



Standards and Design Guidelines for Customer Water Delivery Points

(Updated March 09, 2018)

The following standards are for the design of customer water delivery points to be dedicated to GBRA and/or operated by GBRA. Please review the following guidelines carefully and contact GBRA for a consultation meeting to address any related variances or other construction related matters.

For Owner or Developer information, or for information on provision of services by GBRA and/or to set an initial meeting, please contact:

Alvin Schuerg
Senior Advisor to the General Manager
Guadalupe-Blanco River Authority
933 East Court Street
Seguin, TX 78155
Phone: 830-379-5822 Ext. 233
Fax: 830-379-9718
Email: aschuerg@gbra.org

Teresa Van Booven
Project & Community Representative
Guadalupe-Blanco River Authority
933 East Court Street
Seguin, TX 78155
Phone: 830-379-5822 Ext. 265
Fax: 830-379-9718
Email: tvambooven@gbra.org

For technical questions, or to request technical information, please contact:

Chris Lewis
Project Manager
Guadalupe-Blanco River Authority
4775 S. Cranes Mill Rd.
Canyon Lake, TX 78132
Phone: 210-825-6472
Fax: 830-885-2564
Email: clewis@gbra.org

Charlie Hickman
Manager of Project Engineering
Guadalupe-Blanco River Authority
933 East Court Street
Seguin, TX 78155
Phone: 830-379-5822 Ext. 240
Fax: 830-379-9718
Email: chickman@gbra.org

The following standards are for the design of customer water delivery points where GBRA's responsibility is limited to delivery of water to customer tanks (i.e. customer pumping and storage facilities operated by others). Reference the "Additional Requirements" section below for pumping and storage facilities to be operated by GBRA.

Design and Documents

1. If construction has not commenced within one (1) year of GBRA design approval, that approval is no longer valid.
2. GBRA design approval is reliant upon the adequacy of the work of the engineer of record. All responsibility for the adequacy of the design remains with the engineer of record.
3. Provide complete design submittals for GBRA review and approval prior to bidding. Include master plan, plats, easements, design calculations, process flow diagrams, drawings, and specifications. Provide six (6) printed and bound half size copies and two (2) CD/PDF electronic copies. Allow 30 calendar days for review.
4. All piping shown on drawings shall be labeled as to the size, type, class, process fluid contained, and flow direction.
5. Submit easements and preliminary and final plats for GBRA review and approval.
 - a. Provide dedicated easements in the name of GBRA. Easements shall not overlap or be within residential lots.
 - b. Where outside of public right-of-way, provide dedicated easements with a minimum width equal to pipe outside diameter, rounded up to the nearest foot, plus 10 feet minimum on each side. For easements with multiple pipes, provide 10 feet minimum horizontal clearance between pipes. Provide additional width for easements that are not located adjacent to public right-of-way.
 - c. Other utilities, structures, grading, drainage, detention/retention ponds, landscaping, trees, roads, parking lots, fences, walls, construction of any type, or any other improvements or obstructions, are not allowed within GBRA easements.
 - d. Designs for any proposed alterations or crossings of GBRA easements must be approved in writing by GBRA and the installation of such must be inspected and approved by GBRA.
 - e. Maintenance of easements is the responsibility of the property owner.
 - f. The property owner must install 16 foot gates in any fences that cross GBRA easements; gates must be centered across GBRA utilities.
 - g. Customer water and wastewater services shall not be installed within fenced areas.
6. Copies of each construction submittal (shop drawings, product data, etc.) shall be provided for GBRA review and approval prior to fabrication. Use clouds, boxes, arrows, etc., to clearly mark all proposed options and part numbers. List any proposed deviations on the submittal cover sheet. Allow 21 calendar days for review.
7. Provide the following materials prior to acceptance of facilities by GBRA. Provide one (1) hard copy and one (1) CD/PDF copy unless noted otherwise:
 - a. Engineer's certification of completion in accordance with approved plans, specifications, and permits.

- b. Copies of all close-out submittals required by regulatory agencies (city, county, TCEQ, etc.).
- c. Spare Parts: Provide a spare for each single point of failure item. Provide one change of lubricants and filters for each piece of equipment.
- d. Provide CD backup copies of programming for PLCs, pump controllers, HMI and control room(s).
- e. O&M Manuals: Provide three (3) hard copies and three (3) CD/PDF searchable electronic copies of each O&M manual. Hard copies shall be printed duplex 8.5"x11" in color on 24# bond paper with reinforced holes and bound in D-ring binders (maximum 4" binders per volume) with sheet lifters front and back, table of contents, and tabbed sections. Drawings and schematics shall be 11"x17" and z-folded. Include test reports and calibration certificates. O&M description, project name, contractor name, and specification section shall be printed on the spine and cover of each binder. All copies shall be manufacturer original quality. Scanned and/or photocopies are not acceptable. Submit electronic preliminary copies for GBRA review and approval prior to printing final copies. Submit at least two (2) weeks prior to operator training.
- f. Waiver of lien by contractor (and subcontractors, as appropriate).
- g. Warranty certificates, both from contractor and from manufacturer(s), valid for one (1) year from date of project final acceptance. Warranty shall include parts and labor for removal, repair, and replacement.
- h. Executed operating contract or bill of sale transferring facility to GBRA.
- i. GBRA ownership shall terminate 5ft downstream of the fiberglass building.
- j. As-Built and Record Drawings: Provide complete project drawing sets including all sheets and all trades. Submit electronic preliminary copies for GBRA review and approval prior to printing final copies.
 - i. Contractor shall provide one (1) printed and bound full size copy of red lined as-built drawings and one (1) CD/PDF electronic copy, each sheet stamped "as-built drawing".
 - ii. Engineer shall prepare corrected CAD drawings, each sheet stamped "record drawing", and submit to GBRA five (5) printed and bound half size copies and five (5) CD/PDF searchable electronic copies of the corrected CAD drawings. Scanned and/or photocopies are not acceptable.
- k. Recorded plats and easements.
- l. Title Company review for release of all liens.

Civil and Mechanical Design Requirements

- 1. Design and installation shall be in accordance with TCEQ rules and AWWA standards, and in accordance with GBRA standards as further described in this document (see attachments).
- 2. Noise and odor impacts shall be considered in design.
- 3. All equipment shall be designed to automatically reset after power outages.
- 4. Piping friction losses shall be calculated with a Hazen-Williams coefficient no greater than 120 for plastic pipe, and no greater than 100 for concrete or metal pipe.
- 5. Access road and parking areas shall be asphalt or concrete. Roads shall be 16' wide.

6. All unpaved areas of site within fenced boundaries shall be covered with weed barrier and a 6" layer of TXDOT Grade 1 crushed stone coarse aggregate.
7. Fencing shall be designed to minimize noise impacts if necessary. Comply with TCEQ requirements. If chain link fencing is used, follow GBRA standard details.
8. Water mains and valves shall be located outside of roadways, pavement, curbs, driveways, etc., unless specifically approved otherwise. Install 4ft minimum behind back of curb.
9. All piping shall be designed in straight alignment vertically and horizontally. Pipe curvature and/or deflection are not allowed.
10. Water and wastewater pipe lengths shall be centered at crossings with all other utilities, including dry utility services. Both pipes shall be centered at water and wastewater crossings, including wastewater service laterals and fire hydrant leads.
11. Maintain a minimum of 10 feet horizontal and 12 inches vertical clearance between water and wastewater and other utilities. Shared trenches are not allowed.
12. Water piping shall be sleeved if located under concrete channels, box culverts, or multiple barrel storm sewer crossings regardless of size and single barrels 30" or larger.
13. Profile all water piping regardless of size. Show all utility crossings on all profiles.
14. Drains shall be provided for all water mains regardless of main size.
15. Air release valves shall be provided for all water mains regardless of main size.
16. Services are not allowed on water transmission lines. No exceptions.
17. Engineer to consult manufacturers for proper sizing of V-Port flow control valve and dual pressure reducing valves for contracted flow rate and to minimize cavitation and noise.
18. All equipment, piping, and valves shall be labeled for identification purposes (e.g. pipe labels, color coding, banding, flow arrows, equipment numbers, valve tags, etc.).
19. Cleanouts shall have cast iron frames and covers with concrete collars in accordance with GBRA standard details.
20. Provide color coded tracing wire (copper clad steel, 12 gauge, 30 mil HDPE jacket) for all buried piping.
21. Customer shall install a minimum of two (2) storage tanks. Provide exterior inlet pipe with air gap. Total storage capacity shall be designed to provide 24-hours minimum domestic storage, plus 2-hours minimum fire flow storage. Domestic storage shall be based on maximum daily demand. Residential fire flow storage shall be based on 1,250 GPM minimum for a minimum duration of 2-hours. Engineer shall calculate and incorporate any additional commercial service and fire flows into the project design as required. Any volume below pump minimum suction requirements shall not be used in calculations.
22. All exposed piping 4" and smaller conveying liquids shall be heat traced, insulated, and covered with an aluminum insulation jacket cover. Pipes with continuous flow are exempt from this requirement.
23. All steps, stair treads, and ladders shall have abrasive nosings. The maximum allowable slope for steps and stairs is 32.5 degrees. Provide 7" risers and 11" treads.

Civil and Mechanical Materials

1. Buried water piping shall be blue color C900 DR14. Fittings shall be cement lined AWWA C153 compact mechanical joint ductile iron with Ford Uni-Flange Series 1500 restraints. Pipe bell joint restraints shall be Ford Uni-Flange Series 1300. Fittings for projects near or east of Interstate 35 shall be fusion bonded epoxy coated.
2. Exposed water piping and fittings shall be cement lined flanged ductile iron with field paint coatings as specified herein.
3. MJ tee bolts and nuts for buried locations shall be Corten, except for projects near or east of Interstate 35 use Type 304 stainless steel. Field apply nickel anti-seize compound to threads prior to assembly.
4. All other fasteners shall be Type 304 stainless steel (e.g. hardware, screws, anchor bolts, rods, bolts, nuts, etc. for piping, valves, pumps, motors, equipment, etc.) including those for factory assembly of components. All bolts and nuts shall be heavy hex. Anchor bolts installed within hydraulic structures shall be epoxy type. Field apply nickel anti-seize compound to threads prior to assembly. Stainless steel items shall not be painted.
5. Tapping sleeves 24" and smaller shall be American Flow Control Series 2800. Tapping sleeves 24" and smaller shall be fusion bonded epoxy coated for projects near or east of Interstate 35. Tapping sleeves larger than 24" shall be Smith Blair Model 624. All tapping sleeves shall have stainless steel hardware and split MJ restraints. Field apply nickel anti-seize compound to threads prior to assembly. Tapping sleeves shall be installed 24" minimum from the nearest pipe bell as measured from the edge of the tapping sleeve to taper of bell. Assembly must be successfully disinfected and pressure tested prior to tapping. Perform 100 PSI air test for 10 minutes duration, no allowable leakage. Concrete blocking to undisturbed earth is required under and behind tapping sleeves and valves. Install mechanical restraints 60 LF minimum each way, including on existing piping.
6. All buried metal pipe, fittings, hydrants, and valves shall be wrapped with 8mil poly.
7. Dual pressure reducing valves shall be manufactured by Cla-Val with anti-cavitation trim. Install inside buried H-20 precast concrete vault with lockable aluminum access hatches, aluminum ladder, and floor drain or coarse gravel bottom.
8. Pressure gauge assemblies shall include the following items:
 - a. Stainless steel full port isolation ball valve.
 - b. Pressure diaphragm seal and plain end bibb sampling valve, both stainless steel.
 - c. 4" Pressure gauge, complying with ASME B40.1, Grade 1A, with 1% full scale accuracy, stainless case and stainless steel wetted parts, glycerin filled.
 - d. Gauges shall read in both ftH₂O and PSI. Select range for normal working pressure to be mid-range.
 - e. The entire assembly shall be Type 304 stainless steel.
9. Flange coupling adapters shall be Smith Blair Model 911. Flange adapters are not allowed within hydraulic structures.
10. PVC ball valves shall be Sch 80 true union type by GF, Hayward, Nibco, or Spears.
11. PVC male adapters are not allowed.

12. Paint shall be white color high-build epoxy with topcoat of polyurethane in safety blue color for potable water. Provide other topcoat colors as necessary in accordance with TCEQ rules. Do not paint stainless steel, hot dip galvanized, brass, or aluminum items. Install in accordance with manufacturer recommendations.
13. Chain link fencing shall be in accordance with GBRA standard details.
14. All unpaved areas of site within fenced boundaries shall be covered with weed barrier and a 6" layer of TXDOT Grade 1 crushed stone coarse aggregate.

Civil and Mechanical Testing

1. All other utilities must be complete prior to performing any water or wastewater testing.
2. All testing must be complete prior to paving streets.
3. All testing must be complete prior to performing tie-ins to existing water or wastewater systems.
4. Contractor shall perform pre-testing to verify passing results prior to requesting GBRA inspection. Provide connection point for GBRA digital test gauge.
5. All testing shall be performed by the contractor and witnessed by GBRA.
6. Perform trench backfill density testing at intervals specified by the design engineer, exact locations to be designated by inspector. Schedule GBRA to witness testing. Provide copies of reports to GBRA.
7. Follow AWWA pipe testing procedures and allowable leakage for water lines. Test every valved section (i.e. test against every valve in closed position). Test pressure shall be the maximum rating of material installed. Test duration shall be 2 hours.
8. Follow AWWA procedures for flushing and disinfection of water piping. Flushing and disinfection must be complete prior to performing tie-ins to existing systems.
9. Contractor shall perform operational demonstration testing. Contractor shall startup, test, and verify all equipment is operational prior to scheduling GBRA to witness demonstration testing. Operator training shall be conducted on a separate day after demonstration testing. Contractor shall coordinate schedule with GBRA at least two (2) weeks in advance.

Civil and Mechanical Construction Notes

1. All work shall be in accordance with GBRA standards as published at the following website: <http://www.gbra.org/public/waterwastewaterservices.aspx>
2. Copies of each construction submittal (shop drawings, product data, etc.) shall be provided for GBRA review and approval prior to fabrication. Use clouds, boxes, arrows, etc., to clearly mark all proposed options and part numbers. List any proposed deviations on the submittal cover sheet. Allow 21 calendar days for review.
3. All work must be inspected and approved by GBRA prior to backfilling or otherwise covering the work. This includes crossings by other utilities. GBRA will perform a maximum of one (1) inspection daily for one (1) hour duration between 8:00am and 5:00pm excluding weekends

and holidays. Call 830-379-5822 to schedule inspections (48 hours advance notice is required for all inspections).

4. Trench excavation and pipe installation will not be permitted until subgrade has been established. Survey staking must be installed prior to and maintained during trench excavation and pipe installation. Survey staking shall include horizontal and vertical control at a minimum of 50 foot station intervals. Horizontal offsets shall be 15 feet maximum. Install property pins and stakes. Mark finish grade lines with cut/fill on offset stakes and property stakes. All marks shall face the pipeline. Survey staking shall be performed by the contractor.
5. Backflow prevention in the form of a reduced pressure backflow assembly must be provided for temporary connections to existing water lines. Backflow devices shall be tested by a licensed backflow prevention assembly tester.
6. PVC male adapters are not allowed.
7. Pipe bells shall be installed in upstream direction.
8. All piping shall be designed in straight alignment vertically and horizontally. Pipe curvature and/or deflection are not allowed.
9. Install concrete thrust blocking and mechanical restraints for pressure piping systems.
10. Water and wastewater pipe lengths shall be centered at crossings with all other utilities, including dry utility services. Both pipes shall be centered at water and wastewater crossings, including wastewater service laterals and fire hydrant leads.
11. Maintain a minimum of 10ft horizontal and 12in vertical clearance between water and wastewater and other utilities. Shared trenches are not allowed.
12. Water piping shall be sleeved if located under concrete channels, box culverts, or multiple barrel storm sewer crossings regardless of size and single barrels 30" or larger.
13. Valve boxes, equipment, exposed piping and valves, and appurtenances shall be painted. Do not paint stainless steel, hot dip galvanized, brass, or aluminum items.
14. All equipment, piping, and valves shall be labeled for identification purposes (e.g. pipe labels, color coding, banding, flow arrows, equipment numbers, valve tags, etc.).
15. Provide color coded tracing wire (copper clad steel, 12 gauge, 30 mil HDPE jacket) for all buried piping.
16. All exposed vertical and horizontal concrete edges shall be formed with ¾" chamfer strips.
17. Existing facilities that are disturbed shall be restored and tested to be in full compliance with current GBRA standards. The contractor shall adjust existing water and wastewater facilities to proposed finish grades including but not limited to manholes, cleanouts, valves, hydrants, appurtenances, etc.
18. The contractor shall maintain service to existing water systems at all times during construction. Any work involving power outages, bypass pumping, or any other interruption of flow must be performed between 8:00am and 5:00pm excluding weekends and holidays. All necessary temporary power, bypass pumping, etc., shall be furnished and performed by the contractor. Coordinate and schedule any such activities with GBRA at least two (2) weeks in advance.
19. Explosives and blasting are not allowed.

Electrical, Instrumentation, and Controls Design Requirements

1. Design and installation must be in accordance with GBRA standards (see attachments).
2. Engineer to provide complete design drawings and specifications. Include site plan, load calculations, one-line diagrams, schematics, panel layouts, etc. Include types, sizes, quantities, and routing of all raceways and conductors. Detail each duct bank section. Provide interior and exterior layout details, schematics, and one-line diagrams for all control panels and MCCs.
3. Engineer to design site grounding system to include fencing, tanks, buildings, structures, generator, RTU, antenna, etc. Resistance to ground for site grounding shall be 5 Ohms or less.
4. All equipment shall be designed to automatically reset after power outages.
5. Provide a separate electrical service for GBRA facilities with a Transient Voltage Surge Suppressor (TVSS)/Surge Protection Device (SPD) including overcurrent protection on each leg.
6. Phase converters are not allowed.
7. All facilities shall have a SCADA system, appropriate for the applicable service area. All equipment shall be monitored via SCADA; including instruments, flow meters, and HOA switches. Reference GBRA Standard Specification 13428 for additional requirements.
8. A pressure transmitter assembly shall be installed on the exterior wall of each customer ground storage tank to monitor water level. Connect the transmitters to GBRA SCADA. The transmitters shall be insulated and heat traced. The transmitters shall be owned and maintained by the customer.

Electrical, Instrumentation, and Controls Materials

1. RTU shall be SCADA Pack 32 PLC or Banner Engineering DX80DR9M-H1C. Depending on service area, provide MDS iNet-900 or Banner Engineering DX80DR9M-H1C radio for communication to applicable control room(s). Coordinate with GBRA staff to determine service area, site specific requirements, and appropriate radio and controller. SCADA system shall be designed and installed in accordance with GBRA standards. Reference GBRA Standard Specification 13428 for additional requirements.
2. RTU backup power supply shall be a 24V battery system with trickle charger. The battery system shall have sufficient capacity to power the RTU for a minimum of four (4) hours duration.
3. All components shall be labeled on the backplane with white adhesive tape type labels with black machine printed 3/16" block lettering.
4. Provide LED strip lighting with door switch inside control panels if the enclosure size is greater than or equal to 30" wide and greater than or equal to 12" deep.
5. All control panel and MCC control wiring shall be flexible 41 strand tinned copper, size 14 AWG minimum, 600V insulation, Type SIS for control panels, Type MTW for MCCs, and color coded as follows:
 - a. AC controls Red
 - b. DC controls Blue

- c. DC (+) power Red
 - d. DC (-) power Black
 - e. AC hot Black
 - f. AC neutral White
6. All other conductors shall be stranded copper XHHW-2.
 7. Phase colored insulation is required for all conductors.
 8. All 4-20mA signal wire shall be 20 AWG twisted shielded.
 9. A separate neutral conductor is required for every 120VAC circuit.
 10. A separate grounding conductor is required for every raceway, including electrical and I&C. Minimum size is #12 AWG.
 11. Label wiring with yellow heat shrink type markers with black machine printing. Labels shall be Raychem or Panduit.
 12. Enclosures inside fiberglass buildings shall be NEMA 4X FRP or PVC. Exterior enclosures shall be NEMA 4X 304SS, except service disconnect may be NEMA 3R. All enclosures shall be provided with external mounting lugs and lockable 3-point latch system. Mount all enclosures on vertical strut.
 13. Provide type written panel directories and laminated as-built schematics and diagrams in all electrical panels.
 14. Electrical panels shall have tinned copper bus and bolt-on type circuit breakers.
 15. All electrical enclosures shall have black phenolic labels with white 3/8" block lettering, attach with aluminum rivets. All instruments shall have round shaped black phenolic tags with white 1/4" block lettering, attach with 304SS cable. Label circuit numbers on all device covers with white adhesive tape type labels with black machine printed 3/16" block lettering.
 16. All device boxes in outdoor locations shall be FD type sand cast aluminum with 304SS cover screws.
 17. All receptacles shall be ivory color duplex 110V 20A GFCI-WR. Outdoor locations shall have aluminum in-use covers.
 18. All exterior exposed/above ground conduit shall be aluminum rigid (3/4" minimum). Underground conduit shall be Sch 40 PVC (1" minimum) and shall be installed in reinforced concrete duct banks. Stub-ups from underground to 6" above grade including the 90-degree bends shall be ETL-PVC-001 certified PVC coated GRS conduit, submit installer certification.
 19. Duct banks shall be steel reinforced red-dyed concrete in accordance with GBRA standard details.
 20. Inside fiberglass buildings, use Type LFNC flexible seal tight conduit for 3/4" minimum to 2" sizes (1/2" LFNC flex will be allowed for instruments with 1/2" threaded hub entries, all other flex shall be 3/4" or larger). Use aluminum core liquid tight flexible metal conduit for sizes 2 1/2" and larger. Maximum length of flex conduit shall be 18". All connectors shall be aluminum. All conduit shall be mounted on strut.
 21. Use FRP hardware, strut, straps, and anchors inside fiberglass buildings. Exterior locations shall be 304SS. All electrical enclosures, devices, and light fixtures shall be mounted on strut.

22. All conduit fittings shall be Form 7 sand cast aluminum with aluminum covers and 304SS screws. Snap-on covers are not permitted.
23. Use aluminum grounding type Myers hubs with insulated throats for all enclosure entries.
24. Use UNY and UNF aluminum unions. Galvanized unions are not permitted.
25. Use aluminum seal-off fittings where required by NEC, seal with 3M-2123 re-enterable sealing compound.
26. Use Noalox or other comparable anti-oxidizing agent on all conduit threads.

Electrical, Instrumentation, and Controls Testing

1. All testing shall be performed by the contractor and witnessed by GBRA.
2. Megger test load and line conductors of all power circuits and submit test reports.
3. Resistance to ground for site grounding shall be 5 Ohms or less. Contractor shall perform Fall-of-Potential three point ground megger testing.
4. All testing shall be performed by the contractor and witnessed by GBRA. Test equipment must be calibrated within the previous 12 months.
5. Reference GBRA Standard Specification 13428 for additional requirements.
6. Contractor shall perform operational demonstration testing. Contractor shall startup, test, and verify all equipment is operational prior to scheduling GBRA to witness demonstration testing. Operator training shall be conducted on a separate day after demonstration testing. Contractor shall coordinate schedule with GBRA at least two (2) weeks in advance.

Electrical, Instrumentation, and Controls Construction Notes

1. All work shall be in accordance with GBRA standards as published at the following website: <http://www.gbra.org/public/waterwastewaterservices.aspx>
2. Copies of each construction submittal (shop drawings, product data, etc.) shall be provided for GBRA review and approval prior to fabrication. Use clouds, boxes, arrows, etc., to clearly mark all proposed options and part numbers. List any proposed deviations on the submittal cover sheet. Allow 21 calendar days for review.
3. All work must be inspected and approved by GBRA prior to backfilling or otherwise covering the work. GBRA will perform a maximum of one (1) inspection daily for one (1) hour duration between 8:00am and 5:00pm excluding weekends and holidays. Call 830-379-5822 to schedule inspections (48-hours advance notice is required for all inspections).
4. Field bending of conduit shall be accomplished using the appropriate tools. Flame bending is not allowed.
5. The contractor shall maintain service to existing water systems at all times during construction. Any work involving power outages, bypass pumping, or any other interruption of flow must be performed between 8:00am and 5:00pm excluding weekends and holidays. All necessary temporary power, bypass pumping, etc., shall be furnished and performed by the contractor. Coordinate and schedule any such activities with GBRA at least two (2) weeks in advance.

ADDITIONAL REQUIREMENTS:

If pumping and storage facilities are to be operated by GBRA, the design shall meet the requirements set forth above and shall be in accordance with the following additional requirements.

