountains.
4. An adequate number of hose bibbs, hoses, and watertight barrels shall be provided for the distribution of water.
5. Water service shall be extended by the CONTRACTOR and relocated as necessary to meet temporary water requirements.

J. Fencing

1. Unless directed otherwise in other sections of the Contract Documents, provide a 6-foot high fence completely around Construction site; provided with hinged vehicular and pedestrian gates with locks. Fencing will be galvanized, 2-inch mesh, chain link with solid top rail. Provide line posts and end posts as needed to maintain stretched and uniform fencing with no sags.
2. Fencing plan will be approved by the COUNTY for each phase of the project. Submit fencing layout diagram prior to the Pre-Construction meeting.
3. Provide visual fabric barrier at least 6-foot high on all fencing separating parking areas from Construction activities. Submit barrier fabric for approval before starting fencing. Barrier fabric will be capable of retaining physical integrity and color during the entire Construction period.

K. Confined Spaces

1. The CONTRACTOR shall provide and maintain a safe working environment in confined spaces. The CONTRACTOR shall follow the applicable requirements of

the OSHA Standards for Construction and NIOSH Publications for working in confined spaces.

1.02 REMOVAL OF TEMPORARY UTILITIES, FACILITIES, AND CONTROLS

- A. Remove all temporary utilities, equipment, facilities, and materials prior to submitting Final Application for Payment.
- B. Remove temporary underground installations to minimum depth of 2-feet and re-grade site.
- C. Clean and repair damage caused by installation or use of temporary Work.
- D. Restore any existing facilities used during Construction to original condition, unless otherwise directed in other sections of Contract Documents. Restore existing landscaping, drainage, paving, etc. to an "as-was" condition, unless otherwise directed in other sections of Contract Documents.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

- END OF SECTION -

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SECTION 07190

VAPOR BARRIER

PART 1 -- GENERAL

1.01 THE REQUIREMENT

- A. The CONTRACTOR shall furnish labor, material and equipment required for the installation of vapor barrier under all reinforced concrete placed against soil as specified herein and shown on the Drawings.
- B. Principal items of work include: Vapor barrier below slabs on grade.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Cast-in-Place Concrete

1.03 SUBMITTALS

- A. In accordance with the procedures and requirements set forth in the Section entitled "Submittals", submit the following:
 - 1. Manufacturer's data and installation instructions.

PART 2 -- PRODUCTS

2.01 VAPOR BARRIER

- A. **Except for the ground storage tank,** vapor barrier shall be 10 mil thick polyethylene sheet meeting the requirements of ASTM E 1745 Class A.
 - 1. Minimum tensile strength ASTM E154: 52 lbs/in.
 - 2. Puncture resistance ASTM D1709, Method B: 2600 g.
 - 3. Maximum permeance ASTM E96: 0.036 U.S. perms.
- B. Vapor barrier shall be Vaporblock 10 by Raven Industries, Perminator 10 mil by W.R. Meadows, Florprufe 120 by Grace Construction Products, or approved equal.
- C. Adhesive/Tape: Type approved by the Manufacturer of the vapor material.
- D. **The vapor barrier for the ground storage tank foundation shall be 6 mil thick polyethylene sheet meeting the requirements of ASTM E 1745 Class A.**

PART 3 -- EXECUTION

3.01 INSTALLATION

- A. Place vapor barrier under all slabs on grade; lap edges 12 inches and seal with adhesive tape. Lay with seams perpendicular to and lapped in the direction of placement. Do not penetrate vapor barrier.
- B. Protect from damage until concrete is placed. Punctures and tears in vapor barrier shall be repaired using patches of the material which overlaps puncture or tear a minimum of 12 inches; seal with tape or adhesive.

C. Fill under vapor barrier shall be compacted, clean and free of debris and protrusions.

- END OF SECTION -

SECTION 09900

PAINTING

PART 1 -- GENERAL

1.01 THE REQUIREMENT

- A. The CONTRACTOR shall furnish all labor, tools, materials, supervision and equipment necessary to do all the work specified herein and as required for a complete installation, including surface preparation, priming and painting of CONTRACTOR furnished equipment, materials, and structures.

1.02 GENERAL INFORMATION AND DESCRIPTION

- A. The term "paint," as used herein, includes emulsions, enamels, paints, stains, varnishes, sealers, cement filler, cement-latex filler and other coatings, whether used as prime, intermediate, or finish coats.
- B. All paint for concrete and metal surfaces shall be especially adapted for use around wastewater treatment plants and shall be applied in conformance with the manufacturer's published specifications.
- C. All paint for final coats shall be fume resistant, compounded with pigments suitable for exposure to sewage gases, especially to hydrogen sulfide and to carbon dioxide. Pigments shall be materials which do not tend to darken, discolor, or fade due to the action of sewage gases. If a paint manufacturer proposes use of paint which is not designated "fume resistant" in its literature, it shall furnish full information concerning the pigments used in this paint.
- D. Coatings used in conjunction with potable or public access reuse water supply systems shall have U.S. Environmental Protection Agency (EPA) and FDA approval for use with potable water and shall not impart a taste or odor to the water.
- E. All building, facilities, structures, and appurtenances, as indicated on the Drawings and as specified herein, shall be painted with not less than one shop coat and two field coats, or one prime coat and two finish coats of the appropriate paint. Items to be painted include, but are not limited to, exterior and interior concrete, structural steel, miscellaneous metals, steel and aluminum doors and frames, concrete block, ductwork, sluice gates, operators, pipe fittings, valves, mechanical equipment, motors, conduit, and all other work which is obviously required to be painted unless otherwise specified.
- F. Baked-on enamel finishes and items with standard shop finishes such as graphic panels, electrical equipment, toilet partitions, lockers, instrumentation, etc., shall not be field painted unless the finish is damaged during shipment or installation. Aluminum, stainless steel, fiberglass and bronze work shall not be painted unless color coding and marking is required or otherwise specified. A list of surfaces not to be coated is included in Article 1.09 of this Section.

- G. The CONTRACTOR shall obtain all permits, licenses and inspections and shall comply with all laws, codes, ordinances, rules and regulations promulgated by authorities having jurisdiction which may bear on the work. This compliance will include Federal Public Law 91-596 more commonly known as the "Occupational Safety and Health Act of 1970".

1.03 MANUFACTURERS

- A. All painting materials shall be as manufactured by Tnemec, Carboline or Sherwin Williams.

1.04 SUBMITTALS

- A. The CONTRACTOR shall submit paint manufacturer's data sheets, application instructions, and samples of each finish and color to the ENGINEER for review, before any work is started in accordance with Section 01300 entitled, "Submittals."
- B. Submitted samples of each finish and color shall be prepared in a step-down format so that the area of each sample indicates the appearance of the various coats. For example, where a three-coat system is specified, the sample shall be divided into three areas indicating one coat only, two coats and all three coats. The ENGINEER will provide written authorization constituting a standard, as to color and finish only, for each coating system.
- C. The CONTRACTOR shall prepare a complete schedule of surfaces to be coated and shall identify the surface preparation and paint system he proposes to use. The Paint Schedule shall be in conformance with Article 3.03 of this Section. The schedule shall contain the name of the paint manufacturer, and the name, address and telephone number of the manufacturer's representative that will inspect the Work. The schedule shall be submitted to the ENGINEER for review as soon as possible following the Notice to Proceed so that the schedule may be used to identify colors and to specify shop painting systems on order for fabricated equipment.
- D. Name and detailed qualifications of the protective coating applicator or subcontractor. Qualifications shall include, but not be limited to, five (5) references which show that the painting applicator or subcontractor has previous successful experience with the specified or comparable coating systems, a list of installations that are currently in service and documentation that applicator or subcontractor is currently a qualified applicator of the proposed coatings by the manufacturer.
- E. The CONTRACTOR shall submit daily painting reports. Painting reports shall be as provided by the COUNTY.

1.05 SERVICES OF MANUFACTURER'S REPRESENTATIVE

- A. The CONTRACTOR shall purchase paint from an acceptable manufacturer. The manufacturer shall assign a representative to inspect the application of his product both in the shop and field. The CONTRACTOR, through the manufacturer's representative, shall submit his report to the ENGINEER at the completion of his Work identifying the products used and verifying that said products were properly applied and that the paint systems were proper for the exposure and service.

- B. Services shall also include, but not be limited to, inspecting prior coatings of paint, determination of best means of surface preparation, inspection of complete work, and re-inspection of painted work to be performed six months after the job is completed.
- C. The coating manufacturer shall provide training for the applicator prior to the application of any coatings.

1.06 MANUFACTURER'S INSTRUCTIONS

- A. The manufacturer's published instructions for use as a guide in specifying and applying the manufacturers proposed paint shall be submitted to the ENGINEER. Paint shall not be delivered to the job before acceptance of the manufacturer's instructions is given by the ENGINEER.
- B. A manufacturer's paint will not be considered for use unless that manufacturer's published instructions meets the following requirements:
 - 1. The instructions must have been written and published by the manufacturer for the purpose and with the intent of giving complete instruction for the use and application of the proposed paint in the locality and for the conditions for which the paint is specified or shown to be applied under this Contract.
 - 2. All limitations, precautions, and requirements that may adversely affect the paint; that may cause unsatisfactory results after the painting application; or that may cause the paint not to serve the purpose for which it was intended; that is, to protect the covered material from corrosion, shall be clearly and completely stated in the instructions. These limitations and requirements shall, if they exist, include, but not be limited to the following:
 - a. Methods of application
 - b. Number of coats
 - c. Thickness of each coat
 - d. Total thickness
 - e. Drying time of each coat, including primer
 - f. Primer required to be used
 - g. Primers not permitted
 - h. Use of a primer
 - i. Thinner and use of thinner
 - j. Temperature and relative humidity limitations during application and after application
 - k. Time allowed between coats
 - l. Protection from sun

- m. Physical properties of paint including solids content and ingredient analysis
 - n. Surface preparation
 - o. Touch up requirements and limitations
- C. Concrete surfaces specified by the paint manufacturer to be acid etched shall be etched in accordance with the manufacturer's instructions. The surface shall then be thoroughly scrubbed with clean water, rinsed, and allowed to dry. The surface shall be tested with a moisture meter to determine when dry before coating. The surface shall also be tested for pH to determine the acid has been properly neutralized.

1.07 QUALITY ASSURANCE

- A. The CONTRACTOR shall give the ENGINEER a minimum of three days advance notice of the start of any field surface preparation work of coating application work.
- B. All such Work shall be performed only in the presence of the ENGINEER, unless the ENGINEER has specifically allowed the performance of such Work in his absence.
- C. Review by the ENGINEER, or the waiver of review of any particular portion of the Work, shall not relieve the CONTRACTOR of his responsibility to perform the Work in accordance with these Specifications.
- D. The CONTRACTOR shall provide five references which show previous successful experience with the specified or comparable coating systems. If the coating is to be performed by a Subcontractor, said Subcontractor shall provide five references which show previous successful experience with the specified or comparable coating systems. Include the name, address, and the telephone number for the County of each installation for which the CONTRACTOR or subcontractor provided the protective coating.

1.08 SAFETY AND HEALTH REQUIREMENTS

- A. In accordance with requirements of OSHA Safety and Health Standards for Construction (29CFR1926) and the applicable requirements of regulatory agencies having jurisdiction, as well as manufacturer's printed instructions, appropriate technical bulletins, manuals, and material safety data sheets, the CONTRACTOR shall provide and require use of personnel protective and safety equipment for persons working in or about the project site.
- B. All paints must comply with the requirements of the National Ambient Air Quality Standards.

1.09 SURFACES NOT TO BE COATED

- A. The following items shall not be coated unless otherwise noted:
 - 1. Encased piping or conduit.
 - 2. Stainless steel work.
 - 3. Clear PVC secondary containment piping.

4. Galvanized checkered plate.
5. Aluminum handrails, walkways, windows, louvers, grating and checkered plate.
6. Flexible couplings, lubricated bearing surfaces and insulation.
7. Packing glands and other adjustable parts of mechanical equipment.
8. Finish hardware.
9. Steel encased in concrete or masonry
10. Plastic switch plates and receptacle plates.
11. Signs and nameplates.
12. Any code-required labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name or nomenclature plates.
13. Any moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sensing devices, motor and fan shafts, unless otherwise indicated.

1.10 QUALITY WORKMANSHIP

- A. The CONTRACTOR shall be responsible for the cleanliness of his painting operations and shall use covers and masking tape to protect work whenever such covering is necessary, or if so requested by the OWNER. Any unwanted paint shall be carefully removed without damage to any finished paint or surface. If damage occurs, the entire surface, adjacent to and including the damaged area, shall be repainted without visible lapmarks and without additional cost to the OWNER.
- B. Painting found defective shall be scraped or sandblasted off and repainted as the OWNER may direct. Before final acceptance of the work, damaged surfaces of paint shall be cleaned and repainted as directed by the OWNER.
- C. Any pipe scheduled to be painted and having received a coating of a tar or asphalt compound shall be painted with two coats of "Inertol Tar Stop", "Tnemec Tar Bar" or equal before successive coats are applied in accordance with the paint schedule.

1.11 ADDITIONAL PAINT

- A. At the end of the project, the CONTRACTOR shall turn over to the OWNER a one gallon can (single component material) or small kit (multi component material – minimum of one gallon yield) of each type and color of paint, primer, thinner or other coating used in the field painting. The material shall be delivered in unopened, labeled cans as it comes from the factory. The manufacturer's literature describing the materials and giving directions for their use shall be furnished in three bound copies. A type-written inventory list shall be furnished at the time of delivery.

1.12 SHIPPING, HANDLING AND STORAGE

- A. All painting materials shall be brought to the job site in the original sealed labeled containers of the paint manufacturer and shall be subject to review by the ENGINEER. Where thinning is necessary, only the product of the manufacturer furnishing the paint shall be used. All such thinning shall be done strictly in accordance with the manufacturer's instructions, and with the full knowledge of the ENGINEER.
- B. Materials and their storage shall be in full compliance with the requirements of pertinent codes and fire regulations. Receptacles shall be placed outside buildings for paint gates and containers. Paint waste shall not be disposed of in plumbing fixtures, process drains or other plant systems or process units.

PART 2 -- PRODUCTS

2.01 MATERIALS

- A. Table 09900-1 depicts the coatings referenced in Article 3.03 of this Section entitled, "Paint Schedule".

**TABLE 09900-1
PRODUCT LISTING**

Ref. No.	Description	Manufacturer's Reference		
		Tnemec	Carboline	Sherwin-Williams
102	Water Based Block Filler	1254 Epoxoblock WB	Sanitile 100	Corobond 300
103	Modified Polyamidoamine Epoxy	135 – Color	Carboguard 890 – Color	Macropoxy 646
104	Polyamidoamine Epoxy Primer	N69 – 1211	Carboguard 890 – 0500	Macropoxy 646
105	Polyamidoamine Epoxy	N69 – Color	Carboguard 890 – Color	Macropoxy 646
110	Aliphatic Acrylic Polyurethane	1095 – Color	Carbothane 133HB – Color	Acrolon Ultra
111	Modified Waterborne Acrylate	156 - Envirocrete (Smooth Texture)	Flexxide Elastomer	Loxon XP
114	Acrylic Concrete Primer	6 Tneme-Cryl	Sanitile 120	Loxon Conditioner
115	Aromatic Urethane / Epoxy Zinc Rich	90-97 Tneme-Zinc	Carbozinc 859	Corothane I Galvapak
116	Water repellent	668 Chemprobe Deck A Pell 40	Carbocrete Sealer WB	H&C SL-40
118	Epoxy Modified Cementitious Mortar	218 MortarClad	Carboguard 510 SG	Corobond 300

Ref. No.	Description	Manufacturer's Reference		
		Tnemec	Carboline	Sherwin-Williams
119	Cycloaliphatic Amine Epoxy	104 H.S. Epoxy	Carboguard 893 (Non-immersion) Phenoline 385 (Immersion)	Tank Clad HS
130	<u>Polyamidoamine Epoxy</u>	<u>N140 Pota-Pox Plus</u>	<u>Carboguard 891</u>	<u>Tank Clad Epoxy</u>
136	Modified Polyamine Epoxy / Phenalkamine Epoxy	435 Perma-Glaze	Carboguard 690	Cor-Cote SC Coating
137	Epoxy Novolak Prime Coat	201 – EpoxoPrime Coat	Plasite 5309	Corobond 100 Epoxy Primer/Sealer
138	Epoxy Novolak Base Coat	270 – Stranlok Base Coat	Plasite 5309	Kem Cati-Coat HS Epoxy Filler/Sealer
139	Epoxy Novolak Top Coat	282 – Tneme Glaze Top Coat	Plasite 5309	Cor-Cote EN 7000

2.02 TRAFFIC PAINT

- A. Paint for marking the parking lots shall be Sherwin-Williams PRO-MAR traffic marking paint, or equal. Color shall be white. Paint shall be applied in accordance with the manufacturer's recommendations. Striped areas shall be as indicated on the drawings.

PART 3 -- EXECUTION

3.01 SURFACE PREPARATION

- A. Surfaces to be painted shall be clean and dry, and free of dust, rust, scale and all foreign matter. No solvent cleaning, power or hand tool cleaning shall be permitted unless acceptable to the ENGINEER or specified herein.
- B. Except as otherwise provided, all preparation of metal surfaces shall be in accordance with Specifications SP-1 through SP-10 of the Steel Structures Painting Council (SSPC). Where Steel Structures Painting Specifications are referred to in these Contract Documents, the corresponding Pictorial Surfaces Preparation Standard shall be used to define the minimum final surface conditions to be supplied. Grease and oil shall be removed and the surface prepared by hand tool cleaning, power tool cleaning or blast cleaning in accordance with the appropriate Specification SP-1 through SP-10.
- C. Weld flux, weld spatter and excessive rust scale shall be removed by power tool cleaning as per SSPC-SP-3-63.
- D. Threaded portions of valve and gate stems, machined surfaces which are limited for sliding contact, surfaces which are to be assembled against gaskets, surfaces or shafting on which sprockets are to fit, or which are intended to fit into bearings, machined surfaces of bronze trim on slide gates and similar surfaces shall be masked off to protect them from

the sandblasting of adjacent surfaces. Cadmium-plated or galvanized items shall not be sandblasted unless hereinafter specified, except that cadmium-plated, zinc-plated, or sherardized fasteners used in assembly of equipment to the sandblasted shall be sandblasted in the same manner as the unprotected metal. All installed equipment, mechanical drives, and adjacent painted equipment shall be protected from sandblasting. Protection shall prevent any sand or dust from entering the mechanical drive units or equipment where damage could be caused.

- E. Hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place prior to cleaning and painting, and not intended to be painted, shall be protected or removed during painting operations and repositioned upon completion of painting operations.
- F. Any abraded areas of shop or field applied coating shall be touched up with the same type of shop or field applied coating, even to the extent of applying an entire coating, if necessary. Touch-up coating and surface preparations shall be in addition to and not considered as the first field coat.
- G. Sand from sandblasting shall be thoroughly removed, using a vacuum cleaner if necessary. No surface which has been sandblasted shall be painted until inspected by the ENGINEER.
- H. Exposed Pipe
 - 1. Bituminous coated pipe shall not be used in exposed locations. Pipe which shall be exposed after project completion shall be primed in accordance with the requirements herein. Any bituminous coated ferrous pipe which is inadvertently installed in exposed locations shall be sandblasted to SSPC-SP-5 White Metal before priming and painting.
 - 2. After installation and prior to finish painting, all exterior, exposed flanged joints shall have the gap between adjoining flanges and gaps between the pipe wall and threaded-on flanges sealed with a single component Thiokol caulking to prevent rust stains.
- I. Ferrous Metal Surfaces
 - 1. All ferrous metal surfaces not required to be galvanized shall be cleaned of all oil grease, dirt, rust and tight and loose mill scale by blasting in accordance with the following: SSPC-SP-5 White Metal Blast Cleaning and comply with the visual standard NACE 1, for shop prepared and shop primed metal to be submerged, SSPC-SP10 Near White Metal Blast Cleaning, and comply with the visual standard NACE 2 for field prepared metal to be submerged, SSPC-SP6 and comply with the visual standard NACE 3 for metal in all other locations. Pickling, complying with SSPC-SP-8, may be substituted for Near White Blast in areas as determined by the ENGINEER. Priming shall follow sandblasting before any evidence of corrosion occurs, before nightfall and before any moisture is on the surface.
- J. Field surface preparation of small, isolated areas such as field welds, repair of scratches, abrasions or other marks to the shop prime or finish shall be cleaned by power tools in

accordance with SSPC-SP-3, or in difficult and otherwise inaccessible areas by hand cleaning in accordance with SSPC-SP-2 and spot primed.

K. Primed or Coated Surfaces and Non-Ferrous Surfaces

1. All coated surfaces shall be cleaned prior to application of successive coats. All non-ferrous metals not to be coated shall be cleaned. This cleaning shall be done in accordance with SSPC-SP-1, Solvent Cleaning.

L. Shop Finished Surfaces

1. All shop-coated surfaces shall be protected from damage and corrosion before and after installation by treating damaged areas immediately upon detection. Abraded or corroded spots on shop-coated surfaces shall be prepared in accordance with SSPC-SP-2, Hand Tool Cleaning and then touched up with the same materials as the shop coat.
2. All shop coated surfaces which are faded, discolored, or which require more than minor touch-up, in the opinion of the ENGINEER, shall be repainted. Cut edges of galvanized sheets, electrical conduit, and metal pipe sleeves, not to be finish painted, shall be cleaned in accordance with SSPC-SP-1, Solvent Cleaning and primed with zinc dust-zinc oxide metal primer.

M. Galvanized and Copper Alloy Surfaces

1. All copper, or galvanized metal surfaces shall be brush blasted and given one coat of epoxy primer.

N. Concrete and Masonry Surfaces

1. Concrete and masonry surfaces to be painted shall be prepared by removing efflorescence, chalk, dust, dirt, grease, oil, form coating, tar and by roughening to remove glaze. All surfaces shall be repaired prior to commencement of the coating operation.
2. Concrete and masonry surfaces are to be cured for at least 28 days prior to coating, unless coatings are recommended for application over green concrete surfaces.

- O. New concrete immersion surfaces that are to be coated shall be brush blasted per SSPC-SP13 to produce the necessary "sandpaper texture" surface required for satisfactory adherence of the paint. Refer to manufacturer's recommendation for specific coating being applied and adhere to ICRI Concrete Surface Preparation Profiles (CSP 1-9) when reviewing concrete surface preparation. Areas of concrete which contain bug holes or voids shall be filled with the manufacturer's approved filler material.

P. Existing Painted Concrete and Masonry Surfaces

1. Existing painted concrete and masonry surfaces requiring paint as identified herein shall be prepared by applying a minimum 3500 psi high pressure water blast to the existing painted surface to remove all loose paint, chalk, dust, dirt, grease, oil,

latent's, and other foreign materials. Cracks, chips or voids in the existing concrete shall be repaired in accordance with paint manufacturer recommendations.

Q. PVC Pipe Surfaces

1. All pipe surfaces shall be cleaned and lightly sanded before painting.

3.02 SHOP PAINTING

- A. All fabricated steel work and equipment shall receive at the factory at least one shop coat of prime paint compatible with the paint system required by these Specifications. The CONTRACTOR shall coordinate all shop priming to ensure compatibility with paint system specified. Surface preparation prior to shop painting shall be as specified herein. Finish coats may be applied in the shop if acceptable to the ENGINEER. All shop painted items shall be properly packaged and stored until they are incorporated in the Work. Any painted surfaces that are damaged during handling, transporting, storage or installation shall be cleaned, scraped, and patched before field painting begins so that Work shall be equal to the original painting received at the shop. Equipment or steel Work that is to be assembled on the site shall likewise receive a minimum of one shop coat of paint at the factory. Surfaces of exposed members that will be inaccessible after erection shall be prepared and painted before erection.
- B. The CONTRACTOR shall specify the shop paints to be applied when ordering equipment in order to assure compatibility of shop paints with field paints. The paints and surface preparation used for shop coating shall be identified on shop drawings submitted to the ENGINEER for review. Shop paint shop drawings will not be reviewed until the final project paint system has been submitted by the CONTRACTOR and reviewed by the ENGINEER.
- C. Shop finish coats may be the standard finish as ordinarily applied by the manufacturer if it can be demonstrated to the ENGINEER that the paint system is equal to and compatible with the paint system specified. However, all pumps, motors and other equipment shall receive at least one field applied finish coat after installation.

3.03 PAINT SCHEDULE

- A. The CONTRACTOR shall adhere to this paint schedule, providing those paints named or equal. DFT shall mean the minimum dry film thickness per application measured in mils. Products are referenced by numbers listed in table 09900-1 in Article 2.01 of this Section entitled "Product Listing." The paint schedule identifies the minimum DFT required per coat. If the CONTRACTOR does not achieve the specified DFT range in a single coat, he shall provide additional coats as necessary at no additional cost to the OWNER.
- B. Metal Surfaces, Atmospheric (Exterior) Exposure
 1. Metal surfaces exposed to the atmosphere that do not come into contact with wastewater or corrosive atmosphere including the following types of surfaces shall be painted as described below:
 - a. Pumps, motors, process equipment, machinery, etc.

- b. Above ground piping, valves and pipe supports.
- c. Miscellaneous steel shapes, angles, etc.
- d. Exposed surfaces of conduit, ductwork, etc.

Surface preparation: SSPC-SP6

Ferrous Metal

<u>Application</u>	<u>No.</u>	<u>Description</u>	<u>DFT</u>
First -1 coat	104	Polyamidoamine Epoxy Primer	3.0 - 5.0
Second - 1 coat (*)	105	Polyamidoamine Epoxy	2.0 - 3.0
Finish - 1 coat	110	Aliphatic Acrylic Urethane	<u>3.0 - 4.0</u>
Min. Total			10.0 Mils

(*) Broadcast 50 mesh silica sand while still wet over entire digester cover area.

Non-Ferrous Metal

<u>Application</u>	<u>No.</u>	<u>Description</u>	<u>DFT</u>
First - 1 coat	105	Polyamidoamine Epoxy	2.0 - 3.0
Second - 1 coat	110	Aliphatic Acrylic Urethane	<u>3.0 - 4.0</u>
Min. Total			6.0 Mils

Galvanized

<u>Application</u>	<u>No.</u>	<u>Description</u>	<u>DFT</u>
Spot Repair	115	Aromatic Urethane / Epoxy Zinc-Rich (spot)	2.5 - 3.5
First - 1 coat	105	Polyamidoamine Epoxy	2.0 - 3.0
Second - 1 coat	110	Aliphatic Acrylic Urethane	<u>3.0 - 4.0</u>
Min. Total			6.0 Mils

C. Metal Surfaces, Submerged Exposure subject to H₂S or H₂SO₄

- 1. Metal surfaces that are submerged in wastewater or subjected to wastewater gases subject to H₂S or H₂SO₄.

Surface preparation: SSPC-SP5

<u>Application</u>	<u>No.</u>	<u>Description</u>	<u>DFT</u>
Prime coat	104	Polyamidoamine Epoxy Primer	2.5 - 3.5
Finish - 1 coat	136	Polyamine Epoxy / Phenalkamine Epoxy	<u>15.0 - 20.0</u>
Min. Total (excluding stripe coat)			20.0 Mils

D. Metal Surfaces, Submerged Exposure

1. Metal surfaces that are submerged in wastewater or subjected to wastewater gases of facilities not included in system C above shall be painted as described below:

Surface preparation: SSPC-SP5

<u>Application</u>	<u>No.</u>	<u>Description</u>	<u>DFT</u>
Stripe coat	119	Cycloaliphatic Amine Epoxy	3.0 – 5.0
First – 1 coat	119	Cycloaliphatic Amine Epoxy	4.0 – 6.0
Finish - 1 coat	119	Cycloaliphatic Amine Epoxy	<u>4.0 – 6.0</u>
Min. Total (excluding stripe coat)			10.0 Mils

E. Ductile Iron Pipe, Exterior or Interior Exposure

1. Ductile iron pipe exterior or interior exposure shall receive the following types of paint:

Surface preparation: SSPC-SP6

<u>Application</u>	<u>No.</u>	<u>Description</u>	<u>DFT</u>
First - 1 coat	105	Polyamidoamine Epoxy	6.0 - 10.0
Finish - 1 coat	110	Aliphatic Acrylic Polyurethane	<u>3.0 - 5.0</u>
Min. Total			12.0 Mils

F. PVC Pipes, Exterior or Interior Exposure

1. PVC pipes, valves, and accessories, shall receive the following types of paint:

Surface preparation: Light sanding

<u>Application</u>	<u>No.</u>	<u>Description</u>	<u>DFT</u>
First - 1 coat	105	Polyamidoamine Epoxy	2.0 - 3.0
Finish - 1 coat	110	Aliphatic Acrylic Polyurethane	<u>3.0 - 4.0</u>
Min. Total			6.0 Mils

G. Exterior of Pre-stressed Concrete Storage Tank

1. The entire exterior concrete including but not limited to walls, dome and parapet wall shall receive the following coating system:

Surface preparation: Surface shall be clean and dry without efflorescence, chalk, dust, dirt, grease, oil, form coating, and tar. Allow concrete to cure for 28 days.

<u>Application</u>	<u>No.</u>	<u>Description</u>	<u>DFT</u>
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First – 1 coat	---	Thorseal/Acryl 60*	----
Second – 1 coat	--	Tneme-Cryl Series 6	2.0 – 3.0
Finish – 1 coat	--	Tuferyl Series 29	1.5 – 2.0
<u>First – 1 coat</u>	<u>111</u>	<u>Modified Waterborne Acrylate</u>	<u>4.0 – 8.0</u>
		<u>Series 156</u>	
<u>Second – 1 coat</u>	<u>111</u>	<u>Modified Waterborne Acrylate</u>	<u>4.0 - 8.0</u>
		<u>Series 156</u>	
		<u>Min. Total</u>	<u>8 - 16 Mils</u>

H. Interior of Pre-stressed Concrete Storage Tank

1. The interior concrete surfaces including ~~bottom floor slab~~, walls and underside of the dome up to the overflow/vents.

Surface preparation: Allow 28 days to cure. ICRI CSP-5 (SSPC-SP13)

Either of the following coating systems:

- a. Pota-Pox

<u>Application</u>	<u>No.</u>	<u>Description</u>	<u>DFT</u>
First coat	130	Pota-Pox Plus	6.0 – 8.0
Second coat	130	Pota-Pox Plus	<u>6.0 - 8.0</u>
		Minimum Total	12 - 16 Mils

- b. Thorseal

<u>Application</u>	<u>No.</u>	<u>Description</u>	<u>DFT</u>
First coat	--	Thorseal/Acryl 60	1/16 th inch
Second coat	--	Thorseal/Acryl 60	<u>1/16th inch</u>
		Minimum Total	1/8 th inch

- I. Existing Painted Exterior and Interior Pumps, Equipment, Piping, Valves, Fittings and Supports Requiring Touch-Up Caused by CONTRACTOR's Construction Activities.

1. Existing painted exterior and interior piping, pumps, valves, fittings, supports, shall be painted as described below:

Surface preparation: As recommended by coating manufacturer.

<u>Application</u>	<u>No.</u>	<u>Description</u>	<u>DFT</u>
Spot Repair	103	Modified Polyamidoamine Epoxy	3.0 - 5.0
First - 1 coat	103	Modified Polyamidoamine Epoxy	3.0 - 5.0
Finish - 1 coat	110	Aliphatic Acrylic Polyurethane	<u>2.0 - 3.0</u>
		Minimum Total	8.0 Mils

- J. Concrete Floor Surfaces

1. Concrete deck surfaces not intended to be submerged and not subject to vehicular traffic (Recirculation Pump Slab):

<u>Application</u>	<u>No.</u>	<u>Description</u>	<u>DFT</u>
Finish - 1 coat	116	Water Repellent	150 SFT/Gal

K. Concrete Floor Surfaces

1. Concrete floor surfaces subject to vehicular traffic: refer to Specification Section 03350 entitled "Concrete Finishes".

L. Concrete Surfaces in Areas subject to Chemical Exposure

1. Concrete surfaces subject to sodium hypochlorite exposure including all new concrete supports for sodium hypochlorite pumps, equipment and grating support shall receive the following coating system:

Surface preparation: Allow concrete to cure a minimum of 28 days. ICRI CSP-5 (SSPC-SP13)

<u>Application</u>	<u>No.</u>	<u>Description</u>	<u>DFT</u>
First coat	137	Novolac Epoxy	8.0
Second coat	138	Novolac Epoxy	35
Finish coat	139	Novolac Epoxy	<u>15</u>
		Minimum Total	58 Mils

Novolac epoxy system shall be designed for severe chemical exposure service. Solids content shall be 100 percent by volume. Refer to the manufacturer's recommendations for joints and horizontal to vertical transitions.

