



Standards and Design Guidelines for Wastewater Treatment Plants and Lift Stations

(Adopted March 2018)

Prepared by:



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The following standards are for the design of interim wastewater treatment systems, permanent wastewater treatment systems, and lift stations to be dedicated to GVSUD and/or operated by GVSUD. Please review the following guidelines carefully and contact GVSUD for a consultation meeting to address any related variances or other construction related matters.

Variances shall be accompanied by a cover letter, details and drawings of the proposed variance as well as payment of fees for review by the District's Engineer.

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

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INTERIM WASTEWATER TREATMENT PLANTS

Minimum Standards for Interim Wastewater Treatment Plants (5 Years Maximum and up to 100,000 GPD AADF)

Interim wastewater treatment systems will be allowed with the stipulation that they shall be replaced by permanent wastewater treatment systems within five (5) years, as measured from interim startup to permanent startup. The following standards are for the design of interim conventional extended air process wastewater treatment systems to be dedicated to GVSUD and/or operated by GVSUD. Please review the following guidelines carefully and contact GVSUD for a consultation meeting to address any related variances or other construction related matters.

These guidelines are for facilities with an annual average daily design flow up to 100,000 GPD. Larger facilities may have additional requirements, and the design of these facilities should be coordinated, in advance, with GVSUD staff.

Design and Documents

1. If construction has not commenced within one (1) year of GVSUD design approval, that approval is no longer valid.
2. GVSUD 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 GVSUD review and approval prior to bidding. Include master plan, plats, easements, design calculations, process flow diagrams, drawings, and specifications. Provide three (3) printed and bound half size copies and one (1) CD/PDF electronic copies. Allow 15 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 GVSUD review and approval.
 - a. Provide dedicated easements in the name of GVSUD. 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 GVSUD easements.
 - d. Designs for any proposed alterations or crossings of GVSUD easements must be approved in writing by GVSUD and the installation of such must be inspected and approved by GVSUD.
 - 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 GVSUD easements; gates must be centered across GVSUD utilities.
 - g. Customer water and wastewater services shall not be installed within fenced areas.

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6. Copies of each construction submittal (shop drawings, product data, etc.) shall be provided for GVSUD 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 facility by GVSUD. 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. Engineer to provide TCEQ 217.16 plant operation and maintenance manual.
 - c. Copies of all close-out submittals required by regulatory agencies (city, county, TCEQ, etc.).
 - d. Spare Parts: Provide a spare for each single point of failure item. Provide one change of lubricants and filters for each piece of equipment.
 - e. Provide CD backup copies of programming for PLCs, pump controllers, HMI and control room(s).
 - f. 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" with Engineering Fold. 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 GVSUD review and approval prior to printing final copies. Submit at least two (2) weeks prior to operator training.
 - g. Waiver of lien by contractor (and subcontractors, as appropriate).
 - h. 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.
 - i. Executed operating contract or bill of sale transferring facility to GVSUD.
 - j. As-Built and Record Drawings: Provide complete project drawing sets including all sheets and all trades. Submit electronic preliminary copies for GVSUD 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 GVSUD three (3) printed and bound half size copies and one (1) 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.

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General Requirements

1. Design and installation shall be in accordance with TCEQ rules and AWWA standards, and in accordance with GVSUD standards as further described in this document (see attachments). Any items or components that are intended to be permanent shall be furnished and installed in accordance with GVSUD standards for permanent facilities.
2. Wastewater systems shall be designed shall be based on minimum 300 GPD/EDU average daily flow, 4.0 peak factor, and 300 GPD/acre inflow and infiltration.
3. Noise and odor impacts shall be considered in design.
4. Piping friction losses shall be calculated with a Hazen-Williams coefficient no greater than 130 for plastic pipe, and no greater than 100 for concrete or metal pipe.
5. All equipment shall be designed to automatically reset after power outages.
6. All equipment shall have elapsed time meters.
7. All pumps shall be equipped with mechanical seals.
8. 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.
9. Cleanouts shall have cast iron frames and covers with concrete collars in accordance with GVSUD standard details.
10. 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.).
11. Provide color coded tracing wire (copper clad steel, 12-gauge, 30 mil HDPE jacket) for all buried piping.
12. Valve boxes, equipment, exposed piping and valves, and appurtenances shall be painted. Provide colors in accordance with TCEQ rules. Do not paint hot dip galvanized (except if immersed), stainless steel, brass, or aluminum items.
13. All exposed ferrous metals shall be painted with a minimum 3-coat system consisting of zinc-rich primer, white color high-build epoxy second coat, and polyurethane top coat. Immersed ferrous metals shall be coated with minimum two (2) coats of coal tar epoxy. Immersed hot dip galvanized items shall be coated with minimum two (2) coats of coal tar epoxy for a minimum of 12" above and below the normal water level. Install in accordance with manufacturer recommendations.
14. All submerged steel shall have a minimum thickness of ¼".
15. Provide adequate workspace and walkways to access all in-plant equipment. All valves shall be readily accessible from the walkways. Centerline of valve operators shall be 24" maximum outside handrail.
16. All walkways shall be a minimum of 36" wide. Provide a minimum of 24" workspace on all sides of clarifier drive. Walkways shall be designed for a maximum deflection under 100 PSF live load of L/360.