Design Calculations (additional requirements)

1. Provide a minimum of two (2) storage tanks. Total storage capacity shall be designed to provide 24-hours minimum domestic storage, plus 2-hours minimum fire flow storage. Domestic storage shall be based on maximum daily demand. Residential fire flow storage shall be based on 1,250 GPM minimum for a minimum duration of 2-hours. Engineer shall calculate and incorporate any additional commercial service and fire flows into the project design as required. Any volume below pump minimum suction requirements shall not be used in calculations.
2. Pumping systems shall be designed to maintain domestic peak hourly flows plus fire flows continuously without interruption for a minimum duration of 2-hours with the largest pump out of service. Residential fire flows shall be calculated at 1,250 GPM minimum. Engineer shall calculate and incorporate any additional commercial service and fire flows into the project design as required. Pumping systems shall include fully redundant fire flow capacity.
3. Water distribution systems shall be designed to provide 55 PSI minimum at customer meters.

Site Requirements (additional requirements)

1. Provide 1" Woodford Y1 non-freeze yard hydrant in each process area for wash down purposes; each with 50ft heavy duty rubber hose, brass adjustable spray nozzle, and McMaster-Carr 53325K33 hose rack. Provide Watts 009 RPZ backflow preventer with brass pipe/fittings/valves, insulated and heated aluminum enclosure, and cast-in-place reinforced concrete pad. Install pipe unions inside enclosure on each side of RPZ. Assembly minimum clearances inside the enclosure shall be 12" below, 3" above, and 6" sides. Provide licensed field testing certification for RPZ.

Storage Tanks (additional requirements)

1. Storage tanks shall be welded steel or prestressed concrete and shall comply with applicable AWWA standards.
2. Tank foundations shall be cast-in-place reinforced concrete.
3. Provide floor drain, interior ladder, sample ports, pressure level transmitter, and exterior inlet pipe with air gap. Level transmitter shall be located on exterior tank wall and shall be monitored via SCADA.
4. Provide buried bypass piping to allow for tank maintenance and repair and water quality issues.

Pump Stations (additional requirements)

1. Pump buildings shall be designed for human occupancy. Provide split-face CMU construction, precast concrete, or pre-engineered metal building. Provide for CMU cleaning, sealer, and water repellent. Wooden materials are not allowed.
2. Roof shall be monolithic single panel precast concrete (i.e. no joints) or metal framing with metal roofing. Roof shall be sloped. Flat roofs, wooden materials, and shingles are not allowed.
3. Buildings shall be insulated, including minimum R-30 insulation in ceiling.
4. Provide concrete floors with smooth trowel finish and concrete sealer. Install cast iron floor drains with brass strainers and slope floors to drains.
5. Doors shall be seamless and shall be hot dip galvanized, aluminum, or FRP. Door hinges shall be stainless steel. Exterior door hinges shall be NRP type. All other hardware and accessories shall be aluminum and/or stainless steel. All fasteners for all items shall be stainless steel, including those for factory assembly of components. Hardware shall be mortised. Provide drip caps, 12" tall kick plates, 4 ½" butt hinges, Best brand key system, construction cores, control keys, panic hardware with keyed external lever, hold open arm hydraulic closers, door stops with latches, rubber gaskets, single flap insert type neoprene sweeps, silencers, 4 ½" black vinyl thresholds, and 18" wide x 12" tall wire safety glass in each door. Size doors to accommodate removal of equipment. Minimum door size 3'-0" wide, 7'-0" high, 1 ¾" thick. Doors shall open to exterior. Embed 2"x2"x1/4" hot dip galvanized angles in edge of slab across door openings. Install "Danger" signs indicating any type of chemicals or hazards present.
6. Provide aluminum windows with Low-E break resistant glass.
7. Caulking sealants shall be matching color Sikaflex, Sonneborn NP-1, or approved equal. Use self-leveling sealant for flatwork.
8. Buildings shall have appropriately sized HVAC system capable of maintaining an appropriate working environment within the building.
9. Provide hoisting provisions for pumps and motors.
10. Pumping systems shall be certified for municipal service for 20-years minimum service life. Agricultural grade systems are not allowed.
11. All pumps shall be equipped with mechanical seals and elapsed time meters.
12. All motors shall be Premium Efficiency, totally enclosed, with minimum 1.15 service factor. All motors driven by variable frequency drives shall be inverter-duty rated.
13. Impellers shall be low-zinc bronze, stainless steel, or nickel-aluminum-bronze. Zinc content shall be less than 5%.
14. Provide lead/lag/standby pump operation and first on/first off alternation.
15. Provide a flanged mag meter to measure pump discharge in accordance with GBRA Standard Specification 13442.
16. Packed skid-mounted pumping systems shall be manufactured by Fairbanks-Morse, Flowserve, or Goulds.

17. Vertical turbine pumps shall be manufactured by Fairbanks-Morse, Flowserve, Peerless, or Sulzer.
18. Horizontal split-case pumps shall be manufactured by Fairbanks-Morse, Flowserve, or Peerless.
19. Pumping systems shall include hydropneumatic tanks equipped with B&W probe controls installed inside a sight glass. For freeze protection, install controls end of tank inside the pump building (i.e. tank penetrating building wall). Provide 24" minimum diameter tank access manway. At a minimum air compressors shall be 60 GAL, 5 HP, 150 PSI, with automatic drain valve; engineer to evaluate additional capacity requirements.
20. Exposed gate valves shall be rising stem American Flow Control Series 2500, or GBRA approved equal.

Chemical Feed Systems (additional requirements)

1. Provide automatic flow pacing for each chemical feed system.
2. Each chemical feed system shall be installed inside a dedicated fiberglass building (i.e. separate building for each chemical). Provide sidewalk and ramp at entrance to each chemical building. All equipment and hardware in chemical buildings shall be PVC, FRP, or other chemical resistant materials. Reference GBRA Standard Specification 13124 for additional requirements.
3. Chlorination equipment shall be gas type by Hydro Instruments or Superior. Provide cylinder scales, automatic switchover, brass wye strainer, and manual bypass piping and valves around solenoid valve.
4. Provide chlorine leak detection system with audible and visual alarms. A leak detection sensor shall be installed inside each chlorine room. Detection meter shall be mounted on building exterior adjacent to entry door(s). Alarm beacon shall be LED and red color, mounted 12" minimum above roof peak.
5. Provide an intake fan and exhaust louver. The intake fan shall automatically shutdown when a chlorine leak is detected.
6. Provide concrete floors with smooth trowel finish and concrete sealer. Install cast iron floor drains with brass strainers and slope floors to drains.
7. Provide standard PM kits for each chlorinator, injector, and vacuum regulator.
8. Provide a Chlorine Institute Emergency Kit.
9. Provide Scott SCBA with fully charged carbon fiber tank and Scott AV-2000 face mask. Install storage cabinet in a non-chemical area/location.
10. Provide non-freeze combination eyewash showers in chemical areas.
11. Engineer shall evaluate the need for a LAS feed system and shall incorporate such into the project design as necessary. Provide two (2) peristaltic metering pumps, each rated for ultimate peak flow. Provide concrete curb containment and floors with broom finish and concrete sealer. Slope floors to recessed sump pits. Provide sidewalk and interior and exterior ramp at entrance.

Electrical, Instrumentation, and Controls (additional requirements)

1. Electrical service shall be 480V 3-phase. Phase converters are not allowed.
2. Provide a Power Quality Meter (PQM) on load side of service or on load side of main disconnect. The PQM shall be Shark Model 200 with outputs as required to provide ampacities, voltages, and KWH to the applicable control room(s) via SCADA.
3. Interior light fixtures shall be 48" strip LED, vapor tight, 4000K and 4,000 lumens.
4. Exterior light fixtures shall be weatherproof LED full cutoff wall pack with photocell and motion sensor, 4000K, 24W min., bronze finish, wall/surface mount above doors. Provide one centered above each door frame.
5. Provide manually-controlled full cutoff LED site lighting in each process area: 15,000 lumens and 4,000K. Provide intermediate hinged aluminum poles in bronze color; anchors, hardware, and winch shall be stainless steel. Provide switches, photocells, and receptacles at all lighting poles.
6. All PLCs shall be of the same communication type; each with 10% minimum spare I/O, all mapped to the top end. This applies to the entire site and all equipment.
7. Provide a 15" minimum master OIT local touch screen for the site, mounted on the exterior face of the SCADA panel. Display all statuses and all process values for the entire project. Process setpoints shall be operator adjustable on the OIT. Display main PQM ampacities, voltages, and KWH.
8. All full voltage starters shall be NEMA sized, minimum size of 1. Half sized starters and IEC starters are not allowed. Provide these starters with solid state overload relays.
9. Solid State Reduced-Voltage (SSRV) soft starters shall be used for motors larger than 25 HP or as required by the site electrical service size.
10. Allowable manufacturers for SSRV's and VFD's are ABB, Eaton/Cutler Hammer, GE, and Schneider/SQD. Substitutions are not allowed.
11. Equipment control panels shall have an aluminum dead-front inner door. Panels shall be provided by equipment manufacturer, and shall be tested in accordance with NFPA 70.
12. Indicator lights shall be LED push-to-test type (red/run/open, green/stop/closed, amber/fault, white/power).
13. Alarm beacons shall be LED and red color. Do not penetrate tops of panels.
14. All enclosures shall be provided with external mounting lugs and lockable 3-point latch system. Mount all enclosures on vertical strut.
15. Enclosures in chemical areas shall be NEMA 4X FRP or PVC.
16. In climate controlled areas, provide NEMA 1A gasketed or NEMA 12 enclosures for starters, disconnects, enclosed circuit breakers, control panels, MCCs, and RTU cabinets.
17. In buildings with intake/exhaust fans only, provide NEMA 3R or NEMA 4 enclosures for the above listed electrical equipment.
18. If control panel is mounted on the pump skid, NEMA 4X 304SS enclosure is required.

19. All surface mounted device boxes shall be FD type sand cast aluminum with 304SS cover screws.
20. All receptacles shall be ivory color duplex 110V 20A GFCI-WR. Outdoor locations shall have aluminum in-use covers.
21. Exposed/above ground conduit shall be aluminum rigid ($\frac{3}{4}$ " minimum).
22. Route circuits inside building slabs and walls (not on the surface of walls). Sch. 40 PVC may be used for these feeds where they are enclosed in walls.
23. Strut, straps, anchors, and all mounting hardware shall be 304SS. All electrical enclosures, devices, and light fixtures shall be mounted on strut.

Emergency Generator (additional requirements)

1. Provide a permanent emergency generator at each pump station.
2. Generator shall be as manufactured by Caterpillar, Cummins, Generac, Kohler, MTU, Stewart & Stevenson, or Taylor; substitutions are not allowed. Size generator to operate the facility at 100% capacity with 20% maximum voltage drop at ultimate build-out of facility.
3. For generators less than 105 kW, inclusive, provide natural gas or propane powered generator. Generators larger than 105 kW may be diesel. Fuel capacity shall be 24 hours minimum at 100% generator load rating. Maximum storage for fuel calculations shall be 90% of tank capacity.
4. Maximum noise level shall be 78 dbA at 7 meters.
5. Generator shall have a battery charger and dry contacts for all alarms. Generator and ATS shall be monitored via SCADA.
6. Provide ASCO or Russelectric automatic transfer switch (ATS) with programmable exerciser (with and without load), NEMA 4X 304SS enclosure mounted on vertical strut, external mounting lugs, and lockable 3-point latch system. Substitutions are not allowed.
7. Generator shall be mounted on a cast-in-place reinforced concrete pad with perimeter beam.
8. Perform onsite load bank testing as follows:
 - a. Perform cold start block test at 100% load.
 - b. Perform 4-hour load bank testing, 2-hours of which shall be at 100% load.
 - c. Refill fuel tank to 90% capacity upon completion of testing.
9. All testing shall be performed by the contractor and witnessed by GBRA. Test equipment must be calibrated within the previous 12 months.
10. Contractor shall perform operational demonstration testing. Contractor shall startup, test, and verify all equipment is operational prior to scheduling GBRA to witness demonstration testing. Operator training shall be conducted on a separate day after demonstration testing. Contractor shall coordinate schedule with GBRA at least two (2) weeks in advance.

SECTION 13124

PREFABRICATED FIBERGLASS BUILDINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Prefabricated fiberglass buildings to house various equipment including chemical feed systems, air release valves, pressure transmitters, flow control valves, electrical, SCADA, and/or flow meters.
- B. Related Sections include but are not necessarily limited to:
 - 1. GBRA Standards and Design Guidelines.
 - 2. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 3. Division 1 - General Requirements.
 - 4. Division 3 - Concrete.
 - 5. Division 7 - Thermal and Moisture Protection.
 - 6. Division 8 - Doors and Windows.
 - 7. Division 10 - Specialties.
 - 8. Division 11 - Equipment
 - 9. Division 13 - Special Construction.
 - 10. Division 15 - Mechanical.
 - 11. Division 16 - Electrical.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Society for Testing and Materials (ASTM):
 - a. C518, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - b. D256, Standard Test Method for Determining the Pendulum Impact Resistance of Notched Specimens of Plastics.
 - c. D638, Standard Test Method for Tensile Properties of Plastics.
 - d. D732, Standard Test Method for Shear Strength of Plastics by Punch Tool.
 - e. D790, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 - f. 792, Standard Test Method for Specific Gravity (Relative Density) and Density of Plastics by Displacement.
 - g. D1622, Standard Test Method for Apparent Density of Rigid Cellular Plastics.
 - h. D2583, Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
 - i. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. Qualifications:
 - 1. Manufacturer's qualifications:
 - a. Manufacturer must have minimum of five years experience designing and fabricating structures of the type specified.

1.3 SYSTEM DESCRIPTION

- A. Enclosure shall be one-piece insulated fiberglass shell-type enclosure complete with sloped roof, lighting, heating, and ventilation systems.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. Product technical data including:
 - a. Manufacturer's installation instructions.

- b. Drawings showing layout, dimensions, anchorages, and accessories.
 - 2. Fabrication drawings:
 - a. Details of anchor bolts, base plates, and all other components fastened to the foundation.
 - b. Details of wall panels, roof panels, finishes, lights, heater, louvers, trim, caulking, and all other miscellaneous components.
 - 3. Submit electrical components in accordance with Division 16.
- B. Operation and Maintenance Manuals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
- 1. Prefabricated fiberglass enclosure:
 - a. Jacobs Manufacturing Co.
 - b. Warminster Fiberglass Co.
 - c. Or approved equal.
- B. Submit requests for substitution in accordance with Division 0.

2.2 DESIGN REQUIREMENTS

- A. Design enclosure to withstand 125 mile per hour wind load and 30 PSF snow load.
- B. Minimum inside dimensions:
- 1. Length 12'-0", Width 8'-0", Wall Height 8'-0".
 - 2. Electrical and SCADA conduit, devices, and enclosures shall be field installed inside the fiberglass building by the contractor. The building size shall be as required to achieve NEC required clearances for all electrical and SCADA components and enclosures. All enclosures shall be NEMA 4X PVC or FRP.
- C. Comply with TCEQ Rules.
- D. All materials shall be chemical and corrosion resistant.

2.3 MATERIALS

- A. Molded composite: Exterior and interior resin-fiberglass laminate with foam core.
- 1. Laminate: Polyester resin and chopped strand fiberglass; minimum glass content of 25%.
 - a. Provide gel coat with UV inhibitors.
 - b. Exterior surface: Beige color gel coat with low luster finish, smooth and free from fiber pattern, roughness, or other irregularities.
 - c. Exterior laminate: 1/8" thick minimum; chemically bonded to gel coat.
 - d. Interior laminate: Beige color; 1/8" thick minimum; encapsulate core in place.
 - e. Laminate properties:
 - 1) Tensile strength (ASTM D638): 11,000 PSI.
 - 2) Flexural strength (ASTM D790): 18,000 PSI.
 - 3) Shear strength (ASTM D732): 12,000 PSI.
 - 4) Barcol hardness (ASTM D2583): 40.
 - 5) Impact (ASTM D256): 12 ft lbs/inch.
 - 6) Density/specific gravity (ASTM D792): 93.6 PCF/1.5.
 - 7) Surface burning characteristics (ASTM E84): Flame spread, less than 150; smoke density, less than 1000.
 - 2. Core:
 - a. Rigid closed cell, self extinguishing, polyisocyanurate foam with a density of 2.0 pounds per cubic foot.
 - b. 1" thick with a minimum insulating value of R-7.
 - c. Core properties:
 - 1) Thermal conductivity (ASTM C518): 0.13 BTU inch / Hr. SF F.

- 2) Density/specific gravity (ASTM D 1622): 2.0 PCF/.03.
- 3) Surface burning characteristics (ASTM E84): Flame spread, 35; smoke density, 240.
3. Coupons prepared in accordance with ASTM D 618 test method.
- B. The manufacturer shall maintain a continuous quality control program and upon request shall furnish to the engineer certified test results of the physical properties.

2.4 FABRICATION

- A. Assembly:
 1. Construct buildings using prefabricated molded composite wall and roof panels. Single-piece construction may be employed with the approval of the Engineer.
 2. Provide factory assembled buildings if panel construction is employed.
- B. Encapsulated stainless steel extrusion 3" wide by 1 1/2" high by 0.125" thick with a 1" wide side flange shall be encapsulated into each corner of end panels (full height) and around the entire roof perimeter to maintain flatness, straightness, and structural integrity. Integral internal flanges on mating panels shall be provided for bolting the sides, ends, and roof to the encapsulated extrusions.
 1. Stainless Steel: Incorporate threaded inserts on 12-inch centers for internal bolting to mating panel flange during assembly.
 2. Assembly bolts shall not penetrate the exterior wall of the structure.
 3. Assemble panels with 3/8" diameter stainless steel bolts on 12" centers and a 1/4" thick by 3" wide urethane foam gasket for a weather tight seal at all joints.
 4. Structurally reinforce wall and roof panels with stainless steel or carbon graphite extrusions to meet loading conditions.
 - a. Stainless steel mounting channel reinforcement: 0.078" thick by 13/16" high by 1 5/8" wide. Mechanically attach to the interior surface with Hastelloy-C or titanium pop rivets on 12-inch centers.
 - b. Provide reinforcement panels at equipment mounting locations.
 5. Reinforcement: 1/4" thick by 1 1/2" wide structural angle.
 6. Stainless Steel Reinforcement: Extruded channel sections 3" wide by 1 1/2" high by 0.125" thick with a 1" wide side flange as required.
 7. Encapsulate stainless steel or carbon graphite reinforcements to form a continuous, one-piece molded composite wall or roof panel.
 8. Provide wall panels with an integral 4" wide internal mounting flange pre-drilled on 12" centers with 5/8" diameter holes for attaching to foundation.
- C. Furnish wall and roof panels with beige color gel-coat finish on interior and exterior.

2.5 ACCESSORIES

- A. Doors: One-piece, resin transfer molded (RTM) in matched metal molds to produce an industrial quality door which exhibits a smooth finished, seamless, monolithic, warp-free composite consisting of beige color gel-coat, fiberglass reinforcement, polyester resin, insulating core, and internal reinforcements with all mortises, openings, recesses, and pockets molded in place.
 1. Mount each door with three stainless steel mortise NRP butt hinges 4 1/2" long.
 2. All other hardware and accessories shall be aluminum and/or stainless steel.
 3. All fasteners for all items shall be stainless steel, including those for factory assembly of components.
 4. Door gaskets: Natural sponge rubber bulb type gasket with flexible lock to retain permanent grip.
 5. Provide panic hardware with keyed external lever and floor mounted door stops with latches. Key system shall be Best brand. Provide construction cores and control keys.
 6. Provide doors with hold open arm hydraulic closers.
 7. Provide one-piece purpose built 3" deep fiberglass drip caps above doors, extend 2" past doors on each side. Cut angle will not be acceptable.
 8. Provide two silencers for each door on head of frame, three for each door on strike jamb of frames.
 9. Provide single flap insert type neoprene sweeps.
 10. Provide 4 1/2" wide black vinyl thresholds.
 11. Provide 12" tall kick plates.

12. Provide 18" wide x 12" tall wire safety glass window in each door.
 13. Doors shall open to exterior.
 14. Install "Danger" signs indicating any type of chemicals or hazards present.
 15. Single door size: 3'0" wide, 7'0" high, 1 ¾" thick.
 16. Double door size: Pair of 2'6" wide, 7'0" high, 1 ¾" thick.
- B. Base Mounting Flange Gasket: Provide 3/8" thick by 4" wide closed cell neoprene sponge rubber gasket for a weather tight seal around the building perimeter. Caulk inside and outside perimeters with matching color Sikaflex, Sonneborn NP-1, or approved equal.
- C. Lifting Eye Bolts: Provide ¾" stainless steel eye bolts in roof.
- D. Anchor Bolts: For attaching structure to concrete pad, provide ½" diameter stainless steel threaded rod, flat washers, and nuts. Secure threaded rod in drilled opening with epoxy anchoring system.
- E. Intake Fan: Provide one (1) complete air exchange every three (3) minutes, thermostatically controlled intake fan with gravity shutter, canopy, remote power switch, and removable aluminum insect screen, wall mount in upper portion of building. All components shall be constructed of PVC, FRP, and/or aluminum. The intake fan shall be Hartzell Series 59 or approved equal. The intake fan shall automatically shutdown when a chlorine leak is detected, leak alarm shall be audible and visual, detection meter shall be mounted on building exterior adjacent to entry door(s), alarm beacon shall be LED and red color and mounted 12" minimum above roof peak.
- F. Exhaust Louver: Square, wall mount in lower portion of building, with gravity shutter and removable aluminum insect screen. All components shall be constructed of PVC, FRP, and/or aluminum.
- G. Equipment mounting boards shall be ¾" thick PVC or FRP.
- H. Interior Light Fixtures: 48" strip LED, vapor tight, 4000K and 4,000 lumens. Provide two per building.
- I. Exterior Light Fixtures: Weatherproof LED full cutoff wall pack with photocell and motion sensor, 4000K, 24W min., bronze finish, wall/surface mount above doors. Provide one centered above each door frame.
- J. Fan and Light Switches: Weatherproof, outdoor rated, mount on building exterior adjacent to entry door(s).
- K. 120/240V, 18 circuit panel board with 2P-60A minimum main breaker and branch breakers as required for loads in NEMA 4X PVC or FRP enclosure. Panelboard neutral shall not be bonded to ground inside panel and shall remain separate.
1. Fill all unused spaces with 1P-20A circuit breakers.
 2. Bus shall be tinned copper.
 3. Breakers shall be 20A minimum bolt-on type.
 4. Provide control circuits in low voltage panel for RTU cabinet.
- L. Heater: 1500 watt minimum, 120 VAC, single phase, with thermostat and tip-over switch.
1. Heater shall be portable floor type.
 2. Provide GFCI receptacle for heater.
 3. Heater shall be suitable for use in a damp (corrosive) environment.
- M. Device boxes shall be PVC with stainless steel cover screws.
- N. Three duplex receptacles, ivory color, 120V, 20A, GFCI-WR, outdoor type, aluminum in-use covers.
- O. Electrical wiring shall be in flexible conduit, use Type LFNC flexible seal tight conduit for ¾" minimum to 2" sizes (½" LFNC flex will be allowed for instruments with ½" threaded hub entries, all other flex shall be ¾" or larger). Use aluminum core liquid tight flexible metal conduit for sizes 2 ½" and larger. All connectors shall be aluminum. All conduit shall be mounted on strut. Provide for:
1. Fan and thermostat.
 2. Lights and switch.
 3. Three duplex GFCI receptacles.
 4. Heater.
 5. Any other items shown on drawings.

- P. Wiring shall meet the latest requirements of the National Electrical Code. All control panel wiring shall be flexible 41 strand #14 AWG, 600V insulation, Type SIS tinned copper, and color coded. All other conductors shall be stranded copper XHHW-2. Phase colored insulation is required for all conductors. Label wiring with yellow heat shrink type markers with black machine printing. Labels shall be Raychem or Panduit.
- Q. All electrical enclosures shall be NEMA 4X PVC or FRP with external mounting lugs and lockable 3-point latch system. Mount all enclosures on vertical strut.
- R. Hardware, strut, and straps shall be FRP.
- S. All raceways for instrumentation, power, and wiring shall be installed by the electrical contractor.
- T. Instrumentation shall be installed, terminated, tested, and calibrated by the instrumentation and controls contractor.
- U. Label all enclosures and devices in accordance with GBRA standards.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All work shall be in accordance with GBRA Standards and Design Guidelines.
- B. Install products in accordance with manufacturer's instructions.
- C. Building foundation/floor, perimeter curb, and entrance ramp(s) shall be cast-in-place reinforced concrete. Exposed vertical and horizontal corners shall be formed with $\frac{3}{4}$ " chamfer strips.
- D. Chemical containment shall be accomplished by elevating the building on a perimeter curb with floor sloped to a sump pit for a portable pump. Provide floor with broom finish and concrete sealer.
- E. For buildings where chemical containment is not required, install a floor drain in the center of the building and slope floor to drain. Provide floor with smooth trowel finish and concrete sealer.