Prior to immersion service, the completed system shall be subjected to at least 48 hours of curing time with the concrete temperature at a minimum of 75 degrees F, or 96 hours at a minimum temperature of 60 degrees F, both conditions at a maximum relative humidity of 50 percent and under forced ventilation conditions. More curing time or a higher temperature shall be provided by the CONTRACTOR if recommended by the epoxy coating manufacturer. Other combinations of curing time and temperature may be used if the coating manufacturer presents satisfactory documentation and test results to substantiate that the degree of curing is equal or greater than curing for 240 hours at 70 degrees F.

3.04 PAINTING

- A. All paint shall be applied by experienced painters with brushes or other applicators acceptable to the ENGINEER.
- B. Paint shall be applied without runs, sags, thin spots, or unacceptable marks. Paints shall be applied at the rate specified by the manufacturer to achieve the minimum dry mil thickness required. Additional coats of paint shall be applied, if necessary, to obtain thickness specified.

- C. Paint shall be applied with spraying equipment only on those surfaces approved by the ENGINEER. If the material has thickened or must be diluted for application by spray gun, each coat shall be built up to the same film thickness achieved with undiluted brushed-on material. Where thinning is necessary, only the products of the particular manufacturer furnishing the paint shall be used; and all such thinning shall be done in strict accordance with the manufacturer's instructions, as well as with the full knowledge of the ENGINEER.
- D. Surfaces not accessible to brushes or rollers may be painted by spray by dauber or sheepskins and paint mitt. If any of these methods is to be used, it shall be done in strict accordance with the manufacturer's instructions, as well as with the full knowledge of the ENGINEER.
- E. Drying Time
 - 1. A minimum of twenty-four hours drying time shall elapse between applications of any two coats of paint on a particular surface unless shorter time periods are a requirement of the manufacturer or specified herein. Longer drying times shall be required for abnormal conditions as defined by the manufacturer.
- F. Weather Restrictions
 - 1. No painting whatsoever shall be accomplished in rainy or excessively damp weather when the relative humidity exceeds 85 percent, or when the general air temperature cannot be maintained at 50 degrees Fahrenheit or above throughout the entire drying period. No paint shall be applied when it is expected that the relative humidity will exceed 85 percent or that the air temperature will drop below 50 degrees Fahrenheit within 18 hours after the application of the paint.
 - 2. Dew or moisture condensation should be anticipated; and if such conditions are prevalent, painting shall be delayed until midmorning to be certain the surfaces are dry. The day's painting shall be completed well in advance of the probable time-of-day when condensation will occur.
- G. Inspection of Surfaces
 - 1. Each and every field coat of priming and finishing paint shall be inspected by the ENGINEER or his authorized representative before the succeeding coat is applied. The CONTRACTOR shall follow a system of tinting successive paint coats so that no two coats for a given surface are exactly the same color. Areas to receive black protective coatings shall in such cases be tick-marked with white or actually gauged as to thickness when finished.
- H. Before application of the prime coat and each succeeding coat, any defects or deficiencies in the prime coat or succeeding coat shall be corrected by the CONTRACTOR before application of any subsequent coating.
- I. Samples of surface preparation and of painting systems shall be furnished by the CONTRACTOR to be used as a standard throughout the job, unless omitted by the ENGINEER.

- J. When any appreciable time has elapsed between coatings, previously coated areas shall be carefully inspected by the ENGINEER, and where, in his opinion, surfaces are damaged or contaminated, they shall be cleaned and recoated at the CONTRACTOR's expense. Recoating times of manufacturer's printed instructions shall be adhered to.
- K. Coating thickness shall be determined by the use of a properly calibrated "Nordson-Mikrotest" (or equal) dry mil thickness gauge.
- L. The CONTRACTOR shall provide free of charge to the ENGINEER two new "Nordson-Mikrotest" dry film gauges to be used to inspect coating by ENGINEER and CONTRACTOR. One gauge may be used by CONTRACTOR and returned each day to the ENGINEER. ENGINEER will return gauges to CONTRACTOR at completion of job.
- M. Special Areas
 - 1. All surfaces which are to be installed against concrete, masonry etc., and will not be accessible for field priming and/or painting shall be back primed and painted as specified herein, before erection. Anchor bolts shall be painted before the erection of equipment and then the accessible surfaces repainted when the equipment is painted.
- N. Special attention shall be given to insure that edges, corners, crevices, welds and rivets receive a film thickness equivalent to that of the adjacent painted surfaces.
- O. Safety
 - 1. Respirators shall be worn by persons engaged or assisting in spray painting. The CONTRACTOR shall provide ventilating equipment and all necessary safety equipment for the protection of the workmen and the Work.
- P. Quality Workmanship
 - 1. The CONTRACTOR shall be responsible for the cleanliness of his painting operations and shall use covers and masking tape to protect the Work whenever such covering is necessary, or if so requested by the County. Any unwanted paint shall be carefully removed without damage to any finished paint or surface. If damage does occur, the entire surface, adjacent to and including the damaged area, shall be repainted without visible lap marks and without additional cost to the County.
- Q. Painting found defective shall be scraped or sandblasted off and repainted as the ENGINEER may direct. Before final acceptance of the Work, damaged surfaces of paint shall be cleaned and repainted as directed by the ENGINEER.
- R. Any pipe scheduled to be painted and having received a coating of a tar or asphalt compound shall be painted with two coats of "Intertol Tar Stop", "Tnemec Tar Bar" or equal before successive coats are applied in accordance with the paint schedule.

3.05 SCHEDULE OF COLORS

- A. All colors shall be as designated by the OWNER at the shop drawing review. The CONTRACTOR shall submit color samples including custom color choices as required to

the ENGINEER as specified in Article 1.04 of this Section. The CONTRACTOR shall submit suitable samples of all colors and finishes for the surfaces to be painted, or on portable surfaces when required by the ENGINEER. The OWNER shall decide upon the choice of colors and other finishes when alternates exist. No variation shall be made in colors without the acceptance from the County. Color names and/or numbers shall be identified according to the appropriate color chart issued by the manufacturer of the particular product in question.

3.06 COLOR CODING AND LETTERING OF PIPING

- A. The CONTRACTOR shall paint all piping, valves, equipment, exposed conduits and all appurtenances which are integral to a complete functional mechanical pipe and electrical conduit system, in accordance with Table 09900-2 entitled "Pipe Color Coding Schedule". Where colors are not designated for piping and conduit systems they will be selected during the shop drawing review from the paint manufacturer's standard color charts.
- B. In general, the pumps and equipment shall be painted the same color as the piping system to which it is connected unless otherwise directed by the ENGINEER. Where colors are not designated for piping and conduit systems they will be selected during the shop drawing review from the paint manufacturer's standard color charts.
- C. Lettering of Piping
 - 1. The CONTRACTOR shall apply identification titles and arrows indicating the direction of flow of liquids to all types and sections of all new and existing plant piping. Titles shall be as directed by the ENGINEER. Identification titles shall be located midway between color coding bands where possible. Identification lettering and arrows shall be placed as directed by the ENGINEER, but shall generally be located each fifteen feet in pipe length and shall be properly inclined to the pipe axis to facilitate easy reading. Titles shall also appear directly adjacent to each side of any wall or slab the pipeline passes through.
- D. The titles shall be painted by use of stencils and shall identify the contents by complete names at least once in each area through which it passes and thereafter be abbreviated. Stencils shall be provided for titles and abbreviations listed in Table 09900-3.
- E. Title color shall be black or white as directed and shall have an overall height in inches in accordance with Table 09900-4. Letter type shall be Helvetica Medium upper case. The manufacturer's instructions shall be followed in respect to storage, surface preparation and application. For piping less than 3/4-inch diameter (as identified in Table 09850-2), the CONTRACTOR shall furnish and attach corrosion resistant color tags with the required lettering.
- F. Banding
 - 1. Where bands are indicated in the Pipe Color Coding Schedule, the pipe is to be painted for its full circumference with a band of the color indicated. The bands shall be six inches wide, neatly made by masking, and spaced eight feet apart. The CONTRACTOR may substitute pre-cut prefinished bands on piping subject to acceptance by the ENGINEER. Where banded pipes are running concurrently in

a space, bands shall be located so that on adjacently located pipes, bands will be grouped beside each other.

3.07 OSHA SAFETY COLORS

- A. Items listed in ANSI Z53.1-1971, Section 2.1 shall be painted ANSI Red. In general, these items shall include fire protection equipment and apparatus; wall mounted breathing apparatus, danger signs and locations; and stop bars, buttons or switches. In addition all hose valves and riser pipes, fire protection piping and sprinkler systems, and electrical stop switches shall be painted ANSI Red.
- B. Items listed in ANSI Z53.1-1971, Section 2.3 shall be painted ANSI Yellow. Yellow shall be the basic color for designating caution and for marking physical hazards such as striking against, stumbling, falling, tripping, and "caught in between". In addition, an 8-inch wide strip on the top and bottom tread of stairways shall be coated.

3.08 WORK IN CONFINED SPACES

- A. The CONTRACTOR shall provide and maintain safe working conditions for all employees. Fresh air shall be supplied continuously to confined spaces through the combined use of existing openings, forced-draft fans, or by direct air supply to individual workers. Paint fumes shall be exhausted to the outside from the lowest level in the contained space.
- B. Electrical fan motors shall be explosion proof if in contact with fumes. No smoking or open fires will be permitted in, or near, confined spaces where painting is being done.

3.09 CLEANING

- A. The buildings and all other Work area shall be at all times kept free from accumulation of waste material and rubbish caused by the Work. At the completion of the painting, all tools, equipment, scaffolding, surplus materials, and all rubbish around the inside the buildings shall be removed and the Work left broom clean unless otherwise specified.

**TABLE 09900-2
PIPE COLOR CODING SCHEDULE**

Equipment / Piping	Suggested Color
Reclaimed Water, Recirculation Pumps	Pantone Purple
Potable Water	Blue
Sanitary and Process Drains	Fossil, BG12
Sodium Hypochlorite, Transfer Pump, Booster Pump	Safety Yellow, BV57
Sample Lines	Match Color of Source Water

**TABLE 09900-3
PIPE IDENTIFICATION SCHEDULE***

Pipe Title	Pipe Abbreviation
DRAIN	DR
POTABLE WATER	PW
RECLAIMED WATER	RW
SODIUM HYPOCHLORITE	CLS
SAMPLE	SA

**Refer to Section 15000, Pipe Schedule for additional pipe titles*

**TABLE 09900-4
HEIGHT OF PIPING LETTERING**

<u>Diameter of Pipe or Pipe Covering</u>	<u>Height of Lettering</u>
3/4 to 1-1/4 inches	1/2 inch
1-1/2 to 2 inches	3/4 inch
2-1/2 to 6 inches	1-1/4 inches
8 to 10 inches	2-1/2 inches
Over 10 inches	3-1/2 inches

Notes:

1. Letter type shall be Helvetica Medium upper case. The manufacturer's instructions shall be followed in respect to storage, surface preparation and application.
2. For piping less than 3/4-inch diameter (as identified in Table 09850-2), the CONTRACTOR shall furnish and attach corrosion resistant color tags with the required lettering.

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SECTION 11100
PUMPS - GENERAL

PART 1 -- GENERAL

1.01 THE REQUIREMENT

- A. The CONTRACTOR shall furnish, install, test, and make fully operational all pumping equipment, complete with all necessary accessories, in compliance with the Contract Documents.
- B. All pumping equipment shall be provided in accordance with the requirements of Section 11000 – Equipment General Provisions.
- C. The provisions of this section shall apply to all pumps and pumping equipment specified except where specifically noted otherwise in the Contract Documents.
- D. The pumps shall be provided complete with all accessories, shims, sheaves, couplings, and other appurtenances as specified, and as may be required for a complete and operating installation.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 – Submittals
- B. Section 05500 – Metal Fabrications
- C. Section 09900 – Painting
- D. Section 11000 – Equipment General Provisions
- E. Section 15000 – Basic Mechanical Requirements
- F. Section 16050 – Electrical – General Provisions
- G. Section 16150 – Motors
- H. Section 16370 – Variable Frequency Drive Systems

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. Codes: The Building Code, as referenced herein, shall be the Florida Building Code (FBC), as specified in Section 01090, Reference Standards.
- B. Commercial Standards: Pumping system equipment, installation and testing shall be in accordance with the following applicable codes and standards:
 - 1. Hydraulic Institute

- a. ANSI/HI 1.1-1.2-2008 Centrifugal Nomenclature
 - b. ANSI/HI 1.3-2009 Rotodynamic Pumps for Design and Application
 - c. ANSI/ HI 2.1-2.2-2008 American National Standard for Vertical Pumps for Nomenclature and Definitions
 - d. ANSI/HI 3.1-3.5-2008 American National Standard for Rotary Pumps for Nomenclature, Definitions and Operation
 - e. ANSI/HI 3.6 American National Standard for Rotary Pump Tests
 - f. ANSI/HI 9.6.2 American National Standard for Centrifugal and Vertical Pumps Allowable Nozzle Loads
 - g. ANSI/HI 9.6.4-2009 Centrifugal and Vertical Pumps - Vibration Measurements and Allowable Values
 - h. ANSI/HI 9.6.6-2009 Rotodynamic Pumps for Pump Piping
 - i. ANSI/HI 9.8-1998 American National Standard for Centrifugal and Vertical Pump Intake Design
 - j. ANSI/HI 11.6-2001 Submersible Pump Tests
 - k. ANSI/HI 12.1-12.6 Rotodynamic Slurry Pump Standard
 - l. ANSI/HI 14.6 Rotodynamic Pumps for Hydraulic Performance Acceptance Tests
2. American Water Works Association
- a. ANSI/AWWA E103 Standard for Shafted Pumps
3. American Society for Testing and Materials
- a. A36 Specification for Structural Steel
 - b. A48 Specification for Gray Iron Castings
 - c. A53 Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - d. A148 Specification for Steel Castings, High Strength, for Structural Purposes
 - e. A193 Specification for Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service
 - f. A276 Specification for Stainless Steel Hot/Cold-Finished Bars
 - g. A322 Specification for Steel Bars, Alloy, Standard Grades
 - h. A514 Specification for High Yield Strength, Quenched and Tempered alloy Steel Plate, Suitable for Welding
 - i. A532 Specification for Abrasion-Resistant Cast Irons

- j. A536 Specification for Ductile Iron Castings
 - k. A565 Specification for Martensitic Stainless Steel Bars
 - l. A582 Specification for Free-Machining Stainless and Heat-Resisting Steel Bar, Hot-Rolled and Cold-Rolled
 - m. A743 Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel and Nickel-Base, Corrosion-Resistant for General Application
 - n. B148 Specification for Aluminum-Bronze Sand Castings
 - o. B584 Specification for Copper Alloy Sand Castings for General Application
- 4. American National Standards Institute
 - a. B16.1 Standard for Cast Iron Pipe Flanges and Flanged Fittings
 - b. B16.5 Standard for Pipe Flanges and Flanged Fittings
 - 5. ANSI/NFPA 70 National Electric Code
 - 6. Society of Automotive ENGINEERS SAE J404 Chemical Compositions of SAE Alloy

1.04 SHOP DRAWINGS

- A. Shop Drawings shall include the following information in addition to the requirements of Section 01300 – Submittals and Section 11000 – Equipment General Provisions.
 - 1. Details of shaft sealing system
 - 2. Pump performance curves at rated speed and reduced speed (if reduced speeds are specified). Curves shall indicate flow, head, efficiency, brake horsepower, NPSH required, and minimum submergence for all Operating Conditions defined in the referencing sections. Curves shall indicate the Preferred Operating Range (POR) and Allowable Operating Range (AOR) as specified in ANSI/HI 9.6.3 and include limits for stable operation without cavitation, overheating, recirculation, or excessive vibration.
 - 3. General cutaway sections, materials, dimension of shaft projections, shaft and keyway dimensions, shaft diameter, dimension between bearings, general dimensions of pump, suction head bolt orientation, and anchor bolt locations and forces.
 - 4. Foundry certificates and results of Brinnell hardness testing showing compliance to ASTM A 532 (where required in the individual pump specifications).
 - 5. Detailed plans for performance testing including:
 - a. Location of performance testing and plans for accommodating witnessing by OWNER and ENGINEER.

- b. Confirmation that performance testing will be performed using the project motor and pump.
 - c. Details on all required materials and apparatuses necessary for performing the testing. Details on the locations and instrument types including confirmation of calibration for all instrumentation within 30 days of performing the test.
 - d. Tables demonstrating the output of information to be collected during the Performance Test.
 - e. Description of potential corrective procedures in the event of a failed performance test.
6. Long-term and short-term storage requirements shall be included in the shop drawing including any requirements for regular turning of the vertical turbine pumps in order to prevent deformation of the shafts during storage.

PART 2 -- PRODUCTS

2.01 MATERIALS

- A. All materials employed in the pumping equipment shall be suitable for the intended application. Material not specifically called for shall be high-grade, standard commercial quality, free from all defects and imperfection that might affect the serviceability of the product for the purpose for which it is intended, and shall conform to the following requirements unless otherwise specified in individual pumping equipment Specifications:
 1. Cast iron pump casings and bowls shall be of close-grained gray cast iron, conforming to ASTM A 48, or equal.
 2. Bronze pump impellers shall conform to ASTM B 584, "G" bronze.
 3. Stainless steel pump shafts shall be of Type 400, Series. Miscellaneous stainless steel parts shall be of Type 316.
- B. Suction and discharge flanges shall conform to ANSI standard B16.1 or B16.5 dimensions.

2.02 PUMP REQUIREMENTS - GENERAL

- A. Flanges: Suction and discharge flanges shall conform to ASME B16.1 or B16.5 dimensions.
- B. Handholes: Handholes on pump casings shall be shaped to follow the contours of the casing to avoid any obstructions in the water passage.
- C. Drains: All gland seals, air valves, and drains shall be piped to the weep holes at the edge of the pump room and properly supported with brackets.

- D. Mechanical Seals: Mechanical seal designs shall be selected for highest reliability and for rugged service. Mechanical seals shall be provided where required by the Specifications. Unless the pump manufacturer recommends a better seal for a specific application, mechanical seals shall be furnished as specified in individual pumping equipment sections.
- E. For all seal arrangements, a buffer fluid must be circulated a minimum 20 psi above suction pressure, or as required by manufacturer, in order to maintain reliable seal performance.
- F. All drivers and shafting shall comply with the requirements of Section 01600 – Materials and Equipment.
- G. Drive shaft assemblies shall be sized for ABMA L10 bearing lifetimes of not less than 60,000 hours unless otherwise specified hereinafter in the individual pump Specifications. In addition, shafting length and stiffness shall be such that critical speed conforms to the following requirements:
 - 1. For variable speed pumps, full speed shall not be more than 44 percent of critical speed for horizontal shafts or 75 percent of critical speed for vertical shafts. This may require a heavier shaft than is required to achieve the above stated lifetime requirements.
- H. All shafting shall be dynamically balanced in accordance with the recommendations of the shafting manufacturer.
- I. Drive shaft dimensions and, where applicable, the location of steady bearing supports are shown approximately to scale on the drawings. Exact dimensions and support arrangements will depend on the motor and pump which the CONTRACTOR proposed to install. The CONTRACTOR shall submit complete shop drawings and Specifications to the ENGINEER for review of the drive shaft arrangement proposed.
- J. The drive shaft manufacturer shall furnish to the CONTRACTOR complete installation instructions for the equipment furnished. The CONTRACTOR shall install the drive shaft assemblies per the manufacturer's instructions. The shafts shall be installed with a minimum of one degree offset and a maximum of five degrees offset at each universal joint.
- K. The CONTRACTOR shall furnish and install a heavy-duty shaft guard for all drive shafting which is less than seven feet above floor or platform level in accordance with the provisions of Paragraph 1910.210 of OSHA Rules and Regulations. Provision shall be made in the guard as necessary for lubrication and inspection access of the joints and bearings without the necessity of removing the entire guard assembly.
- L. The minimum ABMA L10 bearing life for all pump, motor and drive bearings shall be 60,000 hours unless otherwise stated in the individual equipment specification sections.
- M. Pump Installation: Pump installation shall conform to industry accepted practices for the equipment being installed. In addition, installation shall comply with all requirements as set forth by the equipment manufacturer.

2.03 APPURTENANCES

A. Pressure Gauges

- ~~1. The CONTRACTOR shall furnish and install pressure gauges on the can of each pump using a factory drilled connection. Bosses shall be provided where appropriate to stabilize the pressure gauge. The pressure gauge shall not be installed on the same tap as the air release valve.~~
- 12.** The CONTRACTOR shall furnish and install pressure gauges on the discharge piping of each **horizontal non-clog** vertical turbine pump in the locations shown on the Drawings or as directed by the ENGINEER.
- 23.** All gauges shall be supplied by one manufacturer and shall be as specified in Section **13650** 47650 – Pressure Gauges.
- 34.** All gauges shall be provided with diaphragm seals as specified in Section **13650 Pressure Gauges** 47698 – Instrumentation and Control System Accessories.

- B. Flexible couplings for direct driven pumps shall be as manufactured by Falk, Dodge, Woods Corp., or equal, and shall be furnished with guards in accordance with OSHA Rules and Regulations. Spacer couplings shall be provided where necessary to allow removal of the pump rotating element without disturbing the driver.

2.04 ELECTRICAL REQUIREMENTS

- A. All pumps shall be furnished with motors such that the motor shall not be overloaded throughout the full range of the pump operation, unless otherwise specifically approved by the ENGINEER.
- B. Where variable frequency drives (VFDs) are specified, the CONTRACTOR shall be responsible for coordinating between pump supplier and VFD supplier to ensure a complete and operational system. VFDs shall be furnished under Division 16 and shall be as specified in Section 16350 – Variable Frequency Drive Systems.
- C. Motor starters and controls shall be furnished and installed under Division 16 and Division 17 unless otherwise specified in the individual pump specifications.

2.05 EQUIPMENT IDENTIFICATION

- A. In addition to the requirements of Section 11000 – Equipment General Provisions, nameplate data for each pump shall include the rating in gallons per minute, rated head, speed, and efficiency at the primary design point.

PART 3 -- EXECUTION

3.01 INSTALLATION

- A. Drains: All gland seals, air valves, and drains shall be piped to the nearest wall opening at the edge of the Pump Room and properly supported with brackets.

- B. Solenoid Valves: Where required, the pump manufacturer shall furnish and install solenoid valves on the water or oil lubrication lines. Solenoid valve electrical rating shall be compatible with the motor control voltage and shall be furnished complete with all necessary conduit and wiring installation from control panel to solenoid.

3.02 TESTING

- A. Factory Testing (Performance Tests): The CONTRACTOR shall be responsible for the coordination of the following tests of each pump, drive, and motor. Pump tests shall utilize the actual motors and pump-motor bases to be furnished with the pumping equipment. Use of the pump manufacturers standard test motors is not acceptable.

1. General: Tests shall be performed in accordance with the Standards of the Hydraulic Institute, Inc. Tests shall be performed on the actual assembled unit. Prototype model tests will not be acceptable. Pump shop tests shall be made by the manufacturer and certified curves shall be submitted prior to witnessed tests. The shop tests shall consist of standard IEEE tests of motors, operation of the pumps and motors installed on the actual pump and motor bases to be furnished for proper balance of equipment and all other requirements as specified under this section. Pumps motors and drives shall be factory witness tested, as defined herein. All electronic transducers, meters, gauges, and test instruments shall be calibrated within 30 days prior to the scheduled test and certified calibration data shall be provided. Differential pressure type flow meters, such as venturis are preferred and shall have been calibrated, and their accuracy certified within the past 12 months. In case of failure of any unit to meet the test requirements, the manufacturer shall make such alterations as are necessary, and the tests shall be repeated without additional cost to the OWNER until the equipment test is passed.
2. Factory Witnessed Tests: All pumps and motors, 150 horsepower and larger and any smaller pumps, as determined by the ENGINEER, shall be factory-tested as complete, assembled units, as specified above, and witnessed by a representative of the ENGINEER and OWNER. The CONTRACTOR shall give the ENGINEER and OWNER a minimum of two weeks notification prior to the test. The CONTRACTOR shall be responsible for making all arrangements for travel for two OWNER representatives and one ENGINEER representative.
3. Certified Test Data: Factory test results shall be submitted to the ENGINEER in accordance with Section 01300 – Submittals. No equipment shall be shipped until the test data is acceptable to the ENGINEER. Acceptance tolerances shall be in accordance with ANSI/HI 14.6 grade 1E for the design point and grade 3B for other points unless otherwise stated in the individual equipment specification sections. The applicable test standard for submersible sump and submersible non-clog pumps shall be ANSI/HI 11.6 Submersible Pump Test. Tests for all pumps shall include those listed below.
4. Hydrostatic Tests: Hydrostatic tests should be carried out in accordance with ANSI/ Hydraulic Institute Standard 14.6 at 130% of the rated pressure. Rated pressure shall be the maximum operating suction pressure plus the pump differential pressure at the design point. Pumps with plastic casings shall be tested at 110% of the rated pressure.

5. Hydraulic Performance Test: Test shall be at rated full speed with a minimum of 10 readings between shutoff head and 25-percent above design capacity including the specified operating conditions of head and capacity, recorded on data sheets as defined by the Hydraulic Institute, signed, dated, and certified. Certified pump tests shall be conducted through the specified range of flow vs./head/capacity/efficiency curves plotted at pump design speed prior to connection to variable speed drive control systems (where provided). During each test, the pump shall be run at each head/capacity condition as specified in the pump schedule for sufficient time to accurately determine and record capacity, head, pump speed, drawn horsepower, pump efficiency and motor efficiency. The above tests shall be repeated at 90 percent, 80 percent and 65 percent of full speed. A minimum of 5 readings are required at each test speed.
 6. NPSH Tests: Where required by the individual equipment specification sections, NPSH tests shall be conducted to demonstrate satisfactory operation with the specified available NPSH.
- B. Field Tests: All pumping units shall be field tested after installation, in accordance with the Contract Documents, to demonstrate satisfactory operation, without causing excessive noise, vibration, cavitation, and overheating of the bearings. The field testing shall be performed in the presence of an experienced field representative of the manufacturer of each major item of equipment, who shall supervise the following tasks and shall certify in writing that the equipment and controls have been properly installed, aligned, lubricated, adjusted, and readied for operation:
1. Start-up: Start-up, check, and operate the equipment over the entire speed range. The vibration shall be within the amplitude limits recommended in the Hydraulic Institute Standards and it shall be recorded at a minimum of four pumping conditions defined by the ENGINEER.
 2. Performance: Pump performance shall be documented by obtaining concurrent readings, showing motor voltage, amperage, pump suction head, and pump discharge head, for at least four pumping conditions at each pump rpm. Each power lead to the motor shall be checked for proper current balance. Flow shall be measured to the extent possible by permanently installed instrumentation or drawdown measurement.
 3. Bearing Temperatures: Bearing temperatures shall be determined by a contact-type thermometer. A running time of at least 20 minutes shall be maintained for this test, unless liquid volume available is insufficient for a complete test.
 4. Natural-Frequency: Natural frequency testing of each installed vertical turbine pump assembly using the "bump test" method.
 5. Vibration: Operate the equipment over the entire speed range. The vibration shall be within the limits of ANSI/HI 9.6.4, meet all Hydraulic Institute Standards for field testing and it shall be recorded at a minimum of 4 pumping conditions defined by the OWNER's representative.

6. Certification: The field testing shall be witnessed by the OWNER or its representative. The CONTRACTOR shall submit to the ENGINEER a written notification of all pump field tests a minimum of one week prior to testing. In the event any of the pumping equipment fails to meet the above test requirements, it shall be modified and retested in accordance with the requirements of these Specifications. The CONTRACTOR shall then certify in writing that the equipment has been satisfactorily tested, and that all final adjustments thereto have been made. Certification shall include date of final acceptance test, as well as a listing of all persons present during tests, and resulting test data. The costs of all Work performed in this Paragraph by factory trained representative shall be borne by the CONTRACTOR.
7. Acceptance: In the event of failure of any pump to meet any of the above requirements or efficiencies, the CONTRACTOR shall make all necessary modifications, repairs, or replacements to conform to the requirements of the Contract Documents and the pump shall be re-tested at no additional compensation, until found satisfactory.

3.03 PROTECTIVE COATING

- A. All exposed materials, except corrosion-resistant metals which have not been shop painted, shall be field coated as specified in Section 09900 – Painting. Shop painted items which suffered damage to the shop coating shall be touched up as specified in Section 09900 – Painting.
- B. Gears, bearing surfaces, and other similar surfaces obviously not to be painted shall be given a heavy shop coat of grease or other suitable rust-resistant coating. This coating shall be maintained as necessary to prevent corrosion during periods of storage and erection and shall be satisfactory to the ENGINEER up to the time of the final acceptance.

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SECTION 11107

HORIZONTAL NON-CLOG PUMPS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

- A. The CONTRACTOR shall furnish, install, and place in satisfactory operation horizontal non-clog pumps at the locations shown on the Drawings and as specified herein. All pumps specified herein shall be supplied by the same manufacturer.
- B. Equipment shall be provided in accordance with the requirements of Section 11000, Equipment General Provisions and Section 11100, Pumps - General.

1.02 OPERATING CONDITIONS AND PERFORMANCE REQUIREMENTS

Recirculation Pump Nos. 1 – No. 2

Number of Units		2	
Design Capacity (gpm)	1,500	2,100	2,500
Total Dynamic Head (feet)	17	15	13
Maximum Brake Horsepower	9	9.9	10.2
Pump Motor Speed (rpm)		500-900	
Temperature of Liquid Pumped		Ambient	
Suction Condition		Flooded	
Minimum Size of Solids (Spherical Diameter, Inches)		3	
Minimum Suction Diameter (In.)		8 10	
Minimum Discharge Diameter (In.)		8 10	

1.03 SUBMITTALS

- A. The following items shall be submitted with the Shop Drawings in accordance with, or in addition to the submittal requirements specified in Section 01300, Submittals; and Section 11000, Equipment General Provisions:

- 1. Performance Affidavit

1.04 WARRANTY AND GUARANTEE

- A. Warranty and Guarantee shall be as specified in Section 11000 with the exception that the warranty period shall be for five (5) years.

PART 2 -- PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Each pump shall be a horizontal, non-clog, centrifugal pump, as manufactured by Aurora, Flowserve, Chicago Pump, or Cornell.

2.02 MATERIALS

- A. The pump shall be end suction, top discharge construction. The volute shall be provided with a cleanout port to allow for removal of any foreign material blocking or impeding performance of the pump. The unit shall be designed such that the motor may be removed from the pump for independent servicing.
- B. Casing shall be made of close grained cast iron conforming to ASTM A48, Class 30, and shall provide smooth unobstructed passages large enough to pass solids of the specified size. A cleanout handhole with removable cover shall be provided for non-clog type pumps. The inner contours of the handhole cover shall match the contours of the casing in which it fits. Casing shall be enclosed by a removable suction and stuffing box cover carefully machined and aligned. Casing shall be designed so that the impeller can be withdrawn without the need to remove the discharge casing or distribute the discharge piping. Suction and discharge connections shall be ANSI Standard flat faced 125 pound flanges. The necessary lifting bolts and eye lugs shall be provided for installation and maintenance of the pumps.
- C. Suction cover shall be constructed of the same material as the casing and shall be integrally cast with 125 pound ANSI standard flange. Cover shall be quickly removable for access to the impeller.
- D. Impeller shall be of the two vane, one piece, single suction, enclosed non-clog type and shall be made from nickel-aluminum-bronze, CA6NM or Type 316 stainless steel, and shall be statically, hydraulically, and dynamically balanced. The impeller shall be designed with smooth flow passages to pass solids of specified size and to prevent clogging by stringy materials. The impeller shall be bolted, keyed and locked to the pump shaft at the factory.
- E. Rotation of pumps shall be clockwise when viewed from the driven end, unless otherwise shown on the Drawings.
- F. Stuffing box cover shall be constructed of cast iron, ASTM A48, Class 30, and shall be designed with a machined self-centering fit with the pump casing. Stuffing box shall be readily accessible. Tapped holes shall be provided for oil or seal water connection as specified.
- G. Sealing shall be accomplished by a single mechanical seal. The single mechanical seal shall be a split mechanical seal, Model # 442 by Chesterton or equal. The mechanical seal system shall be designed to require no seal flush water. The stuffing box shall be equipped with a spiral bushing to remove air and solids from seal chamber. Bushing shall be Spiral-Trac, or equal. The mechanical seal shall consist of silicon carbide seal faces, ethylene propylene flexible members, and 316 stainless metal parts.
- H. Shaft shall be Type SAE 1045 steel, minimum, sufficiently large in diameter to transmit safely the maximum torque developed by the drive unit and of such a design as to provide a

rigid support for the impeller and to prevent excessive vibration. The shaft shall be suitably heat-treated, turned, ground, and polished over its entire length and shall be protected through the stuffing box by a removable hardened stainless steel shaft sleeve with seal to prevent leakage.