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17. 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.
18. Provide access ladders from clarifier bridge into effluent launder trough for cleaning and maintenance purposes.
19. All submersible pumps and mixers shall have dual mechanical seals. All submersible pumps and mixers shall be provided with a hoist, mast, winch, and full length lifting chains.
20. Air lift pumps shall be 3" minimum with expansion box, air release vent pipe, top entry 316SS interior stinger air pipe thru 4" minimum flanged top cleanout with union, lever operated full port ball valve, and 316SS lifting chains. Centerline of cleanout shall be 24" maximum outside handrail.
21. Each basin and clarifier shall have drain piping with a hose connection. Hose connections shall be aluminum 3" female camlock with plug.
22. Each basin and clarifier shall have gates or valves to allow it to be hydraulically isolated.
23. Gate valves are not allowed for wastewater use. Valves shall be round port plug valves, horizontal shaft, closing downward, by Crispin, GA, Milliken, or Pratt.
24. PVC ball valves shall be Sch 80 true union type by GF, Hayward, Nibco, or Spears.
25. PVC male adapters are not allowed.
26. Flange coupling adapters shall be Smith Blair Model 911. Flange adapters are not allowed within hydraulic structures.
27. Non-potable water (NPW) shall be used for all in-plant uses. Suction for NPW pumps shall be from the chlorine contact basin 24" above floor. Provide freeze protection, basket strainers, flow meter, and minimum 250-gallon pressure tank. NPW system shall be designed to maintain 80 PSI minimum working pressure. Provide a 1" hose station 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. At ground level, provide 1" Woodford Y1 non-freeze yard hydrants. In elevated locations, provide insulated 1" hose bibbs. Clearly label as non-potable.
28. For potable water service, 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.
29. Provide open channel effluent flow metering with staff gauge, primary and secondary measuring devices, for both the chlorine contact basin and for plant discharge after the final treatment unit. Provide a 10" diameter, seven (7) day chart recorder for each flow meter. Install flow meter displays and chart recorders inside the Operations Building. Staff gauges shall be painted aluminum displaying feet, tenths, and hundredths. Flow meters shall be HydroRanger 200 or Greyline SLT 5.0 flow monitor.
30. All exposed vertical and horizontal concrete edges shall be formed with 3/4" chamfer strips.
31. Hydraulic structures must pass leakage testing prior to application of any coatings or linings. Fill with clean water to overflow level. Allow minimum 24-hour saturation period. Test

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duration is 1-hour. No allowable leakage. Test each basin or chamber separately. Any areas of visible moisture shall be repaired and retested.

32. All testing shall be performed by the contractor and witnessed by GVSUD.
33. Contractor shall perform operational demonstration testing. Contractor shall startup, test, and verify all equipment is operational prior to scheduling GVSUD to witness demonstration testing. Operator training shall be conducted on a separate day after demonstration testing. Contractor shall coordinate schedule with GVSUD at least two (2) weeks in advance.
34. The contractor shall provide for uninterrupted wastewater treatment at all times during construction. Any work involving power outages, bypass pumping, pump and haul, or any other wastewater process interruption must be performed between 8:00am and 5:00pm excluding weekends and GVSUD approved holidays. All necessary temporary power, bypass pumping, pump and haul, temporary plugs, etc., shall be furnished and performed by the contractor. Coordinate and schedule any such activities with GVSUD at least two (2) weeks in advance.
35. Explosives and blasting are not allowed.
36. Reference "GVSUD Design Guidelines for Developer Utilities" for inspection requirements, survey staking, piping, manholes, testing requirements, etc. All work shall be in accordance with GVSUD standards as published at the following website: <http://www.gvsud.org/>

Headworks

1. Provide manual bar screens with maximum ½" openings and drying decks. Size screens and decks to be removable by one person. Minimum thickness shall be 3/16". For gravity fed facilities, provide mechanical screens with backup manual bypass bar screens.

Anaerobic/Anoxic Zones

1. For systems utilizing an internal recycle of MLSS, provide ability to control recycle rate proportional to plant influent flow.
2. If submersible mixers or pumps are utilized for mixing or internal recycle, all submersible pumps and mixers shall have dual mechanical seals. All submersible pumps and mixers shall be provided with a hoist, mast, winch, and full length 316SS lifting chains.
3. Provisions shall be made for initial low flows. Provide an anoxic zone that can be utilized as aeration during initial low flow phases.

Aeration Zone

1. Guaranteed oxygen transfer efficiency shall be 9% minimum at the design diffuser submergence at design air flow rate. Oxygen transfer efficiency shall be guaranteed and substantiated by submission of test data compiled by a nationally recognized independent testing laboratory.
2. Each diffuser assembly shall be easily removable from tank manually by one person.