3.2 ADJUSTING AND CLEANING

- A. Touch up any damaged factory finished surfaces or remove and replace as directed by GBRA.

END OF SECTION

SECTION 13410
PROCESS CONTROL DESCRIPTIONS

REFERENCE DWG (S):	(by design engineer)
DESCRIPTION:	The In-district customer sites deliver water to the customers on a daily rate basis. This daily rate shall be used as the set point to adjust the control valve to maintain the flow rate.
GENERAL MONITORING:	<p>The HMI monitors for the in-district customer sites the following: the control valve position, fail alarm and statuses; the pipeline pressure and low/high alarms; flow rate and high/low flow alarms, flow total for the day and yesterday and the customer enable status; facilities alarms, intrusion (enclosure contact) and power fail.</p> <p>Valve fail alarm shall be generated when the valve position disagrees with the command position while in the remote mode. The fail shall have a time delay and dead band adjustment.</p> <p>The daily flow total shall be generated from flow rate reading. This total shall be from midnight to midnight and stored locally in the PLC. At midnight the local PLC shall store the previous day total as the yesterday total. Provide continuous totalizing flow reading at control room.</p>
LOCAL MANUAL CONTROL MODE:	For the control valve, when the L/O/R switch is in the local position the valve shall be opened and closed at the local operator station.
LOCAL AUTOMATIC CONTROL MODE:	None.
REMOTE MANUAL CONTROL MODE:	When the L/O/R switch is in remote position the HMI operator shall be able to select a AUTO/MANUAL mode. In the MANUAL the valve shall be opened and closed by adjusting the per cent open set point.

**REMOTE AUTOMATIC
CONTROL MODE:**

When the L/O/R switch is in remote position and the mode is set to AUTO the valve shall modulate to control the flow rate. The flow rate set point shall be the customer daily rate set from the water treatment plant control system. The modulation shall use a PID control algorithm. There shall be two shutdown control points to close the valve in AUTO mode. 1) If the customer enable is off the control valve shall be closed and 2) if a system shutdown occurs the control valve shall be closed.

The customer enable shall be a local control function.

Shutdown Rate: When a shutdown occurs, the valve shall ramp closed on an adjustable rate. This "time to close" setpoint shall be operator adjustable via HMI from 1.0 to 30.0 minutes.

NEW SITES:

Contractor shall integrate new sites into GBRA control system. New sites must be added to the system flow controls including distribution setpoints.

SECTION 13428
RADIOS AND ACCESSORIES

PART 1 - GENERAL

1.1 GENERAL

A. Scope of Work:

1. Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish, install, calibrate, test, start-up and place in satisfactory operation the radio system in accordance with this section and the contract drawings.
2. In order to centralize responsibility, it is required that all equipment provided under this Section be furnished by a single system supplier specified in Article 1.2 below. The contractor shall guarantee and be the source of information on all equipment furnished regardless of the manufacturing and supply source of the equipment.
3. Electrical Work: All equipment, materials, and appurtenances, as well as all signal and power wiring and cable runs and interconnections, shall be in accordance with published GBRA standards and the requirements of Division 16 - Electrical.
4. Specific information is provided below:
 - a) Remote radio sites shall have Omni and/or Yagi antenna(s) as appropriate and shall communicate with the applicable GBRA master radio, GBRA control room(s), and/or with a GBRA remote relay radio site.
 - b) **Depending on service area, radios shall be MDS iNet-900 or Banner Engineering DX80DR9M-H1C. Reference GBRA design guidelines for appropriate RTU, radios, and communications to applicable GBRA control room(s). Coordinate with GBRA staff to determine service area, site specific requirements, and appropriate equipment.**
 - c) **Design engineer shall perform a site investigation and field radio path study with portable masts and radios; submit the radio path study and proposed system design for GBRA approval prior to bidding, including model numbers of antennas used to obtain results. Evaluate terrain and potential obstructions. Radio receive signal level must be -80dBm or better. Design shall include radios, antennas, towers, repeaters, and expansion I/O modules as necessary.**
 - d) Perform programming, development, and integration at the applicable GBRA control room(s).
5. The installation details required for the radio telemetry equipment vary from site to site. The antenna installations and wiring details on the contract drawings shall indicate the sites for which specific installation details are expected to apply. The contract drawings shall also indicate the type of antenna required (i.e. Omni or Yagi).
6. The contractor shall be responsible for all wiring for radio system.
7. The contractor shall obtain the services of a tower manufacturer to furnish all labor, materials and equipment to design, construct and erect in place the antenna towers including the foundation as indicated in the specifications and on the contract drawings. The tower manufacturer shall provide design calculations and

working drawings signed and sealed by a professional engineer registered in the State of Texas.

1.2 QUALIFICATIONS AND QUALITY ASSURANCE

- A. SCADA contractors and integrators must be certified by Inductive Automation for Ignition HMI Software. Contractors must be Premier Certified. Integration must be performed by employees that are Gold Level Certified, experienced, and competent in the implementation of Ignition HMI Software. Submit certifications, qualifications, and experience for GBRA review and approval.
- B. Antenna installation shall be performed by personnel with a minimum of two years experience with antenna installation.
- C. Tower Erection Criteria: Provide erector who is approved by the manufacturer, and has erected at least two antenna tower structures fabricated by manufacturer.
- D. Engineering Responsibility: The contractor shall retain the services of a professional engineer registered in the State of Texas to complete the antenna tower foundation design. Design calculations, design drawings, and shop drawings shall be prepared under the direction of this Engineer. All calculations and drawings shall bear his seal.

1.3 SUBMITTALS

- A. Submit all components required to provide a complete functional system.
- B. The antenna tower submittal shall also comply with the special design consideration of paragraph 1.1.A.7 above.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. All equipment shall be stored in accordance with the manufacturer's recommendations prior to installation.

1.5 SPARE PARTS

- A. Provide a spare for each single point of failure item.

1.6 RADIO NETWORK FUNCTIONAL REQUIREMENTS

- A. The topography of the radio system service area does not permit direct line of sight radio paths to all remote sites from any one location. As a result, the radio network shall provide data routing between radios to establish multiple-hop routes, overcoming local terrain. Provide relay locations as necessary. Submit a radio architecture connectivity diagram. The connectivity diagram must show the paths available for transmission of communications for each remote site.
- B. It shall be possible to interface any radio and/or any PLC in the network directly from a radio/processor interface computer, or from laptop computers anywhere within the telemetry network, directly over the radio network. All radio communication shall be encrypted. The computer interface shall be provided under this section and shall be supplied with the radio diagnostic software specified in paragraph 2.6 from the radio manufacturer.

PART 2 - PRODUCTS

2.1 SPREAD SPECTRUM RADIOS

- A. The 900 MHz Spread Spectrum (SS) radios shall operate under FCC Part 15 rules for unlicensed radio operation in the 902 MHz to 928 MHz band. The radio shall utilize the frequency-hopping technique to accomplish these functions, using 240 FCC-assigned channels.
- B. The following general requirements shall be met by the spread spectrum radio:
 - 1. Frequency Hopping Range: 240 channels, 25 kHz wide, 100 kHz spacing, over 902-928 MHz spread spectrum band.
 - 2. Agency Approvals: FCC Class, Part 15.247, UL, FM
 - 3. Operating Temp. Range: -40 to +60 Degrees Celsius
 - 4. Power Supply Requirements: input 117 VAC 10% and output 12/15 VDC
 - 5. Spreading Technique: frequency hopping
 - 6. Hopping Patterns: 65,536 (unique per network) pseudo random
 - 7. Network Address: latitude/longitude coordinates
 - 8. Electro Magnetic Susceptibility: ANSI C37.90.2 Modified
 - 9. Enclosure: die cast NEMA 4X aluminum enclosure
- C. The spread spectrum radio transmitter shall meet the following requirements:
 - 1. Frequency Range: 902-928 MHz
 - 2. Output Power: +17 dBm, minimum, +20 dBm typical
 - 3. Deviation: +/-5.5 kHz \pm 10%
 - 4. Frequency Stability: 2.5 parts per million @ -30 to +75 Degrees Celsius
5.0 parts per million @ -40 to +85 Degrees Celsius
 - 5. Bandwidth Modulation: 25 kHz
 - 6. Transmitter Keying: data activated
 - 7. Spurious Radiation: -55 dBc (1 kHz bandwidth)
- D. The spread spectrum radio receiver shall meet the following requirements:
 - 1. Frequency Range: 902-928 MHz
 - 2. Dynamic Range: -104 to -20 dBm
 - 3. IF Selectivity: 6 dB down at 30 kHz
 - 4. Frequency Stability: 2.5 parts per million @ -30 to +75 Degrees Celsius
 - 5. Bit Error Rate (unfaded): 1×10^{-6} BER
 - 6. 45 MHz IF Rejection: less than 90 dBm
- E. The spread spectrum radio equipment shall be the following:
 - 1. MDS iNet Ethernet Radio or latest version.

2.2 OMNIDIRECTIONAL ANTENNAS

- A. Omnidirectional remote mount antennas and ground impulse suppressors shall be furnished for each site as shown on the contract drawings.
- B. Antenna mounting at each remote site and at the master site shall be determined by the contractor at the time of installation based on field study of the terrain.
- C. The omnidirectional antennas shall meet the following requirements:
 - 1. Frequency Range: 902-928 MHz
 - 2. Gain: 11.0 dBi or higher if indicated by RF study and/or required to offset coax losses
 - 3. Bandwidth: 26 MHz
 - 4. Power Input: 50 watts minimum

5. VSWR: Less than 1.5
 6. Lightning Protection: dedicated direct ground
 7. Ground: DC grounded type
 8. Wind Rating: 150 mph survival without ice
 9. Wind Rating: 100 mph survival with .5" radial ice
 10. Connector: Type N female direct connection, no factory jumper or whip
 11. Mounting Hardware: stainless steel clamps and standoff hardware as recommended by the antenna manufacturer
 12. Ground Impulse Suppressor: provide with each antenna
- D. Antenna Manufacturer and Products, provide the following:
1. Andrew Decibel Products DB810KE-SY antennas with Polyphaser Model POLISB50LNC2 ground impulse suppressors, or equal.

2.3 YAGI DIRECTIONAL ANTENNAS

- A. Directional remote mount antennas and ground impulse suppressors shall be furnished for each site as shown on the remote site installation details as part of the Contract Drawings.
- B. Antenna mounting at each site shall be determined by the contractor at the time of installation based on field study of the terrain.
- C. The directional antennas shall meet the following requirements:
1. Frequency Range: 902-928 MHz
 2. Gain: 12.0 dBi or higher if indicated by RF study and/or required to offset coax losses
 3. Bandwidth: 26 MHz
 4. Vertical Beamwidth: 30 degrees
 5. Horizontal Beamwidth: 60 degrees
 6. Power Input: 50 watts minimum
 7. VSWR: less than 1.5
 8. Lightning Protection: dedicated direct ground
 9. Ground: DC grounded type
 10. Wind Rating: 150 mph survival without ice
 11. Wind Rating: 100 mph survival with .5" radial ice
 12. Connector: Type N female direct connection, no factory jumper or whip
 13. Mounting Hardware: stainless steel clamps and standoff hardware as recommended by the antenna manufacturer.
 14. Ground Impulse Suppressor: provide with each antenna.
- D. Antenna Manufacturer and Products, provide the following:
1. Kathrein Model TY-900 antennas with Polyphaser Model POLISB50LNC2 ground impulse suppressors, or equal.

2.4 ANTENNA TRANSMISSION CABLE AND ACCESSORIES

- A. The transmission cable connecting the radio antenna port with the antenna shall be the low-loss foam-dielectric coaxial type. This cable shall be 1/2" inch diameter (Andrew LDF4-50A, or equal). A single continuous piece of coaxial cable shall be furnished for each radio. For coax runs exceeding 100 feet in length, furnish 7/8" diameter cable (Andrew LDF5-50A, or equal).

- B. Provide one (1) 3 foot-section of super-flexible transmission cable for coax interconnection at the radio antenna port (one for each radio). Provide standard Type N connectors at each end, which will mate with the radio and the transmission cable.
- C. Furnish two (2) N-type connectors for terminating both ends of each transmission cable.
- D. Coaxial cable grounding kit shall be furnished. Furnish Andrew, or equal. Furnish two (2) kits per radio.
- E. One (1) in-line coaxial cable surge protectors shall be furnished for each cable. Furnish Polyphaser, or equal with N-connector mating.
- F. Provide stainless steel Andrew coaxial cable hanger kits and clamping hardware. Adequate kits shall be installed to anchor the cables at 3-foot intervals on the vertical antenna mast/tower.
- G. All outdoor coaxial connectors shall be wrapped with two layers of Scotch Super 88 UV resistant tape or equal, and then coated with two layers of Scotchkote or equal.

2.5 ANTENNA TOWER

- A. Antenna towers shall be the self-supporting equilateral triangular type. Towers shall be knock-down type structures for site assembly. Tower structural members shall be roll-formed galvanized steel. Provide an external ladder with fall protection and anti-climb devices on all towers. Towers shall be designed for a minimum wind rating of 120 miles per hour with the external ladder assembly, the specified antenna, and all appurtenances. Design for all potential and future loads, including ice.
- B. The antenna tower foundations shall be designed and constructed to safely support all tower loads, including dead and wind loads, without exceeding the allowable stresses or specified strengths when appropriate load factors are applied. Comply with the requirements of the applicable code for minimum factors of safety for stability of antenna tower type structures. Consider the most critical combination of loads utilizing the applicable code as the basis for the load combination.
- C. Furnish and install spline balls with stainless steel mounting hardware in accordance with GBRA standard details.

2.6 RADIO CONFIGURATION AND DIAGNOSTICS SOFTWARE

- A. A radio configuration and diagnostics system shall be furnished with the radio system. This system shall be manufactured by the radio manufacturer. The system shall provide configuration capabilities to set up and modify, if necessary, the operating parameters of each radio, and provide diagnostic features to test system performance.
- B. Specific requirements of the configuration and diagnostics system shall include the following:
 - 1. Read all remote radio tables for: status, node, frequency interference history, and RF signal strength.
 - 2. Write any or all (user selectable) acquired data to hard disk storage for later access.
 - 3. Configure (over the air) all configurable radio parameters.
 - 4. Provide user-programming of radio diagnostic functions.
 - 5. Provide owners manual and application program on CD.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The contractor is responsible for the installation of all radio equipment.
- B. Buried antenna cable shall be installed at least two feet below grade in 2" minimum conduit in accordance with published GBRA standards and the requirements of Division 16 - Electrical.

3.2 CONFIGURATION/PROGRAMMING

- A. Radio system shall be configured and programmed in accordance with GBRA published standards and the contract documents.
- B. Perform programming, development, and integration at the applicable GBRA control room(s). Comply with GBRA revision management policy.
- C. A mandatory pre-construction meeting is required prior to performing any control room work. Coordinate schedule with GBRA. Provide minimum two (2) weeks advance notice.

3.3 FIELD TESTING AND DEMONSTRATION

- A. The contractor shall perform demonstration testing of all signals and points from field equipment and devices to the applicable GBRA control room(s). Schedule GBRA to witness the demonstration testing. Provide minimum two (2) weeks advance notice. The contractor shall verify complete functionality prior to scheduling the witnessed demonstration testing.

3.4 TRAINING

- A. Radio system training shall be provided. Provide minimum two (2) weeks advance notice.

+ + END OF SECTION + +

SECTION 13442
FLANGED MAGNETIC FLOW METERS

- A. Related Sections:
1. The work described in this section shall be performed in accordance with the following related sections:
 - a. Division 1
 - b. Division 15
 - c. Division 16
- B. Magnetic Flow Meters:
1. Acceptable manufacturers:
 - a. Badger.
 - b. Endress + Hauser.
 - c. Foxboro.
 - d. Krohne.
 - e. McCrometer.
 - f. Rosemount.
 - g. Substitutions are not permitted.
 2. Design and fabrication:
 - a. Utilize characterized field principle of electromagnetic induction to produce signal directly proportional to flow rate.
 - b. High input impedance pre-amplifiers.
 - 1) Minimum impedance: 10^{10} ohms.
 - c. Provide flanged end connections per ASME B16.5 rated for piping system operating and test conditions. Rating shall match pipe rating.
 - d. Grounding requirements:
 - 1) Nonmetallic or lined pipe:
 - a) Inlet and outlet grounding rings of same material as electrode.
 - 2) Conductive piping:
 - a) Conductive path between the meter and the piping flanges.
 - e. Provide cable between magnetic flow meter and transmitter. Cable length shall be 10m minimum. The Contractor shall cut cable in the field to suit actual field installation. Splicing is not permitted.
 - f. The signal converter shall be remotely mounted using a remote-mount kit provided by the manufacture. The transmitter shall be FM approved. Rating shall be at least NEMA 4X with separate electronics and termination areas.
 - g. Submergence: The sensor shall be pedestal sealed against accidental submersion to 3 feet for 30 minutes standard, or permanently submerged to 30 feet when the terminal box is backfilled with a non-setting, transparent potting material.
 - h. Pulsed DC magnetic field excitation.
 - i. Automatic zero.
 - j. Adjustable low flow cutoff.
 - k. Minimum signal lock (empty tube zero) to prevent false measurement when tube is empty.
 - l. Inaccuracy:
 - 1) Above 10 percent of range: ± 1.0 percent of rate.
 - 2) Below 10 percent of range: ± 0.1 percent of range setting.
 - 3) Add ± 0.1 percent of range to above inaccuracies for analog outputs.
 - m. 4-20 mA DC isolated output into maximum 800 ohms.
 - n. Power supply: 120 V ± 10 percent, 60 Hz.

- o. Provide surge protection.
 - p. Provide local operator interface display with indication of flow rate and totalized flow at transmitter.
 - q. Meter operable as specified in liquids with 5.0 micro mho/cm or more conductivity.
 - r. Transmitter electronics shall use microprocessor based architecture and be configured using parameters.
 - s. Repeatability : +/- 0.1% of reading or better.
 - t. The meter shall be capable of automatically indicating zero flow under empty pipe conditions.
 - u. The magmeter performance shall be verified on a NIST traceable test facility. Contractor shall also submit factory certified calibration certificates for all magmeters.
 - v. Instruments shall be designed and manufactured under the ISO 9001 series of quality standards.
 - w. Menu or programming changes shall be capable of being performed without removing covers.
 - x. Instruments shall be capable of storing data in non-volatile memory for a minimum of 10 years.
 - y. The instrument shall have password protection to prevent unauthorized personnel from making settings and programming changes.
3. Installation:
- a. In regard to flow disturbances and installation location, provide unobstructed upstream and downstream pipe clearances as recommended by the manufacturer.

END OF SECTION

SECTION 15100
ELECTRIC VALVE ACTUATORS

Electric Actuators (voltage and phase by design engineer)

1. Provide electric valve actuators intended for modulating service with integral control devices and pushbutton station.
2. Furnish electric actuator integral with valve consisting of:
 - a. Motor.
 - b. Gearing.
 - c. Handwheel.
 - d. Limit and torque switches.
 - e. Lubricants.
 - f. Heating elements.
 - g. Wiring.
 - h. Terminals for motor power and controls.
 - i. Drive nut.
3. Housing/Enclosure:
 - a. Provide cast iron gear housing and cast iron load bearing enclosure.
 - b. Nonload bearing enclosure and housing: aluminum or cast iron.
 - c. Watertight NEMA 4X rating.
 - d. Provide O-ring seals for covers and entries. Provide grease vent.
 - e. Terminal and limit switch compartment covers are to be fastened to gear housing by stainless steel fasteners with capture device to prevent loss.
4. Motors:
 - a. Provide motors that are totally enclosed, high torque design made expressly for valve actuator service and capable of operating the valve under full differential pressure for complete open-close and reverse cycle of travel at least twice in immediate succession without overheating.
 - b. Design motors in accordance with NEMA MG1 standards, with Class B insulation, and to operate successfully at any voltage within 10 percent above or below rated voltage.
 - c. Provide positive method to ensure motor bearings are permanently lubricated.
 - d. Provide three thermal switches imbedded in windings:
 - 1) 120 degrees apart.
 - 2) Provide motor shutdown at high temperature.
 - e. Motor housing:
 - 1) Aluminum or cast iron.
 - 2) Totally enclosed nonventilated with cooling fins.
 - f. Provide motor capable of operating in any position.
 - g. Provide motor sealed from gearcase to allow any mounting position.
 - h. Provide motors suitable for voltage and phase shown on drawings.
 - i. Motor shall be rated for modulating duty.
5. Gearing:
 - a. Provide power gearing consisting of heat treated steel helical gears, carburized and hardened alloy steel worm, and alloy bronze worm gear, all grease or oil bath lubricated, designed for 100 percent overload, and effectively sealed against entrance of foreign matter.
 - b. Provide gearing mechanism constructed to permit field changes of reduction gear ratio.

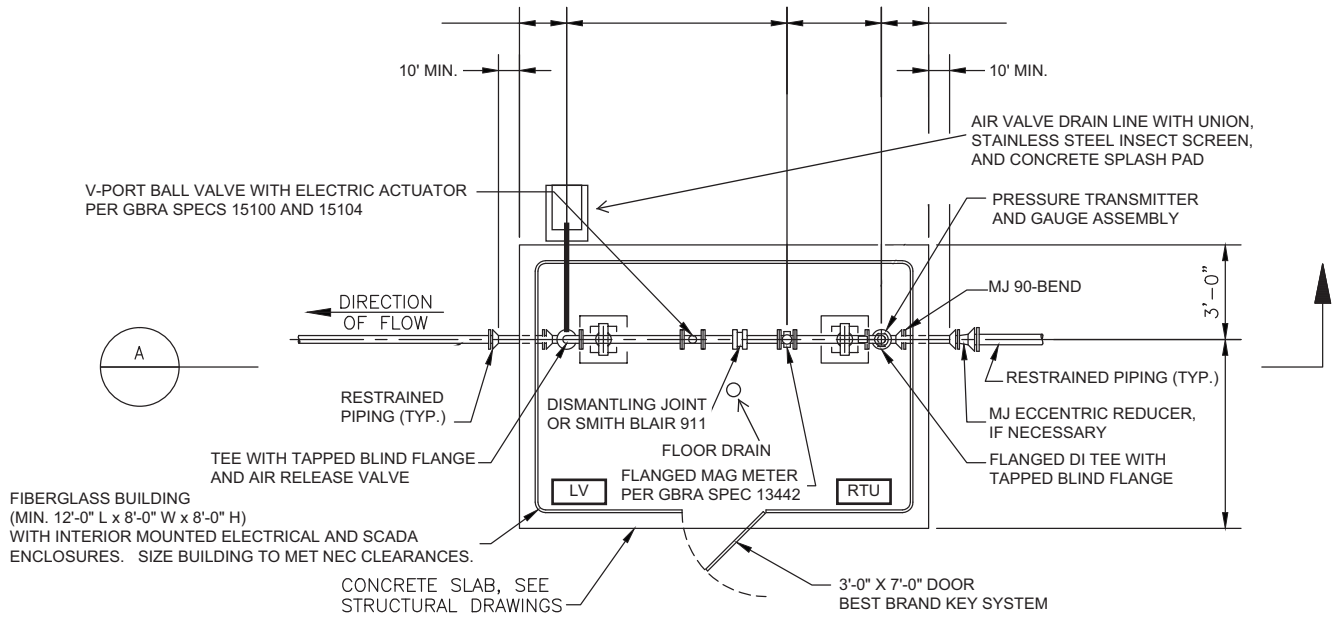
- c. Design actuators so that motor comes up to speed before stem load is encountered in either opening or closing operation.
- d. Limit switch gearings and feedback device reduction gearing:
 - 1) Steel or bronze.
- e. Support rotating shafts with anti-friction bearings.
- f. Provide separate drive nut/thrust bearing assembly:
 - 1) Mounted to base of actuator.
 - 2) High tensile bronze.
 - 3) Quarter turn actuator: Provide 90 degree mounting intervals.
 - 4) Provide grease fitting on drive assembly.
- 6. Handwheel:
 - a. Permanently attached for manual operation.
 - b. Positive declutch mechanism to engage and disengage handwheel.
 - c. Handwheel shall not rotate during motor operation.
 - d. Inoperable motor shall not prevent manual operation.
- 7. Limit torque and thrust loads in both closing and opening directions by torque limit switches.
 - a. Provide torque switches with micrometer adjustment and reference setting indicator. Assure adjustment variation of approximately 40 percent in torque setting.
 - b. Provide switches having rating of not less than 6 A at 120 Vac and 2.2 A at 115 Vdc.
 - c. Limit and torque switches shall have totally sealed contacts.
- 8. Furnish electric actuator with two geared limit switch assemblies with each switch assembly having four separate limit switches:
 - a. Assure each limit switch assembly is geared to driving mechanism and is independently adjustable to trip at any point at and between the fully open and fully closed valve position whether the unit is operated electrically or manually.
 - b. Provide minimum of two normally open contacts and two normally closed contacts at each end of valve travel.
 - c. Provide switches with inductive contact rating of not less than 2 A at 120 Vac, and 2.2 A at 115 Vdc.
 - d. Limit switches shall be fully adjustable when power is applied to actuator.
- 9. Provide space heating elements sized to prevent condensation in both motor and geared limit switch compartment(s).
 - a. Furnish heating elements rated at 120 Vac with heaters continuously energized.
- 10. Open-close actuator controls:
 - a. Provide control assembly with necessary holding relays, reversing starter, control transformers of sufficient capacity to provide control power, space heating element power and valve position transmitter.
 - b. Provide control assembly in an enclosure rated for the defined area classification.
 - c. Controls for open/close actuator:
 - 1) Provide integral pushbutton station on actuator electrical cover to include the following items:
 - a) Open pushbutton.
 - b) Close pushbutton.
 - c) Stop pushbutton.
 - d) Remote/local switch.
 - e) Full open light.
 - f) Full close light.
 - g) Open and close relays as required.
 - 2) Provide control enclosure to accept:
 - a) Remote open/close switches.
 - 3) Provide contacts in control enclosure:
 - a) Remote/local contact.
 - b) Full open contact.
 - c) Full close contact.