- I. Shaft sleeve shall be constructed of **Type 316 stainless steel** ~~420 series stainless steel hardened to 450 Brinell or better or corrosion resistant bronze~~, and secured to prevent reversal of rotation. An "O" ring seal shall be provided between the shaft and the impeller hub to prevent leakage under the sleeve. The shaft sleeve shall not be threaded.
- J. Bearings shall be of the anti-friction ball or tapered roller type in a dust-proof housing. Bearings shall be oil or grease lubricated with provisions for the addition or draining of lubricant. The bearings shall be designed for continuous heavy duty loads and for both axial and radial thrust loads. Bearings shall have a minimum AFBMA B-10 life of 100,000 hours under worst possible operating conditions. The bearing frame shall be of rigid cast iron construction to support the shaft and the bearings, and shall be designed so that the complete rotating element can be removed from the casing without disconnecting the piping.
- K. Bearing housing shall be constructed of cast iron, ASTM, A48, Class 30 designed to provide a fully enclosed bearing housing incorporating a seal water catch basin with a tapped drain and overflow ports where applicable.
- L. Wearing Rings - Wearing rings shall be of the removable type, of 400 series stainless steel hardened to 450 Brinell. One wearing ring shall be on the impeller and one on the casing.
- M. Wear Adjustment - Rotating assembly shall be readily adjustable by jack screws at the end of the bearing housing so that, as wear occurs, proper impeller-to-suction cover liner clearance can be maintained without dismantling the pump.
- N. Base – The combination pump and motor base shall be a heavy duty fabricated steel open channel base with openings to facilitate grouting.
- O. Coupling - Pump shaft connections to drives shall be directly connected through flexible couplings as manufactured by Falk, Dodge, or equal. Couplings shall be provided with coupling guards.

2.03 ELECTRICAL AND CONTROL REQUIREMENTS

A. Electrical Requirements

	Recirculation Pumps No. 1 and No. 2
Motors	
Rating	460V, 3 ph, 60 Hz
Horsepower	15
Speed, rpm	500 - 900
Enclosure	TEFC
Insulation	Class F
Inverter Duty	No
Service Factor	1.15
Space Heater	Yes
Motor Winding Temperature Switches	Yes

RTDs	No
Separate Cooling Fan	No
Motor Differential Current Transformers / Six-Lead External Wye Connection	No

2.04 SPARE PARTS

- A. Spare parts shall be provided in accordance with Section 11000, Equipment General Provisions and shall include the following for each series of pumps:

- One (1) - set of wearing rings
- One (1) - shaft sleeve
- One (1) - set of motor and pump bearings
- One (1) - complete mechanical shaft seal assembly
- Two (2) - sets of gaskets and O-ring seals

PART 3 -- EXECUTION

3.01 MANUFACTURER'S FIELD SERVICES

- A. The services of a qualified manufacturer's technical representative shall be provided in accordance with Section 11000, Equipment General Provisions. For each series of pumps, field services shall include the following site visits:

Service	Number of Trips	Number of Days/Trip
Installation and Testing	1	1
Startup and Training	1	1
Services after Startup	1	1

3.02 SHOP TESTING

- A. Shop testing shall be in accordance with Section 11000, Equipment General Provisions.

3.03 FIELD TESTING

- A. Field testing shall be in accordance with Section 11000, Equipment General Provisions and Section 11100, Pumps-General.

- END OF SECTION -

SECTION 13320

PRESTRESSED CONCRETE TANKS

PART 1 - GENERAL

1.01 THE REQUIREMENT

- A. The tank construction company (TCC) shall provide all labor, material, and equipment required to construct one (1) prestressed composite above ground storage tank (herein called tank), with a cast-in-place concrete membrane floor slab, prestressed composite wall, a dome roof and accessories as shown on the Drawings and as specified herein, suitable for reclaimed water storage.
- B. The TCC shall be responsible for the structural design of the tank, including but not limited to: foundation slab, outlet sump, pipe penetrations, dome roof with parapet wall and wire prestressed composite wall. The prestressed concrete tanks shall in general conform to the applicable section of the "Design and Construction of Circular Wire and Strand-Wrapped Prestressed Concrete Structures" prepared by ACI committee 372 and AWWA Specification D110.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Division 2 - Sitework
- B. Division 3 - Concrete
- C. Division 5 - Metals
- D. Division 7 - Thermal and Moisture Protection
- E. Division 9 - Finishes
- F. Division 15 - Mechanical Construction

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. Reference Specifications, Codes and Standards shall be as specified in Section 01090 entitled "Reference Standards".

1.04 SUBMITTALS

- A. The TCC shall submit Shop Drawings, Operation and Maintenance Instructions, and other information as specified in accordance with Section entitled "Submittals".
- B. Shop Drawings shall include Structural Drawings, complete erection, installation, and adjustment instructions and recommendations. All Drawings shall be signed and sealed by a Professional Engineer registered in the State of Florida. Drawings shall include:
 - 1. Complete plan, elevation and sectional views showing critical dimensions.

2. Size, location and number of all reinforcing bars.
 3. Thickness of all parts of the tank structure including floor, core, wall, dome, and cover coat.
 4. Prestressing schedule including number and placement of prestressing wires on the tank wall and total applied force per foot of wall height.
 5. Location and details of all accessories required.
- C. The TCC shall submit the following in addition to the requirements specified herein:
1. Complete record of experience with sources of Engineers, Cities and dates of construction for no less than ten tanks of comparable size.
 2. Copies of Shotcrete Nozzlemen Certificates.
- D. Properly identified and neatly bound calculations, together with ample sketches and illustrations showing complete details of all required accessories and pipe penetrations shall be submitted to the Engineer for review and acceptance. All design data shall be listed, and references to the chapter, section, or paragraph of the applicable code(s) shall be noted at critical steps in the calculations to ascertain conformance thereto. Review by the Engineer shall not relieve the TCC from responsibility for the accuracy and completeness of its design. Structural calculations shall be reviewed and sealed by a currently registered Professional Engineer in the State of Florida. Computer printouts shall be substantiated with manual calculations verifying the accuracy of the outputs.
- E. Copies of the reviewed shop drawings and submitted calculations shall be forwarded by the TCC to applicable permitting agencies for review and approval. The TCC shall be responsible for demonstrating the conformance of the design to the Florida Building Code and all applicable local requirements. The Owner or Engineer will not be responsible for additional costs over the Contract price for conforming the design to Code requirements.
- F. Design criteria and fully detailed working drawings for the prestressed concrete tank as specified.
- G. Concrete and grout mix design and strength test results of trial mixes for all concrete per Section 03300.
- H. Joint materials.
- I. Mill certificates for prestressing wire and for appurtenant materials.
- J. Details for dome mounted handrail and dome parapet wall construction.

1.05 QUALIFICATIONS

- A. The TCC shall be a specialist in the design and construction of the wire wound circular prestressed composite tanks with at least ten years of experience in central Florida which shall include the construction of no less than ten prestressed composite tanks of

comparable size. The TCC shall give satisfactory evidence that it has the skill, reliability, and financial stability to build and guarantee the tanks in accordance with the quality required by these Specifications. The entire tank, including all portions of the floor, wall, and roof shall be built by the TCC using its own trained personnel and equipment.

- B. The TCC shall have on its staff a full-time Professional Engineer registered in the State of Florida with no less than five years experience in design and field construction of circular prestressed composite tanks and who will be in responsible engineering charge of the work to be done. All working drawings and design calculations shall carry the seal of such registered Professional Engineer.
- C. The TCC constructing the tank shall have built completely in its own name in the past five years, and be presently responsible for, a minimum of ten (10) dome-covered prestressed composite tanks of equal size or larger which meet these Specifications and which are now giving satisfactory service.

1.06 TCC'S RESPONSIBILITY

- A. The TCC shall guarantee workmanship and materials entering into its portion of the Work for a period of five years from date of acceptance of the Work. In case leakage or other defects appear within the five-year period, the TCC shall promptly make required repairs at its own expense upon written notice by the Owner that such defects have been found. Leakage through the side walls shall be defined as the appearance of free liquid showing stream flow on the exterior tank surface, the source of which is from the inside of the tank. Leakage through the bottom shall be defined as the appearance of water flowing or dripping from tank subsurface system with groundwater below invert elevations.
- B. The TCC shall be totally responsible for the structural integrity of the tank and adherence to all applicable codes (local and state).
- C. Provide written warranty signed by Tank Construction Company and Contractor agreeing to repair or replace defective components and workmanship of the tanks as required to maintain the tanks in a water tight condition, at no expense to the owner, for a period of 5 years after date of substantial completion of the project.

1.07 SITE PREPARATION AND FOUNDATION DESIGN

- A. The Contractor shall perform site preparation in the area of the tank. Surface preparation shall be in accordance with project specifications and to the satisfaction of the Tank construction Company. The Owner will retain the services of an independent testing laboratory to perform soil density tests as specified in section 02224 – Excavation and Backfill for Structures. Test reports will be forwarded to the TCC, the ENGINEER, and the Owner for review. The Tank Construction Company shall review the submitted test reports and ensure that Soil preparation is satisfactory to meet their design requirements and design assumptions for strength and serviceability of the tank structure. The tank construction company shall accept or reject the density tests reports in writing. In the event that the TCC requires additional soil preparation to meet the design requirements, the costs of such preparation shall be included in the contract price and will be at no additional cost to the Owner.

- B. A separate geotechnical report is available for information purposes in the Appendices. The report identifies properties below grade and also offers recommendations. The recommendations shall not be construed as requirements of the Contract unless specifically referenced by the Contract Documents.
- C. Prior to submitting its bid, the TCC shall examine the site and review the available geotechnical reports and subsurface information and/or undertake its own soil borings prior to submitting its bid, taking into consideration all conditions that may affect its Work. The Owner and Engineer will not assume responsibility for variations of sub-soil quality or conditions.

1.08 INSPECTIONS

- A. The TCC shall provide the services of a qualified representative having a minimum of ten years experience in concrete tank construction projects in Florida (Special Inspections) who shall instruct and supervise the TCC's personnel in the construction of the tank. The qualified representative shall ensure that the construction is in accordance with the structural shop drawings reviewed and accepted by the Owner.
- B. After the construction of the tank and testing, prior to acceptance by the Owner, the qualified representative shall issue a Certificate of Completion stating that the construction was in conformance with the structural shop drawings.

1.09 PRESTRESSED CONCRETE TANK DESCRIPTION

- A. Tank shall consist of:
 - 1. Cast-in-place concrete floor
 - 2. Prestressed composite wall with steel diaphragm
 - 3. Clear span dome roof with 126" high parapet wall (126" from top of tank sidewall to top of parapet wall)
 - 4. Accessories include:
 - a. Exterior aluminum ladder with safety cage
 - b. Mechanical liquid level indicator
 - c. Interior fiberglass ladder with safety device
 - d. Roof ventilator at center of dome
 - e. Roof hatch
 - f. Sidewall entrance manhole
 - g. Precast concrete overflows with a positive slope between each overflow. Perimeter 126-inch high parapet wall to collect tank stormwater runoff and divert it into the tank through the concrete overflows.

- h. Perimeter double rail handrail with kickplate
 - i. Fall protection system
 - j. Submerged pressure element level indicator system
5. The tank manufacture shall include a parapet wall and drain system to collect rainfall from the roof and divert it into the tank.

1.10 ACCEPTABLE MANUFACTURERS

- A. Acceptable Tank Construction Companies are Crom Corporation, Precon Corporation or approved equal.

PART 2 - MATERIALS

2.01 GENERAL

- A. The tanks shall be designed to the following general requirements. Refer to drawings for pipe penetrations, floor configuration, access details, etc.

<u>Designation</u>	<u>Storage Tank</u>
Capacity, MG	3
Inside diameter, feet	141
Tank floor elevation, feet	111.00
Top of wall elevation, feet	136.75
Elevation of top of dome, feet	143.00
Design water level in tank, feet	136.75
Maximum water level in tank, feet	136.75

- B. The circular tanks shall be constructed of composite steel-shotcrete, wire wound prestressed construction as specified herein. The wire-prestressed composite wall shall consist of a shotcrete cover wall encasing a steel diaphragm continuous over the full wall height.
- C. Dimensions and structural details shown on contract drawings are minimum requirements. The TCC shall provide whatever additional thicknesses, reinforcing, etc., to meet code and structural requirements.
- D. **The** Each entire tank, including all portions of the floor, wall, and roof, shall be built by the TCC using its own trained personnel and equipment.

2.02 DESIGN CRITERIA

- A. Geotechnical Considerations

1. A separate geotechnical report is included in the Appendices that outlines the subsurface conditions to be expected on site. The Tank Construction Company shall review the soil borings and the Specifications for soil preparation to develop the foundation design criteria required for the each tank.
2. Differential settlement can be expected for the structures. All new structures can be expected to undergo an overall settlement of 1-inch and a differential settlement of 1/2-inch. Foundations shall be designed for the anticipated settlements.

B. Groundwater

1. All structures shall be designed for the high groundwater elevations based on the geotechnical report prepared for the project site. The design seasonal high groundwater elevation is approximately 4 feet below grade. All structures shall have a twenty-percent safety factor against uplift under high groundwater conditions.
2. The Tank Construction Company shall design and furnish the tanks structures for all combination of loads per applicable building codes.
3. No pressure relive valves shall be utilized in the construction of any prestressed concrete tanks valves if the structural dead load will not compensate for the design uplift forces.

C. Contract Drawings

1. The Contract Drawings show wall thicknesses, reinforcing steel and construction details at some locations. These details are meant to establish minimum standards and are not intended to represent the Tank Construction Company's scope of work. Modifications shall be made as required by the structural design. Details of tank geometry shall be coordinated and revised as required by the Contractor with the various equipment, piping, and electrical submittals.

D. Load Criteria

1. The tanks shall be designed for the worst case of the following load conditions or its combinations:
 - a. Interior high water level, as shown on the Drawings, to top of tank.
 - b. Wind Load: 135 mph based on a 3-second gust per Florida Building Code (FBC) and ASCE 7-02, Exposure Category C.
 - c. Roof Live Load: Minimum 12 psf as specified by the Florida Building Code.
 - d. Equipment loads.
 - e. Seasonal high groundwater conditions per the geotechnical report prepared for the project site.

- E. The thickness of the prestressed shotcrete walls and concrete core walls shall be calculated so as to accept the initial compressive forces applied by prestressing, hydrostatic stresses induced by contents, and other applicable loads such as soil backfill and wind.
- F. Backfill loads shall not be used in the design of the core wall to counteract hydraulic loads or provide residual compression in the wall.
- G. The design of the circular prestressed walls shall be in conformance with American Concrete Institute (ACI) Title 372R-W "Design and Construction of Circular Wire and Strand Wrapped Prestressed Concrete Structures," and currently accepted engineering principles and practices for the design of such facilities.
- H. Shotcrete:
 - f'_g shall be equal to or greater than 4000 psi at 28 days
 - f_{ci} shall be equal to or less than $0.55 f_{ci}$ at winding
- I. Prestress Wire:
 - $f_{s, \text{ wall}} = 115,000 \text{ psi}$
 - $f_{s, \text{ dome ring}} = 120,000 \text{ psi}$
 - $f_{si} = 145,600 \text{ psi}$ or no greater than $0.70 f'_s$
 - f'_s shall be equal to or greater than 231,000 psi
- J. If requested, the TCC shall furnish certified statements from an approved testing laboratory for wire used. Concrete and shotcrete testing requirements shall be as specified herein.

2.03 CONCRETE

- A. As specified in Section 03300 – Cast-in-Place-Concrete for class A concrete. Maximum size of aggregate for floor concrete shall be 3/4 –inch. Maximum size of aggregate for dome concrete shall be 3/8-inch.

2.04 REINFORCING STEEL (Other Than Prestressing Wire)

- A. As specified in Section 03200 – Concrete Reinforcement.
- B. Reinforcing steel shall have a minimum yield strength (f_y) of 60,000 psi.
- C. Reinforcing steel shall have an allowable tensile stress of 18,000 psi.

2.05 MESH REINFORCEMENT

- A. The wire mesh used shall be electrically welded and shall comply with ASTM Designation A 185 (latest revision), not galvanized.

2.06 PRESTRESSING WIRE

- A. Wire size shall have a minimum diameter of 0.162 inches for 8 gauge and 0.192 inches for 6 gauge but shall not exceed 0.250 inches, for either gauge wire.
- B. Prestressing wire shall comply with the latest revision of ASTM Designation A 821 Class B and shall have a minimum ultimate tensile strength (f'_s) of 231,000 psi or greater for 8 gauge and a minimum ultimate tensile strength of 222,000 psi or greater for 6 gauge.

2.07 SHOTCRETE

- A. The TCC shall submit detailed information regarding the proportions and preparation of the shotcrete to the Engineer before the material is to be used. The shotcrete shall be so proportioned as to be sound, dense, waterproof, and durable.
- B. Fine Aggregates (Sand):
 - 1. Saturated, surface dry, hard, dense, uncoated rock fragments free from injurious amounts of foreign or deleterious substances as specified in Section 03300 – Cast-in-Place-Concrete.
 - 2. Fineness Modulus for Sand: Range from 2.40 to 3.00 with maximum particle size of 1/4 inch.
 - 3. Maintain sand at 3 to 6 percent moisture content; dampen or dry with sand dryers if necessary.
 - 4. Gradation:

<u>Sieve Size</u>	<u>Percent Passing by Weight</u>
No. 4	97-100
No. 8	90-98
No. 16	70-85
No. 30	35-55
No. 50	12-25
No. 100	2-8

- C. Screen sand for finish coat to produce uniform dense surface in texture and appearance.
- D. The mortar shall have the following minimum compressive strengths:

	<u>7 Days</u>	<u>28 Days</u>
Individual minimums	2400 psi	4000 psi
Average minimums	3000 psi	5000 psi

- E. The shotcrete shall have the following allowable compressive stress (f_g):

$1250 + 75t$ with $0.45 f'_g$ maximum
 where t = thickness of the core wall

- F. The shotcrete shall have the following allowable compressive stress due to initial prestressing (f_{gi}):

0.5 f'_{gi} or less, with a maximum of 2,250 psi (where f'_{gi} is defined as compressive strength at the time when the initial prestressing force is applied).

- G. The TCC shall take one set of three test cylinders per 50 cubic yards of shotcrete mix applied per day, or fraction thereof and have tested at an independent materials testing laboratory ~~acceptable to the Engineer~~ **provided by the OWNER**. Test all shotcrete using standard 6 x 12 cylinders in accordance with ASTM C 39 and C 94. ~~All cost associated with the shotcrete testing shall be included in the TCC bid price.~~

2.08 TANK FLOOR AND FOUNDATION

- A. ~~Each~~ **The** concrete tank floor and foundation shall be constructed as a membrane floor slab conforming to Section 03300 – Cast-in-Place Concrete and other applicable sections of these Contract Documents. Concrete membrane floors shall be thickened to a minimum of 8 inches over all pipe encasements and around sumps. Reinforcement shall extend a minimum of 2 feet into the adjacent floor slab.
- B. ~~Each~~ **The** tank floor slab shall be concrete or shotcrete construction, minimum 4-inch thickness, containing no less than 0.60 percent reinforcing steel in each orthogonal direction. Reinforcement shall extend a minimum of 2 feet into the adjacent floor slab. The Tank Construction Company shall be responsible for design and shall provide a sufficiently thick reinforced floor slab, including the foundation slab beneath the walls for the vertical loading. The floor slab shall be capable of transferring loads from the wall, so that the load applied to the soil is as recommended in the geotechnical report.
- C. A sliding water stop shall be used in the floor-wall joint. Load, shear, and deflection data to support shear and deflection must be included in the calculations for the base of the wall. Tests must have been generated for the particular water stop configuration proposed. Maximum allowable foundation bearing pressure shall be selected as a result of a review of the available soils information and tests conducted by the TCC, but in no case shall be greater than ~~3200~~ **3000** psf.
- D. All below grade piping that falls within the foot print of the foundation slab shall be encased in ~~reinforced~~ concrete as shown on the Drawings.
- E. Floors shall be vibratory screeded to affect consolidation of concrete and proper encasement of floor reinforcing steel.
- F. Floors shall be continuously water cured utilizing potable water until tank construction is completed.
- G. Differential Settlement: 0.5-inches.
- H. Total Settlement: 1.0-inches.

2.09 CORE WALL

- A. The core wall shall be constructed of shotcrete placed in accordance with standard practices. A description of shotcrete practice is contained in ACI 506R, "Guide to Shotcrete." Core wall thickness at the top of the tank shall be not less than 3-1/2 inches. Base-of-wall thickness shall be determined by design calculations to resist the initial compressive stresses of the prestressing wire, backfill, and other applicable loads. The wall may taper uniformly on the outside face from top to bottom as required by design computations. Horizontal sections of the wall shall form true circles without flats, excessive bumps, or hollows. All prestressing shall be done with high tensile wire, permanently bound to the tank wall in which a substantial allowance shall be made for loss of prestress due to shrinkage and plastic flow in the shotcrete and to relaxation in the steel. Provide a minimum 2-inch thick section with defined 90 degree angled edge to thicken areas for all materials, supports, equipment, etc. requiring anchorage to the tank wall.

2.10 STEEL SHELL DIAPHRAGM

- A. ~~A 26-gauge full height steel tank shell shall, complying with ASTM A 366 (latest revision) for Commercial Quality Cold Rolled Steel~~ **The galvanized steel diaphragm used in the construction of the core wall shall be 26-gauge with a minimum thickness of 0.017 in. conforming to the requirements of ASTM A653/A653M. Weight of zinc coating shall not be less than G 90 of Table 1 of ASTM A653/A653M. The galvanized steel diaphragm** shall be used throughout the core wall providing a positive waterstop. A shotcrete coat, not less than one-inch thick, shall cover and protect the steel shell diaphragm at all places. The steel shell shall be so formed and erected that a strong mechanical key between shotcrete and shell will be created. The sheets of steel diaphragm shall be continuous from top to bottom of wall. Only vertical joints will be permitted.

2.11 DOME ROOF

- A. The dome roof shall be a circumferentially prestressed free-span dome of concrete or shotcrete construction with a minimum thickness of three inches and a minimum of 0.25 percent reinforcing steel in each orthogonal direction.
- B. Dome shell reinforcement shall consist of reinforcing steel bars or welded wire fabric meeting ASTM A-185, not galvanized. Bolsters for wire fabric and reinforcing bars shall be plastic tipped. Wire ties shall be galvanized.
- C. The dome shell shall be designed as a free span, spherical thin shell, with a one-~~tenth twelfth~~ **twelfth** (1/10~~2~~) rise. The dome ring girder shall be prestressed with sufficient wire to withstand the dome dead load and design live loads. The ring girder shall have a cross section suitable to accept the applied prestressing forces. All surfaces in the wall/dome ring girder joint shall be coated with an approved bonding epoxy.
- D. Overflow outlets shall be installed on the dome roof in such numbers as will provide an overflow open area at least three times the area of the largest tank pipe.
- E. Design and construct a ~~126~~ **12**-inch high parapet wall around the dome perimeter and slope concrete surfaces using grout to drain dome runoff water into the overflow outlets.

2.12 VERTICAL REINFORCING

- A. Vertical reinforcing to compensate for shrinkage, temperature, and vertical bending moments in the core wall shall be as follows:

Inside face - A 26 gauge steel shell diaphragm continuous the full wall height without horizontal splices. Additional vertical and horizontal reinforcing steel bars as required by design computations.

Outside face - Vertical reinforcing steel: minimum of #4 bars at 12 inches center to center. Additional vertical and horizontal reinforcing steel bars as required by design computations.

2.12 WATER STOPS

Water stops shall be PVC and shall meet the minimum requirements in accordance with CRD-C572.

2.13 NEOPRENE BEARING PAD

In accordance with AWWA D110, paragraph 2.5.

2.14 SPONGE FILLER

In accordance with AWWA D110, paragraph 2.5.3.

2.15 EPOXY INJECTION SEALANT

The epoxy sealant shall be suitable for bonding to concrete, shotcrete, and steel. The sealant shall conform to the requirements of ASTM C881/C881M, Type III, Grade 1 and shall be a 100% solids, moisture insensitive, low modulus epoxy system. When pumped, maximum viscosity of the epoxy shall be 10 poises at 77°F.

2.16 TANK ACCESSORIES

- A. Tank accessories shall be furnished by the TCC as shown on the Drawings and specified herein.
1. Wall manhole shall be provided as shown on the drawings. The wall thimble shall be ¼ inch minimum thickness and the cover shall be ½ inch minimum thickness. The cover shall be gasketed for a watertight seal. All metal shall be 316 stainless steel.
 2. Piping Brackets, Grating, and Vortex Shedding Device: Provide piping brackets for all vertical risers supplied under Division 15 to rigidly support the piping to the nearest wall. Stainless steel vortex shedding device on tank outlet shall be as shown on the Drawings. Grating over drain outlet shall be fiber glass.
 3. Interior ladders shall conform to Owner, state, and OSHA requirements. Equip the interior ladders with a ladder-centered notched safety climbing tube of ASTM A276, Type 316 Stainless Steel. Provide storage brackets and box mounted on the handrail for the removable portion of the tube which extends above the roof hatch.

Provide three sets of safety belts and sleeves. Construct the interior ladder of fiberglass with Type 316 Stainless Steel fasteners.

4. Exterior ladders shall conform to Owner, state, and OSHA requirements Construct the exterior ladders of T6061 aluminum with Type 316 Stainless Steel fasteners safety cage and safety climbing device conforming to applicable OSHA standards.
5. Roof Ventilator: Roof ventilator shall be provided as shown on the Drawings. All ventilator material shall be fiberglass or Type 316 Stainless Steel. Ventilator shall include polyester, removable 24/24 mesh insect screens.
6. Overflow Outlets: Dome shall include ~~five~~ **four** integrally cast concrete “eyelet” type overflow outlets as shown on the Drawings ~~complete with fiber glass “eyelid” covers and polyester, removable insect screens.~~
7. Miscellaneous Metals: All miscellaneous metals framing into the tank structure including brackets, fasteners, plates, angles, flanges, etc., shall be furnished and installed by the TCC. Supports and fasteners shall be supplied for all conduit and small pipe mounted to the tank walls or slabs. All fasteners shall be Type 316 Stainless Steel. Miscellaneous metals shall be in conformance to with requirements set forth in Division 5 – Metals of these Contract Documents.
8. Access Hatch: Provide dome mounted fiberglass access hatch as detailed on the drawings complete with all Type 316 stainless steel fasteners and hardware.
9. Mechanical Level Indicator: Provide a mechanical level monitoring device and connections to the tank wall as shown on the Drawings to provide visual indication of tank level that does not require power. Materials shall be fiberglass with Type 316 stainless steel fasteners.
10. Submerged pressure element system for continuous level monitoring in accordance with Section 13310.
11. Perimeter Handrail: Provide double rail aluminum handrail with kickplate as specified under Division 5 around the perimeter of the tank. TCC shall provide integrally cast bosses to mount handrail posts as required to facilitate installation of the handrail for level and rigid connection. Coordinate handrail design with perimeter parapet wall design. Fasteners and anchors shall be Type 316 stainless steel. Provide protective coating on aluminum surfaces that will be in contact with concrete.
12. Tank Hardware: All tank hardware (fasteners, bolts, nuts, anchor bolts, screws, etc) shall be Type 316 stainless steel.
- ~~13. Fall Protection System: the tank manufacturer shall provide the design and installation of a fall protection system around the perimeter parapet wall of the tank. The system shall be compliant with all current standards and design criteria dictated by the United States Occupational Safety & Health Administration and Orange County’s Office of Risk Management. The basis of the system shall be perimeter cable system mounted along the roof of the tank at the parapet wall. The system will be for Operators to harness into with a typical personal fall arrest system using~~

~~body harness and locking snap hooks. The system shall be designed by an Engineer Licensed in the State of Florida with experience in design of safety systems to serve as the Safety System Design Engineer. The system shall be submitted for review by the Owner and Engineer as part of the submittal process. The submittal shall include all materials of construction, assumptions, loads, etc. and be signed and sealed by the Safety System Design Engineer. Following the construction of the tanks tank and prior to acceptance by the Owner, the Safety System Design Engineer shall inspect the installation by the Contractor and provide a Certification Letter confirming that the system was installed in accordance with design prepared and submitted.~~

PART 3 - INSTALLATION

3.01 CONCRETE WORK

- A. The formwork, mixing, placement, finishing, etc., for concrete Work shall be as specified under applicable Sections of these Specifications.

3.02 STEEL DIAPHRAGM

- A. The diaphragm shall be erected plumb and securely anchored and aligned to serve as a shooting form for the shotcrete mortar.
- B. No holes, including nailholes, shall be made for any purpose, including the purpose of erection, before, during, or subsequent to erection, except for those required for inserting pipe sleeves, reinforcing steel, bolts, or other special appurtenances. Such penetration shall be sealed with an approved epoxy sealant. The diaphragm shall be interlocked, lapped, and completely sealed with an approved epoxy bonding material.
- C. All vertical joints shall be sealed water tight by epoxy injection. This epoxy injection shall be carried out from bottom of the wall to top of wall, using a pressure pumping procedure, after the steel shell has been fully encased, inside and outside, with shotcrete. The epoxy sealant shall be suitable for bonding to concrete, shotcrete, and steel. The sealant shall conform to the requirements of ASTM C 881, Type III, Grade 1, and shall be a 100 percent solids, moisture insensitive, low modulus epoxy system. When pumped, maximum viscosity of the epoxy shall be 10 poises at 77 degrees Fahrenheit.
- D. The diaphragm and the epoxy injection procedure must have demonstrated suitability through successful use in the ten-tanks required in the TCC's experience record. The final determination of suitability shall be determined solely by the Engineer.
- E. Maximum dimension tolerances for core wall construction (including diaphragm as applicable) shall be as follows:

Thickness: +/- 1/4 inch

Height: 1/4 inch in 100 feet not to exceed a total of 1/2 inch

Out-of-plumb: 1/4 inch in 10 feet of height

Out-of-round: +/- 1 inch per 100 feet diameter

3.03 PLACING SHOTCRETE

- A. All shotcrete shall be applied by or under direct supervision of experienced nozzle men certified by the American Concrete Institute (ACI) as outlined in ACI certification publication CP-60. Shotcrete nozzle men shall provide proof of current certification in accordance with ACI certification publication CP-60 guidelines, "Certification of Shotcrete Nozzle men." The nozzle shall be held at such a distance and position that the stream of flowing material shall be nearly perpendicular as practicable to the surface being covered. Any rebound or overspray or sags shall be immediately cut out and replaced with proper material.
- B. The velocity of the material at impact shall be uniform and such as to produce a minimum rebound of sand and fully encase re steel. No shotcrete shall be placed when the temperature is below 40 degrees Fahrenheit or when other weather conditions are unfavorable. The surface to which shotcrete is applied shall be free from frost.
- C. At the end of each day's Work, or similar stoppage period, the shotcrete shall be cut off as square as possible. Before resuming shooting, these exposed portions shall be thoroughly cleaned and wetted by means of air and water blast. Should the strengths of shotcrete shown by the test specimens made and tested in accordance with the above provisions fall below the values given, the Engineer shall have the right to require changes in the shotcrete mix for the remainder of the Work. Furthermore, the Engineer shall have the right to require additional curing on those portions of the structure represented by the failing test specimens. In the event that such additional curing does not give the strength required, as evidenced by core and/or other tests, the Engineer shall have the right to require strengthening or replacement of those portions of the structure which fail to develop the required strength. The TCC shall have no claim for reimbursement for the required corrective measures.

3.04 CURING CONCRETE AND SHOTCRETE

- A. The TCC shall be responsible for the curing of all concrete masonry and shotcrete. Curing shall include protection such that the temperature at the surface does not fall below 50 degrees Fahrenheit and such that there is no loss of moisture from the surface for a period of seven days, where normal portland cement is used.
- B. If low temperatures are anticipated, the TCC shall submit, for the approval of the Engineer, the method he proposes to use for protecting the concrete and shotcrete against low temperatures prior to placing.

3.05 HORIZONTAL PRESTRESSING

- A. Circumferential prestressing of the tank walls shall be accomplished by applying continuously and uniformly a prestressing steel wire to the core wall in a helix of such pitch as to provide an initial predetermined force and unit compressive stress in the core wall per lineal foot of height equivalent to that derivable from the Drawings. Splicing of the wire shall be permitted only when terminating an application of one complete coil of wire or in the event a defective section of wire must be removed during application. A machine shall be used for applying the wire, capable of continuously inducing a uniform initial force in

the wire as it is laid on the tank wall. Force in the wire shall be induced by methods not dependent on cold working or re-drawing the wire. Only the aggregate force of all stressed wires per foot shall be considered rather than the force per individual wire. No circumferential movement of the wire along the tank wall will be permitted during or after stressing of the wire. The steel wire bands on the core wall and dome ring shall be so placed that the prestress "working force" per foot of wall height shall exceed the hydraulic ring tension forces by not less than five percent. The "work force" shall be defined as the force determined by multiplying the area of steel wire by the unit wire stress after an allowance for losses of 20,000 psi has been made from the initial unit wire stresses. Such initial unit wire stress readings shall be made the same day the wire is placed, or if made later and after some stress losses have already occurred due to creep of wire, plastic flow, and shrinkage of core wall, allowances shall be made for such losses. The clear space between adjacent wires is to be no less than one wire diameter.