- 4) Wire all components to an internal terminal strip and include mounted wiring diagram inside enclosure.
11. Additional requirements for modulating valve actuators:
 - a. Proportional position servo-amplifier mounted integral with the actuator control compartment.
 - b. Positioning of valve shall be proportional to a 4-20 mA signal input to the position servo-amplifier when remote control has been selected.
 - c. Servo-amplifier adjustments shall include zero, span, gain, and dead-band.
 - d. Provide 4-20 mA signal position control as shown on the drawings that interfaces with the position control/position feedback instrumentation wiring to and from PLC.
 - e. Reversing starter shall be rated for modulating duty.
 - f. The positioner shall fail to last position on loss of 4-20 mA command signal.
 - g. Stroke time shall be 60 seconds.
12. Actuators shall be manufactured by EIM. Any substitutions must be pre-approved by GBRA prior to project bid date.

SECTION 15104
V-PORT BALL VALVES

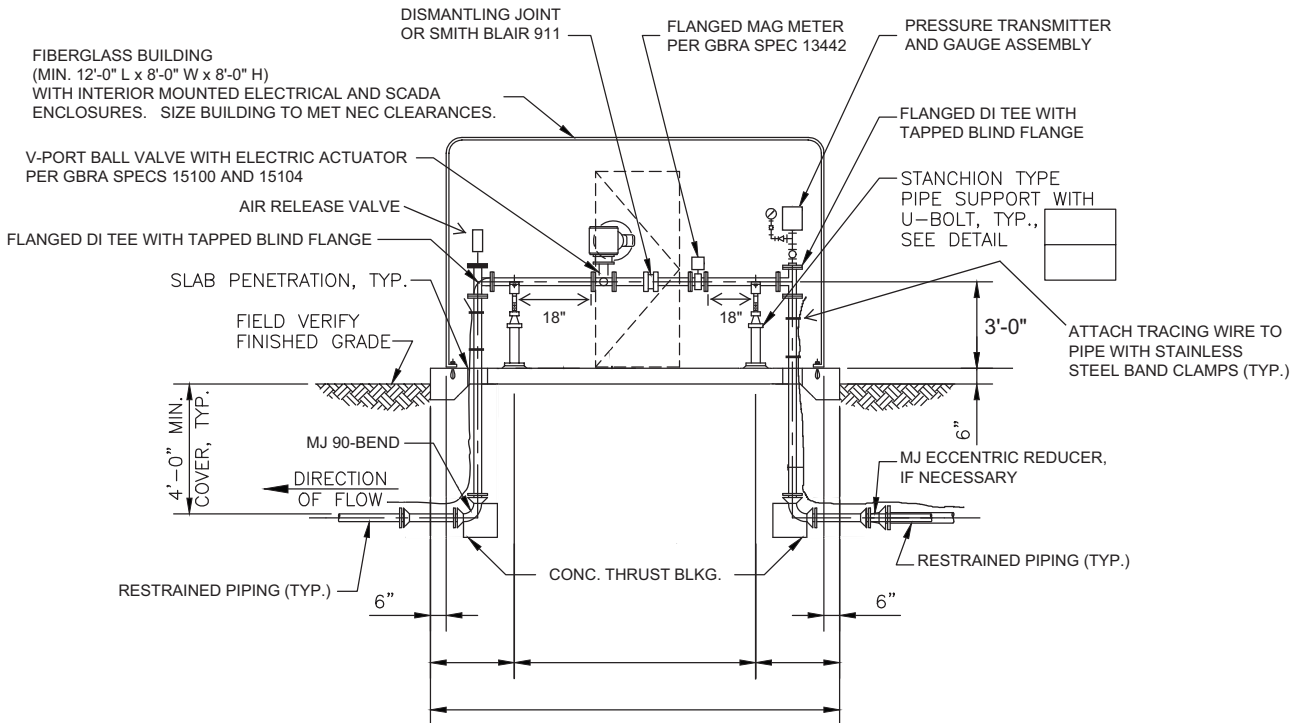
V-PORT BALL VALVES

- A. Applicable Valves: Customer flow control valves designed for modulating service.
- B. Acceptable Manufacturers:
 - 1. DeZurik.
 - 2. Any substitutions must be pre-approved by GBRA prior to project bid date.
- C. Materials:
 - 1. Body:
 - a. Carbon Steel, ASTM A216, Grade WCB.
 - 2. Ball:
 - a. 317 Stainless Steel with heat treated nickel overlay, A351, Grade CG8M.
 - 3. Upper & Lower Shaft:
 - a. 2205 Duplex Stainless Steel .
 - 4. Upper & Lower Bearing:
 - a. 440C Stainless Steel, ASTM A276.
 - 5. Packing Gland:
 - a. 317 Stainless Steel , ASTM A743, Grade CG8M.
 - 6. Seat:
 - a. Reinforced PTFE.
 - 7. Actuator:
 - a. Electric, modulating type per Section 15100.
 - b. Pressure and flow control via valve modulation.
- D. Design Requirements:
 - 1. Design Pressure: 150 psi .
 - 2. Flanges: Class 150 per ANSI B16.5.
 - 3. Ball Valve shall provide modulation for flow control.
 - 4. Size in accordance with manufacturer recommendations.
 - 5. Actuators:
 - a. Electric cylinder for modulation control per Section 15100.



METER ENCLOSURE PIPING PLAN

1

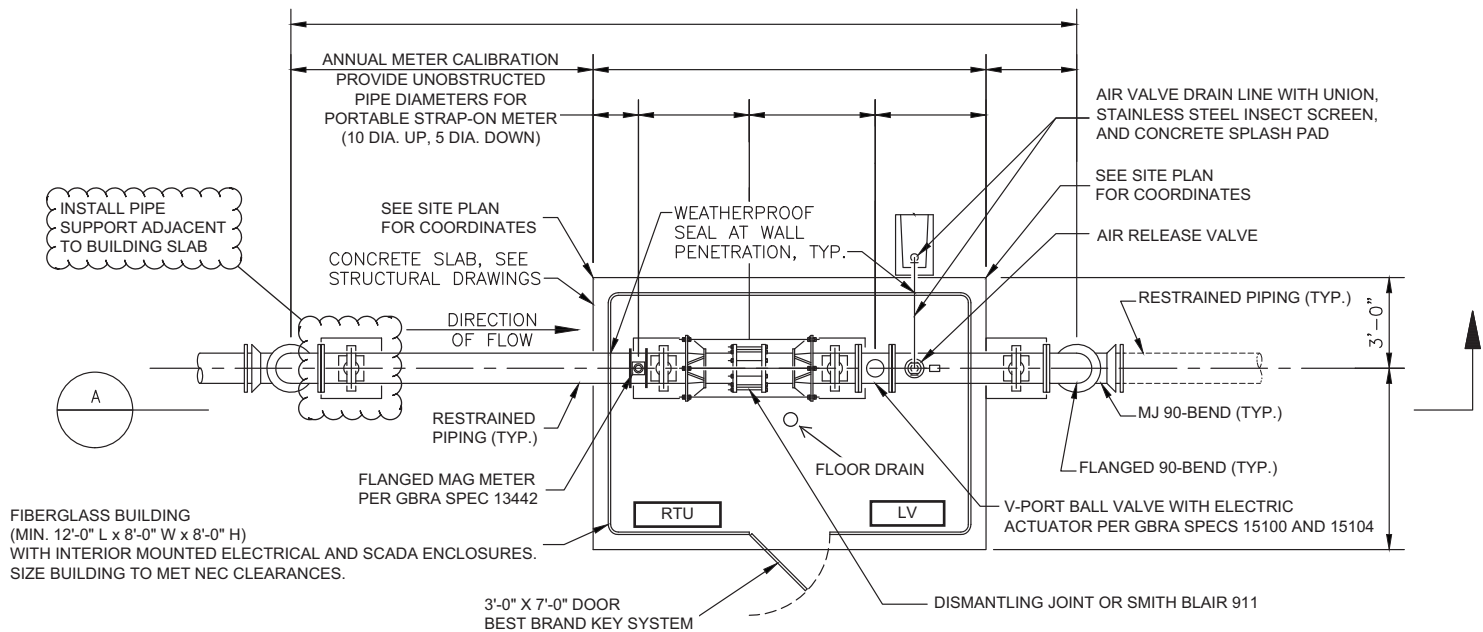


METER ENCLOSURE PIPING SECTION

A

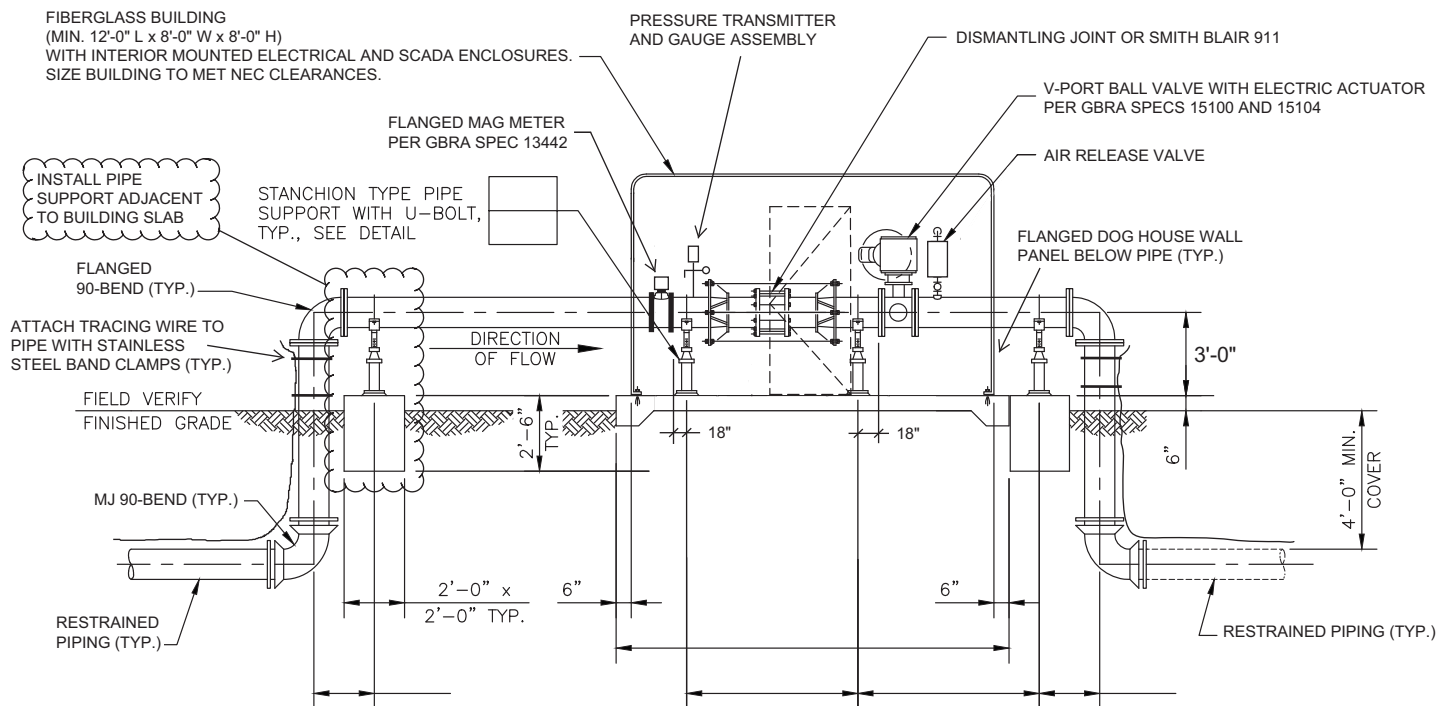
NOTES:

THIS DETAIL MAY BE USED FOR SMALLER DIAMETER PIPING THAT CAN FIT INSIDE BUILDING. IF THIS DETAIL IS USED, THE GROUND STORAGE TANK MUST HAVE EXTERIOR INLET PIPING, AS EXPOSED UNOBSTRUCTED STRAIGHT RUN PIPE IS REQUIRED FOR ANNUAL METER CALIBRATIONS (PORTABLE METER REQUIRES 10 DIAMETERS UPSTREAM AND 5 DIAMETERS DOWNSTREAM). ENGINEER TO DESIGN REQUIRED PIPE AND VALVE SIZE. REFERENCE GBRA STANDARD SPECIFICATION 13124 FOR ADDITIONAL FIBERGLASS BUILDING REQUIREMENTS.



METER ENCLOSURE PIPING PLAN

1

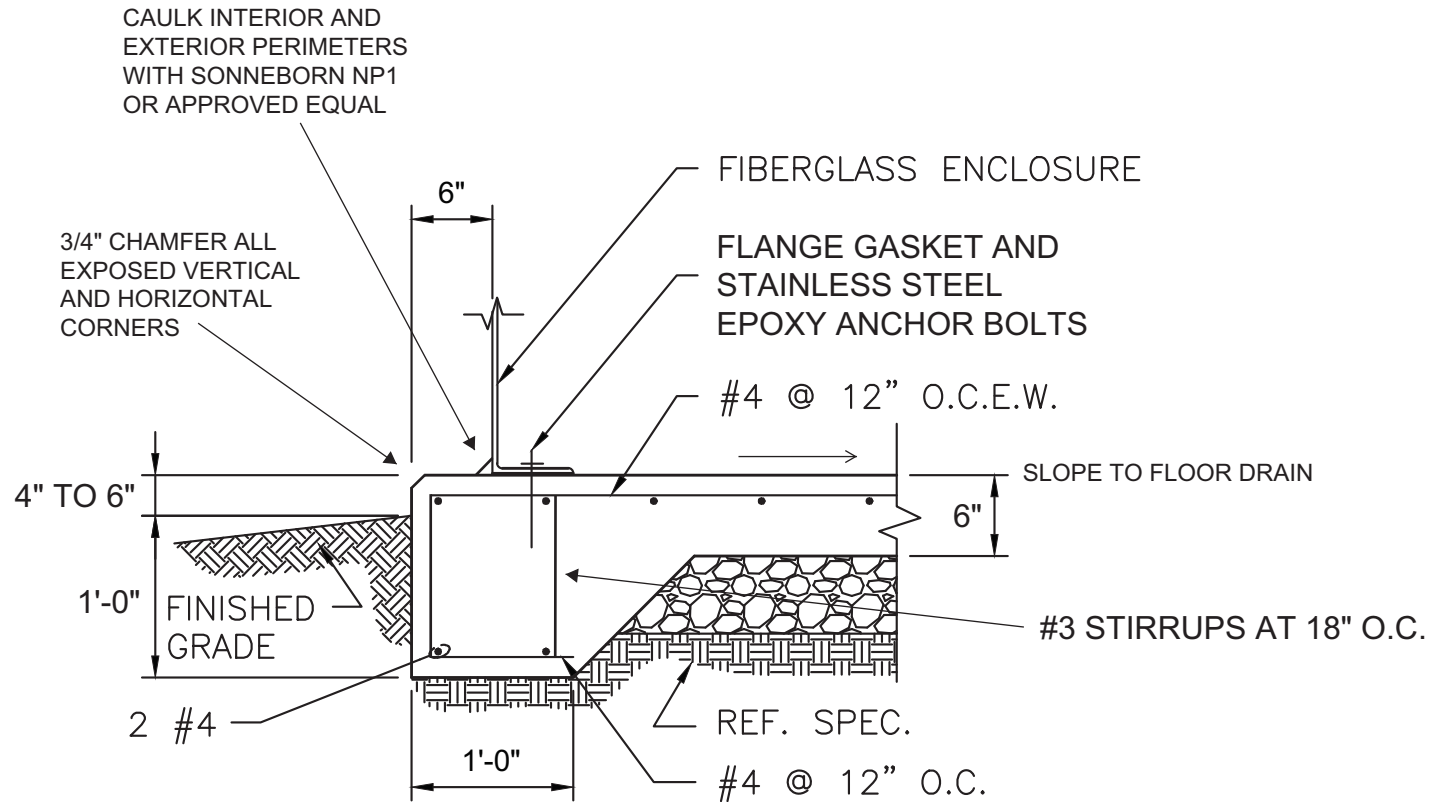


METER ENCLOSURE PIPING SECTION

A

NOTES:

THIS DETAIL MAY BE USED FOR LARGER DIAMETER PIPING TO MINIMIZE SIZE OF BUILDING. THIS DETAIL MUST ALSO BE USED IF GROUND STORAGE TANK HAS INTERIOR INLET PIPING, AS EXPOSED UNOBSTRUCTED STRAIGHT RUN PIPE IS REQUIRED FOR ANNUAL METER CALIBRATIONS (PORTABLE METER REQUIRES 10 DIAMETERS UPSTREAM AND 5 DIAMETERS DOWNSTREAM). ENGINEER TO DESIGN REQUIRED PIPE AND VALVE SIZE. REFERENCE GBRA STANDARD SPECIFICATION 13124 FOR ADDITIONAL FIBERGLASS BUILDING REQUIREMENTS.



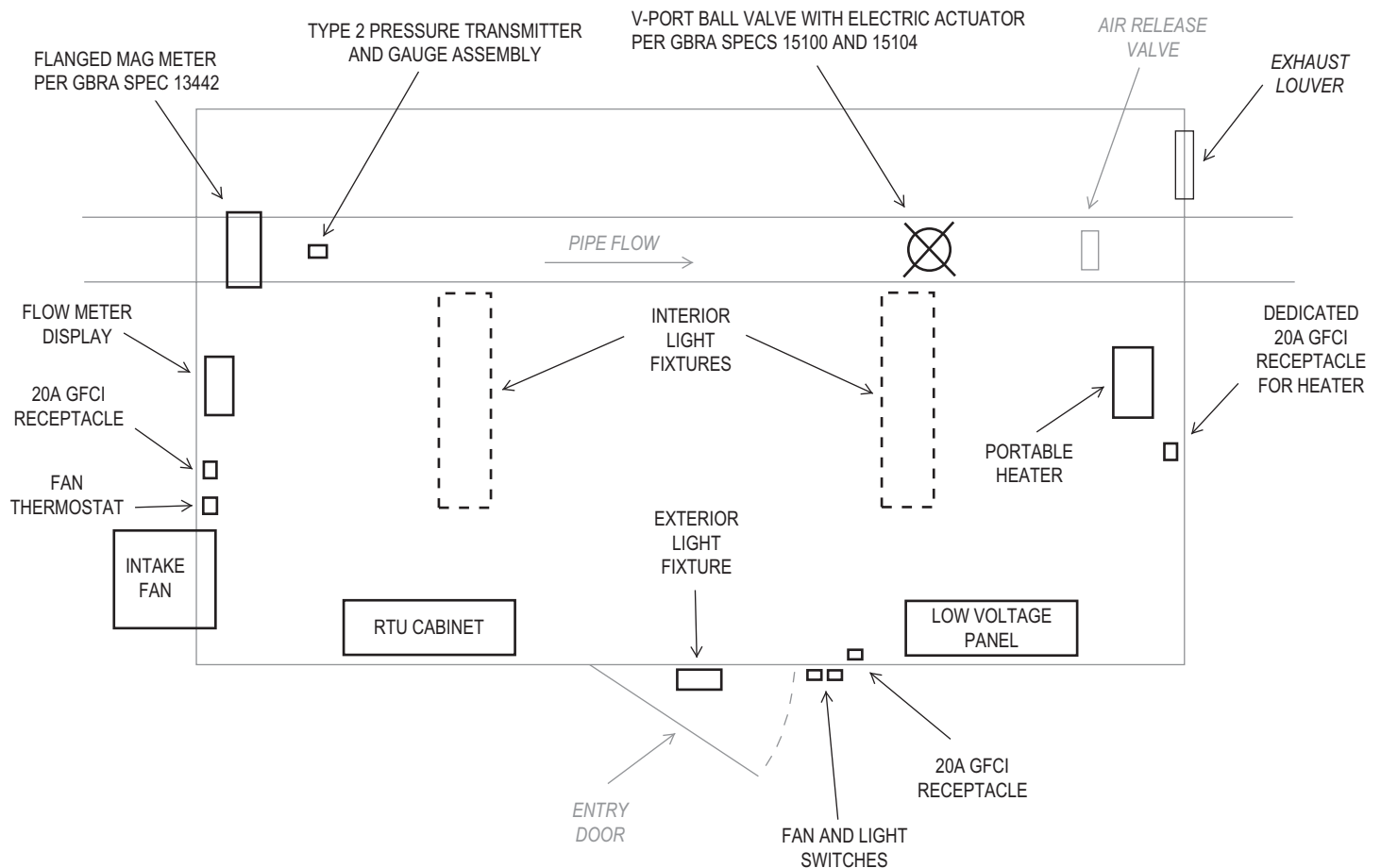
NOTES:

EMBED 2"x2"x1/4" HDG ANGLES ACROSS DOOR OPENINGS. PROVIDE CAST IRON FLOOR DRAIN WITH BRASS STRAINER IN CENTER OF BUILDINGS. SLOPE FLOOR TO DRAIN. REFERENCE CIVIL DRAWINGS FOR ROUTING. REFERENCE GBRA STANDARDS FOR FLOOR FINISH, CONCRETE SEALER, CURB CONTAINMENT, AND SUMP PITS.

EQUIPMENT PAD DETAIL

TYPICAL FOR FIBERGLASS BUILDINGS, GENERATORS, TRANSFORMERS, BLOWERS, MISC. EQUIP., ETC.

Guadalupe-Blanco River Authority, 01/28/2018



NOTES:

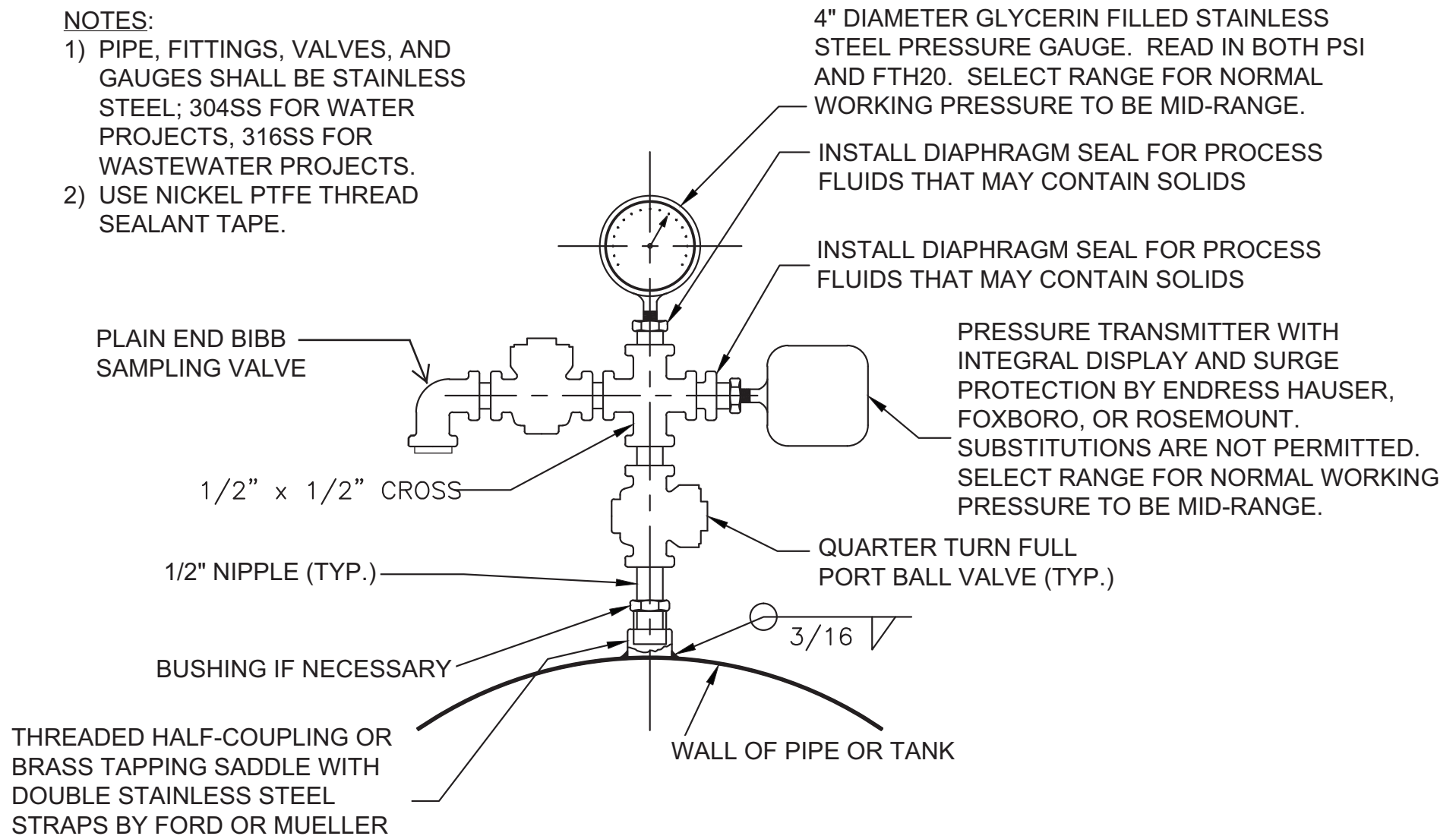
- 1) REFERENCE GBRA DESIGN GUIDELINES AND GBRA STANDARD SPECIFICATION 13124 FOR ADDITIONAL FIBERGLASS BUILDING REQUIREMENTS.
- 2) ALL ENCLOSURES TO BE NEMA 4X PVC OR FRP. MOUNT ENCLOSURES ON STRUT WITH TOP OF ENCLOSURES 72" ABOVE FLOOR.
- 3) LOW VOLTAGE PANEL: 18 CIRCUIT MINIMUM, 60A MAIN, BOLT-ON BREAKERS, TINNED COPPER BUS, SUPPLY SPD EXTERNAL TO PANEL WITH OVERCURRENT PROTECTION PROVIDED BY 2-POLE BREAKER INSIDE PANEL.
- 4) RTU CABINET: PLC WITH EXPANSION MODULES AS NEEDED, RADIO, 24V BATTERY BACKUP (4HR MIN), 20A RECEPTACLE, LED LIGHT WITH DOOR ACTIVATED SWITCH, HOFFMAN TYPE THERMOSTATICALLY CONTROLLED ENCLOSURE HEATER. REFERENCE GBRA DESIGN GUIDELINES AND GBRA STANDARD SPECIFICATION 13428 FOR ADDITIONAL REQUIREMENTS.
- 5) INTAKE FAN SHALL BE MOUNTED AT TOP OF WALL.
- 6) EXHAUST LOUVER SHALL BE MOUNTED AT BOTTOM OF WALL.
- 7) MOUNT RECEPTACLES 30" ABOVE FLOOR.
- 8) CONDUITS SHALL STUBUP THRU FLOOR. WALL PENETRATIONS ARE NOT ALLOWED.

GBRA FIBERGLASS BUILDING ELECTRICAL & HVAC DRAWING

Guadalupe-Blanco River Authority, 01/30/2018

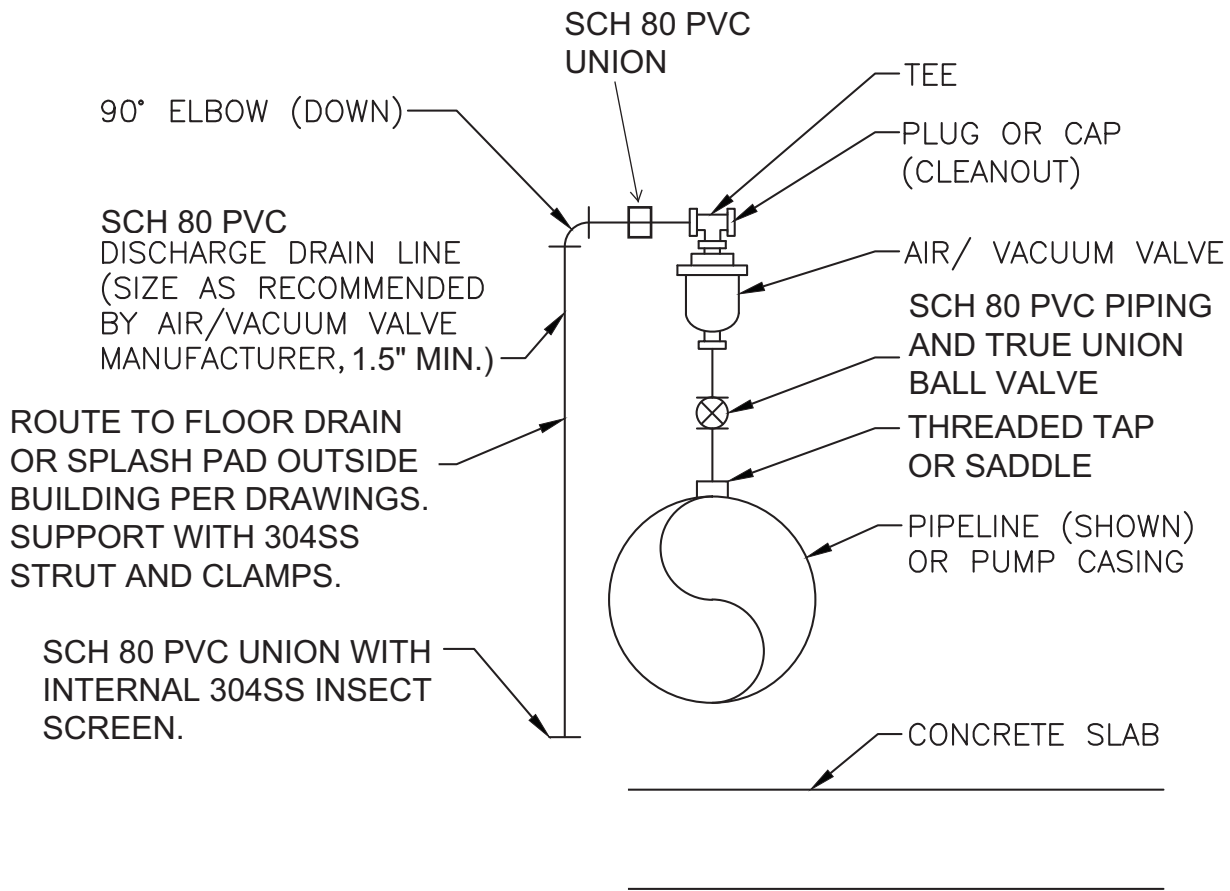
NOTES:

- 1) PIPE, FITTINGS, VALVES, AND GAUGES SHALL BE STAINLESS STEEL; 304SS FOR WATER PROJECTS, 316SS FOR WASTEWATER PROJECTS.
- 2) USE NICKEL PTFE THREAD SEALANT TAPE.



PRESSURE TRANSMITTER AND GAUGE ASSEMBLY

Guadalupe-Blanco River Authority, 01/29/2018



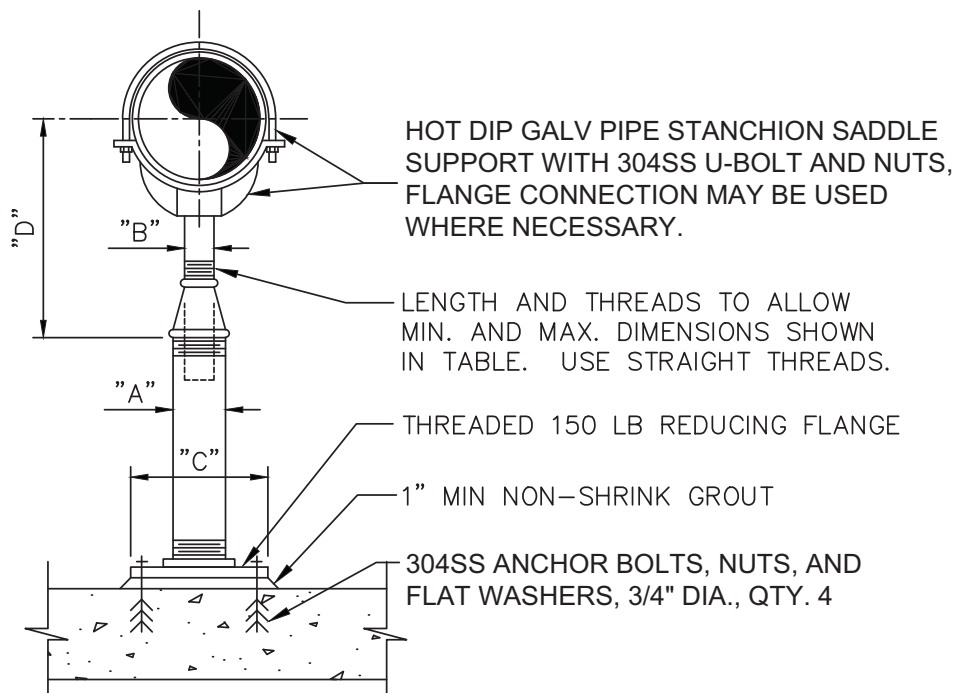
NOTES:

- 1) AIR RELEASE VALVE SHALL BE A.R.I. MODEL D-040, 2" MINIMUM.
- 2) SCH 80 PVC TRUE UNION BALL VALVES SHALL BE GF, HAYWARD, NIBCO, OR SPEARS.
- 3) TAPPING SADDLES SHALL BE BRASS WITH DOUBLE STAINLESS STEEL STRAPS BY FORD OR MUELLER.

AIR/VACUUM VALVE DETAIL

Guadalupe-Blanco River Authority, 01/30/2018

ADJUSTABLE PIPE SUPPORT SCHEDULE DIMENSIONS IN INCHES					
PIPE SIZE	"A"	"B"	"C"	"D"	
				MINIMUM	MAXIMUM
≤ 2 1/2	2 1/2	1 1/2	9	8	13
3	2 1/2	1 1/2	9	8 1/2	13 1/2
3 1/2	2 1/2	1 1/2	9	8 1/2	13 1/2
4	3	2 1/2	9	9 1/2	14
6	3	2 1/2	9	10 1/2	15 1/2
8	3	2 1/2	9	11 1/2	16 1/2
10	3	2 1/2	9	13 1/2	18 1/2
12	3	2 1/2	9	15	19 1/2
14	4	3	11	16 1/2	20 1/2
16	4	3	11	17 1/2	22 1/2
18	6	3 1/2	13 1/2	19 1/2	24
20	6	3 1/2	13 1/2	21	25 1/2
24	6	4	13 1/2	23 1/2	28 1/2
30	6	4	13 1/2	27	31 1/2
32	6	4	13 1/2	28 1/2	32 1/2
36	6	4	13 1/2	30 1/2	34 1/2



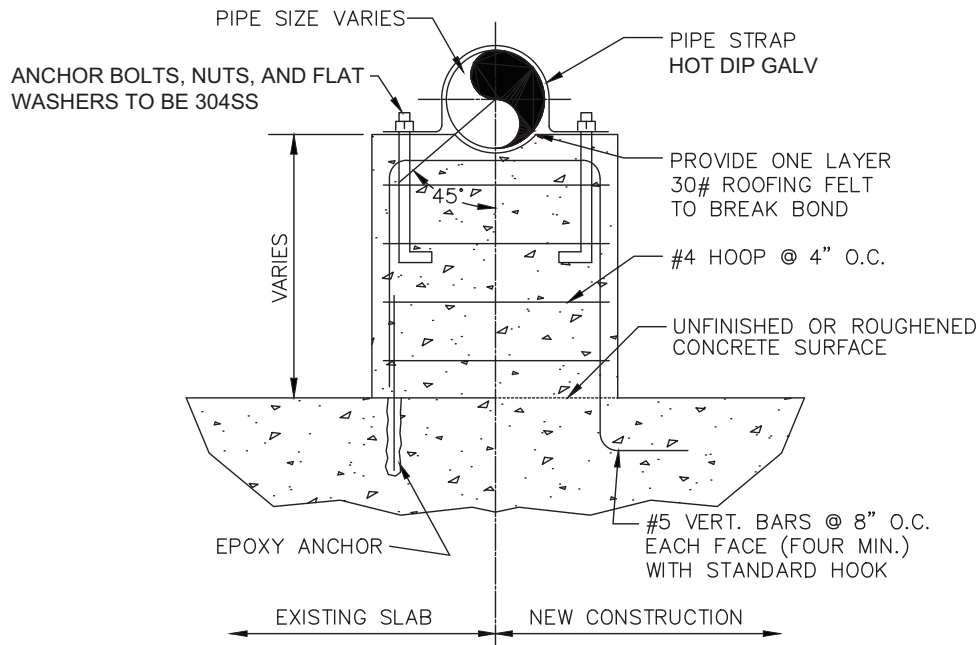
NOTES:

1. INSTALL WHERE SHOWN ON DRAWINGS.
2. HOT-DIP GALVANIZE AFTER FABRICATION.
3. PIPE SHALL BE SCHEDULE 40.

ADJUSTABLE STANCHION PIPE SUPPORT DETAIL

Guadalupe-Blanco River Authority, 01/28/2018

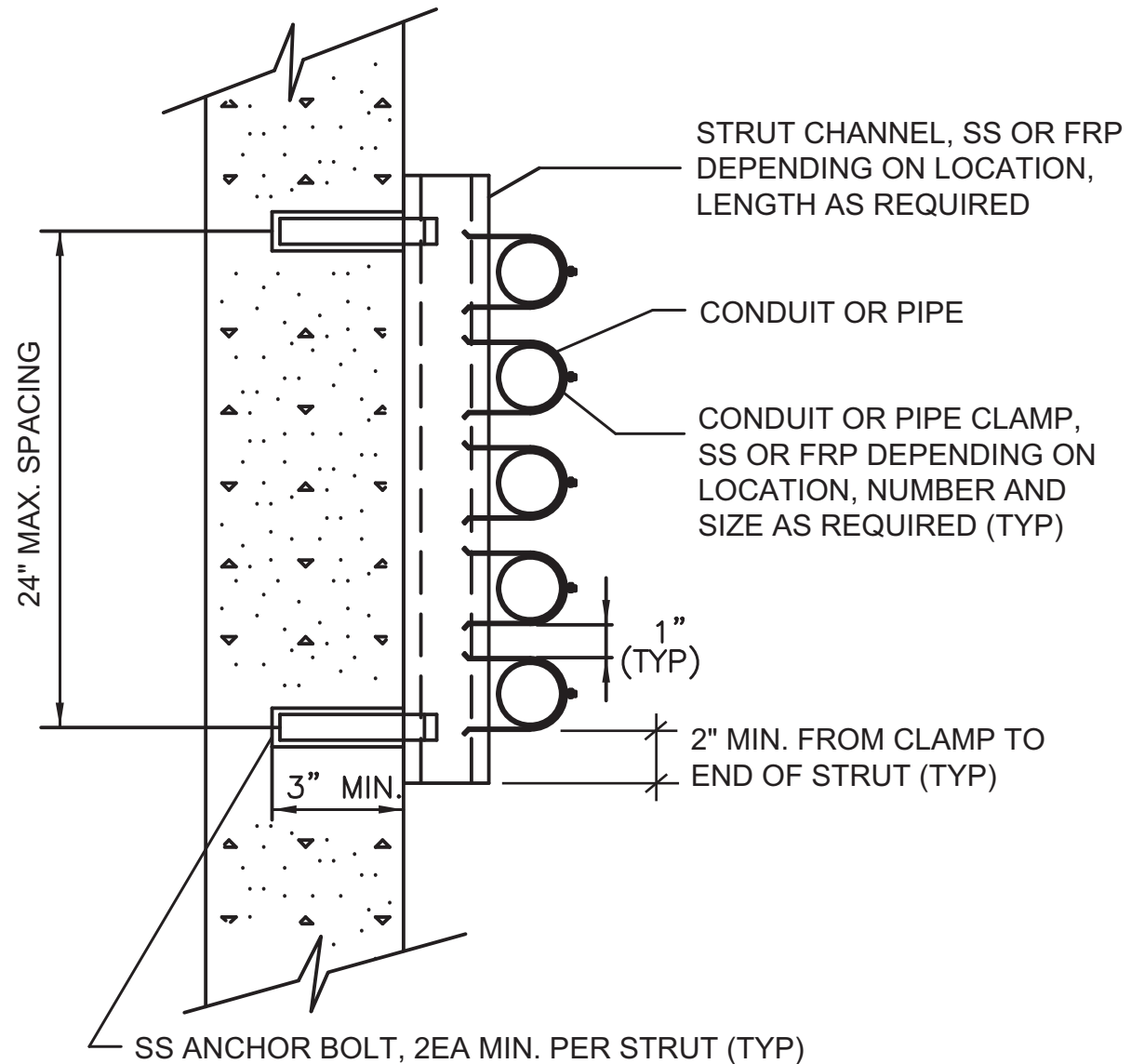
CONCRETE PEDESTAL SUPPORT SCHEDULE DIMENSIONS IN INCHES			
PIPE SIZE NOM. DIA.	STRAP WIDTH	ANCHOR BOLTS DIA.	PEDESTAL THICKNESS
6"-12"	3"	3/4"	8"
14"-24"	4"	1"	10"
30"-36"	6"	1 1/4"	12"



NOTES:
 INSTALL WHERE SHOWN ON DRAWINGS. ALL EXPOSED
 VERTICAL AND HORIZONTAL CONCRETE EDGES SHALL BE
 FORMED WITH 3/4" CHAMFER STRIPS.

CONCRETE PEDESTAL SUPPORT DETAIL

Guadalupe-Blanco River Authority, 01/28/2018

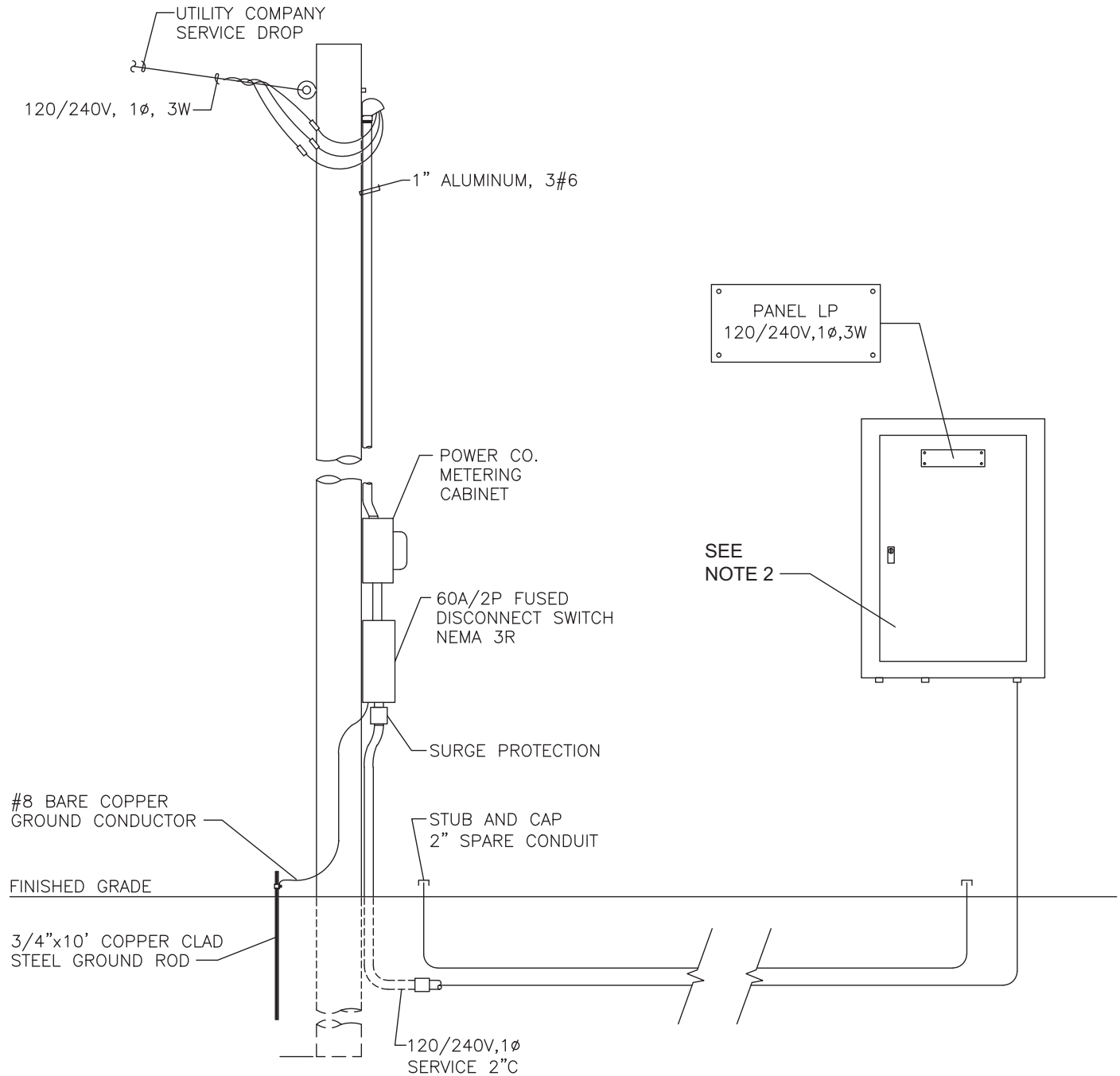


NOTE:

STAINLESS STEEL (SS) SHALL BE 304SS FOR WATER PROJECTS AND 316SS FOR WASTEWATER PROJECTS.

STRUT AND CLAMP DETAIL

Guadalupe-Blanco River Authority, 01/28/2018

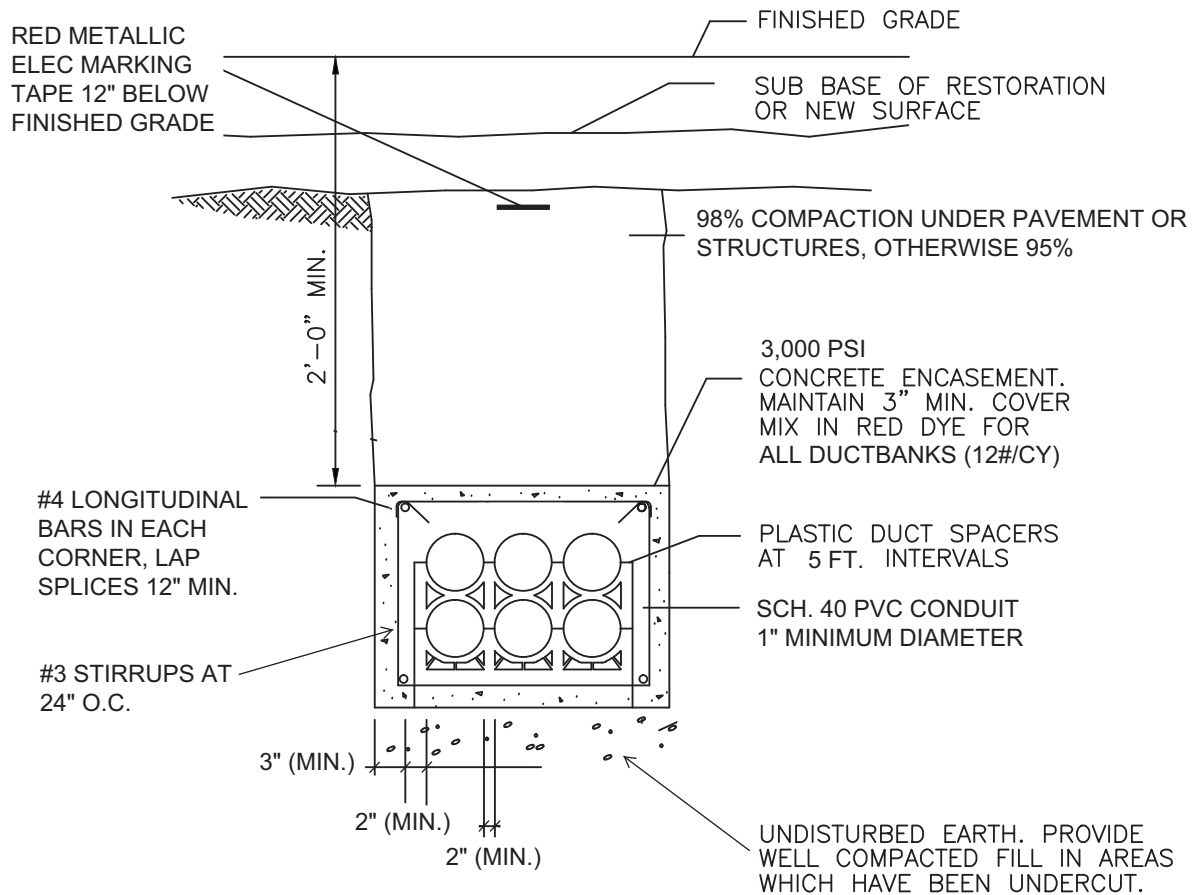


NOTES:

- 1) MOUNT ALL ENCLOSURES ON STRUT.
- 2) INSTALL SPD/TVSS WITH OVERCURRENT PROTECTION EITHER ON POLE OR OUTSIDE OF PANEL LP.
- 3) DISCONNECT SHALL BE LOCKABLE IN THE ON AND OFF POSITIONS.