- B. No prestressing wire shall be installed until the concrete or shotcrete mortar core wall has been shown by test to have attained 75 percent of the 28-day compressive strength hereinbefore specified. No prestressing wire shall be applied when weather conditions are unfavorable.
- C. Where more than one layer of wire is required, underlayers shall be covered with shotcrete of sufficient thickness to provide approximately 1/8-inch cover over the wire.
- D. Attention is directed to the fact that prestressing wire is susceptible to failure through corrosion. Extreme care shall be used to protect the wire against leakage of water both from within and without the tank.

3.06 STRESS MEASUREMENT

- A. The TCC, at its own expense, shall furnish special equipment at the construction site capable of measuring the stress in the wire after it is placed on the tank wall. This stress-measuring equipment shall consist of an electronic direct-reading stressometer accurate to within two percent, complete with calibrated dynamometers and a test stand to verify the accuracy of the stressometer from time to time if necessary. The initial tension in each wire shall be recorded.

3.07 EXTERIOR COVERCOAT

- A. After circumferential prestressing wires have been placed by a wire winding machine, they shall be covered with shotcrete that will provide a minimum thickness over the wire of 1-inch. The shotcrete encasement shall completely encapsulate each wire and permanently bond the wire to the tank wall. When more than one layer of wire is required, under layers shall be covered with shotcrete of sufficient thickness to provide approximately 1/8-inch cover between layers.

3.08 WALL OPENINGS

- A. At all openings through the sidewalls, the wires shall be placed equally above and below the opening. The displaced wires will be added to those for a foot or two above and below the opening, leaving an entire strip around the tank which is unbanded. Such unbanded strip shall be no more than 36 inches high.

- B. An axi-symmetric finite element shell analysis will be required for unbanded wall spaces having a vertical dimension greater than 36 inches.
- C. All pipe sleeves passing through the wall shall be sealed to the steel shell diaphragm by epoxy injection.

3.09 CLEANING

- A. After construction of the tank has been completed and accessories installed, all trash, loose material and debris shall be removed from the tank. The tank should be thoroughly cleaned with a high pressure water jet, sweeping, scrubbing or equally effective means. All water and dirt or foreign material accumulated in this cleaning operation should be discharged from the tank or otherwise removed. All interior surfaces of the tank shall be kept clean until final inspection and acceptance.

3.10 FILLING AND TESTING

- A. Filling and testing of the tank shall be carried out prior to placing backfill around the structure. Watertightness shall be tested and the tank disinfected in accordance with Section 02667 entitled "Hydraulic Structures Testing". Reuse water shall be used for filling and testing. Testing shall be performed after interior coatings are applied.
- B. If the structure does not pass the hydraulic test, repairs shall be performed after acceptance of the repair procedure by the Engineer. The hydraulic test shall then be repeated. All costs including schedule impacts, costs of reuse or potable water and other indirect costs resulting from a re-test shall be borne by the Tank Construction Company.

3.11 PAINTING

- A. Painting of all tank walls, roof and other exterior concrete surfaces as well as the interior of tank shall be coated as specified in Section 09900 entitled "Painting".
- B. A uniform finish shall be provided for the tank exterior walls and roof. The standard of finish and colors shall be determined by the Owner. The surface to be painted shall be cured for a minimum of 28 days prior to application of paint materials.

3.12 DISINFECTION

- A. Following the successful hydrostatic tests, the tanks shall be disinfected by the Contractor in accordance with AWWA C652-92, Disinfection for Water Storage Facilities, and FDEP requirements. Following disinfection the tanks ~~tanks~~ **tank** shall be immediately put into service.

3.13 CONCRETE SURFACE FINISHES

A. Concrete surfaces shall be finished as follows:

- 1. Tank floor, interior wall, and dome shall have a light broom finish.**
- 2. Tank exterior wall covercoat shall be trowel sliced with a light broom finish.**

3.14 MATERIAL TESTING

A. Prepare and test the number of cylinder sets shown in the following schedule using ASTM C 39.

	At 7 Days	At 28 Days	Hold	Total Sets
Concrete Floor (per quarter area)	1	2	1	4
Shotcrete (per quarter area)				
Inside Core Wall	1	2	1	4
Outside Core Wall	2	2	2	6
Dome	1	2	1	4
Exterior Covercoat	1	2	1	4
Concrete Wall (per quarter area)				
Each pour of wall	1	2	1	4
Dome	1	2	1	4
Exterior (Overcoat)	1	2	1	4

The OWNER will pay for the initial sets of tests as described in the table above. The TCC shall pay for all re-tests above and beyond the tests shown in the table above due to failed test results or re-work facilitated by the TCC's failure to meet the requirements of the Contract Documents.

3.153 WARRANTY

The TCC shall provide a written warranty for workmanship and materials on the new 3 MG Ground Storage Tank for a period of five years from date of acceptance of the work. In case leakage or other defects appear within the five-year period, the tank constructor shall make repairs upon written notice by the Owner that such defects have been found. Leakage is defined as damp spots where moisture can be picked up by touching with a dry hand on the exterior of the tank surface, the source of which is from the inside of the tank, or the continuous loss of water by volume measure which is determined to be penetrating the bottom slab. Any repair or corrective work shall be the responsibility of the Contractor at no cost to the Owner.

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SECTION 15000

BASIC MECHANICAL REQUIREMENTS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

- A. The CONTRACTOR shall furnish and install to the required line and grade, all piping together with all fittings and appurtenances, required for a complete installation. All piping located outside the face of structures or building foundations and all piping embedded in concrete within a structure or foundation shall be considered exterior piping.
- B. The CONTRACTOR shall furnish and install fittings, couplings, connections, sleeves, adapters, harness rods and closure pieces as required to connect pipelines of dissimilar materials and/or sizes herein included under this Section and other concurrent Contracts for a complete installation.
- C. The CONTRACTOR shall furnish all labor, materials, equipment, tools, and services required for the furnishing, installation and testing of all piping as shown on the Drawings, specified in this Section and required for the Work. Piping shall be furnished and installed of the material, sizes, classes, and at the locations shown on the Drawings and/or designated in this Section. Piping shall include all fittings, adapter pieces, couplings, closure pieces, harnessing rods, hardware, bolts, gaskets, wall sleeves, wall pipes, hangers, supports, and other associated appurtenances for required connections to equipment, valves, or structures for a complete installation.
- D. Piping assemblies under 4-inch size shall be generally supported on walls and ceilings, unless otherwise shown on the Drawings or ordered by the ENGINEER, being kept clear of openings and positioned above "headroom" space. Where practical, such piping shall be run in neat clusters, plumb and level along walls, and parallel to overhead beams.
- E. The CONTRACTOR shall provide taps on piping where required or shown on the Drawings. Where pipe or fitting wall thicknesses are insufficient to provide the required number of threads, a boss or pipe saddle shall be installed.
- F. The work shall include, but not be limited to, the following:
 - 1. Connections to existing pipelines.
 - 2. Test excavations necessary to locate or verify existing pipe and appurtenances.
 - 3. Installation of all new pipe and materials required for a complete installation.
 - 4. Cleaning, testing and disinfecting as required.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Division 1, General Requirements

- B. Division 2, Sitework
- C. Division 5, Metals
- D. Division 9, Finishes
- E. Division 11, Equipment
- F. Division 16, Electrical

1.03 MATERIAL CERTIFICATION AND SHOP DRAWINGS

- A. The CONTRACTOR shall furnish to the OWNER (through the ENGINEER) a Material Certification stating that the pipe materials and specials furnished under this Section conform to all applicable provisions of the corresponding Specifications. Specifically, the Certification shall state compliance with the applicable standards (ASTM, AWWA, etc.) for fabrication and testing.
- B. Shop Drawings for major piping (2-inches in diameter and greater) shall be prepared and submitted in accordance with Section 01300 – Submittals. In addition to the requirements of Section 01300 – Submittals, the CONTRACTOR shall submit laying schedules and detailed Drawings in plan and profile for all piping as specified and shown on the Drawings.
- C. Shop Drawings shall include, but not be limited to, complete piping layout, pipe material, sizes, class, locations, necessary dimensions, elevations, supports, hanger details, pipe joints, and the details of fittings including methods of joint restraint. No fabrication or installation shall begin until Shop Drawings are approved by the ENGINEER.

PART 2 -- PRODUCTS

2.01 GENERAL

- A. All specials and each length of pipe shall bear the name or trademark of the manufacturer, the location of the manufacturing plant, the class or strength classification of the pipe, size, and the date of manufacture. The markings shall be plainly visible on the pipe barrel. Pipe, which is not clearly marked, is subject to rejection. The CONTRACTOR shall remove all rejected pipe from the project site within five Normal Working Days.
- B. All pipe not factory color-coded shall have a field applied, three inch wide pantone purple 522c stripe down the length of the pipe.
- C. Material Testing Requirements:
 - 1. If requested by the OWNER's Representative, a sample of pipe to be tested shall be selected at random by the OWNER's Representative or the testing laboratory hired by the OWNER.
 - 2. When the samples tested conform to applicable standards, all pipe represented by such samples shall be considered acceptable based on the test parameters

measured. Copies of test reports shall be available before the pipe is installed on the project.

3. In the event that any of the test samples fail to meet the applicable standards, all pipe represented by such tests shall be subject to rejection. The CONTRACTOR may furnish two additional test samples from the same shipment or delivery, for each sample that failed and the pipe will be considered acceptable if all of these additional samples meet the requirements of the applicable standards. All such retesting shall be at the CONTRACTOR's expense.
 4. Pipe that has been rejected by the OWNER's Representative shall be removed from the site of the work by the CONTRACTOR and replaced with pipe that meets these specifications.
- D. Special care in handling shall be exercised during delivery, distribution, and storage of pipe to avoid damage and unnecessary stresses. Damaged pipe will be rejected and shall be replaced at the CONTRACTOR's expense. Pipe and specials stored prior to use shall be stored in such a manner as to keep the interior free from dirt and foreign matter.
 - E. The CONTRACTOR shall provide sufficient dunnage to maintain all piping and specials in a neat and orderly manner until their use.
 - F. Testing of pipe before installation shall be as described in the corresponding ASTM or AWWA Specifications and in the applicable standard specifications listed in the following sections. Testing after the pipe is installed shall be as specified in 3.07.
 - G. Joints in piping shall be of the type as specified in the appropriate Piping System Schedule in Section 15390, Schedules.
 - H. ALL BURIED EXTERIOR PIPING SHALL HAVE RESTRAINED JOINTS FOR THRUST PROTECTION UNLESS OTHERWISE SPECIFIED OR SHOWN ON THE DRAWINGS. ALL EXPOSED EXTERIOR PIPING SHALL HAVE FLANGED JOINTS, UNLESS OTHERWISE SPECIFIED OR SHOWN ON THE DRAWINGS.
 - I. The CONTRACTOR shall verify existing above ground and buried piping tie-in connections before fabricating new piping assemblies. The CONTRACTOR shall verify size, type, and location of all existing buried piping and appurtenances by excavating test pits as required of all buried connections and crossings which may affect the CONTRACTOR's work prior to ordering pipe and fittings to determine sufficient information for ordering materials. The CONTRACTOR shall take whatever measurements that are required to complete the work as shown or specified.
 - J. Before setting wall sleeves, pipes, castings and pipes to be cast in place, the CONTRACTOR shall check the Drawings and equipment manufacturer's drawings which may have a direct bearing on the pipe locations.
 - K. Piping shall be attached to pumps, valves, equipment, etc., in accordance with the respective manufacturers' recommendations. This includes the use of flexible connectors as required.
 - L. All changes in directions or elevations shall be made with fittings, unless otherwise shown.

2.02 SLEEVES

- A. Unless shown otherwise, all piping passing through walls and floors shall be installed in sleeves or wall castings accurately located before concrete is poured, or placed in position during construction of masonry walls. Sleeves passing through floors shall extend from the bottom of the floor to a point 3 inches above the finished floor, unless shown otherwise. Water stop flanges are required on all sleeves located in floors or walls which are continually wet, under hydrostatic pressure on one or both sides of the floor or wall or buried on one side.
- B. Sleeves shall be cast iron, black steel pipe, or fabricated steel in accordance with details shown on the Drawings. If not shown on the Drawings, the CONTRACTOR shall submit to the ENGINEER the details of sleeves he proposes to install; and no fabrication or installation thereof shall take place until the ENGINEER's approval is obtained. Steel sleeves shall be fabricated of structural steel plate in accordance with the standards and procedures of AISC and AWS. Steel sleeve surfaces shall receive a commercial sandblast cleaning and then be shop painted in accordance with Section 09900 – Painting.
- C. When shown on the Drawings or otherwise required, the annular space between the installed piping and sleeve shall be completely sealed against a maximum hydrostatic pressure of 20 psig. Seals shall be mechanically interlocked, solid rubber links, trade name "Link-Seal", as manufactured by the Thunderline Corp., Wayne, Michigan, or equal. Rubber link, seal-type, size, and installation thereof, shall be in strict accordance with the manufacturer's recommendations. For non-fire rated walls and floors, pressure plate shall be glass reinforced nylon plastic with EPDM rubber seal and 304 stainless steel bolts and nuts. For fire rated walls and floors, two independent seals shall be provided consisting of low carbon steel, zinc galvanized pressure plates, silicon rubber seals and low carbon steel, zinc galvanized bolts and nuts.
- D. Cast iron mechanical joint adapter sleeves shall be Clow # 1429, as manufactured by the Clow Corp., or equal. Mechanical joint adapter sleeves shall be provided with suitable gasket, follower ring, and bolts to effect a proper seal. In general, sleeves installed in walls, floors, or roofs against one side of which will develop a hydrostatic pressure, or through which leakage of liquid will occur, shall be so sealed. If welded waterstop flanges are employed, welds shall be 360 degree continuous on both sides of flange.

2.03 SOLID SLEEVE COUPLINGS

- A. Solid sleeve couplings shall be provided where shown on the Drawings. Solid sleeves shall be ductile iron, long body and shall conform to the requirements of ANSI A21.10 (AWWA C110). Unless otherwise shown or specified, solid sleeve couplings shall be as manufactured by American Cast Iron Pipe Co., Sigma Corp. or equal. Harnessing or joint restraint shall be provided where either shown on the Drawings or identified elsewhere in the Specifications.

2.04 SLEEVE TYPE COUPLINGS

- A. Sleeve type couplings shall be furnished and installed where shown on the Drawings or otherwise required to resist internal operating pressures. In addition to that specified herein, harnessed, sleeve type couplings shall be provided on all exposed pipe 3 inches and larger in diameter that spans any expansion joint in a building or structure.
- B. Materials shall be of high strength steel and couplings shall be rated for the same pressures as the connecting piping.
- C. Gaskets shall be rubber. Bolts and nuts shall be alloy steel, corrosion-resistant and prime coated.
- D. Couplings shall be shop primed with a premium quality primer compatible with the painting system specified in Section 09900 - Painting. Field painting of wetted area shall be done prior to installation.
- E. Harnessing
 - 1. Harness couplings to adjacent flanges as shown, specified or otherwise required to restrain all pressure piping.
 - 2. Dimensions, sizes, spacing and materials for lugs, tie rods, washers, and nuts shall conform to the standards for the pipe size, and design pressure specified.
 - 3. No less than two (2) bolts shall be furnished for each coupling.
 - 4. Tie bolts, nuts and washers shall be ASTM A 193, Grade B7 steel or better.
 - 5. Harness rods shall have lengths less than 10 feet between adjacent flanged joints on fittings and shall be coated in accordance with Section 09900 – Painting.
- F. Couplings shall be as manufactured by Dresser Industries, Style 38, or equal as required and shown on the Drawings. All couplings shall be provided without interior pipe stop.

2.05 FLANGED ADAPTERS

- A. Flanged adapters shall be furnished as required and as shown on the Drawings.
- B. All flanged adapters, 12 inches in diameter and smaller, except as shown on the Drawings or directed by the ENGINEER, shall be locking type flanged adapters.
- C. Pressure and service shall be the same as connected piping.
- D. Materials shall be cast iron for pipes up to 12 inch diameter and high strength steel for pipes larger than 12 inch diameter.
- E. Flanged adapters shall be shop primed with a premium quality primer compatible with the paint system specified in Section 09900 – Painting. Field painting of wetted area shall be done prior to installation.

- F. Bolts and nuts shall be alloy steel, corrosion-resistant and prime coated.
- G. Flanged coupling adapters larger than 12 inches in diameter shall be harnessed by tying the adapter to the nearest pipe joint flange using threaded rods and rod tabs. The threaded rods and rod tabs shall be as shown on the Drawings.
- H. Flanged adapters shall be as manufactured by Dresser Industries, Style 127 or 128, Smith Blair Corporation, or equal.

2.06 MEGAFLANGE JOINTS

- A. Megaflange joints may ~~shall~~ be furnished for buried ductile iron pipe. ~~Use of megaflange joints shall be limited to High Service Pump suction piping only in locations shown on the Drawings.~~
- B. Megaflange joints shall be made of ductile iron conforming to ASTM A536 and shall have flange bolt pattern that are compatible with ANSI/AWWA C110/A21.10.
- C. Restraint for the megaflange joint shall consist of individual actuated gripping wedges spaced evenly around the connecting plain end pipe. Torque limiting actuating screws shall be used to insure proper initial set of gripping wedges.
- D. The megaflange joint shall be capable of deflection during assembly or permit lengths of pipe to be field cut to allow a minimum 0.6" gap between the end of the pipe and the mating flange without affecting the integrity of the seal.
- ~~E. The megaflange joint shall have a minimum safety factor of 2:1.~~
- EF.** The megaflange joint shall be EBAA Iron, Inc. Series **21100**.

2.07 DISMANTLING JOINTS

- A. Dismantling joints shall be furnished as required and as shown on the Drawings. Dismantling joints shall be comprised of a standard flange coupling adapter and a flange spool piece. Dismantling joints shall provide up to 5 inches of longitudinal adjustment.
- B. Pressure and service shall be the same as connected piping.
- C. Materials shall be high strength carbon steel complying with AISI C1010-C1015. Flanges shall comply with ANSI B16.5.
- D. Dismantling joints shall be shop primed on the exterior with a premium quality primer compatible with the paint system specified in Section 09850 – Painting. Lining shall be fusion bonded epoxy that is ANSI/NSF 61 listed for drinking water service.
- E. Bolts and nuts shall be alloy steel complying with AWWA C111/ANSI A31.11, corrosion-resistant and prime coated.
- F. Dismantling joints shall be harnessed by tying between the flanges using a minimum of two threaded rods. Tie rods shall be steel ASTM A193, Grade B7. The length and

diameter of the rods, size of nuts, and washers shall be as recommended by the joint manufacturer for the dismantling joint size used.

- G. Flanged adapters shall be as manufactured by Dresser Industries, Style 131, or equal.

2.08 HARNESSING

1. Harnessing of solid sleeve and sleeve type couplings, expansion joints, flanged adapters, mechanical couplings and other pipe assemblies shall be provided where shown, specified or otherwise required to restrain all pressure piping.
2. Tie bolts, rods, steel tabs, nuts and washers shall be ASTM A 193, Grade B7 steel or better and as a minimum shall be hot dip galvanized. Dimensions, sizes, and spacing for tabs, tie rods, washers, and nuts shall conform to the standards for the pipe size and design pressure specified.
3. No less than two (2) rods shall be furnished for each coupling.
4. Harness rods shall be less than 10 feet long between the tabs at flanged joints.

2.09 TAPPING SLEEVES AND TAPPING SADDLES

- A. Tapping sleeves shall be similar to JCM model 412. All sleeves shall have a minimum working pressure equivalent to the pipe the sleeve is attaching to. All sleeves larger than twelve (12) inches shall be ductile iron. All taps shall be machine drilled; no burned taps will be allowed.

2.10 UNIONS

- A. For ductile iron, carbon steel, and grey cast iron pipes assembled with threaded joints and malleable iron fittings, unions shall conform to ANSI B16.39.
- B. For copper piping, unions shall have ground joints and conform to ANSI B16.18.
- C. For PVC and CPVC piping, unions shall be socket weld type with Viton O-ring.

2.11 MEGA-COUPPLINGS

- A. Joint Restraint to prevent axial separation shall be incorporated into the design of the sleeve or coupling used to connect two plain pipe ends. The restraint mechanism shall consist of a plurality of individually actuated gripping surfaces to maximize restraint capability. Torque limiting twist off nuts shall be used to insure proper actuating of the restraint devices. The restraint devices shall be coated using a corrosion resistant coating system intended for buried use, such as EBBA Iron MEGABOND™. Ductile Iron components shall be of a minimum of 65- 45-12 ductile iron meeting the requirements of ASTM A536 of the latest revision and shall be tested in accordance with the stated standard. The restrained joining system shall meet the applicable requirements of AWWA C219, ANSI/AWWA C111/A21.11, and ASTM D2000. The restrained joining system shall be the EBAA Iron Series 3800.**

PART 3 -- EXECUTION

3.01 INSTALLATION

- A. All piping shall be installed by skilled workmen and in accordance with the best standard practice for piping installation as shown on the Drawings, specified or recommended by the pipe manufacturer. Proper tools and appliances for the safe and convenient handling and installing of the pipe and fittings shall be used. Great care shall be taken to prevent any pipe coating from being damaged on the inside or outside of the pipe and fittings. All pieces shall be carefully examined for defects, and no piece shall be installed which is known to be cracked, damaged, or otherwise defective. If any defective pieces should be discovered after having been installed, it shall be removed and replaced with a sound one in a satisfactory manner by the CONTRACTOR and at his own expense. Pipe and fittings shall be thoroughly cleaned before they are installed and shall be kept clean until they are accepted in the complete work. All piping connections to equipment shall be provided with unions or flange coupling adapters located so that piping may be readily dismantled from the equipment. These connections shall be as shown on the Drawings with alternatives used only when approved by the ENGINEER. All piping shall be installed in such a manner that it will be free to expand and contract without injury to itself or to structures and equipment to which it is connected. All piping shall be erected to accurate lines and grades with no abrupt changes in line or grade and shall be supported and braced against movement, temporary, or permanent. All exposed piping shall be installed with vertical and horizontal angles properly related to adjoining surfaces or pipes to give the appearance of good workmanship. Unless otherwise shown or approved, provided a minimum headroom clearance under all piping of 7 feet 6 inches.
- B. Unless otherwise shown or specified, all waste and vent piping shall pitch uniformly at a 1/4-inch per foot grade and accessible cleanouts shall be furnished and installed as shown and as required by local building codes. Installed length of waste and vent piping shall be determined from field measurements in lieu of the Drawings.
- C. All excavation shall be made in such a manner and to such widths as will provide ample room for properly installing the pipe and permit thorough compaction of backfill around the pipe. The minimum trench widths shall be in strict accordance with the "Trench Width Excavation Limits" as shown on the Drawings. All excavation and trenching shall be done in strict accordance with these specifications and all applicable parts of the OSHA Regulations, 29CFR 1926, Subpart P.
- D. Enlargements of the trench shall be made as needed to give ample space for operations at pipe joints. The width of the trench shall be limited to the maximum dimensions shown on the Drawings, except where a wider trench is needed for the installation of and work within sheeting and bracing. Except where otherwise specified, excavation slopes shall be flat enough to avoid slides which will cause disturbance of the subgrade, damage to adjacent areas, or endanger the lives or safety of persons in the vicinity.
- E. Hand excavation shall be employed wherever, in the opinion of the ENGINEER, it is necessary for the protection of existing utilities, poles, trees, pavements, or obstructions.
- F. No greater length of trench in any location shall be left open, in advance of pipe laying, than shall be authorized or directed by the ENGINEER and, in general, such length shall be limited to approximately one hundred (100) feet. The CONTRACTOR shall excavate

the trenches to the full depth, width and grade indicated on the Drawings including the relevant requirements for bedding. The trench bottoms shall then be examined by the ENGINEER as to the condition and bearing value before any pipe is laid or bedding is placed.

- G. No pressure testing shall be performed until the pipe has been properly backfilled in place except where the pipe is under gravity pressure only. All pipe passing through walls and/or floors shall be provided with wall pipes or sleeves in accordance with the specifications and the details shown on the Drawings. All wall pipes shall be of ductile iron and shall have a water stop located in the center of the wall. Each wall pipe shall be of the same class, thickness, and interior coating as the piping to which it is joined. All buried wall pipes shall have a coal tar outside coating on exposed surfaces.
- H. JOINT DEFLECTION SHALL NOT EXCEED 75 PERCENT OF THE MANUFACTURERS RECOMMENDED DEFLECTION FOR DUCTILE IRON PIPE. NO DEFLECTION SHALL BE ALLOWED FOR PVC AND CPVC PIPE; USE FITTINGS TO ATTAIN CHANGE OF DIRECTION. Excavation and backfilling shall conform to the requirements of Section 02200 - Earthwork, and as specified herein. Maximum trench widths shall conform to the Trench Width Excavation Limits shown on the Drawings. All exposed, submerged, and buried piping shall be adequately supported and braced by means of hangers, concrete piers, pipe supports, or otherwise as may be required by the location.
- I. Following proper preparation of the trench subgrade, pipe and fittings shall be carefully lowered into the trench so as to prevent dirt and other foreign substances from gaining entrance into the pipe and fittings. Proper facilities shall be provided for lowering sections of pipe into trenches. UNDER NO CIRCUMSTANCES SHALL ANY OF THE MATERIALS BE DROPPED OR DUMPED INTO THE TRENCH.
- J. Water shall be kept out of the trench until jointing and backfilling are completed. When work is not in progress, open ends of pipe, fittings, and valves shall be securely closed so that no water, earth, or other substance will enter the pipes, fitting, or valves. Pipe ends left for future connections shall be valved, plugged, or capped, and anchored as required.
- K. All piping shall be installed in such a manner that it will be free to expand and/or contract without injury to itself or to structures and equipment to which it is connected. All piping shall be erected to accurate lines and grades with no abrupt changes in line or grade and shall be supported and braced against movement, temporary, or permanent. All exposed piping shall be installed with vertical and horizontal angles properly related to adjoining surfaces or pipes to give the appearance of good workmanship. Pipes crossing within a vertical distance of less than or equal to one (1) foot shall be encased and supported with concrete at the point of crossing to prevent damage to the adjacent pipes as shown on the Drawings.
- L. The full length of each section of pipe shall rest solidly upon the bed of the trench, with recesses excavated to accommodate bells, couplings, joints, and fittings. Before joints are made, each pipe shall be well bedded on a solid foundation; and no pipe shall be brought into position until the preceding length has been thoroughly bedded and secured in place. Pipe that has the grade or joint disturbed after laying shall be taken up and relaid by the CONTRACTOR at his own expense. Pipe shall not be laid in water or when trench conditions are unsuitable for work.

- M. Proper and suitable tools and appliances for the safe convenient handling and laying of pipe shall be used and shall in general agree with manufacturer's recommendations.
- N. AT THE CLOSE OF EACH WORK DAY THE END OF THE PIPELINE SHALL BE TIGHTLY SEALED WITH A CAP OR PLUG SO THAT NO WATER, DIRT, OR OTHER FOREIGN SUBSTANCE MAY ENTER THE PIPELINE, AND THIS PLUG SHALL BE KEPT IN PLACE UNTIL PIPE LAYING IS RESUMED.
- O. During the laying of pipe, each pipe manufacturer shall provide his own supervisor to instruct the CONTRACTOR's pipe laying personnel in the correct procedure to be followed.
- P. Ordinarily only full lengths of pipe (as furnished by the pipe manufacturer) shall be used.
- Q. ALL PIPING SHALL HAVE TYPE "A" BEDDING AS SHOWN ON THE DRAWINGS, UNLESS OTHERWISE SPECIFIED HEREIN OR INDICATED ON THE DRAWINGS.

3.02 REINFORCED CONCRETE PIPE, CONCRETE CULVERT, AND DRAIN PIPE

- A. The laying of reinforced concrete pipe shall conform to the applicable sections of the Concrete Pipe Handbook as published by the American Concrete Pipe Association.

3.03 DUCTILE IRON PIPE

- A. Ductile iron pipe (DIP) shall be installed in accordance with the requirements of the Ductile Iron Pipe Handbook published by the Ductile Iron Pipe Research Association, and AWWA C600.
- B. Where it is necessary to cut ductile iron pipe in the field, such cuts shall be made carefully in a neat workmanlike manner using approved methods to produce a clean square cut. The outside of the cut end shall be conditioned for use by filing or grinding a small taper, at an angle of approximately 30 degrees.
- C. UNLESS OTHERWISE APPROVED BY THE ENGINEER, FIELD WELDING OF DUCTILE IRON WILL NOT BE PERMITTED.
- D. See Section 15006 – Ductile Iron Pipe.

3.04 JOINTS IN PIPING

- A. Restrained joints shall be provided for all buried pipe joints except where flanged joints are indicated on the Drawings.
- B. Flanged joints shall be brought to exact alignment and all gaskets and bolts or studs inserted in their proper places. Bolts or studs shall be uniformly tightened around the joints. Where stud bolts are used, the bolts shall be uniformly centered in the connections and equal pressure applied to each nut on the stud. Pipes in all lines subject to temperature changes shall be cut short and cold sprung into place to compensate for expansion when hot.

- C. Mechanical joints shall be made up with gaskets, glands and bolts. When a joint is to be made up, the bell or socket and plain end shall be cleaned and washed with a solution of mild soap in water; the gland and gasket shall be slid onto the plain end and the end then entered into the socket until it is fully "home" on the centering ring. The gasket shall then be painted with soapy water and slid into position, followed by the gland. All bolts shall be inserted and made up hand tight and then tightened alternately to bring the gland into position evenly. Excessive tightening of the bolts shall be avoided. All nuts shall be pulled up using a torque wrench which will not permit unequal stresses in the bolts. Torque shall not exceed the recommendations of the manufacturer of the pipe and bolts for the various sizes. Care shall be taken to assure that the pipe remains fully "home" while the joint is being made. Joints shall conform to the applicable AWWA Specifications.
- D. Threaded and/or screwed joints shall have long tapered full depth threads to be made with the appropriate paste or jointing compound, depending on the type of fluid to be processed through the pipe. All pipe up to, and including 1-1/2-inches, shall be reamed to remove burr and stood on end and well pounded to remove scale and dirt. Wrenches on valves and fittings shall be applied directly over the joint being tightened. Not more than three pipe threads shall be exposed at each connection. Pipe, in all lines subject to temperature changes shall be cut short and cold sprung into place to compensate for expansion when hot. Joints in plastic piping (PVC/CPVC) shall be laid and joints made with compounds recommended by the manufacturer. Installation shall conform to the requirements of ASTM D2774 and ASTM D2855. Unions required adjacent to valves and equipment.
- E. Soldered joints shall have the burrs removed and both the outside of pipe and the inside of fittings shall be thoroughly cleaned by proper tools recommended for that purpose. Flux shall be applied to both pipe and inside of fittings and the pipe placed into fittings and rotated to insure equal distribution of flux. Joints shall be heated and solder applied until it shows uniformly around the end of joints between fitting and pipe. All joints shall be allowed to self-cool to prevent the chilling of solder. Combination flux and solder paste manufactured by a reputable manufacturer is acceptable. Unions required adjacent to valves and equipment.
- F. Welded joints shall be made by competent operators in a first class workmanlike manner, in complete accordance with ANSI B31.1 and AWWA C206. Welding electrodes shall conform to ASTM A233, and welding rod shall conform to ASTM A251. Only skilled welders capable of meeting the qualification tests for the type of welding which they are performing shall be employed. Tests, if so required, shall be made at the expense of the CONTRACTOR, if so ordered by the ENGINEER. Unions shall be required adjacent to valves and equipment.
- G. Copper joints shall be thoroughly cleaned and the end of pipes uniformly flared by a suitable tool to the bevels of the fittings used. Wrenches shall be applied to the bodies of fittings where the joint is being made and in no case to a joint previously made. Dimensions of tubing and copper piping shall be in complete accordance with the fittings used. No flare joints shall be made on piping not suited for flare joints. Installations for propane gas shall be in accordance with NFPA 54 and/or 58.
- H. Solvent or adhesive welded joints in plastic piping shall be accomplished in strict accordance with the pipe manufacturer's recommendations, including necessary field cuttings, sanding of pipe ends, joint support during setting period, etc. Care shall be taken that no droppings or deposits of adhesive or material remain inside the assembled piping.

Solvent or adhesive material shall be compatible with the pipe itself, being a product approved by the pipe manufacturer. Unions are required adjacent to valves and equipment. Sleeve-type expansion joints shall be supplied in exposed piping to permit 1-inch minimum of expansion per 100 feet of pipe length.