SERVICE POLE DETAIL

Guadalupe-Blanco River Authority, 01/28/2018

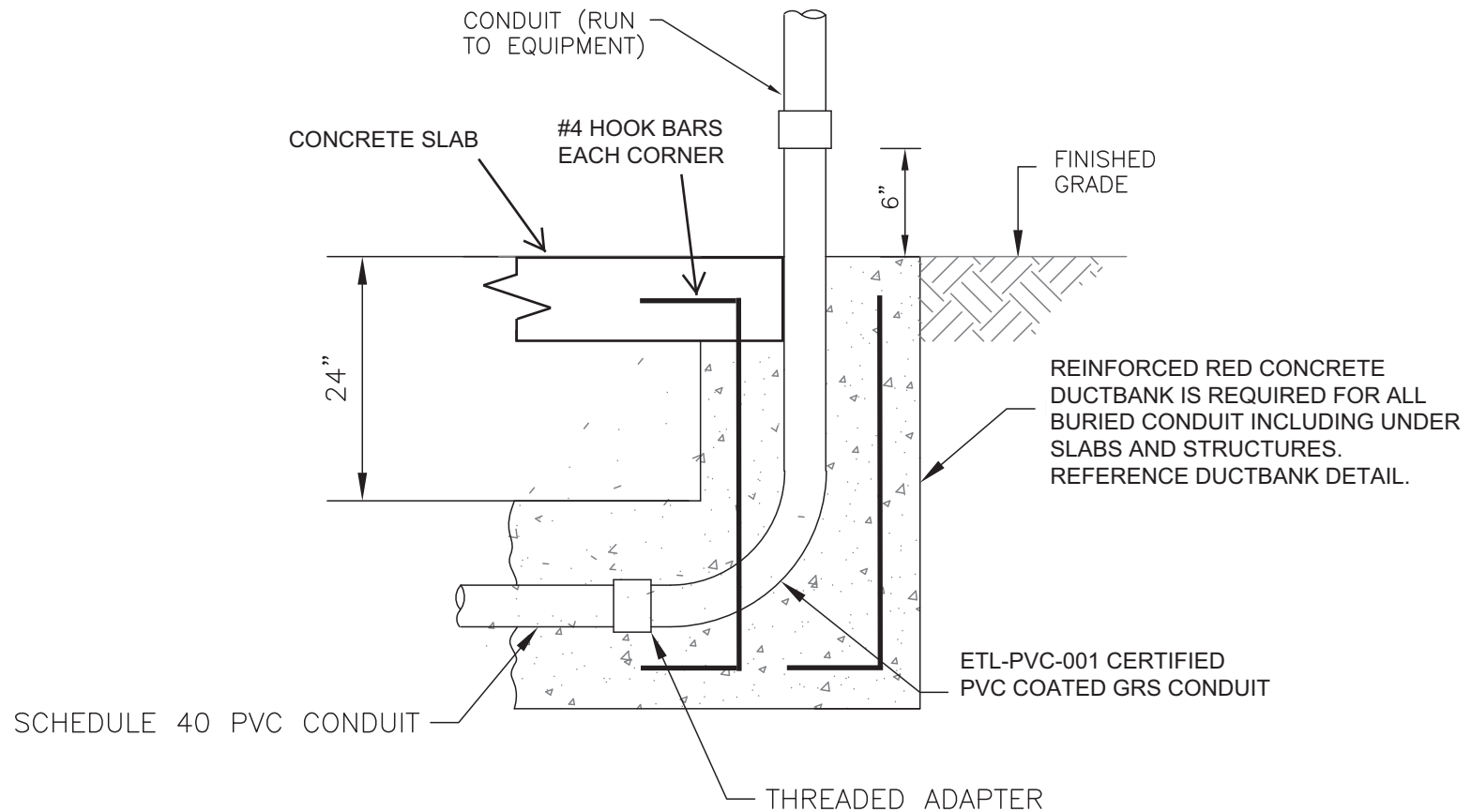


NOTES:

- 1) CONCRETE AND REBAR ARE REQUIRED FOR ALL DUCT BANKS, INCLUDING UNDER SLABS AND STRUCTURES.
- 2) DUCT BANK REBAR SHALL BE DOWELLED INTO SLABS AND STRUCTURES.
- 3) MINIMUM 2" SEPARATION BETWEEN DUCTS FOR LIKE SERVICES.
- 4) SIGNALS, POWER, AND CONTROLS SHALL BE ROUTED IN SEPARATE DUCTS.
- 5) MINIMUM 12" SEPARATION BETWEEN SIGNAL DUCTS AND POWER OR CONTROLS DUCTS.
- 6) DO NOT MIX VOLTAGES IN THE SAME CONDUIT.
- 7) MINIMUM 2" CLEARANCE BETWEEN REBAR AND CONDUIT.
- 8) MINIMUM 3" CONCRETE COVER AROUND REBAR.
- 9) PROVIDE ONE SPARE CONDUIT OF EACH SIZE AND TYPE IN ALL DUCT BANKS.
- 10) MAINTAIN 12" MINIMUM VERTICAL CLEARANCE BETWEEN DUCT BANK CONCRETE AND OTHER UTILITIES.
- 11) SHARED TRENCHES ARE NOT ALLOWED.

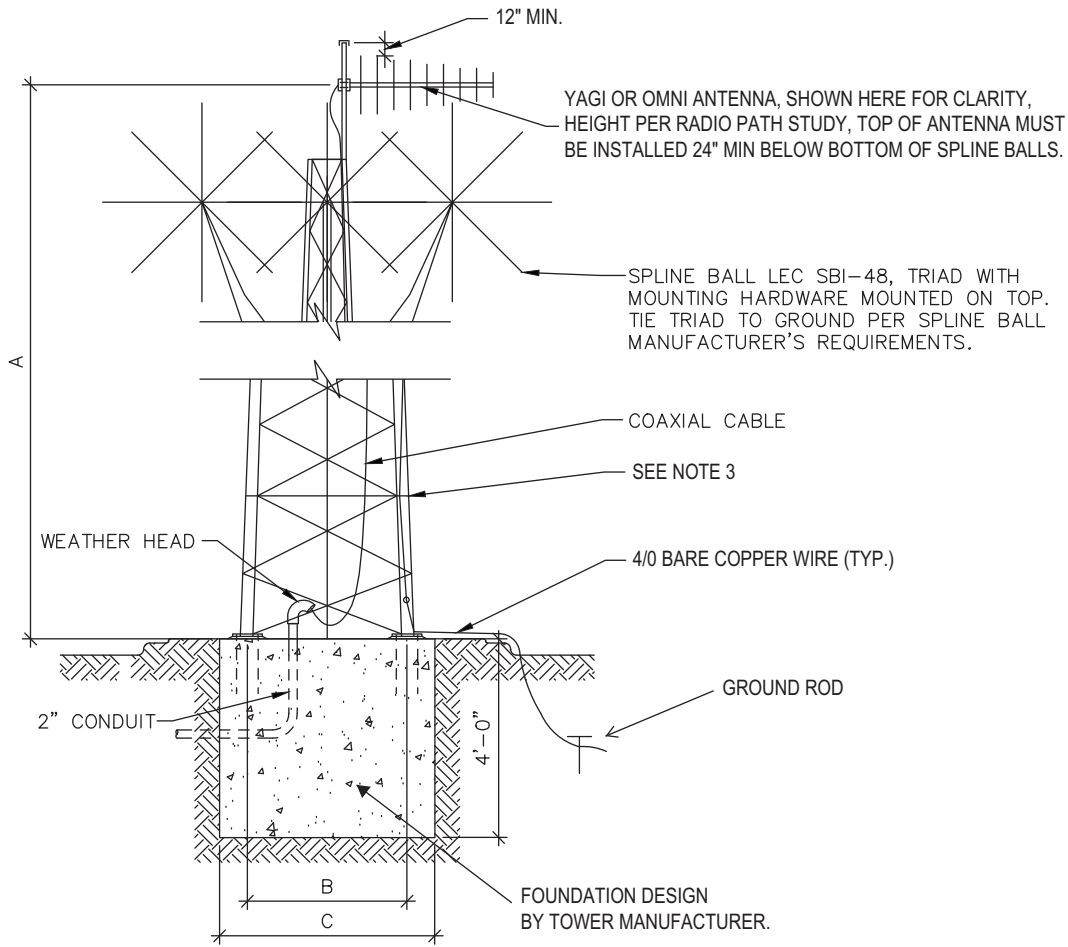
REINFORCED CONCRETE DUCT BANK

Guadalupe-Blanco River Authority, 01/30/2018



CONDUIT STUBUP DETAIL

Guadalupe-Blanco River Authority, 01/28/2018



GENERAL NOTES:

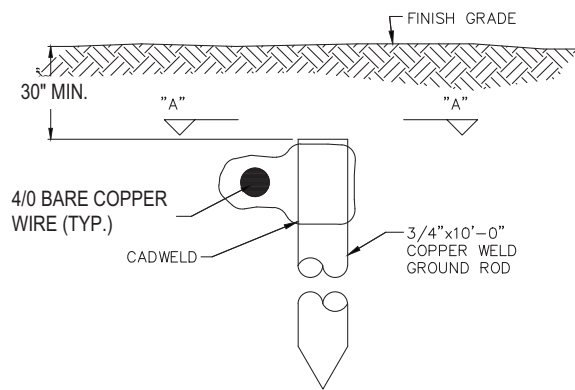
1. SUBMIT SPLINE BALL EQUIPMENT WITH STAINLESS STEEL MOUNTING HARDWARE. QUANTITY OF SPLINE BALLS PER MANUFACTURER RECOMMENDATION (3 MINIMUM).
2. COAXIAL AND GROUND CABLE SHALL BE SUPPORTED AT 3-FOOT INTERVALS IN ACCORDANCE WITH GBRA STANDARD SPECIFICATION SECTION 13428.
3. PROVIDE FALL PROTECTION AND ANTI-CLIMB DEVICES.
4. REFERENCE GBRA STANDARD SPECIFICATION 13428 FOR ADDITIONAL REQUIREMENTS.

OPTIONAL MAST

PERFORM RADIO PATH STUDY. PROVIDE TOWER OR MAST IN ACCORDANCE WITH RADIO PATH STUDY. IF MAST IS PROPOSED, MINIMUM 2" SCH 40 HDG PIPE OR LARGER WILL BE REQUIRED DEPENDING ON HEIGHT, MAST SPLICES OR COUPLINGS ARE NOT ALLOWED. IT MAY BE POSSIBLE TO MOUNT ANTENNA MASTS ON TOP OF GROUND STORAGE TANKS OR ATTACHED TO ELECTRICAL SHELTERS. EXTEND CONDUIT TO ROOF OF GROUND STORAGE TANKS. DEDICATED DIRECT GROUNDING AND LIGHTNING PROTECTION ARE REQUIRED. TOP OF ANTENNA TO BE 12" MIN BELOW TOP OF MAST. INSTALL THREADED HDG CAP ON TOP OF MAST.

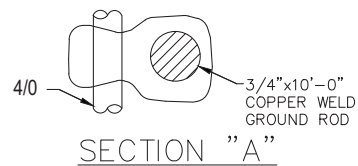
ANTENNA TOWER DETAIL

Guadalupe-Blanco River Authority, 01/28/2018



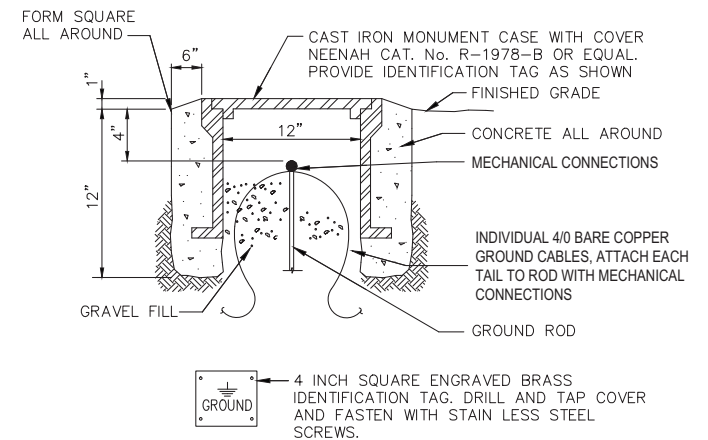
GROUND ROD

NTS



NOTE:

ANY EXPOSED OR ABOVE GRADE CONNECTIONS SHALL BE MECHANICAL TYPE WITH CRIMP LUGS. USE CADWELD FOR BURIED LOCATIONS.

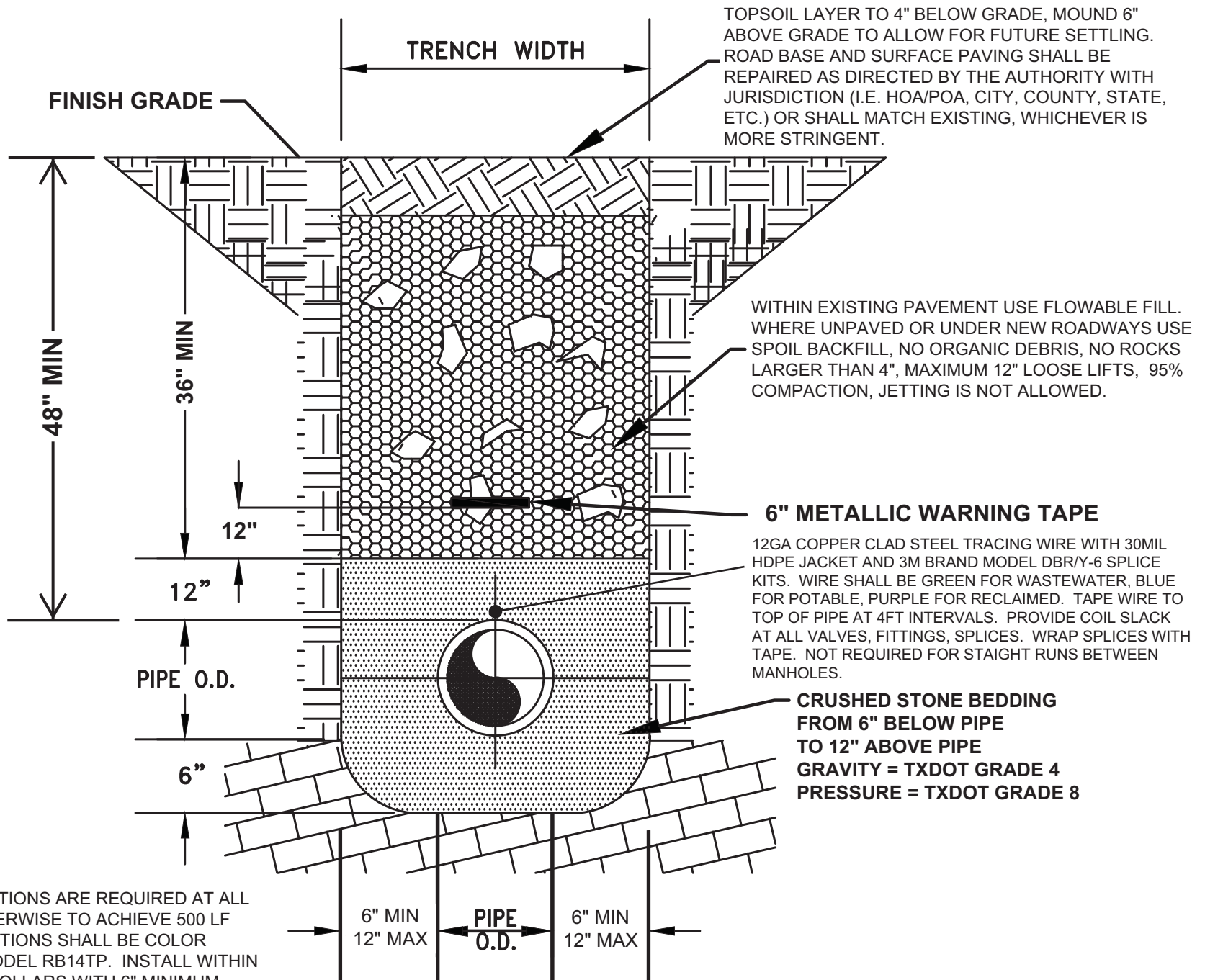


GROUND TEST WELL

NTS

GROUNDING DETAILS

Guadalupe-Blanco River Authority, 01/28/2018

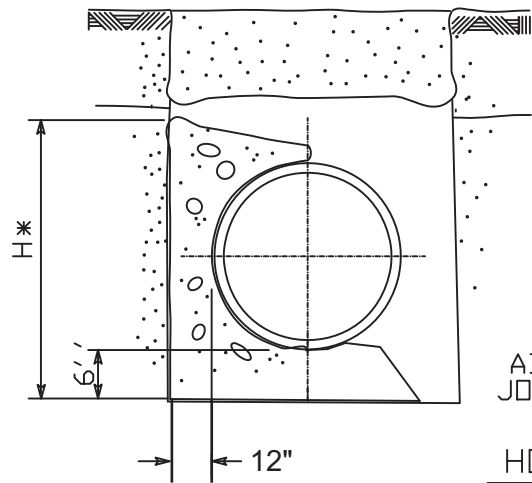


NOTE:

TRACING WIRE TEST STATIONS ARE REQUIRED AT ALL FIRE HYDRANTS OR OTHERWISE TO ACHIEVE 500 LF MAX SPACING. TEST STATIONS SHALL BE COLOR CODED COPPERHEAD MODEL RB14TP. INSTALL WITHIN VALVE BOX CONCRETE COLLARS WITH 6" MINIMUM CONCRETE COVER ON ALL SIDES. LEAVE 12" WIRE SLACK INSIDE TEST STATIONS. NOT REQUIRED FOR STRAIGHT RUNS BETWEEN MANHOLES.

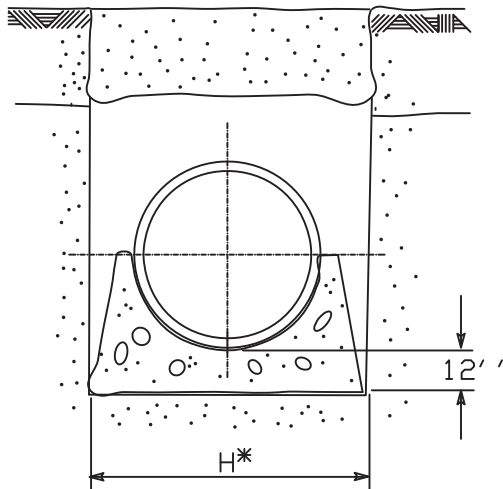
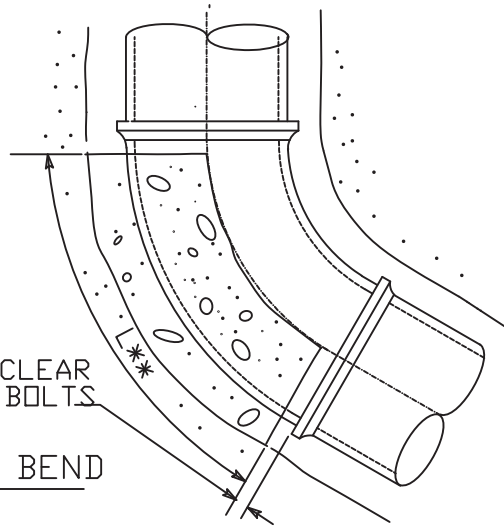
TYPICAL PIPE TRENCH

Guadalupe-Blanco River Authority, 02/05/2018

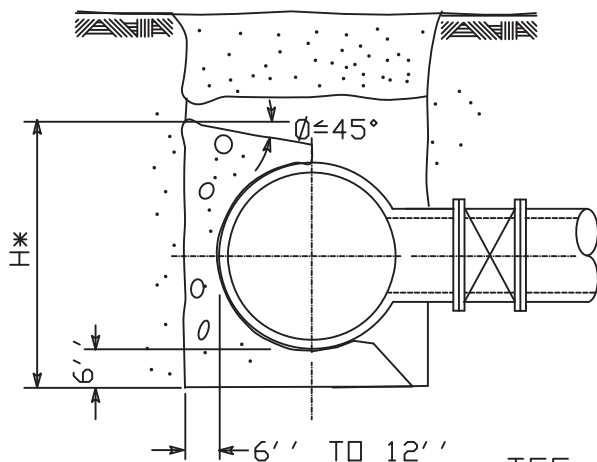
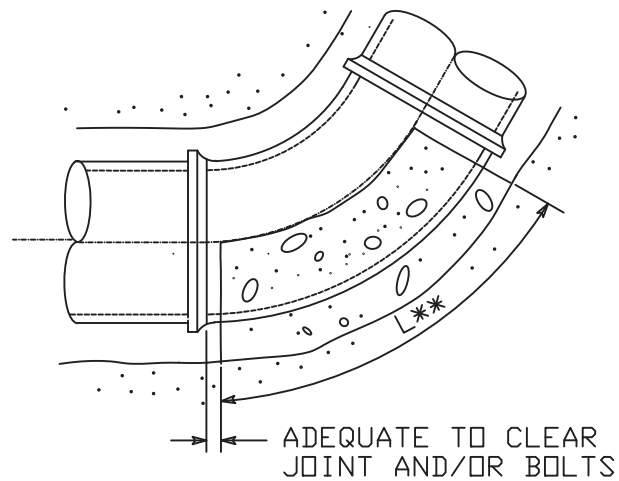


ADEQUATE TO CLEAR
JOINT AND/OR BOLTS

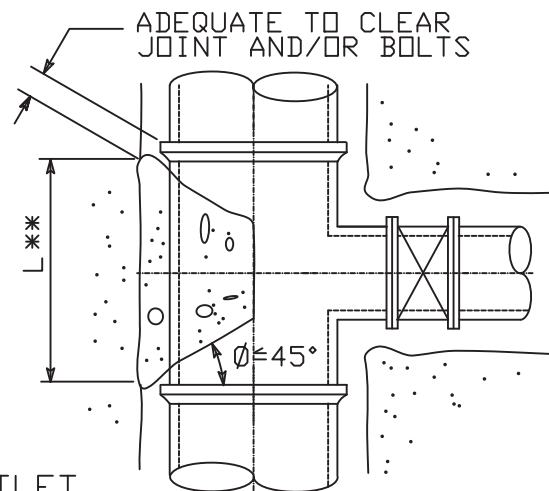
HORIZONTAL BEND



VERTICAL BEND UPWARD



TEE / OUTLET

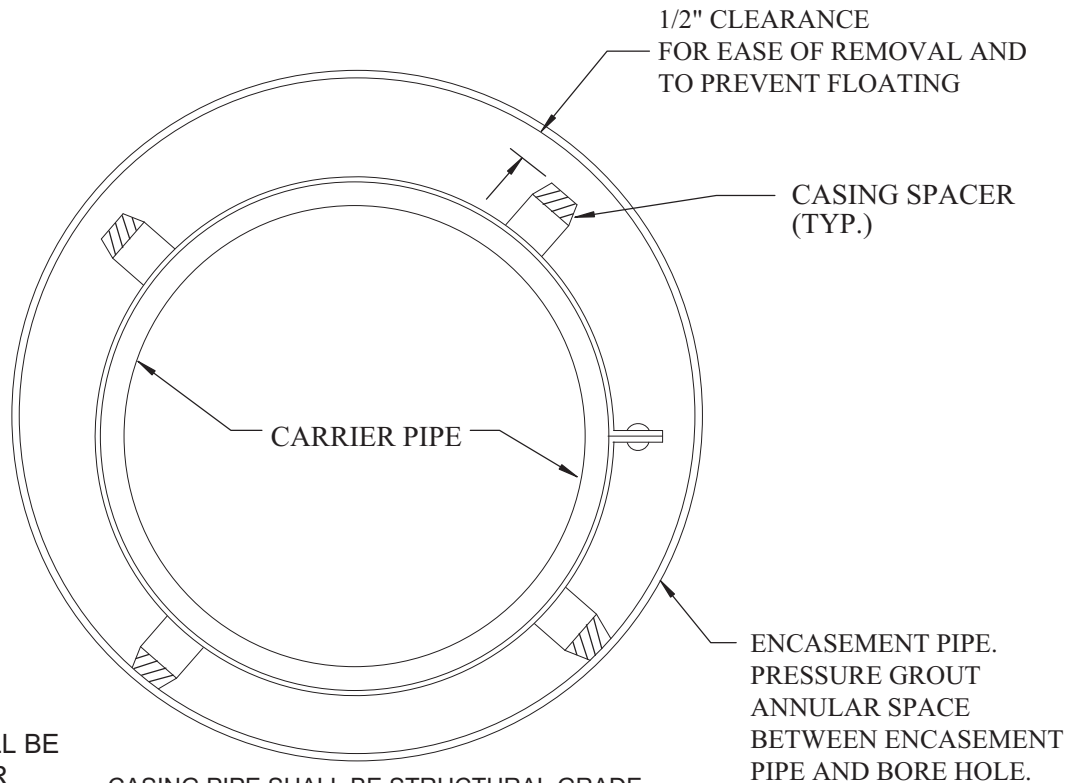


* THE DIMENSION FOR "H" MUST BE GREATER THAN DIAMETER OF THE PIPE.