- I. Dielectric unions shall be installed wherever dissimilar metals are connected except for bronze or brass valves in ferrous piping. Unions shall be provided downstream of each valve with screwed connections. The CONTRACTOR shall provide screwed or flanged unions at each piece of equipment, where shown, and where necessary to install or dismantle piping.
- J. Eccentric reducers shall be installed where air or water pockets would otherwise occur in mains because of a reduction in pipe size.
- K. Joints in polypropylene and polyvinylidene fluoride pipe shall be butt fusion weld. All butt welding shall follow the requirements of ASTM D-2657 and the manufacturer's recommendations.

3.05 FLUSHING AND TESTING

- A. All piping shall be properly flushed and tested with water unless specifically exempted elsewhere in the Specifications or otherwise approved by the ENGINEER. Air and gas pipelines shall be flushed and tested with compressed air. The CONTRACTOR shall furnish and install all means and apparatus necessary for getting the air or water into the pipeline for flushing and testing including pumps, compressors, gauges, and meters, any necessary plugs and caps, and any required blow-off piping and fittings, etc., complete with any necessary reaction blocking to prevent pipe movement during the flushing and testing. All pipelines shall be flushed and tested in such lengths or sections as agreed upon among the OWNER, ENGINEER, and CONTRACTOR. Test pressures shall be as specified in Section 15390 – Schedules, and shall be measured at the lowest point of the pipe segment being tested. The CONTRACTOR shall give the OWNER and ENGINEER reasonable notice of the time when he intends to test portions of the pipelines. The ENGINEER reserves the right, within reason, to request flushing and testing of any section or portion of a pipeline.
- B. The CONTRACTOR shall provide water for all flushing and testing of liquid conveying pipelines. Raw water or non-potable water may be used for flushing and testing liquid pipelines not connected to the potable water system. Only potable water shall be used for flushing and testing the potable water system.
- C. Air and gas piping shall be completely and thoroughly cleaned of all foreign matter, scale, and dirt prior to start-up of the air or gas system.
- D. At the conclusion of the installation work, the CONTRACTOR shall thoroughly clean all new liquid conveying pipe by flushing with water or other means to remove all dirt, stones, pieces of wood, etc., which may have entered the pipe during the construction period. If after this cleaning any obstructions remain, they shall be corrected by the CONTRACTOR, at his own expense, to the satisfaction of the ENGINEER. Liquid conveying pipelines shall be flushed at the rate of at least 2.5 feet per second for a duration suitable to the ENGINEER or shall be flushed by other methods approved by the ENGINEER.

- E. Compressed/service air and gas piping shall be flushed by removing end caps from the distribution lines and operating one (1) compressor, in accordance with the manufacturer's instructions.
- F. After flushing, all air piping shall be pressure and leak tested prior to coating and wrapping of welded joints. Immediately upon successful completion of the pressure and leak test, welded joints shall be thoroughly cleaned of all foreign matter, scale, rust, and discoloration and coated in accordance with the Specifications.
- G. During testing the piping shall show no leakage. Any leaks or defective piping disclosed by the leakage test shall be repaired or replaced by the CONTRACTOR, at his own expense, and the test repeated until all such piping shows tight.
- H. After flushing, all liquid conveying pipelines shall be hydrostatically tested at the test pressure specified in the appropriate Piping System Schedule in Section 15390 – Schedules. The procedure used for the hydrostatic test shall be in accordance with the requirements of AWWA C600. Each pipeline shall be filled with water for a period of no less than 24 hours and then subjected to the specified test pressure for 2 hours. During this test, exposed piping shall show no leakage. Allowable leakage in buried piping shall be in accordance with AWWA C600.
- I. Any leaks or defective pipe disclosed by the hydrostatic test shall be repaired or replaced by the CONTRACTOR, at his own expense, and the test repeated until all such piping shows tight.
- J. After flushing, all gas piping shall be leak tested in accordance with all local codes and regulations and in conformance with the recommendations or requirements of any National Institute or Association for the specific service application.

3.06 PAINTING AND COLOR CODING SYSTEM

- A. All exposed piping specified shall be color coded in accordance with the COUNTY's standard color designation system for pipe recognition and in accordance with Section 09900 Painting. In the absence of a standard color designation system, the ENGINEER will establish a standard color designation for each piping service category from color charts submitted by the CONTRACTOR in compliance with Section 09900 – Painting.
- B. All piping specified in this Section shall be painted in accordance with Section 09900 – Painting, except as follows:
 - 1. Copper pipe
 - 2. Stainless steel pipe. Flanges and supports or hangers shall be painted.

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SECTION 15006

DUCTILE IRON PIPE

PART 1 -- GENERAL

1.01 WORK INCLUDED

- A. The CONTRACTOR shall furnish and install ductile iron pipe and all appurtenant Work, complete in place, all in accordance with the requirements of the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01600 - Materials and Equipment
- B. Section 02222 - Excavation and Backfill for Utilities
- C. Section 01300 - Submittals
- D. Section 09900 - Painting
- E. Section 15000 – Basic Mechanical Requirements
- F. Section 15995 - Pipeline Testing and Disinfection

1.03 REFERENCED SPECIFICATIONS, CODES, AND STANDARDS

- A. Commercial Standards:

AWWA C104	Cement Mortar Lining for Ductile Iron Pipe and Fittings For Water
AWWA C110	Ductile-iron and Gray-Iron Fittings
AWWA C111	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C150	Thickness design of ductile iron pipe
AWWA C151	Ductile-iron Pipe, Centrifugally Cast, For Water
AWWA C600	Installation of Ductile-Iron Water Mains and Their Appurtenances

1.04 SUBMITTALS

- A. Shop Drawings: The CONTRACTOR shall submit Shop Drawings of pipe and fittings in accordance with the requirements set forth in the Sections entitled – “Piping, General” and “Submittals”.

1.05 SCHEDULE OF PIPING MATERIALS

- A. A schedule of piping materials is included in the Section entitled "15390 - Schedules". The schedule indicates service, nominal pipe size, material, class or pressure class, joint type, fitting type, restraint design pressure, test pressure, coatings and linings.

PART 2 -- PRODUCTS

2.01 GENERAL

- A. Pipe shall be centrifugally cast in metal molds or sand lined molds in accordance with AWWA C151 of grade 60-42-10 ductile iron. The above standard covers ductile iron pipe with nominal pipe sizes from three inches up to and including sixty-four inches in diameter.

B. Wall Thickness

1. Buried Pipe:

<u>Size</u>	<u>Class</u>
4" – 12"	52
14" – 54"	54 Pressure Class 250
60" – 64"	Pressure Class 150

2. Flanged Pipe: Pipe wall thickness of threaded pipe for a flanged pipe end shall be minimum special thickness Class 53 from 4-inch to 54-inch and/or minimum pressure Class 350 for 60-inch to 64-inch diameter pipe in accordance with AWWA C115.
3. Grooved Pipe: Grooved coupling pipe shall be special thickness Class 54.

C. Joints

1. All above grade ductile iron pipe shall be flanged.
2. All pipe and fittings below grade shall be restrained joint.
3. Mechanical and push-on type joints shall be in accordance with ANSI/AWWA A21.11/C111.
4. Flanges for flanged pipe shall be in accordance with AWWA C115, shall be ductile iron, shall be rated at 250 psi maximum working pressure, and shall be similar to flange Class 125 per ASME B16.1. Where shown on the Drawings, pipe and fittings shall be furnished with flanges similar to flange Class 250 per ASME B16.1. Fittings shall be provided with flanges having a bolt circle and bolt pattern the same as the adjacent pipe and/or mechanical devices. Joint materials shall be ANSI sized and approved and shall consist of hot dip galvanized carbon steel bolts and nuts and full faced 1/8" thick neoprene gaskets, unless otherwise specified.
5. No raised face flanges shall be used. The raised faces shall be milled flat.

D. Restrained Joints

1. Manufacturer's Proprietary Restrained Joint Piping: Restrained joint pipe **and fittings** shall be Flex-Ring or Lok-Ring type as manufactured by American Cast Iron Pipe, TR Flex as manufactured by U.S. Pipe, or equal.
2. **Mechanical Joints:** Mechanical pipe joints shall conform to the requirements of ANSI A21.11/AWWA C111. Joints shall be made employing a tapered rubber gasket forced into a tapered groove with a ductile iron follower ring. If required by installation conditions, pipe and fittings shall have cast on lugs for adequately tying the pipe and fittings together. These shall be in conformance with standard practice and as outlined under the appropriate AWWA Specifications. Bolts for mechanical joints shall be high strength corrosion resistant low-alloy steel tee-head bolts with hexagonal nuts.
3. **Mechanical joint valves shall be restrained by manufacturer MJ coupled glands where installed in new pipe. New pipe being connected to existing mechanical joints and pipe being connected to fittings for which restrained joints named in paragraph 1 above are not available, shall be restrained by MJ coupled glands or follower ring and wedge type MJ restraints.**
4. **Follower Ring and Wedge Type Restrained Mechanical Joint Restraints Fittings:**

Follower ring and wedge type mechanical joint restraints may be used in lieu of MJ coupled gland AWWA C111 mechanical joints unless specified otherwise such as with mechanical joint valves. The restraining mechanism shall consist of a follower gland having a seal gasket and individually actuated wedges that increase their resistance to pullout as pressure or external forces increase. The system manufacturer shall provide all the components (follower ring, wedges, and gaskets) for the restraining device. The device shall be capable of full mechanical joint deflection during assembly, and the flexibility of the joint shall be maintained after burial. The joint restraint ring and its wedging components shall be constructed of ductile iron conforming to ASTM A536, Grade 60-42-10. The wedges shall be ductile iron, heat-treated to a minimum hardness of 370 BHN. Dimensions of the gland shall be such that it can be used with mechanical joint bells conforming to AWWA C111 and AWWA C153. The design shall use torque limiting twist-off nuts to provide actuation of the restraining wedges. The mechanical joint restraint shall be available in the size range of 3 through 48 inches. Minimum rated pressure shall be 350 psi for sizes 16 inches and smaller and 250 psi in sizes 18 inches and larger. Products: Megalug Series 1100 as manufactured by EBAA Iron, Inc., Stargrip by Star Pipe Systems, ONE LOK by Sigma, or Grip Ring by Romac.

~~All mechanical joint fittings, valves and appurtenances shall be restrained as described herein. The restraint rings shall be manufactured of ductile iron conforming to ASTM A536 and incorporate a plurality of individually-actuating gripping surfaces to grip the pipe. The restraint device shall be coated in MEGA-BOND® Restraint Coating System. The restraint system shall consist of two series 1100 MEGALUGS® mechanical joint restraint follower glands with the second follower gland having the mechanical joint lip removed at the factory to seat~~

~~properly behind the first. The restraint system shall have a sufficient number of fastening bolts to connect the rings to the mechanical joint. The restraint system shall have a minimum safety factor of 2 to 1. The restraint system shall be the Series 1100TDM Tandem MEGALUG Mechanical Joint Restraint manufactured by EBAA Iron, Inc., or approved equal.~~

E. Fittings

1. General: ~~Fittings shall be manufactured in accordance with AWWA C110 or AWWA C153 or the manufacturer's standard. Fittings shall be either AWWA C110 unless AWWA C153 as identified in the Piping Schedule in Specification Section 15390 entitled "Schedules".~~ **Flanged fittings shall be manufactured in accordance with ANSI A21.10/AWWA C110. Mechanical and restrained joint fittings shall be manufactured in accordance with ANSI A21.10/AWWA C110 or ANSI A21.53/AWWA C153.**
2. Pressure Rating: 350 psi minimum working pressure for 4- to 24-inch fittings and 250 psi minimum working pressure for 30- to 64-inch fittings.
3. Materials: Fittings shall be ductile iron.
4. Joints - General: Fittings shall be either flanged, mechanical joint or manufactured proprietary restrained joint type as indicated on the Drawings and specified herein.
5. Flanged Joint Fittings: Above ground fittings shall be flanged.
6. Manufacturer Proprietary Restrained Joint Fittings: ~~Unless otherwise indicated on the Drawings or specified herein, all below ground fittings 30-inches in diameter and greater shall be provided with manufacturer proprietary restrained joints.~~ **Manufacturer proprietary restrained joint fittings may be used for below ground ductile iron pipe sizes 14 to 36-inches. Field Flex-Ring joint pipe ends and gaskets may be used to connect to manufacturer proprietary restrained joints where field cuts are necessary to make adjustments.**
7. Mechanical Joint Fittings: ~~Underground ductile iron fittings 24-inches in diameter and less shall be restrained mechanical joint fittings.~~ **Mechanical joint fittings using MJ coupled glands conforming to ANSI A21.11/AWWA C111 or follower ring and wedge type mechanical joint restraints may be used for all below grade piping.**

F. Pipe Lining and Coating General: Pipe linings and coatings shall be as follows.

1. Buried Service: The piping manufacturer's standard asphaltic coating, minimum 1-mil thick in accordance with ANSI/AWWA A21.51/C151, shall be applied prior to shipment to the exterior wall of buried pipe and fittings. Polyethylene encasement shall be used for all below grade ductile iron piping in accordance with ANSI/AWWA A21.51/C105, wrapping colors to be pantone purple 522-C.
2. Above Ground Piping and Exposed Piping within Underground Vaults: A coating of rust inhibitive primer, compatible with the coating system specified in Section 09900 – Painting, shall be applied to the pipe exterior prior to shipment for piping

that is above ground and exposed piping within vaults. Final field coat shall be pantone purple 522-C for reclaimed water pipe, valves and appurtenances.

3. Cement-Mortar Lining: Where scheduled, pipe and fittings shall be cement-lined and seal-coated with a coat of asphaltic material in accordance with ANSIAWWA A21.4/C104, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.

PART 3 -- EXECUTION

3.01 INSTALLATION

- A. The CONTRACTOR shall perform all earthwork including excavation, backfill, bedding, compaction, sheeting, shoring and bracing, dewatering and grading in accordance with Division 2.
- B. Unless otherwise directed, ductile iron pipe shall be laid with the bell ends facing upstream in the normal direction of flow and in the direction of laying.
- C. Thrust restrained and mechanical joints shall be made in accordance with the manufacturer's standards except as otherwise specified herein. Joints between mechanical joint pipe and/or fittings shall be made in accordance with AWWA C600, except that deflection at joints shall not exceed one-half of the manufacturer's recommended allowable deflection, or one-half of the allowable deflection specified in AWWA C600, whichever is the lesser amount.
- D. Before laying thrust restrained and mechanical joint pipe and fittings, all lumps, blisters and excess bituminous coating shall be removed from the bell and spigot ends. The outside of each spigot and the inside of each bell shall be wire brushed, and wiped clean and dry. The entire gasket groove area shall be free of bumps or any foreign matter which might displace the gasket. The cleaned spigot and gasket shall not be allowed to touch the trench walls or trench bottom at any time. Vegetable soap lubricant shall be applied in accordance with the pipe manufacturer's recommendations, to aid in making the joint. The workmen shall exercise caution to prevent damage to the gasket or the adherence of grease or particles of sand or dirt.
- E. Prior to making up flanged joints in ductile iron pipe and fittings, the back of each flange under the bolt heads and the face of each flange shall have all lumps, blisters and excess bituminous coating removed and shall be wire brushed and wiped clean and dry. Flange faces shall be kept clean and dry when making up the joint, and the workmen shall exercise caution to prevent damage to the gasket or the adherence of grease or particles of sand or dirt. Bolts and nuts shall be tightened by opposites in order to keep flange faces square with each other, and to insure that bolt stresses are evenly distributed.
- F. Bolts and nuts in thrust restrained, mechanical and flanged joints shall be tightened in accordance with the recommendations of the pipe manufacturer for a leak-free joint. The mechanics shall exercise caution to prevent overstress. Torque wrenches shall be used until, in the opinion of the ENGINEER, the mechanics have become accustomed to the proper amount of pressure to apply on standard wrenches.
- G. Cutting of the ductile iron pipe for inserting valves, fittings, etc., shall be done by the CONTRACTOR in a neat and workmanlike manner without damage to the pipe, the lining, or the coating. Pipe 16 inches and larger in diameter shall be cut with a mechanical pipe

saw. After cutting the pipe, the plain end shall be beveled with a heavy file or grinder to remove all sharp edges.

- H. Areas of loose or damaged lining associated with field cutting shall be repaired or replaced as recommended by the pipe manufacturer and required by the ENGINEER. Repair methods shall be as recommended by the manufacturer and shall be submitted to the ENGINEER for review.
- I. Any work within the pipe shall be performed with care to prevent damage to the lining. No cable, lifting arms or other devices shall be inserted into the pipe. All lifting, pulling or pushing mechanisms shall be applied to the exterior of the pipe barrel.
- J. Homing the pipe shall be accomplished by the use of a hydraulic or mechanical pulling device, unless otherwise accepted by the ENGINEER. No pipe shall be driven or struck in order to seat it home.
- K. Pipe interior cleaning methods shall be acceptable to the ENGINEER, and must be sufficient to remove silt, rocks, or other debris which may have entered the pipeline during its installation and shall also follow the requirements of Section 15995, entitled "Pipeline Testing and Disinfection".

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SECTION 15106

BALL VALVES

PART 1 -- GENERAL

1.01 THE REQUIREMENT

- A. The CONTRACTOR shall furnish and install ball valves, complete and operable, as shown and specified herein, including epoxy coating, appurtenances, operators, and accessories, all in accordance with the requirements of the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 15100 - Valves and Appurtenances

1.03 SUBMITTALS

- A. The CONTRACTOR shall furnish submittals in accordance with the section entitled "Submittals."

PART 2 -- PRODUCTS

2.01 PLASTIC BALL VALVES

- A. Plastic ball valves shall be used at all PVC pipe installations where required, and be made of polyvinyl chloride (PVC) or polyvinylidene fluoride (PVDF), as recommended by the manufacturer for any specific applications. All valves shall have manual operators, unless otherwise specified or shown.
- B. All plastic ball valves shall have socket true union ends or flanged ends to ANSI B 16.5, class 150, for easy removal. The balls shall have full size ports and PTFE seats. PTFE seats shall have elastomeric backing cushion of the same material as the valve seals. All body seals, union O-ring seals, and stem seals shall be Viton. The valves shall be suitable for a maximum working non-shock pressure of 150 psi at 73 degrees F for PVC, with decreasing ratings for higher temperatures and other plastics.
- C. Manufacturers or equal
 1. ASAHI-America
 2. IPEX Inc.
 3. Plast-O-Matic Valves, Inc
 - 4. Spears Manufacturing**

2.02 BALL VALVES FOR CHEMICAL SERVICES

- A. Service: All ball valves for chemical services shall be polyvinyl chloride (PVC)

- B. Size Range: ½-inch to 6-inch
- C. PVC Material Standard: ASTM D1785
- D. Body Material: PVC
- E. Ball: PVC
- F. Stem: PVC
- G. Valve Seat Material: Valve seats shall be PTFE (a.k.a., Teflon, Polytetrafluoroethylene) with an elastomeric backing to provide smooth even torque and to compensate for wear.
- H. Valve Seat Backing Material: FKM (a.k.a., Viton).
- I. O-Ring Material: FKM (a.k.a., Viton).
- J. Stems Construction: Stems shall have double o-rings and be of the blowout-proof design.
- K. Vent Hole Construction: Valves used for sodium hypochlorite service shall have vented balls. The valve manufacturer shall drill a 1/8-inch diameter vent hole in the ball. The drilled hole shall be deburred to remove any rough edges that would score the seats if they were not removed. The valve shall be installed with the vent hole on the upstream side of the system to keep the cavity of the ball fluidized.
- L. Actuator Mounting Pad: ISO mounting pad shall be integrally molded to the valve body for actuation.
- M. Blocks: Valves shall have two-way blocking capability.
- N. Joints:
 - 1. Construction: All valves shall be true union design for easier installation.
 - 2. Allowable Joint Types: The type of joints shall be as shown on the Drawings and specified as follows.
 - 3. Socket Ends: Socket ends shall be suitable for schedule 80 PVC piping.
 - 4. Flanged Ends: Flanges shall be ANSI B 16.5 Class 150. Flanges shall be directly attached to the union nut of the valve with no added glued joints.
 - 5. Threaded Ends: Threaded ends shall not be used.
 - 6. Spigot Ends: Spigot ends shall not be used.
- O. Operators: All valves shall have manual operators, unless otherwise specified or shown on the Drawings.

- P. Stem Extensions: Where shown on the Drawings the ball valve manufacturer shall furnish stem extensions. The extension shall be a two piece design with outer housing 100 percent sealed. The extension shall include an intermediate support. The valve manufacturer is responsible for designing and furnishing the stem extension, intermediate support bracket and support anchor bolts. Anchor bolts shall be 316 stainless steel.
- Q. Locking Devices: Where called for on the Drawings valves shall be furnished with locking devices by the valve manufacturer. The locking device shall be installed over the handle, or shall be integral to the handle itself, to prevent unauthorized operation of the valve.
- R. Manufacturer, Or Equal: Type 21, as manufactured by ASAHI/AMERICA, or equal.

2.03 STAINLESS STEEL BALL VALVES

- A. This section applies to all stainless steel ball valves unless specifically covered elsewhere.
- B. Ball valves for use with stainless steel piping systems, including instrument isolation, air lines, and moisture drains shall be end entry type with type 316 stainless steel body and trim, Teflon seats and seals and flanged or threaded connections as indicated. Valve body shall be three piece design, no internal ring for the ball shall be acceptable. Valves shall be ASME or ANSI Class 600 or 800.
- C. Valves shall be supplied with stainless steel manual lever or "T" handle.
- D. Manufacturers or equal
 - 1. Jamesbury Corporation Series 4000
 - 2. Swagelock Series 60
 - 3. Apollo Series 86-B 200
 - 4. Flowserve/Worcester Controls Series 44

PART 3 -- EXECUTION

3.01 GENERAL

- A. All valves shall be installed in accordance with provisions of section entitled "Valves and Appurtenances". Care shall be taken that all valves in plastic lines are well supported on each end of the valve.
- B. All valves shall be tested for unidirectional or bi-directional shut-off as required by service conditions.

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SECTION 15390

SCHEDULES

PART 1 -- GENERAL

1.01 THE REQUIREMENT

- A. Reference Section 15000, Basic Mechanical Requirements.

1.02 PIPING SYSTEM SCHEDULES

- A. Piping requirements for this Section are outlined on the Drawings, and in the Piping System Schedule. In the absence of a specified test pressure, pipe shall be tested at a pressure 50 percent greater than the normal operating pressure as determined by the ENGINEER or 10 psig, whichever is greater unless the Schedule indicates that no test is required.
- B. If the pipe material is not shown on the Piping System Schedule or otherwise specified, the following materials shall be used:

Pipe Size	Material	Type of Joint	Class/Design	Test Pressure
4-in and larger	DIP	Flanged (Exposed)	53	(1)
4-in through 24-in	DIP	Restrained (Buried)	Pressure Class 350	(1)
30-in and greater	DIP	Restrained (Buried)	Pressure Class 300 250	(1)
Less than 4-in	PVC	Socket	Sch 80	(1)

(1) Test at 150 percent of normal operating pressure or 100 psi, whichever is greater.

- C. Non-critical gravity lines such as drains, floor drains, roof drains, etc., do not typically require a pressure test.

1.03 PIPING SCHEDULE ABBREVIATIONS

- A. Service:

- CLS - Sodium Hypochlorite Solution (Chlorine Solution)
- DR - Drain
- RW - Reuse Water
- SA - Sample Piping

B. Material:

- CPVC - Chlorinated Polyviyl Chloride
- DI - Ductile Iron
- PVC - Polyvinyl Chloride
- SS - Stainless Steel

C. Thickness, Class or Schedule:

- CL - Class
- PC - Pressure Class
- Sch - Schedule

D. Type of Joints:

- Flg - Flanged
- MJ - Mechanical Joint
- RJ - Restrained Joint
- SW - Solvent Welded
- Thd - Threaded
- WeldGrv** - **Socket Welded Grooved Coupling**

E. Type of Fittings:

- CPVC Chlorinated Polyvinyl Chloride
- DI Ductile Iron
- PVC Polyvinyl Chloride
- SS Stainless Steel

G. Interior Protective Coating:

- CML Cement Mortar Lined

H. Exterior Protective Coating:

- AC Asphalt Coated
- P Painted

1.04 PIPING SCHEDULE

Service	Nominal Pipe Diameter (Inches)	Material	Thickness Class or Schedule	Design Pressure (PSIG)	Test Pressure (PSIG)	Type of Joints	Type of Fittings	Protective Coating		Remarks
								Interior	Exterior	
RW Piping										
Above Ground	4 inch and above	DI	CL 53	125	150	Flg	DI	CML	P	
Below Ground	4 inch to 24 inch	DI	PC 350	125	150	<u>MJ or RJ</u>	DI	CML	AC	2
Below Ground	Greater than 24 inch	DI	PC 300	125	150	<u>MJ or RJ</u>	DI	CML	AC	2
CLS Piping										
Above Ground	3 inch and less	PVC	Sch 80	100	150	Thd or SW	PVC	--	P	1
Below Ground	3 –inch and less	PVC	Sch 80	100	150	SW	PVC	--	--	
Drain Piping										
Below Ground Concrete Encased	4 inch and greater	DI	CL 53	--	--	RJ	DI	--	AC	
Below Ground 2 feet beyond concrete encasement	4 inch and greater	PVC	SDR	--	--	SW	PVC	--	--	
Sample Lines										
Above Ground	3 inch and less	316L SS	Sch 40S	--	--	<u>Weld</u> Thd	316L SS	--	--	
Below Ground	3 inch and less	PVC	Sch 80	50	75	SW	PVC	--	--	

Notes:

1. Solvent cement shall be silica free and suitable for sodium hypochlorite service per Specification Section 15008.
2. Wrap pipe with polyethylene per Specification Section 15006

1.05 VALVE SCHEDULES

- A. Performance Affidavits shall be required for all valves listed in the valve schedule(s). Performance Affidavits shall be provided in accordance with Section 11000, Equipment General Provisions and Section 01300, Submittals. All valves shall be tagged by the manufacturer according to the control valve designations listed in the Schedule.
- B. Valves not listed in the valve schedule(s) shall be manually operated, unless otherwise shown on the Drawings.
- C. The following abbreviations are used in the schedule:

1. System:

- CLS - Sodium Hypochlorite Piping (Chlorine Solution)
- DR - Drain Piping
- RW - Reuse Water
- SA - Sample Piping

2. Ends:

- Flg - Flanged
- Thd - Threaded
- DU - Double Union

3. Materials Body/Trim:

- CI - Cast Iron
- DI - Ductile Iron
- PVC - Polyvinyl Chloride
- SS - Stainless Steel

(Continued on Next Page)

General Valve Schedule								
System	Function	Valve Type	Description	Ends	Size (Inches)	Materials Body/Trim	Spec. No.	Notes
RW Piping	Check	Check	Rubber Flapper	Flg	10	CI/SS	15105	1
	Isolation Above Grade	Butterfly	NRS Resilient Seat	Flg or MJ	8 - 16	CI/DI	15101	2
	Air Release Valve	Air Release	--	Thd	½ - 1 ½	CI/SS	15114	
	Drain	Butterfly	NRS Resilient Seat	MJ	8	CI/DI	15101	
	Isolation Below Grade	Gate	AWWA C509 or C515	MJ	8 to 16	CI/DI	15108	
CLS Piping	Isolation	Ball	Double Union PVC	DU	½ - 2	PVC/Viton	15104	3
SA Piping	Isolation	Ball	3 Piece	Thd	½ - 2 ½	316L SS	15104	

Notes:

1. With external position indicator and switch
2. Flanged ends for above ground and mechanical joint ends for below ground.
3. Vented ball and Viton O-rings for sodium hypochlorite service.

ELECTRICALLY ACTUATED VALVE SCHEDULE

VALVE DESIGNATION	TYPE VALVE	TYPE OPERATOR	SIZE (INCHES)	MAXIMUM FLOW (GPM)	MAX. DIFFERENTIAL PRESSURE (PSI)	CLASS	SERVICE	LOCATION	NEW OR EXISTING ELECTRIC ACTUATOR
MOV-211	BUTTERFLY VALVE	OPEN/CLOSE	24	27,000	15	150	PAR TANKS ISOLATION	EXISTING YARD VALVE	EXISTING
MOV-214	GATE VALVE	OPEN/CLOSE	12	13500	15	150	TANK 1 INLET	EXISTING YARD VALVE	NEW
MOV-221	GATE VALVE	OPEN/CLOSE	12	13500	15	150	To TANK 2 INLET	EXISTING YARD VALVE	NEW
MOV-212	GATE VALVE	OPEN/CLOSE	12	6,550	15	150	TANK 1 RETURN	EXISTING YARD VALVE	NEW
MOV-213	GATE VALVE	OPEN/CLOSE	16	11,800	15	150	TANK 1 TO PUMPS	EXISTING YARD VALVE	NEW
MOV-222	GATE VALVE	OPEN/CLOSE	12	6,550	15	150	TANK 2 RETURN	YARD	NEW
MOV-223	GATE VALVE	OPEN/CLOSE	16	11,800	15	150	TANK 2 TO PUMPS	YARD	NEW
MOV-232	GATE VALVE	OPEN/CLOSE	16	11,800	15	150	PUMP SUCTION	EXISTING YARD VALVE	NEW
MOV-337	BUTTERFLY VALVE	MODULATING	12 12	4,300	15	150	PUMP DISCHARGE	PUMP STATION	NEW

ELECTRICALLY ACTUATED VALVE POSITION SCHEDULE

Operating Scenario	Existing PAR Tanks Isolation Valve MOV-211	PAR Tank 1 Inlet MOV-214	PAR Tank 1 Recirculation Valve MOV-212	PAR Tank 1 Outlet to Recirculation Pumps MOV-213	PAR Tank 2 to Inlet MOV-221	PAR Tank 2 Recirculation Valve MOV-222	PAR Tank 2 Outlet to Recirculation Pumps MOV-223	PAR Tank 2 to PAR Service Pumps MOV-232	Recirculation Pump Flow Control Valve MOV-337
Both PAR Tanks out of service	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED
Normal Operation both PAR Tanks In service	OPEN	OPEN	CLOSED	CLOSED	OPEN	CLOSED	CLOSED	OPEN	CLOSED
Off-Spec Water Capture	OPEN	CLOSED	CLOSED	CLOSED	OPEN	CLOSED	CLOSED	CLOSED	CLOSED
Off-Spec Water Chlorinate or Recirculate	CLOSED	CLOSED	CLOSED	CLOSED	OPEN	OPEN	OPEN	CLOSED	OPEN to setpoint
PAR Tank 1 in service, PAR Tank 2 Out of Service	OPEN	OPEN	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED
Transfer water from PAR Tank 1 to PAR Tank 2	CLOSED	CLOSED	CLOSED	OPEN	CLOSED	OPEN	CLOSED	CLOSED	OPEN to setpoint
Transfer water from PAR Tank 2 to PAR Tank 1	CLOSED	OPEN	OPEN	CLOSED	CLOSED	CLOSED	OPEN	CLOSED	OPEN to setpoint

**ISOLATION VALVE SCHEDULE
(DOES NOT INCLUDE MOTORIZED VALVES)**

VALVE DESIGNATION	VALVE TYPE	SIZE (INCHES)	MAXIMUM FLOW (GPM)	MAX. DIFFERENTIAL PRESSURE (PSI)	CLASS	DESCRIPTION
ISV-215	GATE	16	11,800	15	150	TANK 1 OUTLET EXISTING
ISV-224	GATE	12	6,550	15	150	TANK 2 INLET
ISV-225	GATE	16	11,800	15	150	TANK 2 OUTLET
ISV-226	GATE	8	3,500	15	150	TANK 2 DRAIN
ISV-311	BUTTERFLY	10	4,300	15	150	PUMP 1 SUCTION ISOLATION
ISV-312	BUTTERFLY	10	4,300	15	150	PUMP 1 DISCHARGE ISOLATION
ISV-321	BUTTERFLY	10	4,300	15	150	PUMP 2 SUCTION ISOLATION
ISV-322	BUTTERFLY	10	4,300	15	150	PUMP 2 DISCHARGE ISOLATION

SECTION 15995

PIPELINE TESTING AND DISINFECTION

PART 1 -- GENERAL

1.01 THE REQUIREMENT

- A. The CONTRACTOR shall perform flushing and testing of all pipelines and appurtenant piping, complete, including conveyance of test water from COUNTY designated source to point of use and all disposal thereof, all in accordance with the requirements of the Contract Documents.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Commercial Standards
 - 1. ANSI/AWWA B300 Hypochlorites
 - 2. ANSI/AWWA B301 Liquid Chlorine
 - 3. ANSI/AWWA C651 Disinfecting Water Mains

1.03 SUBMITTALS

- A. A pumping and transmission equipment, testing schedule, including proposed plans for water conveyance, control, disposal, and disinfection shall be submitted in writing for approval a minimum of 48 hours before testing on any particular structure is to commence.

PART 2 -- PRODUCTS

2.01 MATERIALS REQUIREMENTS

- A. All test equipment, temporary valves or bulkheads, or other water control equipment and materials shall be determined and furnished by the CONTRACTOR subject to the ENGINEER's review. No materials shall be used which would be injurious to the construction or its future function.

PART 3 -- EXECUTION

3.01 GENERAL

- A. Unless otherwise provided herein, water for testing pipelines will be from a COUNTY furnished source; however, the CONTRACTOR shall make all necessary provisions for conveying the water from the COUNTY designated source to the points of use.
- B. All pressure and gravity pipelines shall be tested. All testing operations shall be performed in the presence of the ENGINEER.

3.02 HYDROSTATIC TESTING OF PIPELINES

- A. All equipment, including, but not limited to, pumps, gauges, and special fittings required to perform the testing shall be provided by the CONTRACTOR. The CONTRACTOR shall perform all excavation and other work required to locate and repair leaks and correct other defects which may be disclosed or develop under tests. The CONTRACTOR shall replace all coating, painting, backfill, or other permanent work removed in locating or repairing leaks and correcting defective piping. All gauges and control devices connected to lines being tested must be disconnected for the duration of the test. Water shall not be used in testing air lines, chlorine gas lines, or other gas carrying pipes. High pressure air testing of PVC or FRP pipe in exposed or above ground installations is not permitted. All tests shall be witnessed by the ENGINEER.
- B. Prior to hydrostatic testing, all pipelines shall be flushed or blown out as appropriate. **It will not be practical to flush the new segment of 30-inch effluent pipeline prior to pressure testing, disinfection and making final connections. The CONTRACTOR shall take other measures to minimize the amount of sand and other debris that enter the pipe during installation, pressure testing, disinfection and tie-ins.** The CONTRACTOR shall test all pipelines either in sections or as a unit. No section of the pipeline shall be tested until all field-placed concrete or mortar have attained an age of fourteen days. The test shall be made by closing valves when available, or by placing temporary bulkheads in the pipe and filling the line slowly with water. The CONTRACTOR shall be responsible for ascertaining that all test bulkheads are suitably restrained to resist the thrust of the test pressure without damage to, or movement of, the adjacent pipe. Care shall be taken to see that all air vents are open during filling.
- C. The pipeline shall be filled at a rate which will not cause any surges or exceed the rate at which the air can be released through the air valves at a reasonable velocity and all the air within the pipeline shall be properly purged. After the pipeline or section thereof has been filled, it shall be allowed to stand under a slight pressure for at least twenty-four hours to allow the concrete or mortar lining, as applicable, to absorb what water it will and to allow the escape of air from any air pockets. During this period, bulkheads, valves, and connections shall be examined for leaks. If leaks are found, corrective measures satisfactory to the ENGINEER shall be taken.
- D. Hydrostatic test pipelines at the pressures designated on the pipe schedule in Section 15000 Piping General.
- E. Following successful pressure testing and disinfection, the CONTRACTOR shall be responsible for coordinating tie-ins of the new segment of 30-inch effluent piping with the COUNTY's RPR. Once the new segment of 30-inch effluent pipeline has been tied-in and the COUNTY has deemed that the pipeline is ready to be placed back into service, the COUNTY will operate the effluent pumping system to divert effluent flow to RIBs 14 and 15 to facilitate flushing of the pipeline. It is anticipated that the flushing will take approximately 30 to 60 minutes to get the water from the new segment of 30-inch pipe into RIBs 14 and 15. The CONTRACTOR shall be responsible for cleaning out undesirable sand and other debris that are deposited into RIBs 14 and 15 during flushing. Within 24 hours of flushing and in the presence of the COUNTY RPR, the CONTRACTOR shall observe and photograph the pre-flushing condition of RIBs 14 and 15. The photographs will be used to compare pre and post flushing conditions to determine the extent of cleaning the CONTRACTOR**

needs to do in the RIBs. The intent is for the CONTRACTOR to minimize the amount of sand and other debris that enters the new segment of 30-inch effluent pipeline during installation, pressure testing, disinfection and tie-in activities such that there will be minimal cleaning required in the RIBs following flushing.

3.03 DISINFECTION AND CONNECTIONS TO EXISTING POTABLE WATER SYSTEM

- A. Before being placed in service, all new **reuse and potable** water mains and repaired portions of, or extension to existing mains shall be disinfected. Disinfection shall be done in accordance with the provisions of AWWA Standard C651, State of Florida and local applicable regulations.
- B. The basic disinfection procedure consists of:
1. Inject treatment disinfectant to yield a minimum chlorine content of 50 ppm into piping system.
 2. Allow solution to remain in the tanks and pipes for twenty-four hours or longer, if required, to destroy all harmful bacteria.
 3. Operate all valves and other appurtenances during disinfection to assure the sterilizing mixture is dispersed into all parts of the system.
 4. After the solution has been retained for the required time, pipes shall be flushed and filled with municipal domestic water. Sterilizing water shall be disposed of in an approved manner. Sterilizing water shall not be allowed to flow into a waterway without reducing chlorine concentrations to a safe level. The CONTRACTOR shall be responsible for meeting all applicable requirements and acquiring all necessary permits for this work.
 5. Take one bacteriological sample and test for every 1000 L.F. of line or fraction thereof plus one at each dead end location. Samples shall be taken and tested on each of two successive days. CONTRACTOR shall submit sample to a laboratory, approved by ENGINEER, for testing.
- C. Disinfection of **reuse and potable** water mains shall be considered as incidental to the work of constructing the water main and all costs thereof shall be included in the unit contract price per linear foot for pipe installation.
- D. Should the initial treatment result in an unsatisfactory bacterial test, the original chlorination procedure shall be repeated by the CONTRACTOR until satisfactory results are obtained. Failure by the CONTRACTOR to get a satisfactory test shall be considered as failure of the CONTRACTOR to keep the pipe clean during construction, or to properly chlorinate the main, and no additional payment will be made for reflushing and rechlorinating until a satisfactory test is made.

3.04 TESTS

- A. Provide analysis of treated water to meet standards and received acceptance from the FDEP.

- B. Test samples in accordance with AWWA C601.
- C. Quality Assurance
 - 1. Testing Laboratory: Certified for examination of drinking water in compliance with applicable legislation of the State of Florida.
- D. Regulatory Requirements
 - 1. Conform to Chapter 17-22 of the Florida Administrative Code.
- E. Submittals
 - 1. Submit name of testing laboratory and evidence of qualification.
 - 2. Submit three copies of reports.
- F. Project Record Documents
 - 1. Submit reports under provisions of Section 01700 - Project Closeout.
 - 2. Bacteriological report shall accurately record:
 - a. Date issued, project name, and testing laboratory name, address, and telephone number.
 - b. Time and date of water sample collection.
 - c. Name of person collecting sample.
 - d. Test locations.
 - e. Initial and twenty-four hour disinfectant residuals in ppm for each outlet tested.
 - f. Coliform bacteria test results for each outlet tested.
 - g. Certification that water conforms, or fails to conform to bacterial standards of State of Florida.
 - h. Bacteriologist's signature.

-END OF SECTION-

**FINAL REPORT
GEOPHYSICAL INVESTIGATION
NORTHWEST WRF
APOPKA, FL**

Prepared for Gator Engineering and Aquifer Restorations, Inc.
Altamonte Springs, FL

Prepared by GeoView, Inc.
St. Petersburg, FL



September 4, 2014

Mr. Jim Russell
Gator Engineering and Aquifer Restorations, Inc.
1173 Spring Centre South Boulevard, Suite C
Altamonte Springs, FL 32714

**Subject: Transmittal of Final Report for Geophysical Investigation
Northwest WRF - Apopka, FL
GeoView Project Number 21411**

Dear Mr. Russell,

GeoView, Inc. (GeoView) is pleased to submit the final report which summarizes and presents the results of the geophysical investigation conducted at the Northwest WRF site in Apopka, FL. GeoView appreciates the opportunity to have assisted you on this project. If you have any questions or comments about the report, please contact us.

Sincerely,
GEOVIEW, INC.

Michael J. Wightman, P.G.
Principal Geophysicist, President
Florida Professional Geologist
Number 1423

Stephen Scruggs, P.G.
Senior Geophysicist
Florida Professional Geologist
Number 2470

A Geophysical Services Company

4610 Central Avenue
St. Petersburg, FL 33711

Tel.: (727)209-2334
Fax: (727) 328-2477

1.0 Introduction

A geophysical investigation was conducted at the Northwest WRF site located at 701 West McCormick Road in Apopka, Florida. The project site consisted of the proposed lot for the construction of a new settling tank. The investigation was conducted on August 26, 2014.

The purpose of the investigation was to help characterize near-surface geological conditions and to identify subsurface features that may be associated with sinkhole activity within the proposed area. The results of the investigation are provided on Figure 1.

2.0 Description of Geophysical Investigation

2.1 Ground Penetrating Radar Survey

The GPR survey was conducted along a series of transects spaced 20 feet (ft) apart (Figure 1). The GPR data was collected with a Mala radar system. Table 1 presents the settings used for the GPR survey.

Table 1
GPR Equipment Settings Used for GPR Surveys

Antenna Frequency	Time Range (nano-seconds)	Estimated Depth of GPR Signal Penetration
250 MHz ^{1/}	196	20 to 28 ft bls

1/ MHz means mega-Hertz and is the mid-range operating frequency of the GPR antenna.

A description of the GPR technique and the methods employed for geological characterization studies is provided in Appendix 2.1.

2.2 Hand Auger Boring

A hand auger boring was performed at the project site (Figure 1). The purpose of the hand auger boring was to obtain information regarding near-surface soil conditions. This information was used to assist in the interpretation of the GPR data. A discussion of the methods used for the hand auger boring is provided in Appendix A2.2. The location of the boring (HA) is provided on Figure 1 and the results are presented in Table 2.

Table 2
Hand Auger Results

Hand Auger Designation	Depth Interval	Soils Description
HA	0 to 9 ft bls	Sand

3.0 Identification of Possible Sinkhole Features Using GPR

The features observed on GPR data that are most commonly associated with sinkhole activity are:

- A downwarping of GPR reflector sets, that are associated with suspected lithological contacts, towards a common center. Such features typically have a bowl or funnel shaped configuration and can be associated with a deflection of overlying sediment horizons caused by the migration of sediments into voids in the underlying limestone. If the GPR reflector sets are sharply downwarping and intersect, they can create “bow-tie” shaped GPR reflection feature, which often designates the apparent center of the GPR anomaly.
- A localized significant increase in the depth of the penetration and/or amplitude of the GPR signal response. The increase in GPR signal penetration depth or amplitude is often associated with either a localized increase in sand content at depth or decrease in soil density.
- An apparent discontinuity in GPR reflector sets, that are associated with suspected lithological contacts. The apparent discontinuities and/or disruption of the GPR reflector sets may be associated with the downward migration sediments.

The greater the severity of these features or a combination of these features the greater the likelihood that the identified feature is a sinkhole. It is not possible based on the GPR data alone to determine if an identified feature is a sinkhole or, more important, whether that feature is an active sinkhole.

4.0 Survey Results

Results of the GPR survey indicated the presence of a well-defined, relatively continuous set of GPR reflectors at an approximate depth range of 8 to 15 ft bls. The hand auger was performed in a location where this GPR reflector set was below 9 ft bls, and accordingly cannot be correlated to any lithological contact.

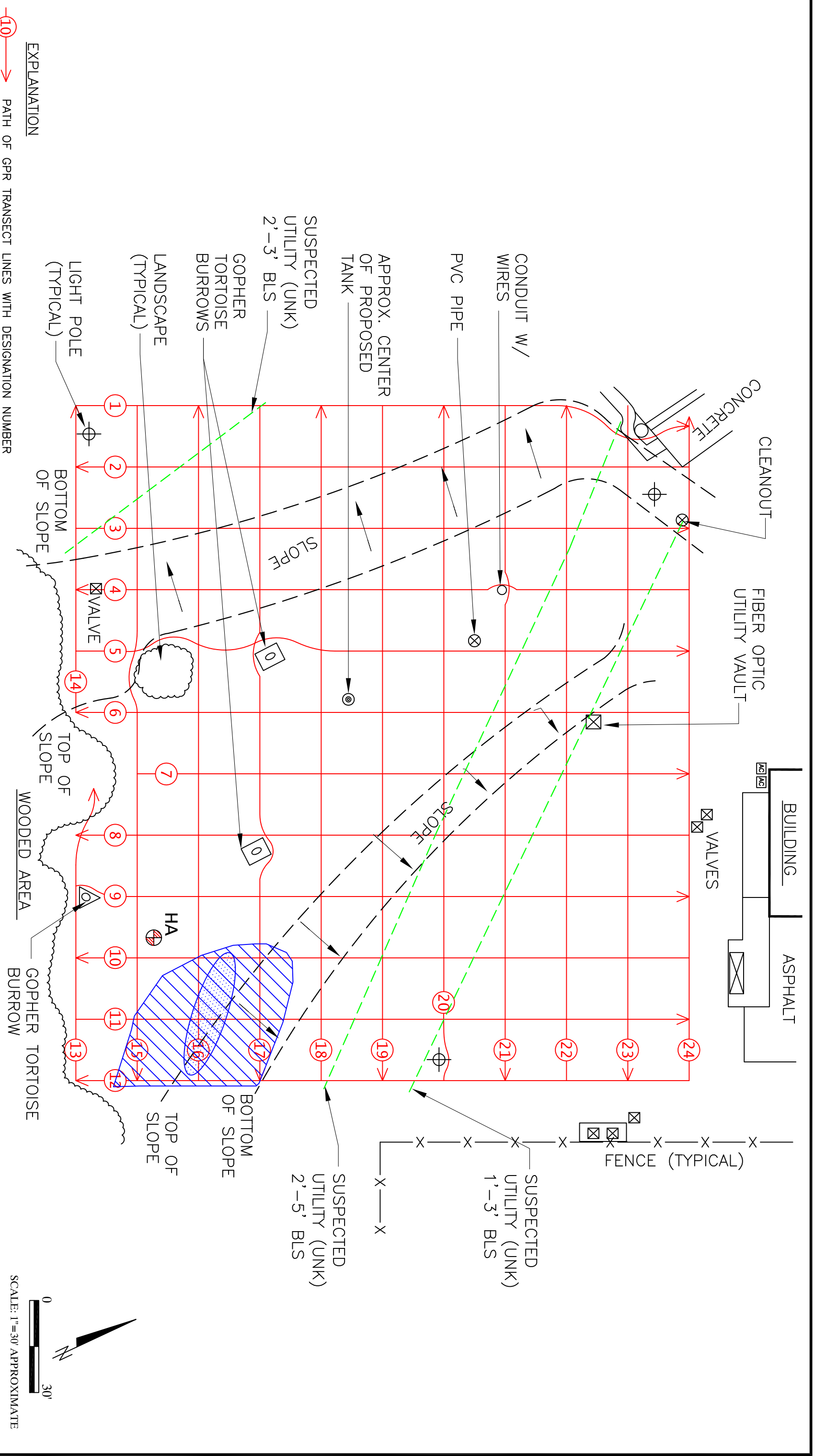
However, the reflector set is most likely associated with some change in lithological conditions at that depth range.

Description of GPR Anomaly

One GPR anomaly area was identified in the southeastern portion of the survey area. The anomaly is semi-elliptical in shape with a total area of approximately 2,000 square ft. The apparent vertical relief of the upper portion of the anomaly area is 2 to 3 ft as characterized by the observed downwarping of the GPR reflector set. A localized minor increase in the depth of penetration of the GPR signal was also observed within the anomaly area. The apparent center of the feature is characterized as the area of maximum downwarping of the previously referenced GPR reflectors.

This GPR investigation was not designed to locate buried utilities. However, three suspected utilities were identified within the survey area at depth ranges of approximately 1 to 5 ft bls (Figure 1). An example of the GPR data collected across the anomaly area is provided in Appendix 1. A discussion of the limitations of the GPR technique in geological characterization studies is provided in Appendix 2.

APPENDIX 1
FIGURE AND EXAMPLE OF GPR ANOMALY



EXPLANATION

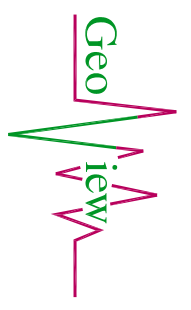
- ⑩ → PATH OF GPR TRANSECT LINES WITH DESIGNATION NUMBER
- HA ⊕ LOCATION OF HAND AUGER BORING
- ▨ LOCATION OF GPR ANOMALY
- APPARENT CENTER OF GPR ANOMALY

FIGURE 1

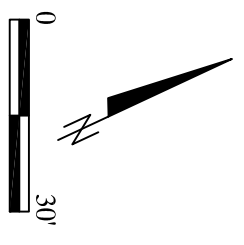
**SITE MAP
SHOWING RESULTS
OF GEOPHYSICAL
INVESTIGATION**

**NORTHWEST WRF
701 WEST McCORMICK ROAD
APOPKA, FLORIDA**

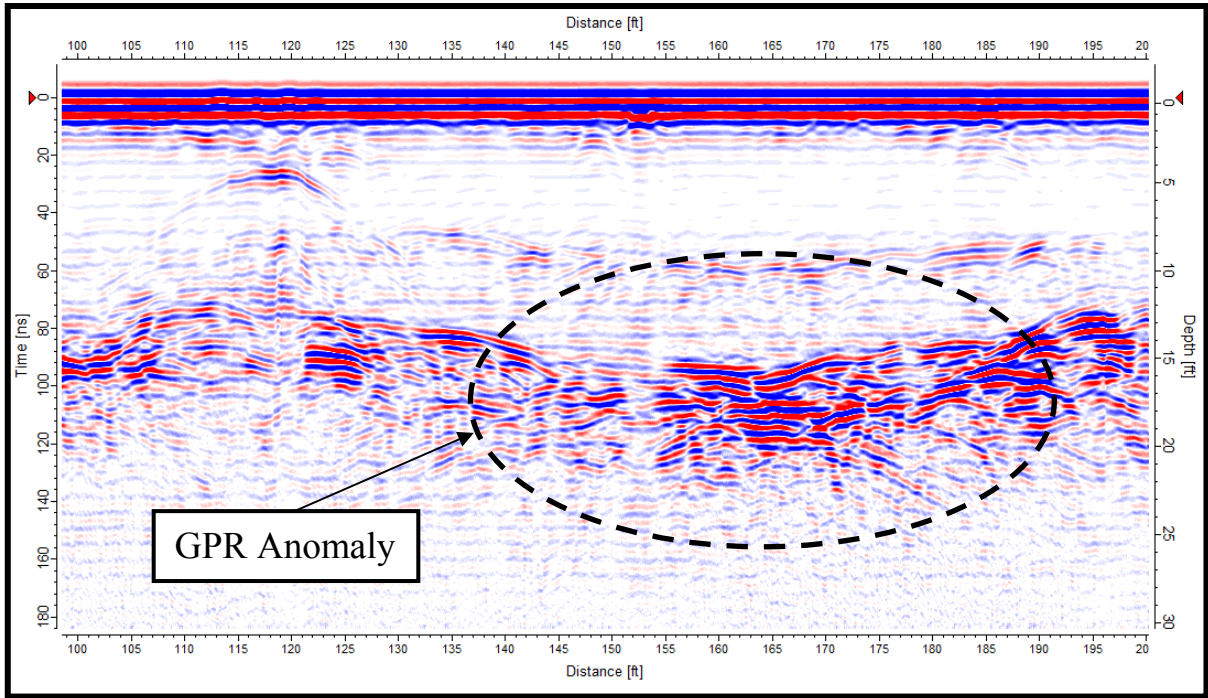
**GATOR ENGINEERING AND
AQUIFER RESTORATIONS, INC.
ALTAMONTE SPRINGS, FLORIDA**



SCALE: 1"=30' APPROXIMATE



PROJECT:
21411
DATE:
08/29/14



GPR Transect 12 Showing Example of GPR Anomaly

APPENDIX 2

DESCRIPTION OF GEOPHYSICAL METHODS, SURVEY METHODOLOGIES AND LIMITATIONS

A2.1 Ground Penetrating Radar

Ground Penetrating Radar (GPR) consists of a set of integrated electronic components that transmits high frequency (200 to 1500 megahertz [MHz]) electromagnetic waves into the ground and records the energy reflected back to the ground surface. The GPR system consists of an antenna, which serves as both a transmitter and receiver, and a profiling recorder that both processes the incoming signal and provides a graphic display of the data. The GPR data can be reviewed as both printed hard copy output or recorded on the profiling recorder's hard drive for later review. GeoView uses a Mala GPR system. Geological characterization studies are typically conducted using a 250 MHz antenna.

A GPR survey provides a graphic cross-sectional view of subsurface conditions. This cross-sectional view is created from the reflections of repetitive short-duration electromagnetic (EM) waves that are generated as the antenna is pulled across the ground surface. The reflections occur at the subsurface contacts between materials with differing electrical properties. The electrical property contrast that causes the reflections is the dielectric permittivity that is directly related to conductivity of a material. The GPR method is commonly used to identify such targets as underground utilities, underground storage tanks or drums, buried debris, voids or geological features.

The greater the electrical contrast between the surrounding earth materials and target of interest, the greater the amplitude of the reflected return signal. Unless the buried object is metal, only part of the signal energy will be reflected back to the antenna with the remaining portion of the signal continuing to propagate downward to be reflected by deeper features. If there is little or no electrical contrast between the target interest and surrounding earth materials it will be very difficult if not impossible to identify the object using GPR.

The depth of penetration of the GPR signal is very site specific and is controlled by two primary factors: subsurface soil conditions and selected antenna frequency. The GPR signal is attenuated (absorbed) as it passes through earth materials. As the energy of the GPR signal is diminished due to attenuation, the energy of the reflected waves is reduced, eventually to the level that the reflections can no longer be detected. The more conductive the earth materials, the greater the GPR signal attenuation, hence a reduction in signal penetration depth. In Florida,

the typical soil conditions which severely limit GPR signal penetration are near-surface clays and/or organic materials.

The depth of penetration of the GPR signal is also reduced as the antenna frequency is increased. However, as antenna frequency is increased the resolution of the GPR data is improved. Therefore, when designing a GPR survey a tradeoff is made between the required depth of penetration and desired resolution of the data. As a rule, the highest frequency antenna that will still provide the desired maximum depth of penetration should be used. For most sinkhole studies, a low-frequency (250 MHz) antenna is used. This allows for maximum signal penetration and thereby maximum depth from which information will be obtained.

A GPR survey is conducted along survey lines (transects) which are measured paths along which the GPR antenna is moved. Electronic marks are placed in the data by the operator at designated points along the GPR transects. These marks allow for a correlation between the GPR data and the position of the GPR antenna on the ground.

Depth estimates to the top of lithological contacts or sinkhole features are determined by dividing the time of travel of the GPR signal from the ground surface to the top of the feature by the velocity of the GPR signal. The velocity of the GPR signal is usually obtained from published tables of velocities for the type and condition (saturated vs. unsaturated) of soils underlying the site. The accuracy of GPR-derived depths typically ranges from 20 to 40 percent of the total depth.

Interpretation and Limitations of GPR data

The analysis and collection of GPR data is both a technical and interpretative skill. The technical aspects of the work are learned from both training and experience. Interpretative skills for geological characterization studies are developed by having the opportunity to compare GPR data collected in numerous settings to the results from geotechnical studies performed at the same locations.

The ability of GPR to collect interpretable information at a project site is limited by the attenuation (absorption) of the GPR signal by underlying soils. Once the GPR signal has been attenuated at a particular depth, information regarding deeper geological conditions will not be obtained. GPR data can only resolve subsurface features which have a sufficient electrical contrast between the feature in question and surrounding earth materials. If an insufficient contrast is present, the subsurface feature will not be identified.

GeoView can make no warranties or representations of geological conditions which may be present beyond the depth of investigation or resolving capability of

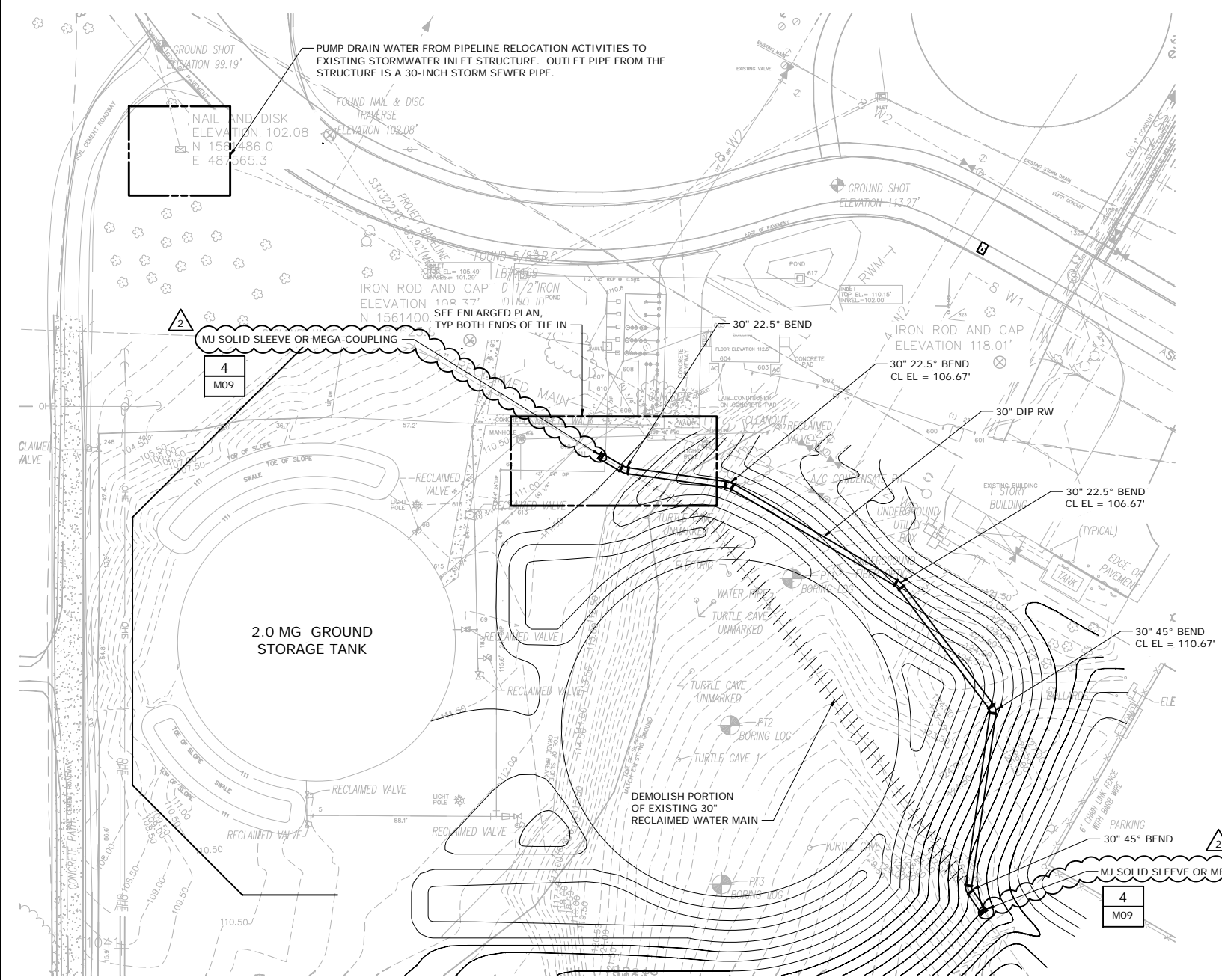
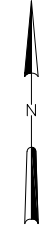
the GPR equipment or in areas that were not accessible to the geophysical investigation.

A2.2 Hand Auger Boring

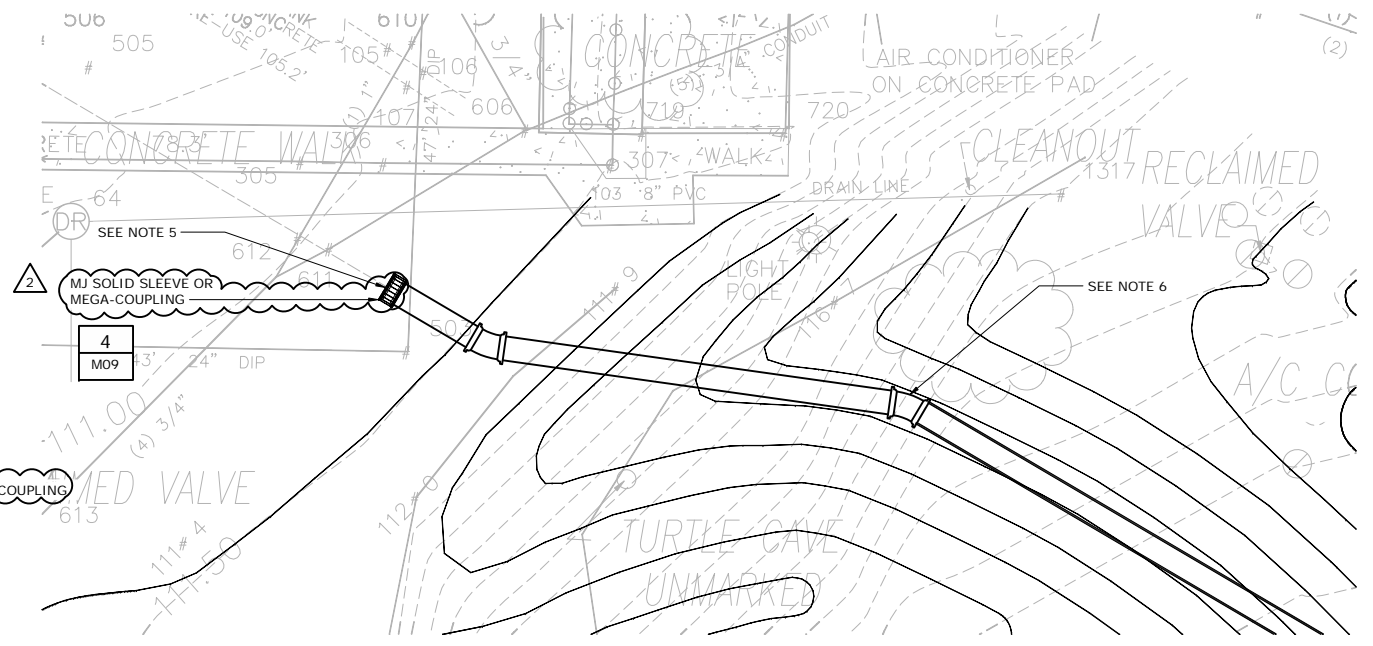
A hand auger boring was performed within the survey area. The boring was performed in general accordance with ASTM standards D1452-90 (1995) titled "Standard Practice for Soil Investigation and Sampling by Auger Borings". The purpose of the hand auger boring was to obtain information regarding near-surface soil conditions to assist in the interpretation of the GPR data. The boring was performed by manually advancing the auger bucket into the ground in approximate increments of 6 inches. Soils were retrieved and placed on plastic sheet for identification. Classifications of soils were made in the field based upon observed textural, color and compositional characteristics. Hand auger borings are typically advanced to the depth of the first competent clay layer, the water table or to a maximum depth of 9 ft. Unless requested, soil samples are not saved.