** LENGTH "L" ALONG THE BEND MUST BE GREATER THAN "H" AND LESS THAN 2 TIMES "H".

NOTES: BLOCKING SHALL BE USED IN ADDITION TO MECHANICAL RESTRAINTS. BLOCKING MUST BE PLACED AGAINST UNDISTURBED EARTH. MECHANICAL RESTRAINTS SHALL BE PROVIDED 60 LF EACH WAY FROM ALL FITTINGS, VALVES, DEAD ENDS, ETC. MECHANICAL RESTRAINTS SHALL BE UNIFLANGE SERIES 1300, 1400, 1500.

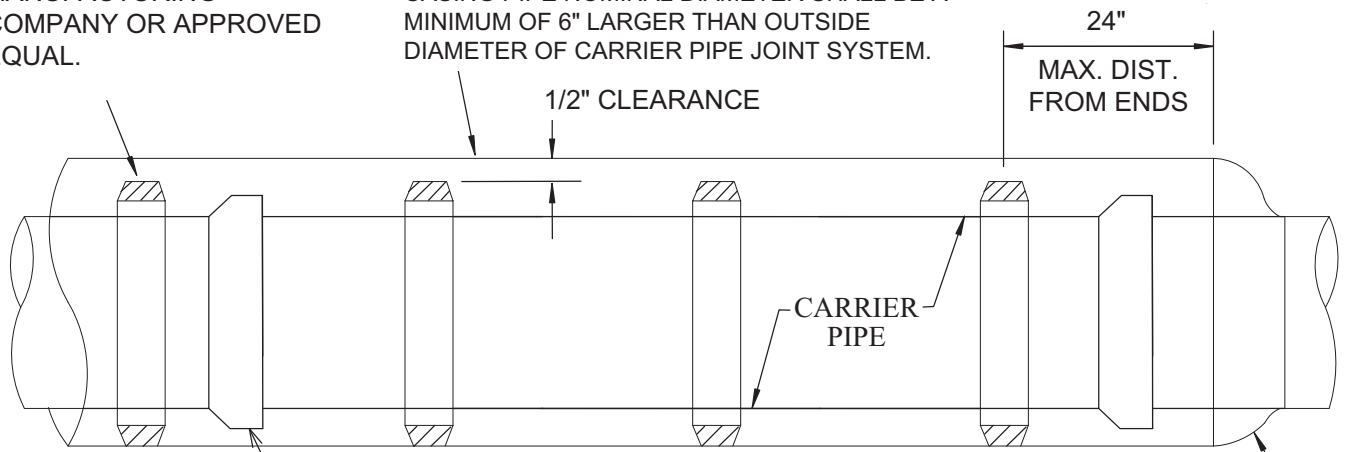
MECHANICAL RESTRAINTS & THRUST BLOCKING



CASING SPACERS SHALL BE STYLE CCS, CCS-ER, OR CCS-JR BY CASCADE WATERWORKS MANUFACTURING COMPANY OR APPROVED EQUAL.

CASING PIPE SHALL BE STRUCTURAL GRADE STEEL WITH A MINIMUM YIELD STRENGTH OF 35,000 PSI AND 3/8" MINIMUM WALL THICKNESS. CASING PIPE NOMINAL DIAMETER SHALL BE A MINIMUM OF 6" LARGER THAN OUTSIDE DIAMETER OF CARRIER PIPE JOINT SYSTEM.

ENCASEMENT PIPE. PRESSURE GROUT ANNULAR SPACE BETWEEN ENCASEMENT PIPE AND BORE HOLE.



CARRIER PIPE SHALL HAVE RESTRAINED JOINTS.

A MINIMUM OF THREE CASING SPACERS ARE REQUIRED PER FULL JOINT OF PIPE. MAXIMUM SPACING 8 FEET (O.C.). INSTALL SPACERS A MAXIMUM OF 2 FEET ON EACH SIDE OF BELLS OR MECHANICAL JOINTS.

CASING END SEALS SHALL BE SEAMLESS RUBBER PULL-ON TYPE WITH STAINLESS STEEL BAND CLAMPS.

NOTE:

THE MATERIALS SHOWN APPLY TO JACK AND BORE INSTALLATIONS AND STREAM/RIVER CROSSINGS. OPEN CUT SLEEVING OF SUBDIVISION UTILITIES UNDER STORM SEWER MAY BE C900/905 DR18 CASING (COLOR TO MATCH CARRIER PIPE) AND HDPE SPACERS WITH STAINLESS STEEL HARDWARE. THE CLEARANCES AND DIMENSIONS SHOWN APPLY TO ALL INSTALLATIONS.

Guadalupe-Blanco River Authority

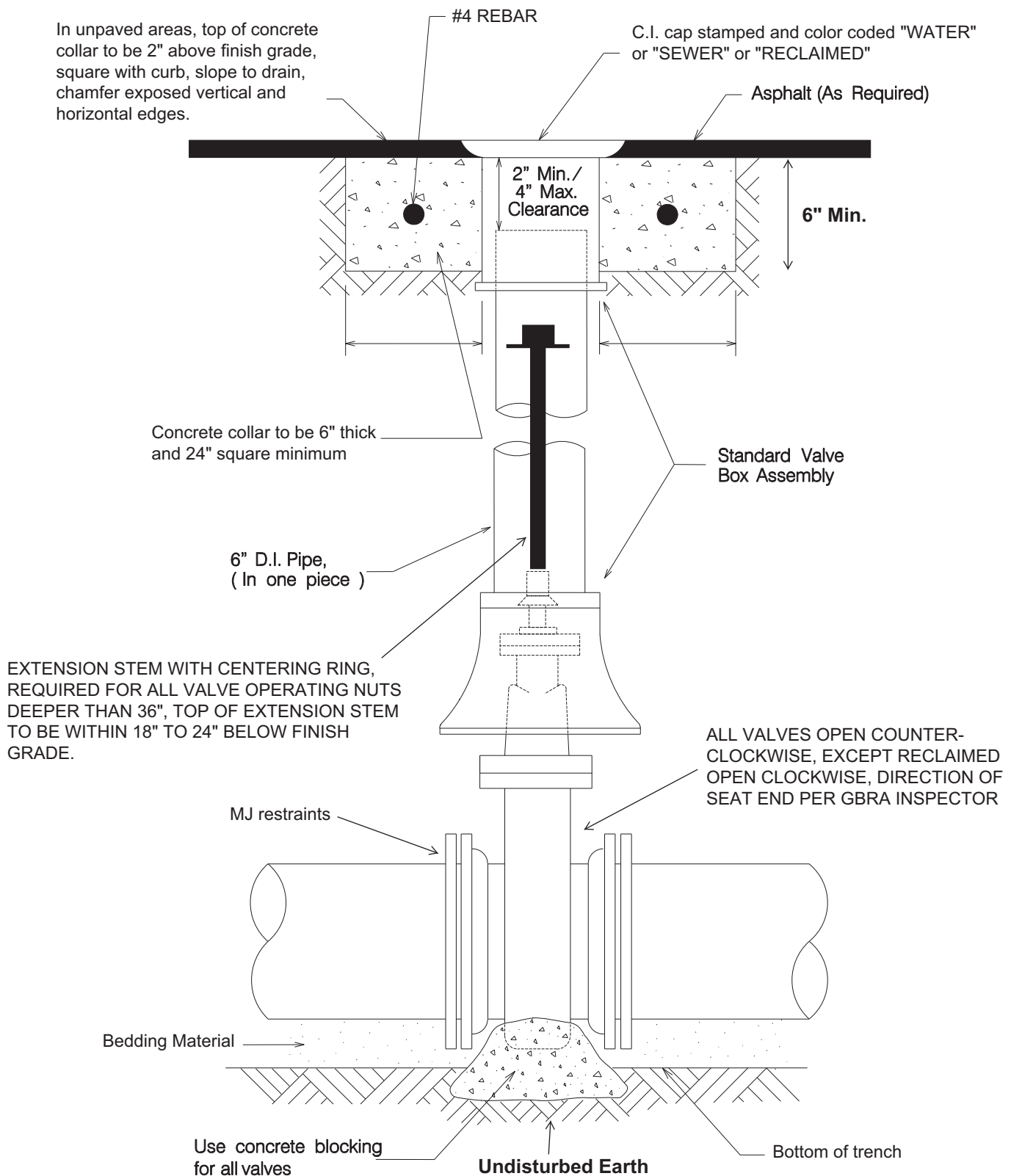
CASING AND SPACERS DETAIL

C. LEWIS

JAN. 28, 2018

THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD.

STANDARD NO.



NOTES:

- 1) FOR WATER, USE MJ RESILIENT WEDGE GATE VALVES, AFC SERIES 2500 OR GBRA APPROVED EQUAL.
- 2) FOR SEWER, USE MJ ROUND PORT PLUG VALVES BY CRISPIN, GA, MILLIKEN, OR PRATT WITH 304SS EXTERNAL BOLTS, NUTS, AND HARDWARE. PLUG VALVES SHALL BE HORIZONTAL SHAFT CLOSING DOWNWARD.
- 3) VALVE MARKERS ARE REQUIRED FOR ALL BURIED VALVES IN UNPAVED AREAS.
- 4) PVC MALE ADAPTERS ARE NOT ALLOWED.

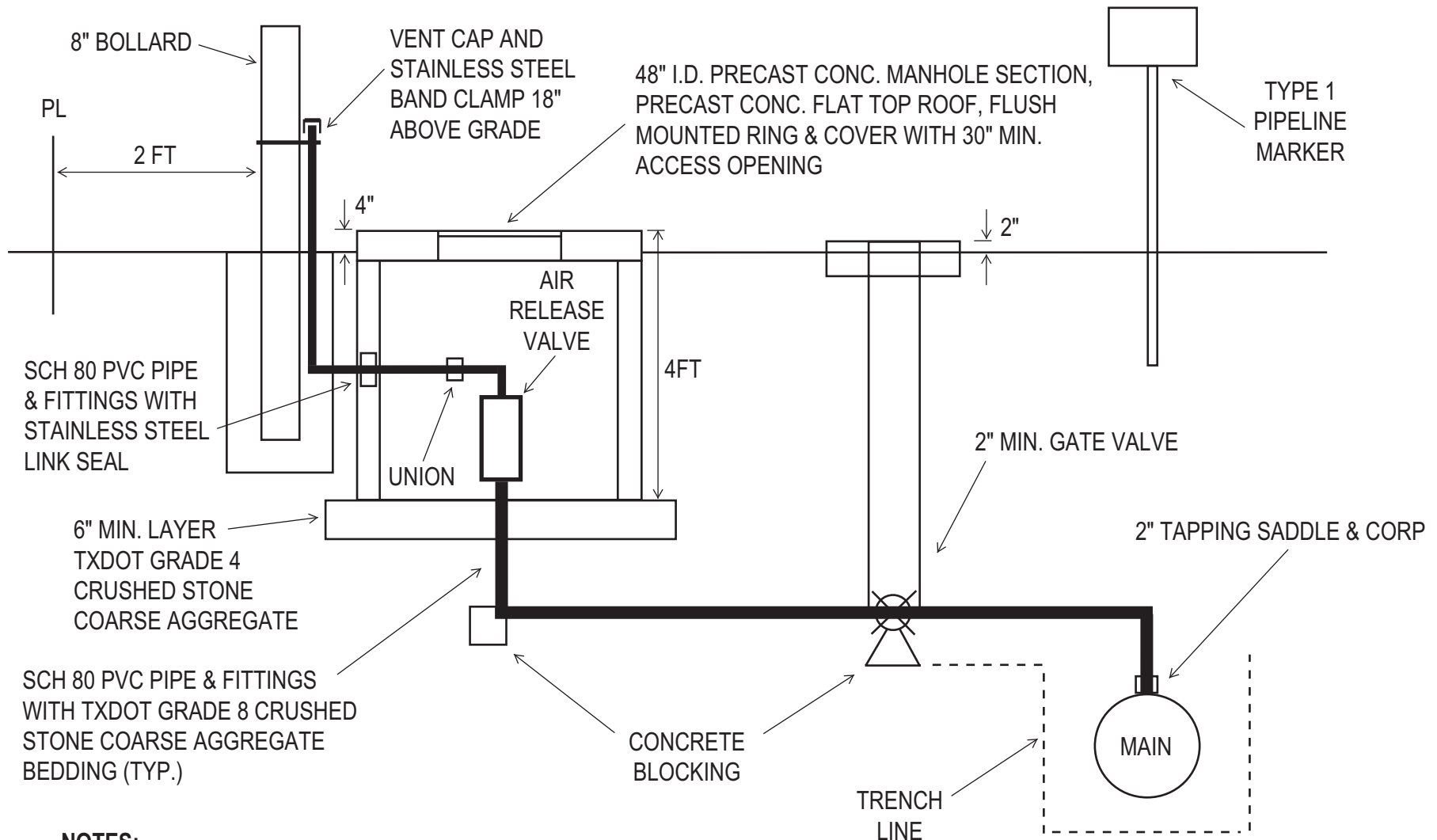
**Guadalupe-Blanco
River Authority**

**INSTALLATION OF VALVE
WITH VALVE BOX AND
EXTENSION**

APPROVED
C. LEWIS

REVISED
AUG. 31, 2017

SHEET

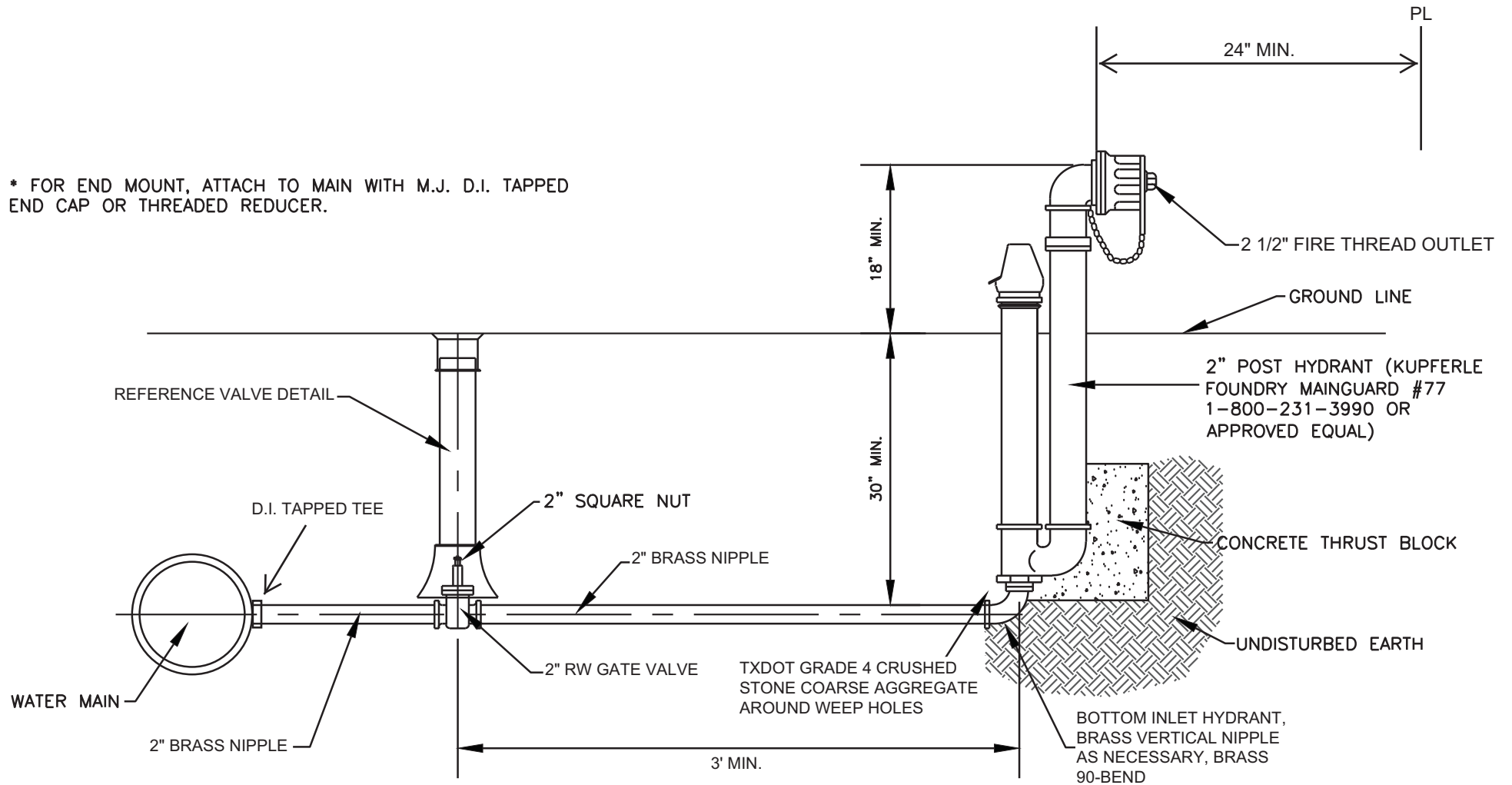


NOTES:

- 1) AIR RELEASE VALVE SHALL BE 2" MINIMUM A.R.I. MODEL D-040.
- 2) PVC MALE ADAPTERS ARE NOT ALLOWED.
- 3) TAPPING SADDLE SHALL BE BRASS WITH DOUBLE STAINLESS STEEL STRAPS BY FORD OR MUELLER.
- 4) CORP STOP SHALL BE 200 PSI MINIMUM BALL TYPE BY FORD OR MUELLER.
- 5) REFERENCE GBRA STANDARD DETAILS FOR BOLLARDS, BURIED VALVES, PIPELINE MARKERS, THRUST BLOCKING, ETC.
- 6) VENT CAP SHALL BE GALVANIZED CLAY AND BAILEY MFG. CO. #401 OR EQUAL WITH STAINLESS STEEL SCREEN.
- 7) EXPOSED VERTICAL AND HORIZONTAL CONCRETE EDGES SHALL BE FORMED WITH 3/4" CHAMFER STRIPS.

AIR RELEASE VALVE FOR WATER TRANSMISSION MAIN

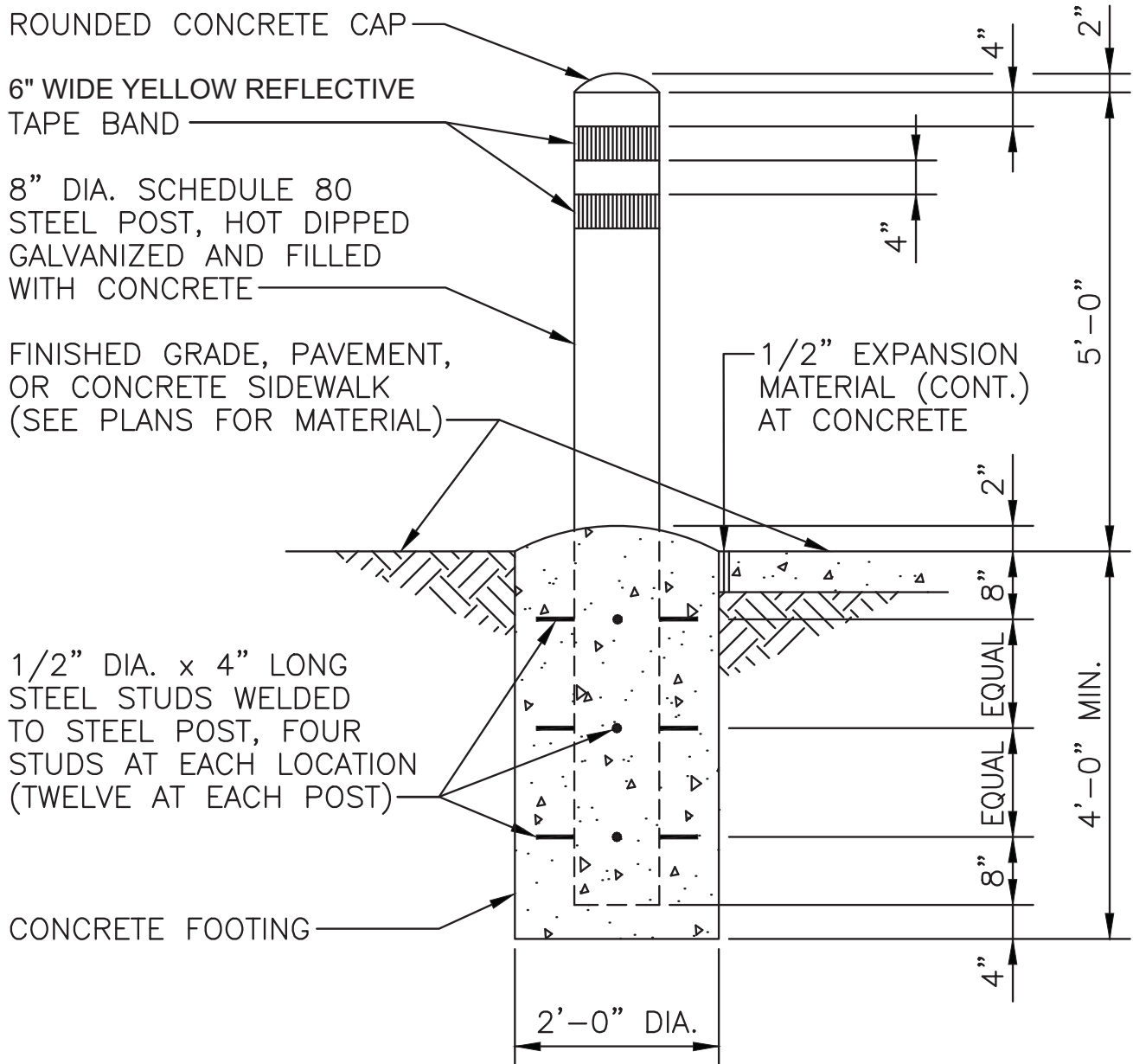
* FOR END MOUNT, ATTACH TO MAIN WITH M.J. D.I. TAPPED
END CAP OR THREADED REDUCER.



2" BLOWOFF HYDRANT DETAIL

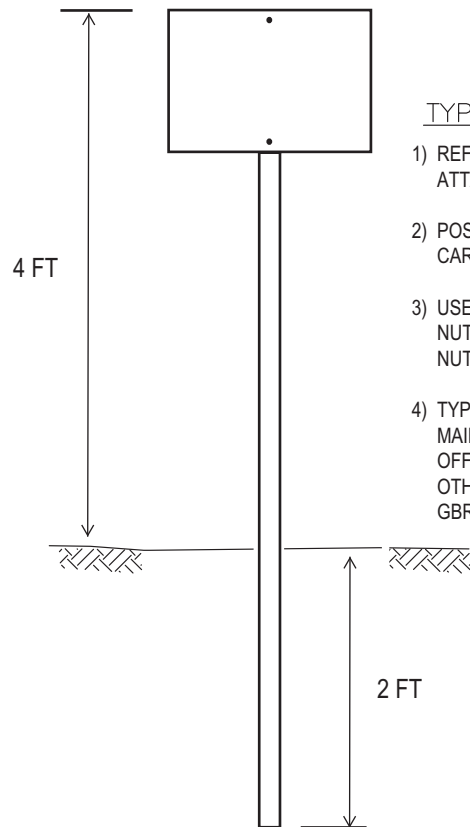
Guadalupe-Blanco River Authority, 01/28/2018

NOTE:
BOLLARDS ARE REQUIRED AT ALL BURIED VALVES AND AT OTHER
LOCATIONS WHERE SHOWN ON DRAWINGS.