NOTES:

- SEQUENCE OF CONSTRUCTION
- COORDINATE SEQUENCE OF CONSTRUCTION FOR PIPE TIE-INS WITH THE COUNTY AT LEAST 7 DAYS IN ADVANCE OF SCHEDULED DATE FOR TIE-INS.
 - FIELD LOCATE UNDERGROUND UTILITIES.
 - RELOCATE SITE ELECTRICAL CABLES AND PULLBOXES IN ADVANCE OF 30-INCH PIPE CONSTRUCTION - REFER TO DWG E-03.
 - CONSTRUCT NEW 30-INCH PLANT EFFLUENT PIPE TO WITHIN ONE PIPE LENGTH OF TIE-IN LOCATIONS AT EACH END OF NEW 30-INCH PLANT EFFLUENT PIPE.
 - FIELD VERIFY EXISTING 30 INCH PLANT EFFLUENT PIPE ELEVATIONS AT PROPOSED TIE-IN LOCATIONS. ESTIMATED CENTERLINE ELEVATIONS ARE:
NORTH TIE-IN 106.67 FT.
SOUTH TIE-IN 116.67 FT.
 - MAINTAIN CENTERLINE ELEVATION AT 106.67' FOR ALL SEGMENTS OF 30 INCH PLANT EFFLUENT PIPELINE WITHIN 25 FEET OF THE PROPOSED 3.0 MG GROUND STORAGE TANK TO FACILITATE TANK CONSTRUCTION.
 - PRESSURE TEST NEWLY CONSTRUCTED 30-INCH PLANT EFFLUENT PIPE.
 - DEWATER, SHORE AND EXCAVATE PITS AS REQUIRED TO CONNECT NEW 30-INCH PLANT EFFLUENT PIPE TO EXISTING 30-INCH PLANT EFFLUENT PIPE (TYPICAL EACH END OF NEW 30-INCH PLANT EFFLUENT PIPE).
 - INSTALL TEMPORARY PUMPS AND PIPING TO CONVEY PLANT EFFLUENT FROM EXISTING PIPING AFTER THE PIPE HAS BEEN CUT. TEMPORARY PIPING SHALL CONVEY PIPE DRAIN WATER TO LOCATIONS DESIGNATED ON THE DRAWINGS. INSTALL EROSION AND SEDIMENT CONTROLS AT TEMPORARY PIPE DISCHARGE LOCATIONS.
 - CUT EXISTING 30-INCH PLANT EFFLUENT PIPE AND ALLOW WATER TO DRAIN FROM THE PIPE. PUMP DRAIN WATER TO LOCATION(S) DESIGNATED ON THE DRAWINGS.
 - TIE-IN NEW 30-INCH PLANT EFFLUENT PIPE TO EXISTING 30-INCH PLANT EFFLUENT PIPE USING RESTRAINED PIPE COUPLINGS AND FITTINGS AS SHOWN ON THE DRAWINGS. LEAVE TIE-INS EXPOSED UNTIL NEW 30-INCH PLANT EFFLUENT PIPE HAS BEEN PLACED BACK INTO SERVICE AND THERE ARE NO VISIBLE LEAKS FOR AT LEAST 2 FULL DAYS OF PLANT EFFLUENT PIPE SERVICE. DO NOT REMOVE TEMPORARY PUMPS OR PIPING UNTIL THE NEW 30-INCH PLANT EFFLUENT PIPE HAS BEEN DEEMED TO BE LEAK-FREE BY THE COUNTY'S ON-SITE REPRESENTATIVE.



PLAN
1"=30'



ENLARGED PLAN
1"=10'

LOT DATE: 2017/04/12 10:15:56 AM BY: BARTHEL
 FILE: C:\Users\barthel\OneDrive\Documents\Projects\2017\04\12\840_MW

2	ADDENDUM No. 3	06/2017	RKA
1	BID SET	04/2017	RKA
REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. ANDERSON
DESIGNED BY:	RKA
DRAWN BY:	ESM
CHECKED BY:	CIK
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	

DO NOT USE FOR CONSTRUCTION

Hazen

HAZEN AND SAWYER
919 LAKE BALDWIN LANE, SUITE A
ORLANDO, FLORIDA 32814
CERTIFICATE OF AUTHORIZATION No. 2771

ROBERT K. ANDERSON, PE No. 47129

P.E.

ORANGE COUNTY
FLORIDA

NORTHWEST WATER RECLAMATION FACILITY
REUSE WATER STORAGE IMPROVEMENTS

CIVIL

PROPOSED 30 INCH RW RELOCATION,
AND SOIL BORING LOCATIONS

DATE: APRIL 2017

HAZEN NO.: 44014-001

CONTRACT NO.: 1

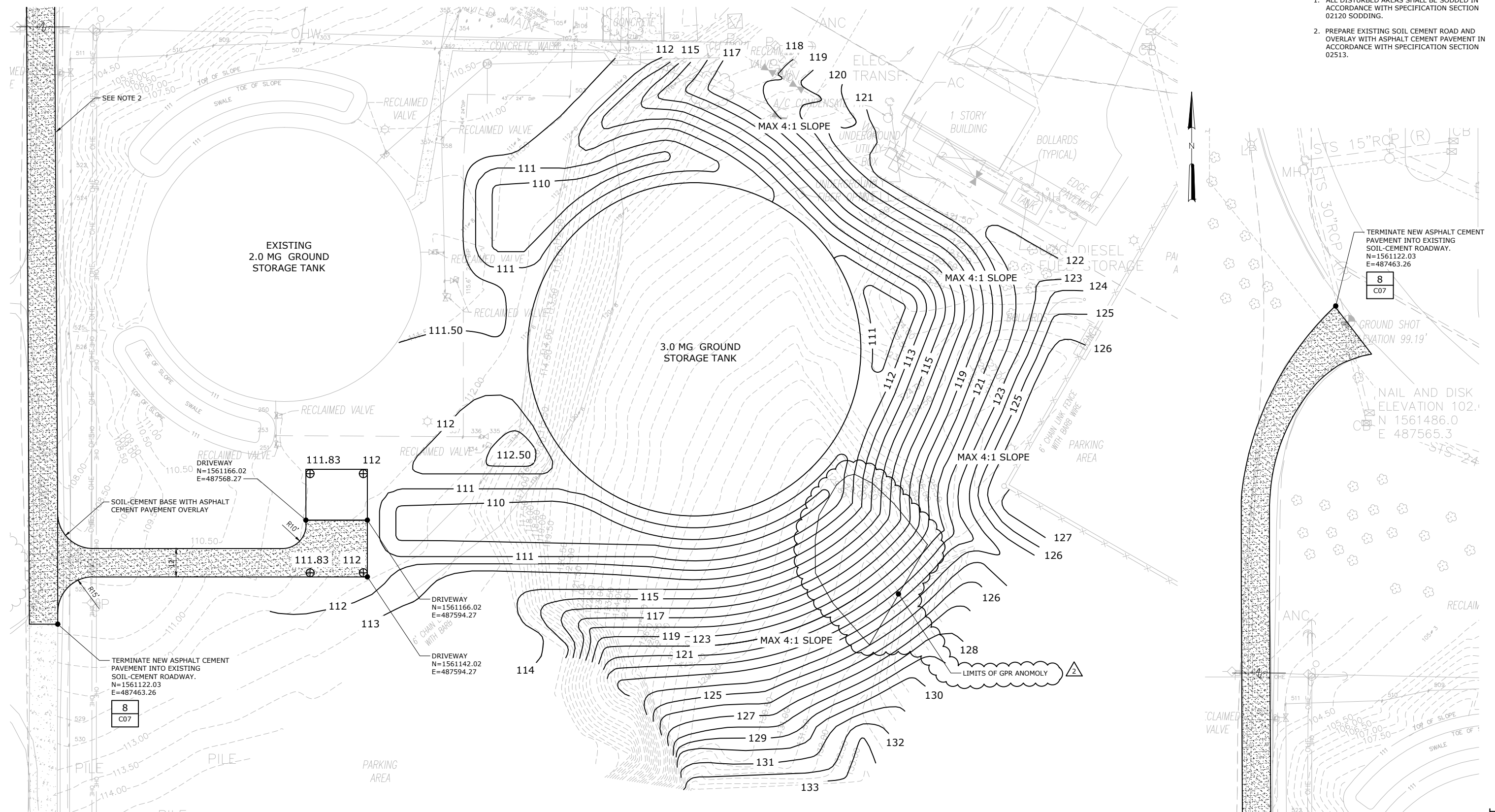
DRAWING NUMBER: C03

BID SET

CONTINUED ON PLAN - ROADWAY NORTH ON THIS SHEET

NOTES:

1. ALL DISTURBED AREAS SHALL BE SODDED IN ACCORDANCE WITH SPECIFICATION SECTION 02120 SODDING.
2. PREPARE EXISTING SOIL CEMENT ROAD AND OVERLAY WITH ASPHALT CEMENT PAVEMENT IN ACCORDANCE WITH SPECIFICATION SECTION 02513.



PLAN
1"=20'

PLAN - ROADWAY NORTH
1"=20'

CUT DATE: 04/17/17 12:54:04 PM BY: R. ANDERSON
 FILE: P:\Veg\04-14-17\04-14-17\ADMIN\04-14-17\04-14-17.dwg
 PLOT DATE: 04/17/17 12:54:04 PM BY: R. ANDERSON
 FILE: P:\Veg\04-14-17\04-14-17\ADMIN\04-14-17\04-14-17.dwg

PROJECT ENGINEER:	R. ANDERSON
DESIGNED BY:	RKA
DRAWN BY:	ESM
CHECKED BY:	CIK
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	

DO NOT USE FOR CONSTRUCTION

ROBERT K. ANDERSON, PE No. 47129

Hazen

HAZEN AND SAWYER
 919 LAKE BALDWIN LANE, SUITE A
 ORLANDO, FLORIDA 32814
 CERTIFICATE OF AUTHORIZATION No. 2771

ORANGE COUNTY
 FLORIDA

NORTHWEST WATER RECLAMATION FACILITY
 REUSE WATER STORAGE IMPROVEMENTS

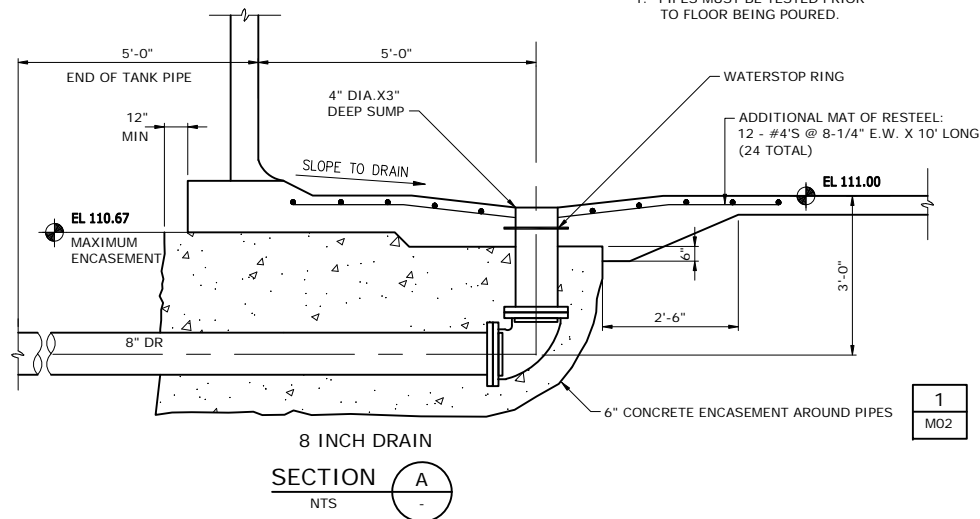
CIVIL
 PAVING, GRADING AND
 DRAINAGE PLAN

DATE:	APRIL 2017
HAZEN NO.:	44014-001
CONTRACT NO.:	1
DRAWING NUMBER:	C04

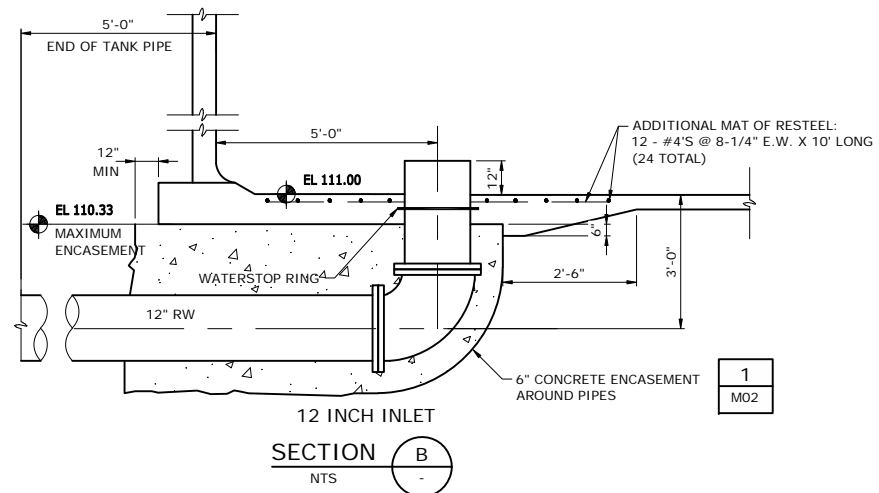
BID SET

NOTES:

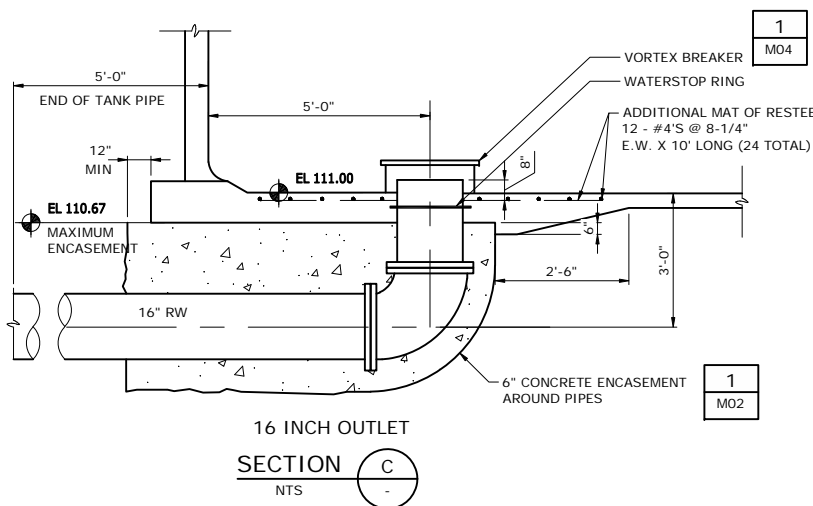
1. PIPES MUST BE TESTED PRIOR TO FLOOR BEING POURED.



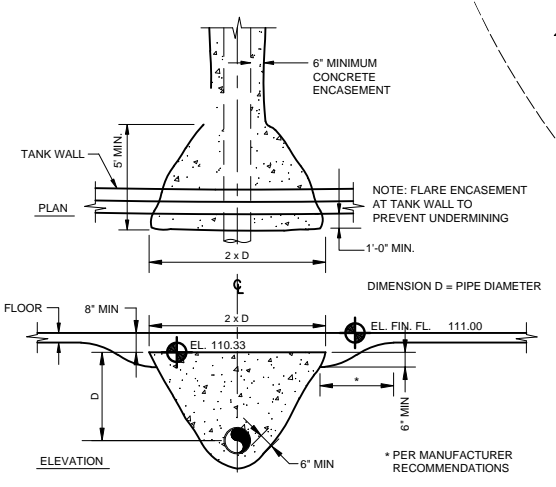
8 INCH DRAIN
SECTION A
NTS



12 INCH INLET
SECTION B
NTS

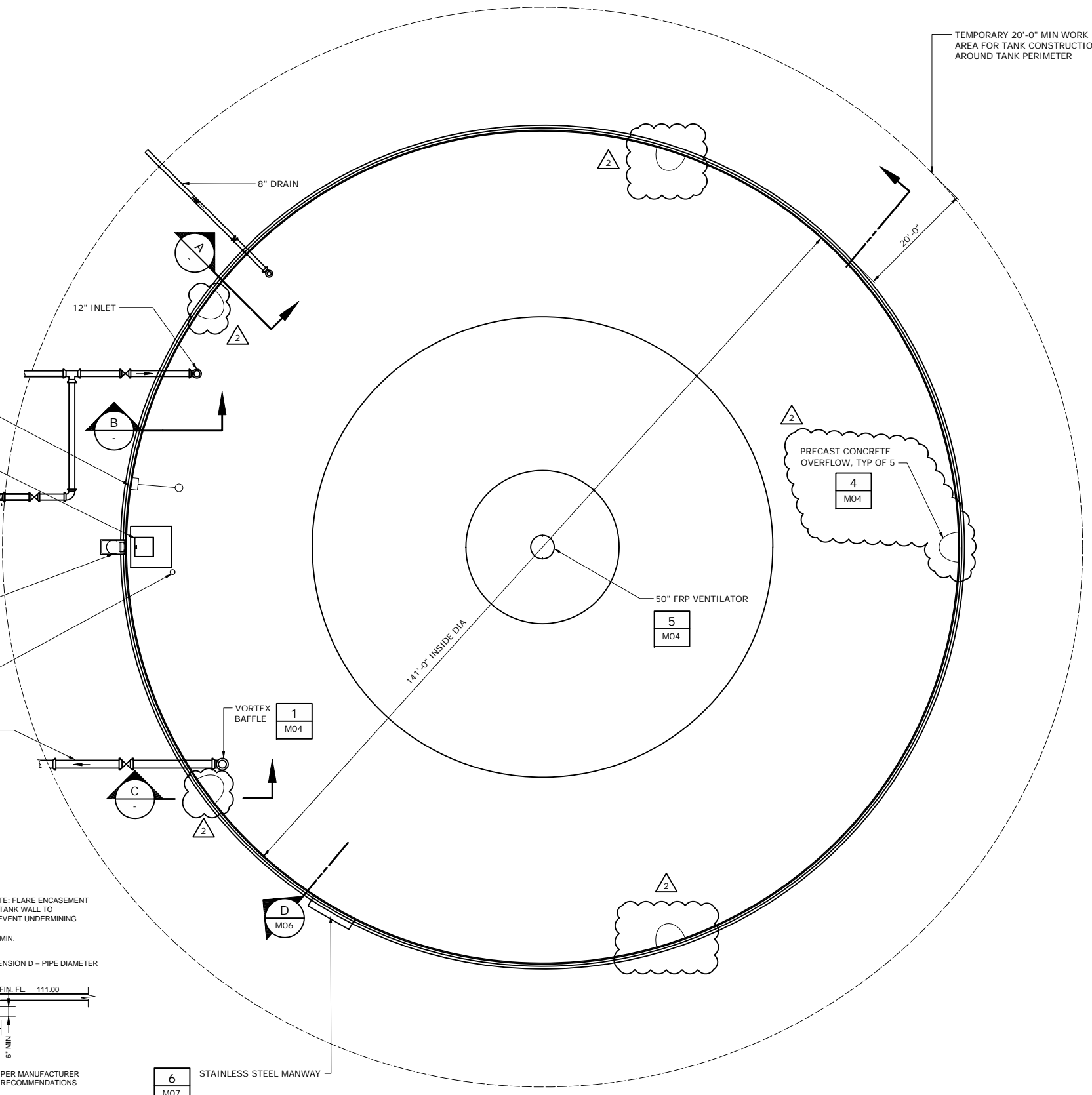


16 INCH OUTLET
SECTION C
NTS



TYPICAL PIPE ENCASEMENT
DETAIL
NTS

- 1 M03 FIBERGLASS LIQUID LEVEL INDICATOR
- 3 M04 ACCESS HATCH W/FIBERGLASS COVER
- EXTERIOR ALUMINUM LADDER W/ SAFETY CAGE (SEE SHEET M03)
- LIQUID LEVEL SWITCH, SEE ELECTRICAL DRAWINGS



REUSE STORAGE TANK ENLARGED PLAN
3/32"=1'-0"

PLOT DATE: 2017/04/12 10:56:54 AM
 PLOT BY: RKA
 PLOT FILE: C:\Users\RKA\AppData\Local\Temp\1\170412105654.dwg
 PLOT SCALE: 1/32"=1'-0"
 PLOT SHEET: 1 OF 1
 PLOT STATUS: SUCCESS
 PLOT START: 2017/04/12 9:49 AM

REV	ISSUED FOR	DATE	BY
2	ADDENDUM No. 3	06/2017	RKA
1	BID SET	04/2017	RKA

PROJECT ENGINEER:	R. ANDERSON
DESIGNED BY:	RKA
DRAWN BY:	ESM
CHECKED BY:	CIK

DO NOT USE FOR CONSTRUCTION

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

0 1/2" 1"

ROBERT K. ANDERSON, PE No. 47129

Hazen

HAZEN AND SAWYER
 919 LAKE BALDWIN LANE, SUITE A
 ORLANDO, FLORIDA 32814
 CERTIFICATE OF AUTHORIZATION No. 2771

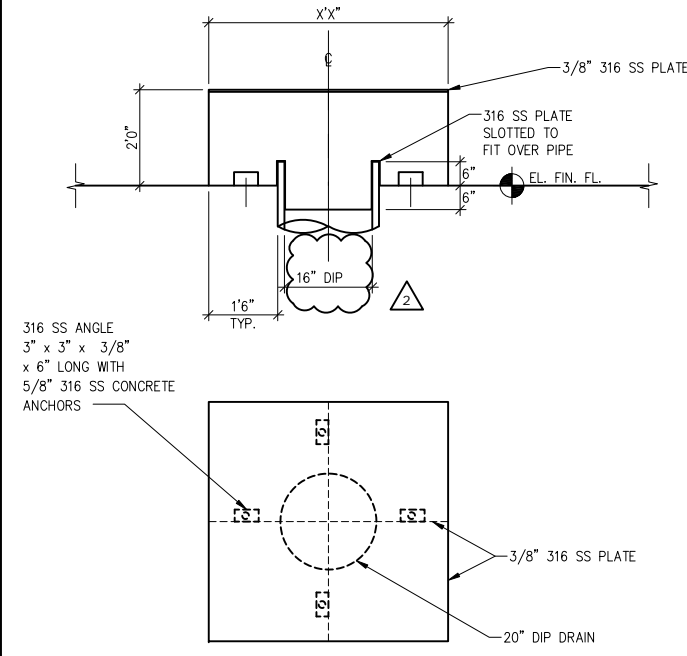
ORANGE COUNTY
 FLORIDA

NORTHWEST WATER RECLAMATION FACILITY
 REUSE WATER STORAGE IMPROVEMENTS

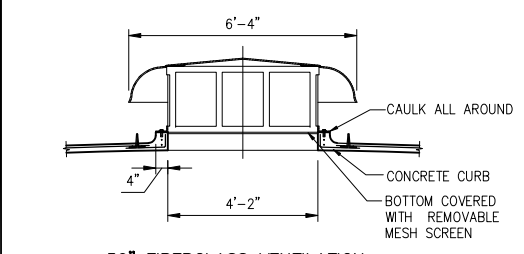
MECHANICAL
 REUSE STORAGE TANK
 ENLARGED PLAN

DATE:	APRIL 2017
HAZEN NO.:	44014-001
CONTRACT NO.:	1
DRAWING NUMBER:	M02

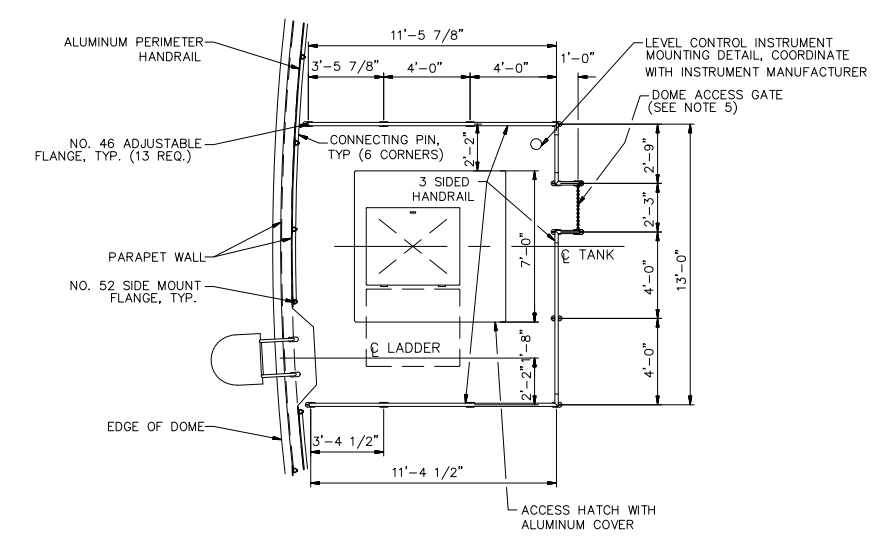
BID SET



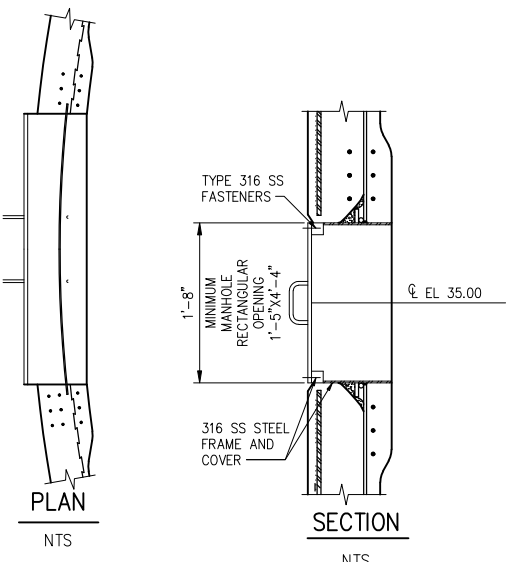
VORTEX BAFFLE
DETAIL 1
 NTS M04



**50\"/>
DETAIL 5
 NTS M04**

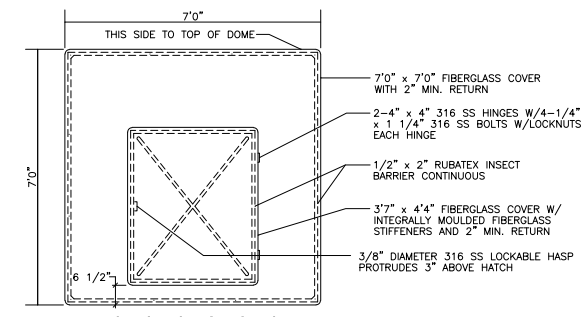


HANDRAIL DETAIL
DETAIL 2
 NTS M04

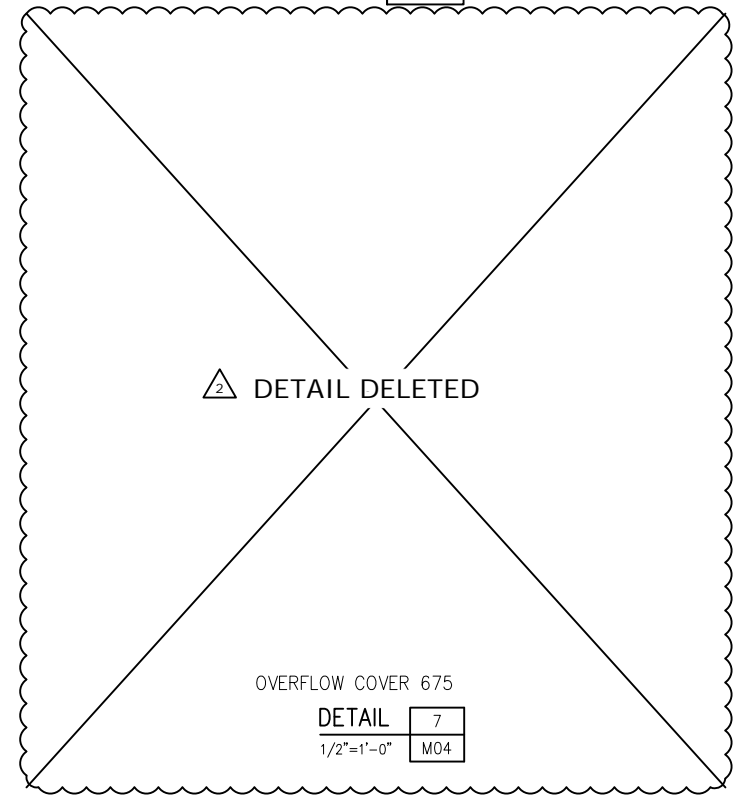
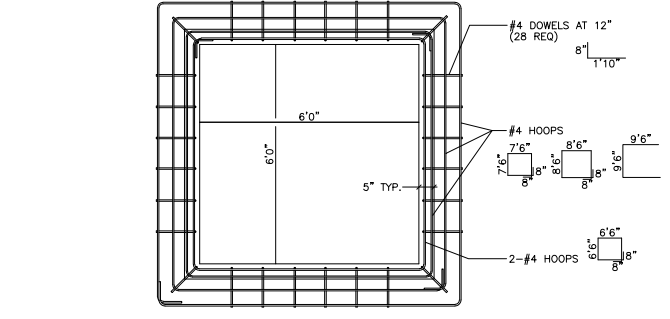


STAINLESS STEEL MANWAY
DETAIL 6
 1\"/>

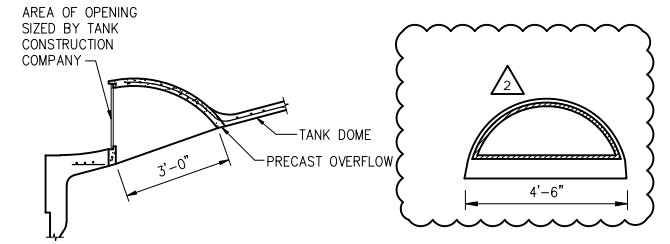
- NOTES**
1. USE TUBULAR HOLLAENDER HIGH TENSILE ALUMINUM ALLOY FITTINGS.
 2. USE 1 1/2\"/>
 - 3. TOEBOARDS TO BE 6061-T6 ALUMINUM.
 - 4. USE 1/2\"/>
 - 5. 316 SS CHAIN WITH CLASS \"D\" HOOK AT ONE END x 2'6\"/>
 - 6. ALL ALUMINUM IN DIRECT CONTACT WITH CONCRETE SHALL BE COATED WITH A MINIMUM 8.0 DRY MIL THICKNESS SERIES 46-465 H.B. TNEMECOL OR EQUAL.
 - 7. ALL TUBULAR MATERIAL TO BE NOMINAL DIAMETER SCHEDULE 40 ALUMINUM PIPE 6061-T6 OR 6063-T6.