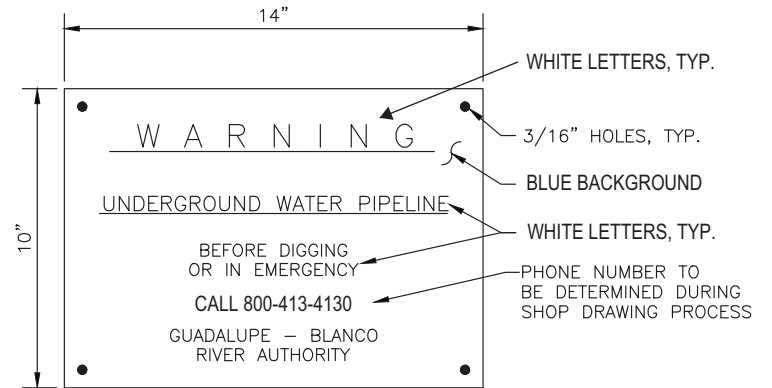
BOLLARD DETAIL

Guadalupe-Blanco River Authority, 01/28/2018



TYPE 1 MARKER NOTES:

- 1) REFERENCE TYPE 2 MARKER DETAIL FOR SIGN REQUIREMENTS. ATTACHMENT HOLES WILL DIFFER.
- 2) POST SHALL BE DRIVE-IN TYPE GALVANIZED U-CHANNEL (MCMASTER-CARR 5735T61 OR EQUAL).
- 3) USE 1/4" DIAMETER STAINLESS STEEL BOLTS, FLAT WASHERS, AND LOCK NUTS TO ATTACH SIGN TO POST. INSTALL FLAT WASHERS ON BOLTS AND NUTS. DO NOT OBSTRUCT LETTERING.
- 4) TYPE 1 MARKERS ARE REQUIRED IN UNPAVED AREAS AT ALL MANHOLES, MAIN LINE BENDS, VALVES, AIR RELEASE VALVES, TEST STATIONS, BLOW-OFF/DRAIN VALVES, HYDRANTS, LINE PLUGS OR CAPS, AND AT ANY OTHER LOCATIONS INDICATED ON THE DRAWINGS, OR AS DIRECTED BY GBRA.

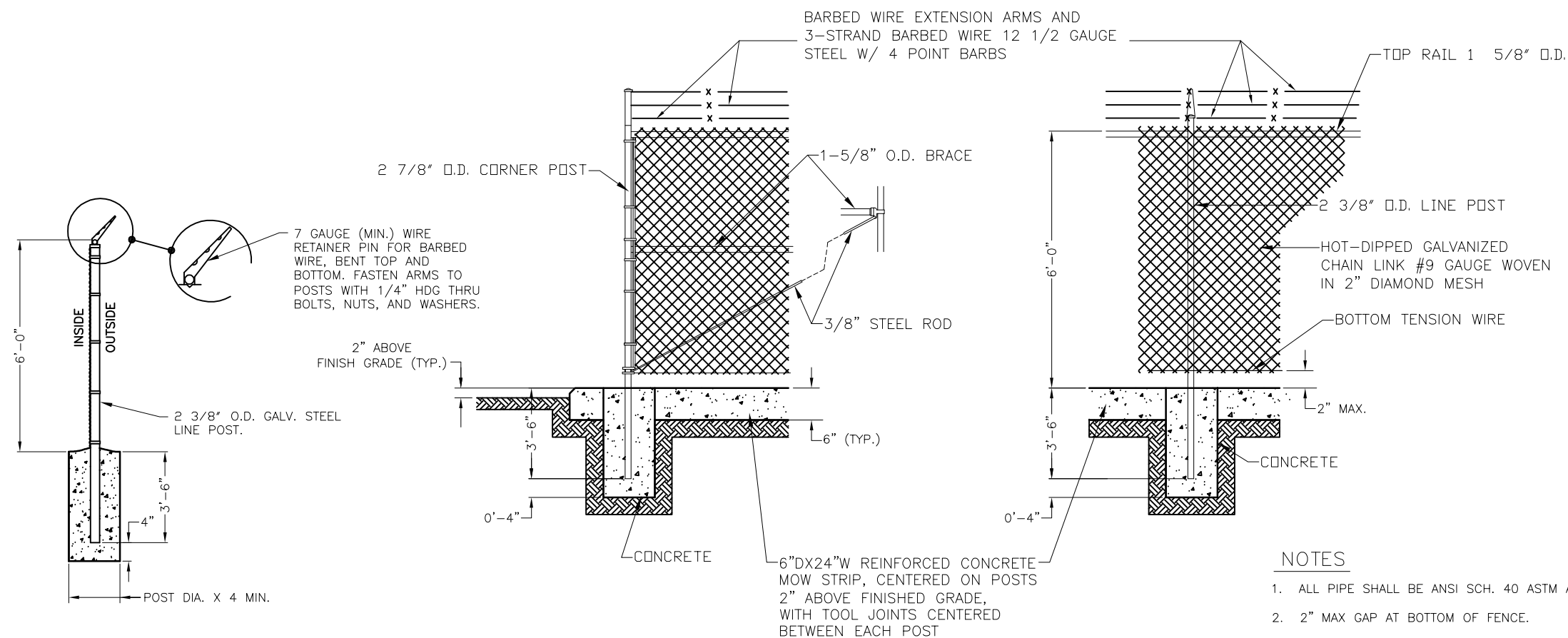
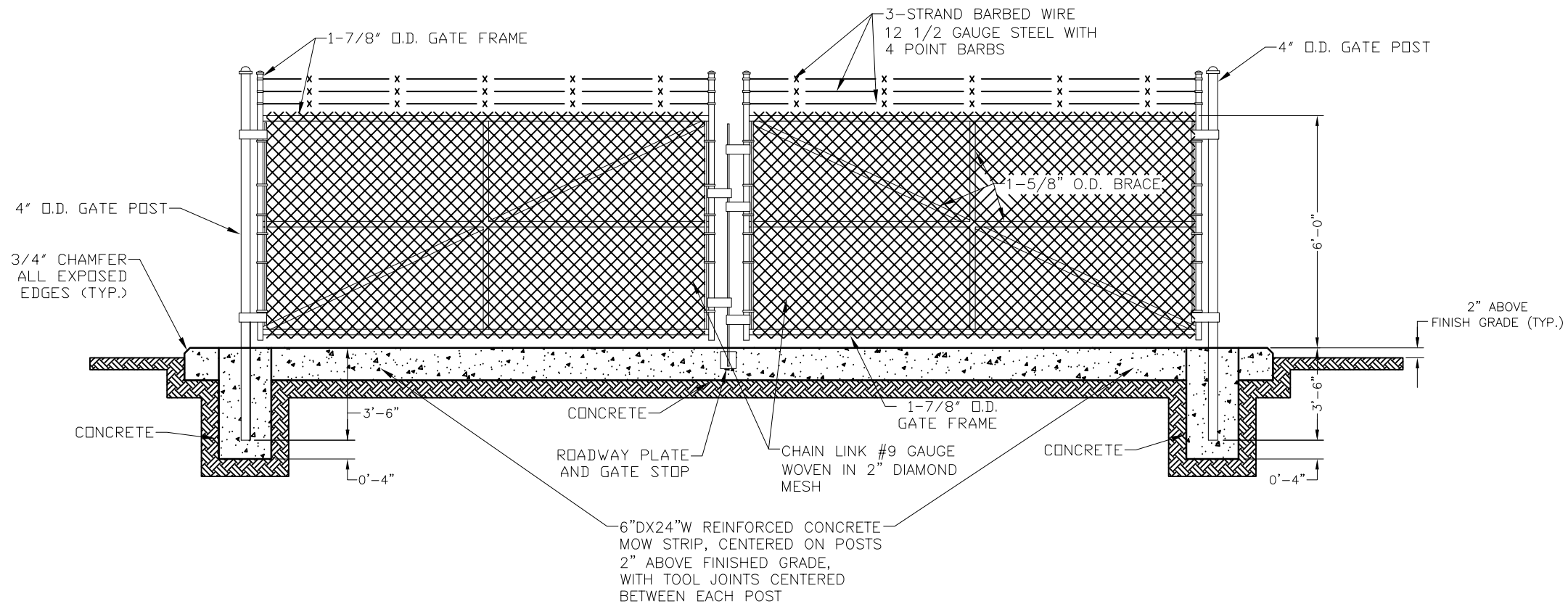


TYPE 2 MARKER NOTES:

- 1) MARKERS SHALL BE 0.080" THICK ALUMINUM WITH PAINTED BACKGROUND AND PAINTED LETTERING.
- 2) INSTALL TYPE 2 MARKERS ON PIPE CENTERLINE AT ALL GATE AND FENCE CROSSINGS AND AT ANY OTHER LOCATIONS INDICATED ON THE DRAWINGS, OR AS DIRECTED BY GBRA.
- 3) ATTACH TO GATES AND FENCES WITH 14 GAUGE STAINLESS STEEL WIRE.
- 4) COLORS AND LABELS SHOWN ARE FOR POTABLE WATER. FOR WASTEWATER CHANGE BACKGROUND TO GREEN AND CHANGE "WATER" TO "SEWER". FOR RECLAIMED CHANGE BACKGROUND TO PURPLE AND CHANGE "WATER" TO "RECLAIMED".

PIPELINE MARKERS

Guadalupe-Blanco River Authority, 01/30/2018



NOTES

1. ALL PIPE SHALL BE ANSI SCH. 40 ASTM A53.
2. 2" MAX GAP AT BOTTOM OF FENCE.
3. 10' MAX. POST SPACING.
4. INSTALL GATE LEAF HOLD BACKS.
5. ALL MATERIAL TO BE HOT DIP GALV.



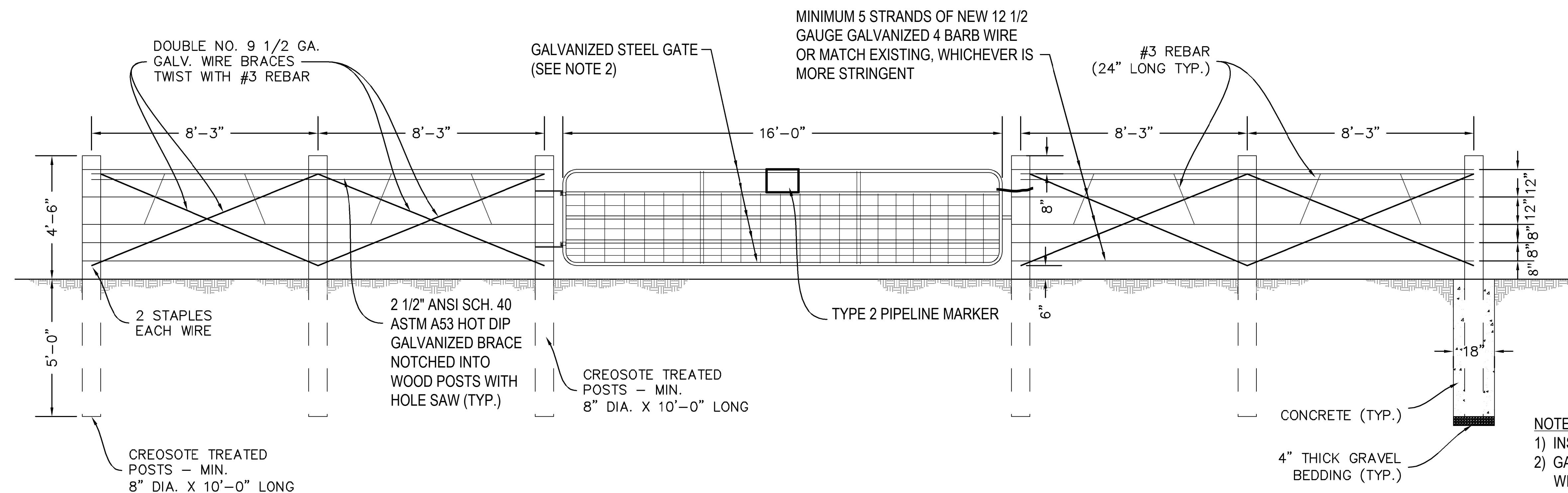
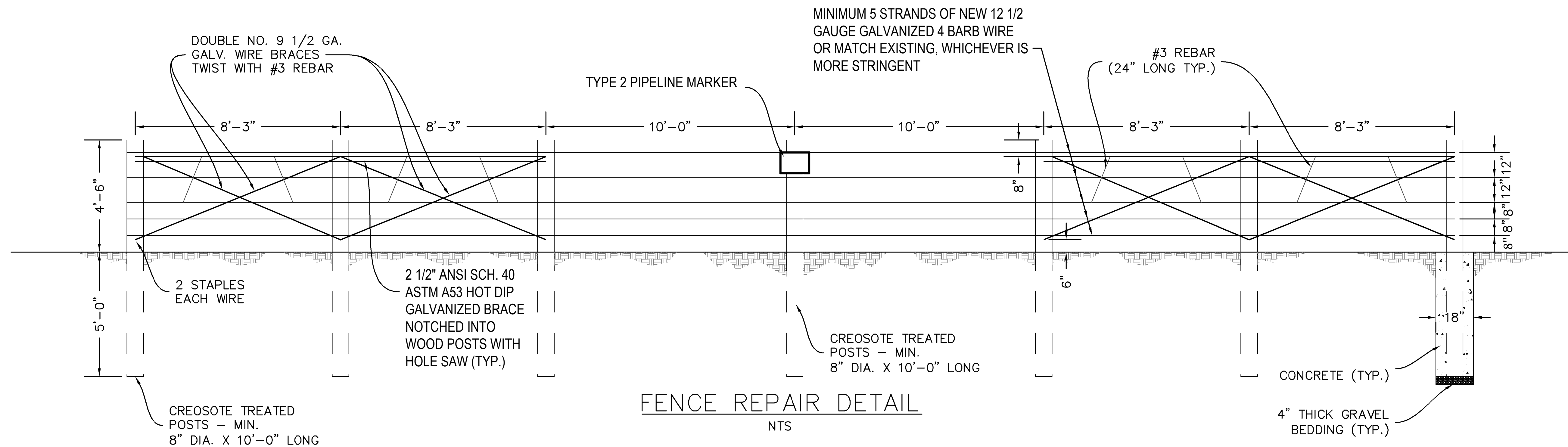
CHAIN LINK FENCE AND GATES DETAILS

REVISION
JAN 2018

OPERATIONS & MAINTENANCE ENGINEERING

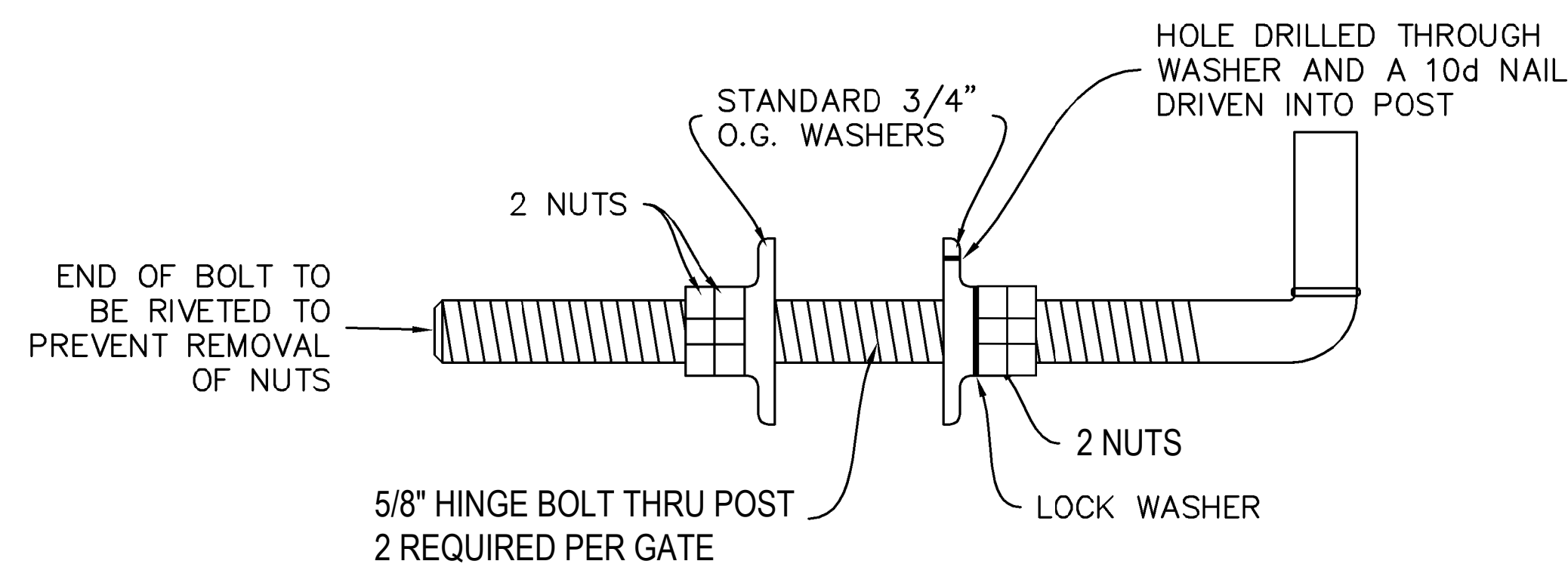
PROPERTY OF
GUADALUPE-BLANCO RIVER AUTHORITY
SEGUIN, TEXAS

LS-04



NOTES:

- 1) INSTALL GATE IN CENTER OF PERMANENT EASEMENT.
- 2) GATES SHALL BE CONSTRUCTED OF 16 GAUGE GALVANIZED STEEL 1 5/8" O.D. TUBING WITH WELDED SADDLE CONNECTIONS AND 4 GAUGE GALVANIZED HOG WIRE. CRIMPED CONNECTIONS ARE NOT ACCEPTABLE.
- 3) HINGES SHALL BE HOT DIP GALVANIZED, THRU BOLT TYPE AT POST, WITH RECEIVERS WELDED TO GATE.
- 4) LATCH SHALL BE 3 1/2" BRASS DOUBLE BOLT SNAP HOOK WITH 1/4" DIAMETER HOT DIP GALVANIZED CHAIN AROUND POST. SECURE CHAIN TO POSTS WITH FENCE STAPLES.
- 5) ALL POSTS SHALL BE TREATED WITH CREOSOTE.
- 6) CONCRETE SHALL CONTAIN AT LEAST 4 SACKS OF CEMENT PER YARD.
- 7) FASTEN EXISTING FENCE WIRES TO NEW BRACE POSTS BEFORE CUTTING THE EXISTING WIRES.



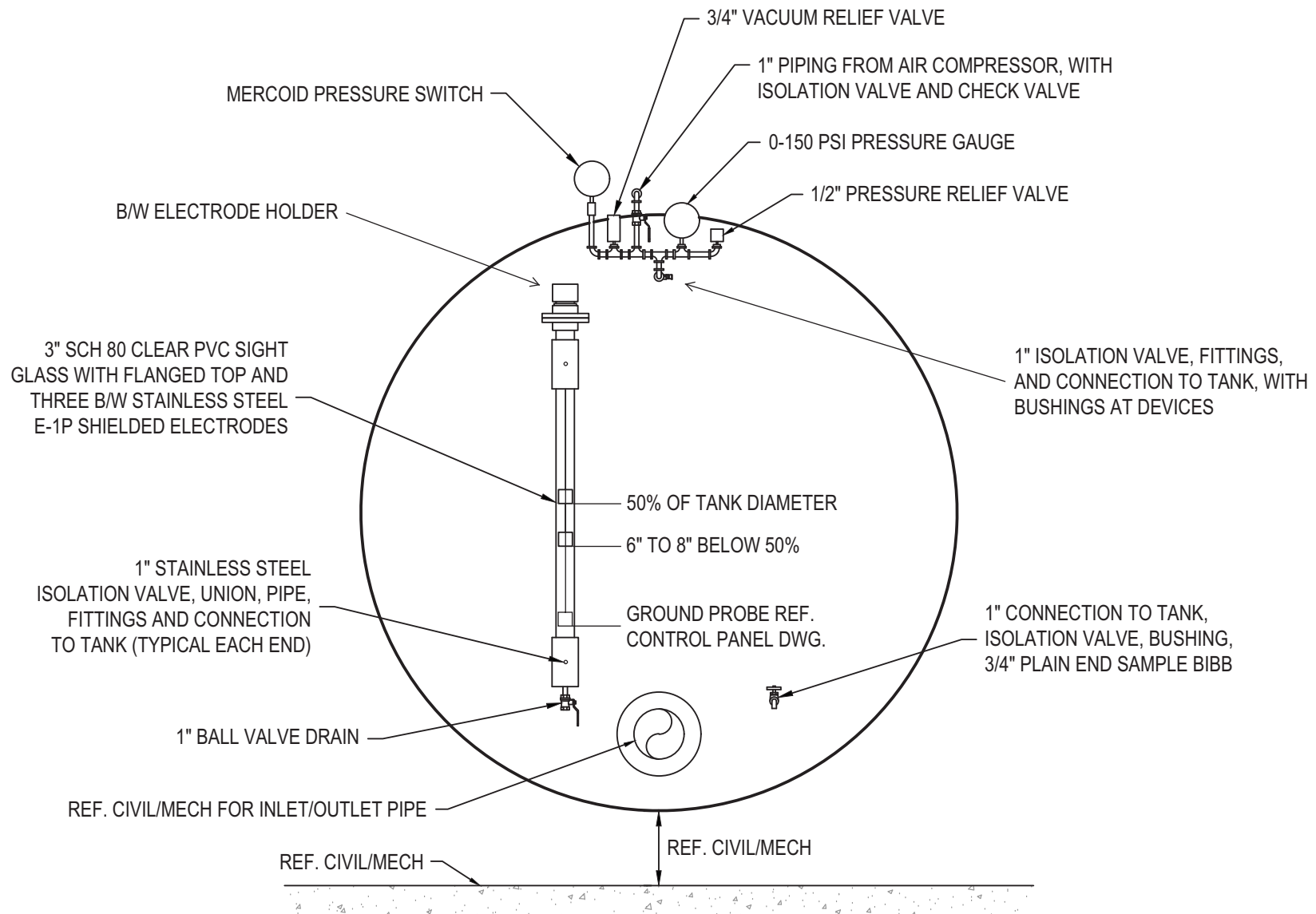
DETAIL OF GATE HINGE BOLT ASSEMBLY

NTS

GATE DETAIL

NTS

GATE AND BARBED WIRE FENCE DETAILS



NOTES:

- 1) ALL PIPE, FITTINGS, AND VALVES TO BE TYPE 316 STAINLESS STEEL WITH NICKEL PTFE THREAD SEALANT TAPE. PIPING TO BE SCH 40. ISOLATION VALVES TO BE LEVER HANDLE FULL PORT BALL VALVES.
- 2) REFERENCE AIR CUSHION CONTROL AND MAINTENANCE NARRATIVE.

HYDROPNEUMATIC TANK CONNECTIONS DETAIL

Guadalupe-Blanco River Authority, 01/30/2018

Hydropneumatic Tanks
Air Cushion Control & Maintenance Narrative
01/27/2018

Design Capacity

- TCEQ: minimum 20 gallons per connection
- Pump Runtime: water volume should be 50% of tank capacity (ideally 60% air, 40% water); verify maximum 15% of the water volume provides minimum 1 minute pump runtime (e.g. 500 GPM pump requires 6,667 GAL tank minimum; calc. $500/0.15 \times 2 = 6,667$)

Probes (3ea)

- The probes control the add air solenoid valve only, not the pumps
- The pumps should be controlled by pressure transmitters
- The air solenoid valve should not be allowed to open while pumps are running
- Top probe enables the add air solenoid valve to open, install bottom of probe at 50% tank capacity
- Middle probe closes/disables the add air solenoid valve, install this probe 6" to 8" below top probe
- Bottom probe is always submerged, it is a common/ground

Mercoird Switch

- This is for over pressure protection; it should lock the add air solenoid valve closed
- The switch should be normally closed
- High side should be set 5 PSI above system pressure for all pumps off (switch open)
- Low side should be set at system pressure for all pumps off (switch closed/reset)

Initial Startup

- Fill system with water
- Isolate tank from system
- Fill tank with water to 50% capacity
- Add air to system pressure for all pumps off
- Gradually introduce pressure from tank into system
- Allow system to stabilize
- Fully open valve from tank to system