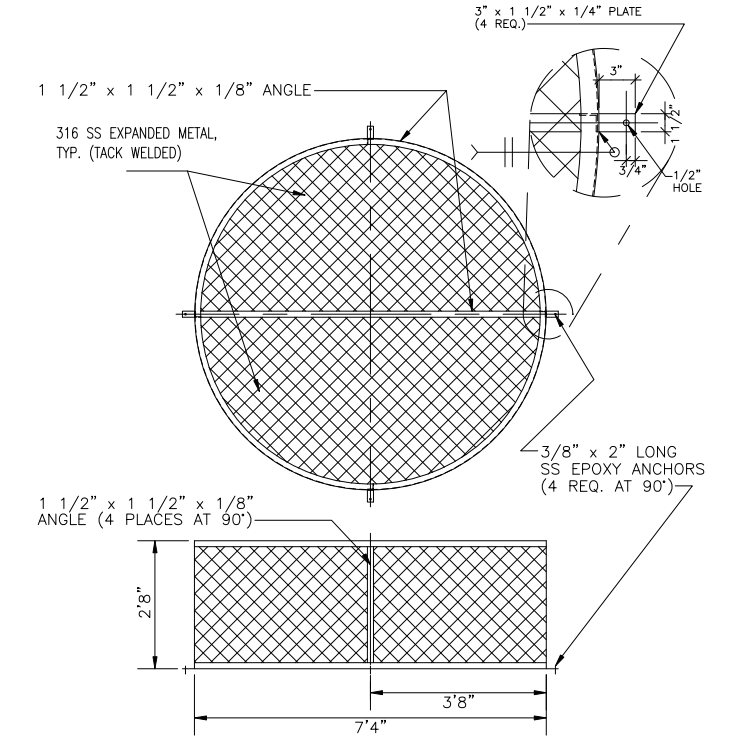
FIBERGLASS HATCH COVER
DETAIL 3
 M04



OVERFLOW COVER 675
DETAIL 7
 1/2\"/>



PRECAST CONCRETE OVERFLOW
DETAIL 4
 3/8\"/>



VENT COVER
DETAIL 8
 1/2\"/>

- NOTES:**
1. PROVIDE 316 SS BOLTS AND NUTS FOR FLANGE CONNECTIONS.
 2. THIS NOTE DELETED

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 PLOT: C:\Users\parker\OneDrive\Documents\Drawings\2017\04\12\9-50.MXD
 Saved By: PARKER, Date: 2017/04/12 9:50 AM

PROJECT ENGINEER:	R. ANDERSON
DESIGNED BY:	RKA
DRAWN BY:	ESM
CHECKED BY:	CIK
ADDENDUM No. 3	06/2017 RKA
BID SET	04/2017 RKA
ISSUED FOR	DATE BY

DO NOT USE FOR CONSTRUCTION

ROBERT K. ANDERSON, PE No. 47129

Hazen

HAZEN AND SAWYER
 919 LAKE BALDWIN LANE, SUITE A
 ORLANDO, FLORIDA 32814
 CERTIFICATE OF AUTHORIZATION No. 2771

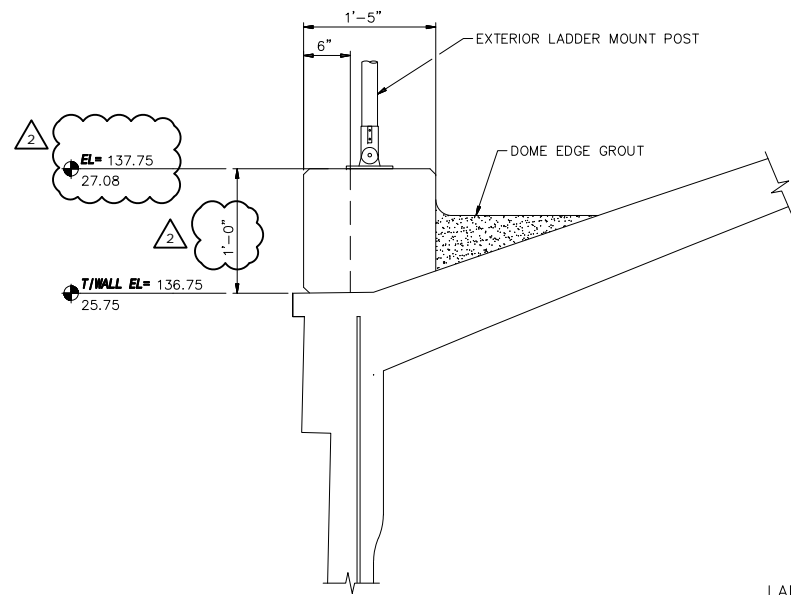
ORANGE COUNTY
 FLORIDA

NORTHWEST WATER RECLAMATION FACILITY
 REUSE WATER STORAGE IMPROVEMENTS

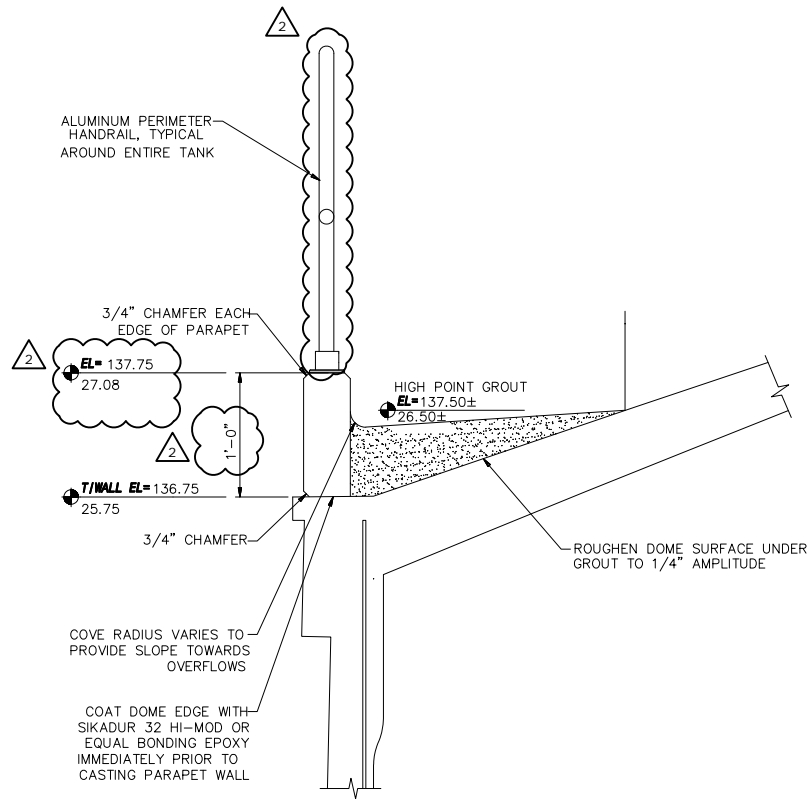
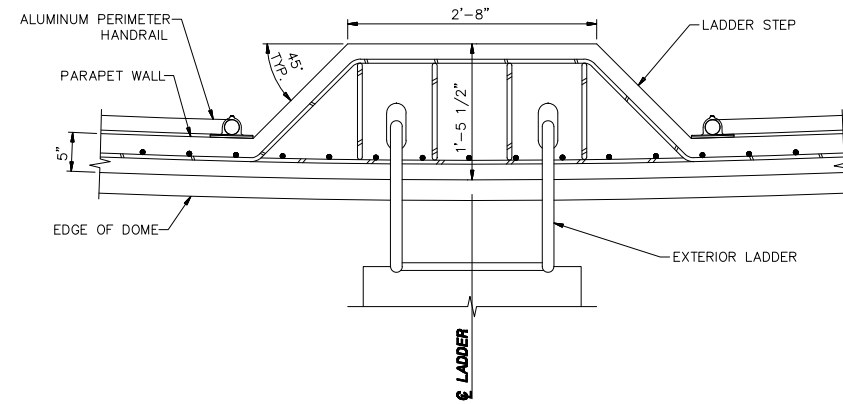
MECHANICAL
 REUSE STORAGE TANK
 DETAILS - SHEET 1

DATE:	APRIL 2017
HAZEN NO.:	44014-001
CONTRACT NO.:	1
DRAWING NUMBER:	M04

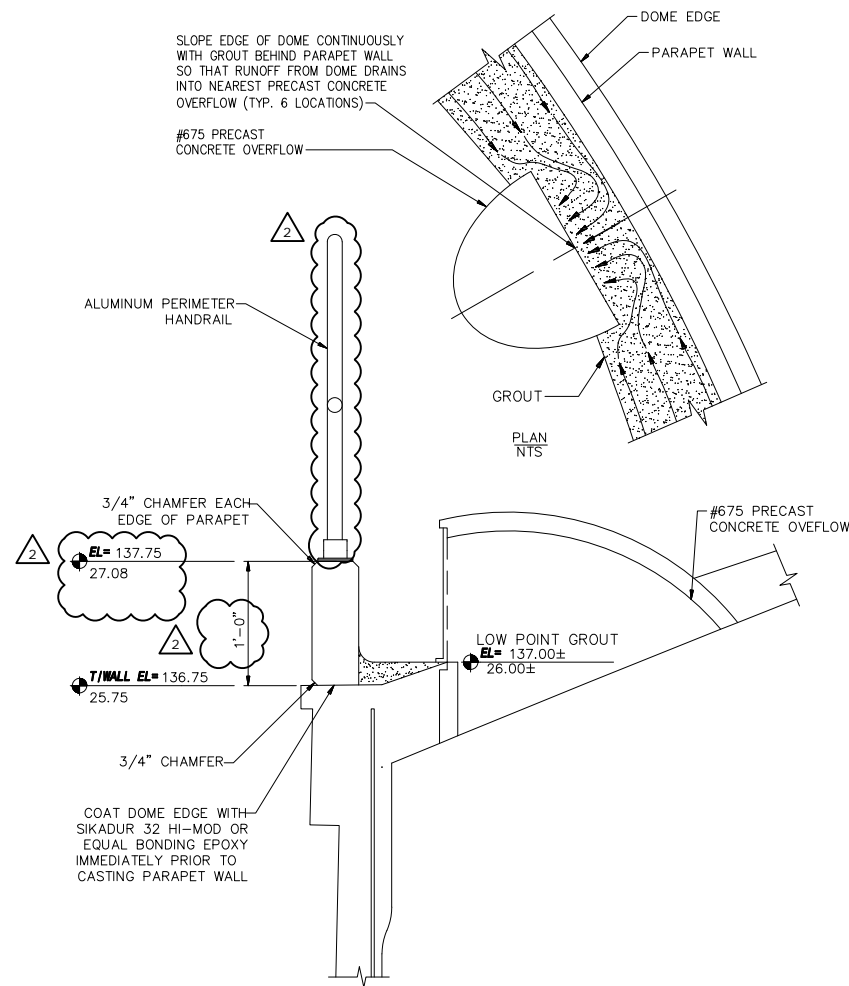
BID SET



LADDER STEP DETAIL



GROUT HIGH POINT DETAIL



GROUT LOW POINT DETAIL

LOT DATE: 2/17/17, 10:08:59 AM, BY: RKA
 FILE: C:\Users\RKA\OneDrive\Documents\Projects\44014-001\Drawings\44014-001-02.dwg, Saved By: RKA, Date: 2017/09/12 9:43 AM

2	ADDENDUM No. 3	06/2017	RKA
1	BID SET	04/2017	RKA
REV	ISSUED FOR	DATE	BY

PROJECT ENGINEER:	R. ANDERSON
DESIGNED BY:	RKA
DRAWN BY:	ESM
CHECKED BY:	CIK
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE	

DO NOT USE FOR CONSTRUCTION

P.E.

ROBERT K. ANDERSON, PE No. 47129

Hazen

HAZEN AND SAWYER
 919 LAKE BALDWIN LANE, SUITE A
 ORLANDO, FLORIDA 32814
 CERTIFICATE OF AUTHORIZATION No. 2771

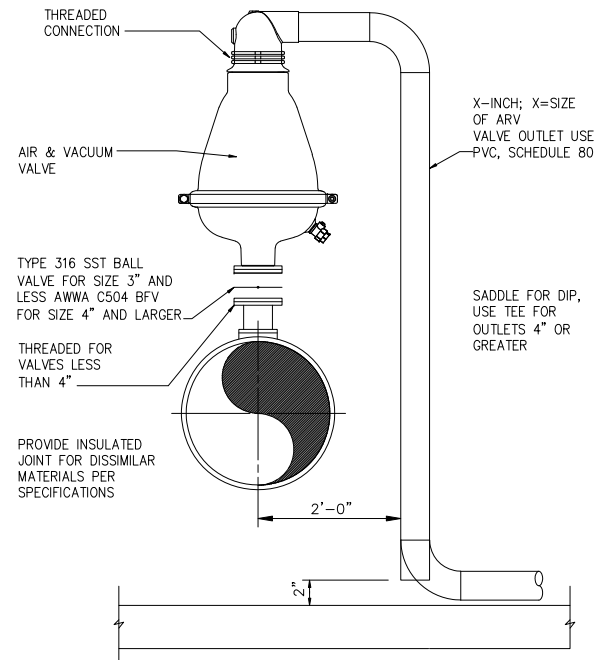
ORANGE COUNTY
 FLORIDA

NORTHWEST WATER RECLAMATION FACILITY
 REUSE WATER STORAGE IMPROVEMENTS

MECHANICAL
 REUSE STORAGE TANK
 DETAILS - SHEET 2

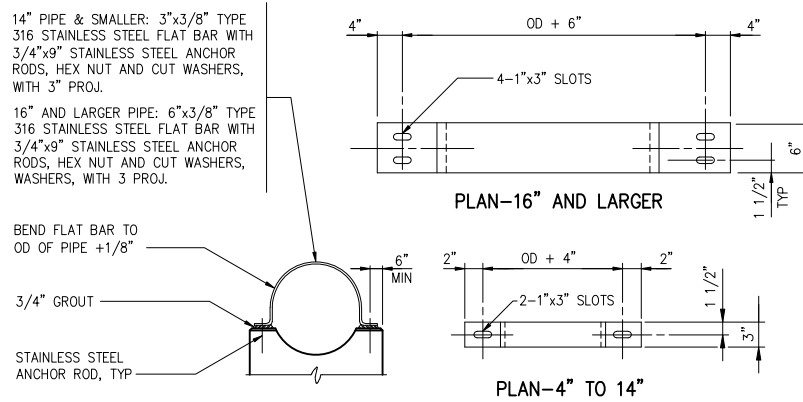
DATE:	APRIL 2017
HAZEN NO.:	44014-001
CONTRACT NO.:	1
DRAWING NUMBER:	M05

BID SET



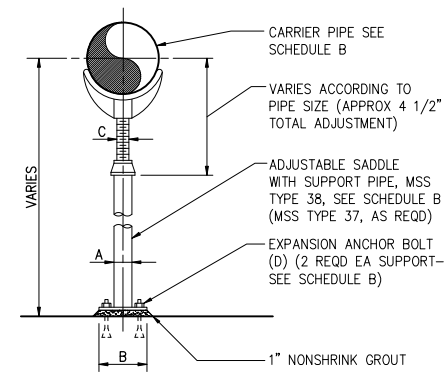
AIR RELEASE/AIR VACUUM VALVE

DETAIL	1
N.T.S.	M09



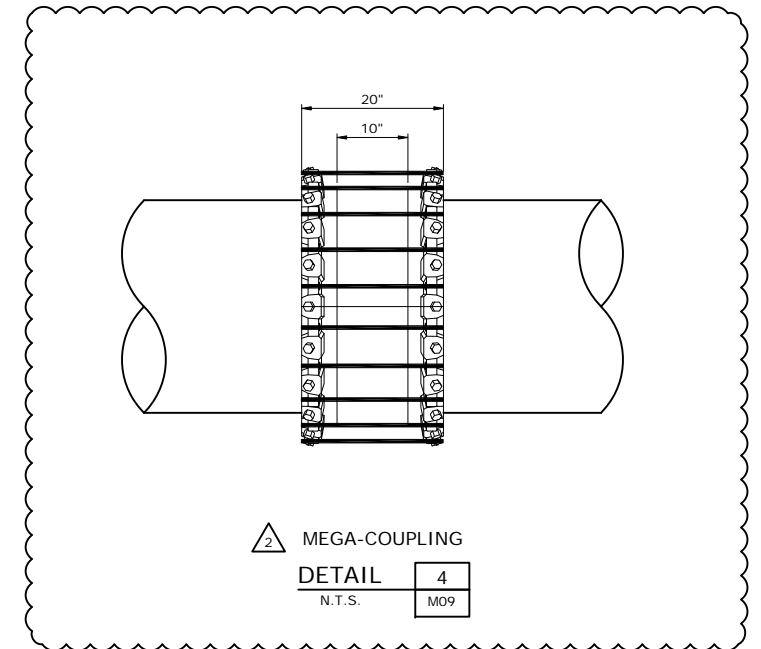
PIPE HOLD DOWN STRAP

DETAIL	2
N.T.S.	M09



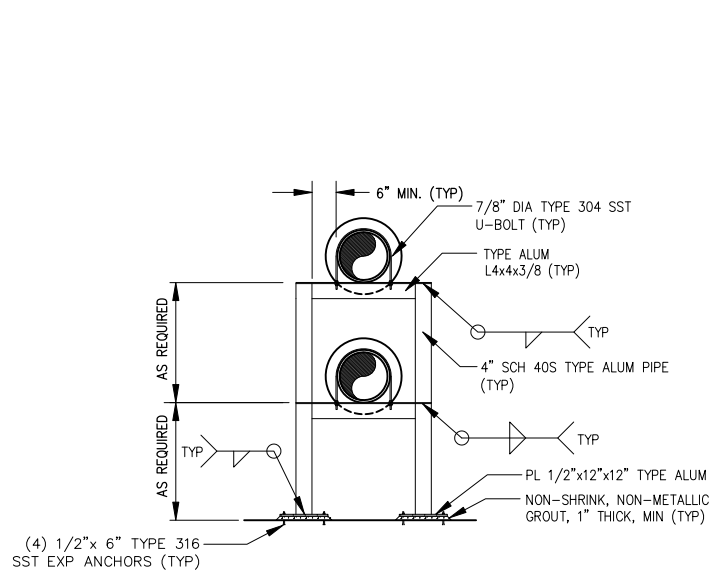
ADJUSTABLE SADDLE

DETAIL	3
N.T.S.	M09



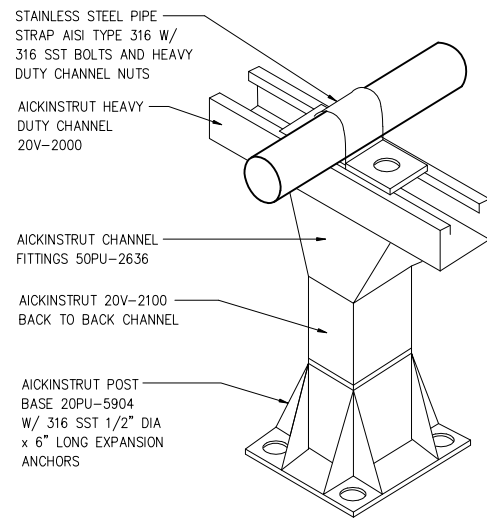
MEGA-COUPLING

DETAIL	4
N.T.S.	M09



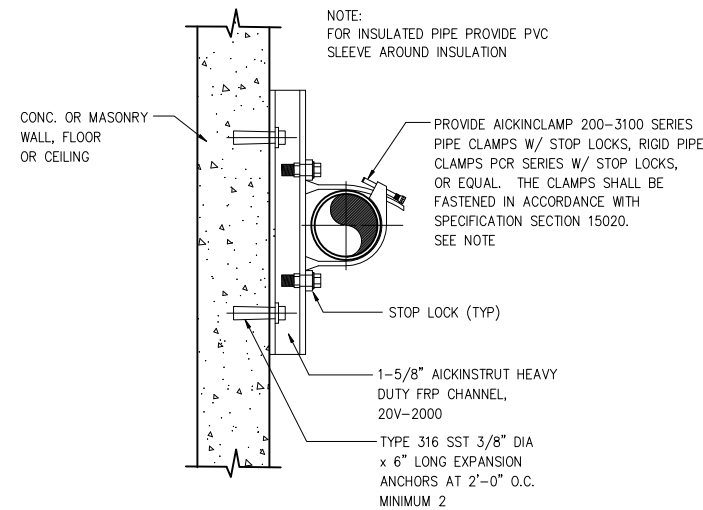
STACKED PIPE SUPPORT

DETAIL	5
NONE	M09



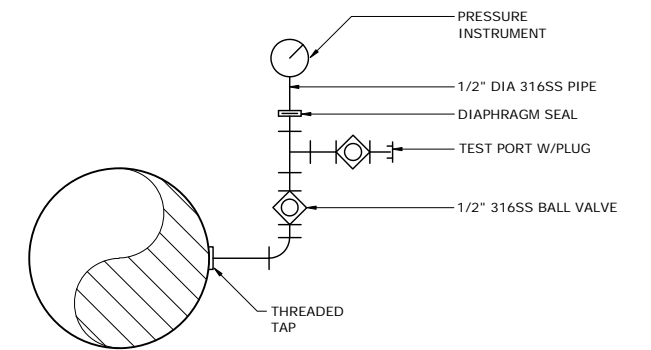
NON-METALLIC CHANNEL ON CONCRETE PIPE SUPPORT

DETAIL	6
NONE	M09



NON-METALLIC CHANNEL ON CONCRETE PIPE SUPPORT

DETAIL	7
NONE	M09



SIDE MOUNTED PRESSURE GAUGE

DETAIL	8
NONE	M09

LOT DATE: 07/17/12 10:00:01 AM
 PLOT BY: R. ANDERSON
 PLOT DATE: 07/17/12 10:00:01 AM
 PLOT BY: R. ANDERSON

PROJECT ENGINEER:	R. ANDERSON
DESIGNED BY:	RKA
DRAWN BY:	ESM
CHECKED BY:	CIK
ADDENDUM No. 3	06/2017 RKA
BID SET	04/2017 RKA
ISSUED FOR	DATE BY

DO NOT USE FOR CONSTRUCTION

Hazen

HAZEN AND SAWYER
 919 LAKE BALDWIN LANE, SUITE A
 ORLANDO, FLORIDA 32814
 CERTIFICATE OF AUTHORIZATION No. 2771

ROBERT K. ANDERSON, PE No. 47129

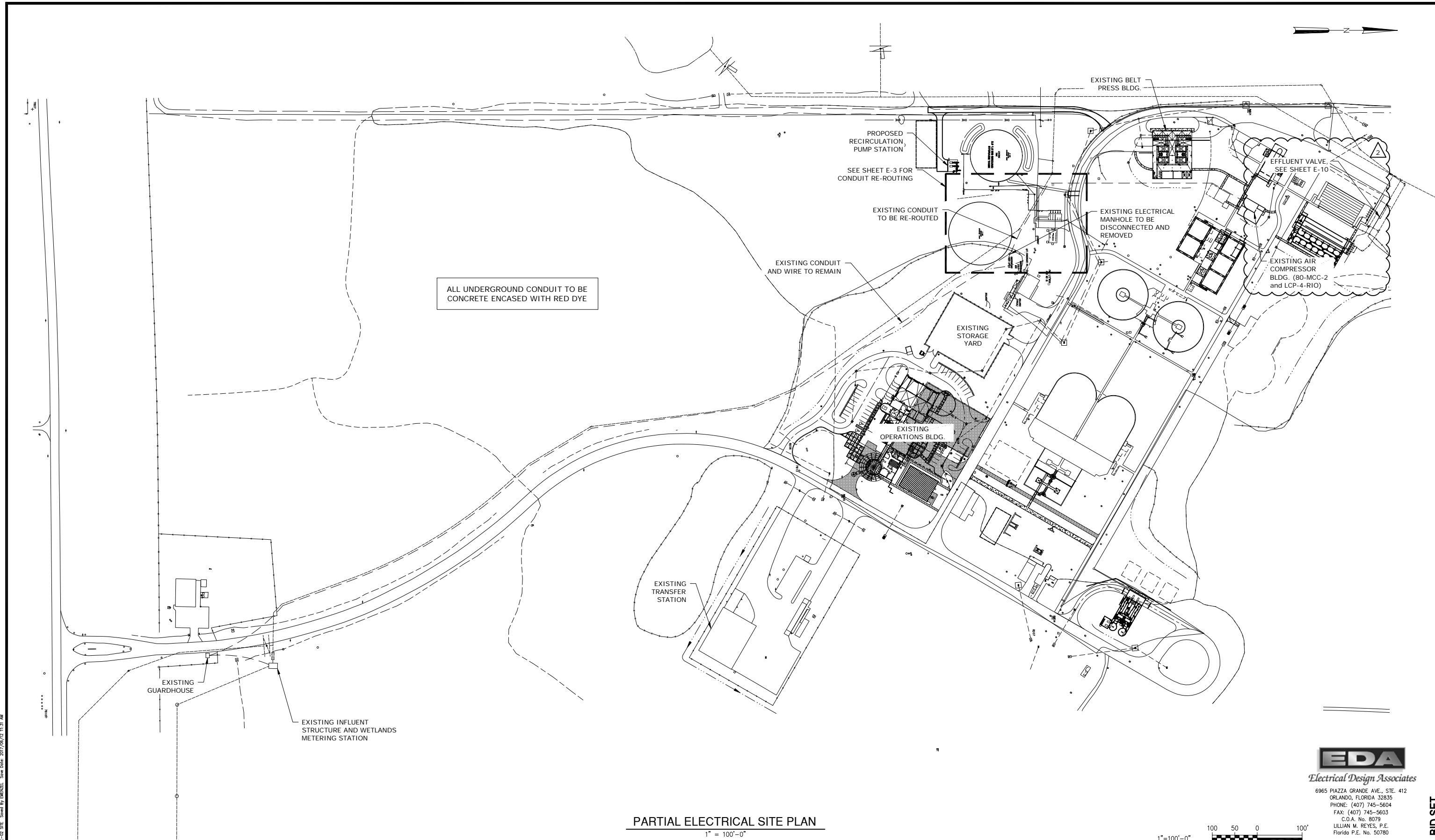
ORANGE COUNTY
 FLORIDA

NORTHWEST WATER RECLAMATION FACILITY
 REUSE WATER STORAGE IMPROVEMENTS

MECHANICAL
 DETAILS SHEET 1

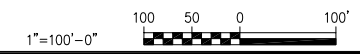
DATE:	APRIL 2017
HAZEN NO.:	44014-001
CONTRACT NO.:	1
DRAWING NUMBER:	M09

BID SET



PARTIAL ELECTRICAL SITE PLAN
1" = 100'-0"

EDA
Electrical Design Associates
 6965 PIAZZA GRANDE AVE., STE. 412
 ORLANDO, FLORIDA 32835
 PHONE: (407) 745-5604
 FAX: (407) 745-5603
 C.O.A. No. 8079
 LILLIAN M. REYES, P.E.
 Florida P.E. No. 50780



LOT DATE: 2017/04/12 11:46:13 AM BY: EDA/MLR
 FILE: C:\Users\lreyes\OneDrive\Documents\2017\04\12\11:46:13 AM

PROJECT ENGINEER:	R. ANDERSON		
DESIGNED BY:	LMR		
DRAWN BY:	RRM		
CHECKED BY:	LMR		
2	ADDENDUM No. 3	06/2017	RKA
1	BID SET	04/2017	RKA
REV	ISSUED FOR	DATE	BY

DO NOT USE FOR CONSTRUCTION

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

0 1/2" 1"

LILLIAN M. REYES, PE NO. 50780

Hazen
 HAZEN AND SAWYER
 919 LAKE BALDWIN LANE, SUITE A
 ORLANDO, FLORIDA 32814
 CERTIFICATE OF AUTHORIZATION No. 2771

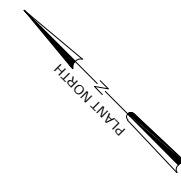
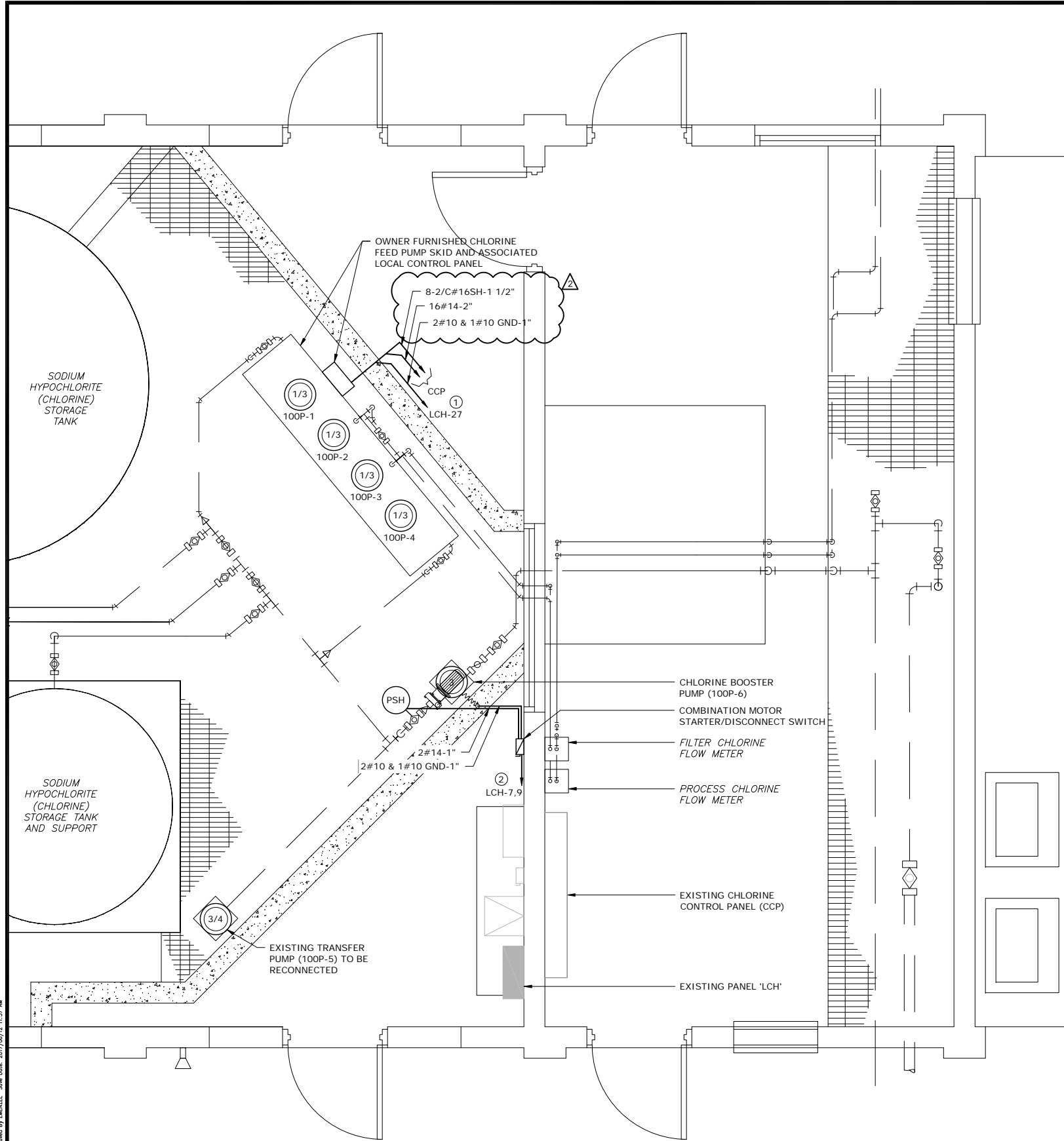
ORANGE COUNTY
 FLORIDA

NORTHWEST WATER RECLAMATION FACILITY
 REUSE WATER STORAGE IMPROVEMENTS

ELECTRICAL
 PARTIAL ELECTRICAL SITE PLAN -
 SHEET 1

DATE:	APRIL 2017
HAZEN NO.:	44014-001
CONTRACT NO.:	1
DRAWING NUMBER:	E-02

BID SET



NOTES:

- ① TIE INTO EXISTING 20A,1P CIRCUIT BREAKER IN EXISTING PANEL 'LCH'.
- ② CONTRACTOR TO REPLACE TWO (2) EXISTING 20A,1P CIRCUIT BREAKERS WITH NEW 20A,2P CIRCUIT BREAKER IN EXISTING PANEL 'LCH'.
- ③ PROVIDE NEW TYPEWRITTEN PANEL SCHEDULE.



EXISTING CHLORINE CONTROL PANEL (CCP)

FIGURE NO. 3
N.T.S.

PANEL: LCH		BUS: 100 AMP		VOLT: 120/208-3φ-4W											
LOCATION: CHLORINE ROOM		MAINS: MLO		REMARKS: WESTINGHOUSE PRL1											
MOUNTING: SURFACE		POLES: 30		A.I.C. SYMM: 10,000											
AMPS	POLE	WIRE	GND.	COND.	LOAD SERVED	BUS KVA	BUS A B C	BUS KVA	A B C	LOAD SERVED	WIRE	GND.	COND.	POLE	AMPS
40	3	-	-	-	MAIN BREAKER	-	1	0.85	2	THICKEN DLD /BLDG. LTG	-	-	-	1	20
-	-	-	-	-	-	-	3	0.72	4	THICKEN DLD RECEPT	-	-	-	1	20
-	-	-	-	-	-	-	5	0.85	6	CHLORINATOR BLDG. LTG	-	-	-	1	20
② 20	2	10	10	1"	CL2 BOOSTER PUMP	1.10	7	0.72	8	CHLORINATOR BLDG. RECPT	-	-	-	1	20
② -	-	-	-	-	-	-	9	0.72	10	CHLORINATOR RM RECEPT	-	-	-	1	20
20	1	-	-	-	SPARE	-	11	0.18	12	SCALE RECEPT	-	-	-	1	20
20	1	-	-	-	CL2 ALARM PANEL	0.36	13	1.25	14	EXHAUST FAN & LIGHTING	-	-	-	1	20
20	1	-	-	-	CL2 PLC	0.36	15	-	16	SPARE	-	-	-	1	20
20	1	-	-	-	BROOM SNIFFER	0.36	17	-	18	SPARE	-	-	-	1	20
20	1	-	-	-	SPARE	-	19	-	20	SPARE	-	-	-	1	20
20	1	-	-	-	SPARE	-	21	0.50	22	EFFLUENT PUMP CONTROL PANEL	-	-	-	1	20
20	1	-	-	-	FIT	0.36	23	0.36	24	AUTO SAMPLER	-	-	-	1	20
20	1	-	-	-	EYEWASH PANEL	0.36	25	-	26	SPARE	-	-	-	1	20
① 20	1	10	10	1"	CHLORINE PUMP SKID	1.10	27	0.36	28	CCC FIT	-	-	-	1	20
20	1	-	-	-	SPARE	-	29	1.20	30	BLEACH PUMPS 1 & 2	-	-	-	1	20
TOTAL (PHASE):						1.82	2.56	0.72		2.82	2.30	2.59	NOTES:		
TOTAL KVA:										12.81	PROVIDE NEW TYPEWRITTEN PANEL SCHEDULE.				
TOTAL AMPS:										35.55					
TOTAL DEMAND AMPS:										24.88					

CHLORINATION BUILDING ELECTRICAL PLAN
1/2"=1'-0"



LOT DATE: 07/26/17, 11:51:11 AM BY: R. ANDERSON
 FILE: C:\Users\lreyes\Documents\Projects\2017\06\12\11-57 AM

PROJECT ENGINEER:	R. ANDERSON		
DESIGNED BY:	LMR		
DRAWN BY:	RRM		
CHECKED BY:	LMR		
2	ADDENDUM No. 3	06/2017	RKA
1	BID SET	04/2017	RKA
REV	ISSUED FOR	DATE	BY

DO NOT USE FOR CONSTRUCTION

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

0 1/2" 1"

LILLIAN M. REYES, PE NO. 50780

Hazen

HAZEN AND SAWYER
919 LAKE BALDWIN LANE, SUITE A
ORLANDO, FLORIDA 32814
CERTIFICATE OF AUTHORIZATION No. 2771

ORANGE COUNTY
FLORIDA

NORTHWEST WATER RECLAMATION FACILITY
REUSE WATER STORAGE IMPROVEMENTS

ELECTRICAL
CHLORINATION BLDG. PLAN

DATE:	APRIL 2017
HAZEN NO.:	44014-001
CONTRACT NO.:	1
DRAWING NUMBER:	E-09

BID SET

EDA
Electrical Design Associates

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ORLANDO, FLORIDA 32835
PHONE: (407) 745-5604
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