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3. PVC is not acceptable for aeration drops. Each diffuser drop pipe assembly shall consist of a union to allow for ease of removal, a lever operated ball valve accessible from the walkway for the purpose of shut off and regulation of air supply, and the necessary pipe and fittings. All valves shall be readily accessible from the walkways. Centerline of valve operators shall be 24" maximum outside handrail.
4. Provisions shall be made for initial low flows. Provide an anoxic zone that can be utilized as aeration during initial low flow phases.

Aeration Blowers

1. Aeration blowers shall be one of the following:
 - a. Positive displacement blowers, operating at a speed less than 1780 rpm; by Aerzen, Gardner Denver, or Kaeser.
 - b. High speed turbo blowers by Hoffman or HSI.
 - c. Multi-stage centrifugal blowers by Gardner Denver, Hoffman, or HSI.
2. Provide the following items for each blower:
 - a. Isolation valves.
 - b. Check valves.
 - c. Adjustable pressure relief valves.
 - d. Inlet and discharge silencers and separate inlet filter. Combined inlet filter/silencers are not acceptable. Provide inlet air filter monitor gauges.
 - e. Secure blowers to equipment pad with vibration isolators and anchor bolts.
3. Maximum allowable sound level shall be 75 dBA at 10 feet. Provide insulated housings if necessary to meet this requirement.
4. Provide a pressure gauge and transmitter assembly on the common discharge header, in accordance with GVSUD standards, for monitoring and to provide low pressure alarm to auto dialer.
5. PVC piping is not allowed for aeration piping.

Clarifiers

1. Clarifiers, including piping, inlet, feedwell, and sludge scrapers, shall be in accordance with recommendations of WEF MOP-8.
2. Minimum sidewater depth in clarifier shall be 10'-0", with a minimum floor slope of 1:12.
3. Provide dual scum skimmers and a rotating pipe scum collection trough that extends the full radius of the clarifier, from the scum baffle at the outside, to the torque tube on the inside, thereby eliminating any possibility of scum escaping the system. Scum piping shall be provided to allow discharge to either the digester or the aeration basin.
4. Provide scum spray system with brass nozzles and an isolation valve at each nozzle and a master valve to isolate the entire system. Use Sch. 80 PVC pipe, valves, and fittings.
5. Weirs and scum baffle fasteners shall allow for adjustment.

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6. RAS/WAS pumping
 - a. Air-lift pumps are acceptable for RAS and WAS pumping, but shall be provided with sludge measurement box and weir. RAS piping shall be minimum 6" diameter with maximum 45-degree bends. Reference "General" above for additional requirements.
 - b. If mechanical pumps are utilized, they shall be positive displacement type by Gorman-Rupp, Hayward-Gordon, or Wemco; and shall be capable of passing 2" solids. Provide belt drive or VFD (adjustable sheaves are not allowed).

Aerobic Digesters, Sludge Dewatering and Disposal

1. Provide telescoping valve, air lift, or other means of decanting digester and returning supernatant to plant headworks.
2. Provide a staff gauge in each digester extending from floor to top of wall. Staff gauges shall be painted aluminum displaying feet, tenths, and hundredths.

Filtration (if required)

1. Filters shall be required for any facilities with permit limitations requiring phosphorus removal, for facilities with effluent TSS limits less than or equal to 5 mg/L, or where required by TCEQ.
2. Design overflow piping to accommodate peak flow.
3. Provide chlorine injection upstream of filters.
4. Provide hoist and access platform. Access platform shall be of sufficient size to lay a filter element flat on the platform with 18" minimum clearance on all sides to facilitate replacement of cloth media.

UV Disinfection (if utilized)

1. Provide minimum of two (2) channels of UV equipment.
2. Flow-pace UV system to reduce energy consumption.

Chlorination (if utilized)

1. All equipment and hardware in chlorination rooms shall be PVC, FRP, or other materials resistant to chlorine gas.
2. Chlorination equipment shall be gas type by Hydro Instruments or Superior. Provide automatic flow pacing, cylinder scales, automatic switchover, brass wye strainer, and manual bypass piping and valves around solenoid valve.
3. 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.
4. Provide an intake fan and exhaust louver. The intake fan shall automatically shutdown when a chlorine leak is detected.

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5. Provide sidewalk and ramp at entrance to chlorination rooms.
6. Provide standard PM kits for each chlorinator, injector, and vacuum regulator.
7. Provide a Chlorine Institute Emergency Kit.
8. Provide Scott SCBA with fully charged carbon fiber tank and Scott AV-2000 face mask. Install storage cabinet in a non-chemical area/location.
9. Provide non-freeze combination eyewash showers.
10. Provide a potable water hose bibb in the chlorination room for backup supply during NPW maintenance and repair. Provide a hose connection point and isolation valve on the NPW supply piping in the chlorination room.
11. For fiberglass chemical buildings, reference GVSUD Standard Specification 13124.

Chemical Feed (if required)

1. Provide automatic flow pacing for each chemical feed system.
2. Provide redundancy for each chemical feed system.
3. Each chemical storage tank shall be equipped with an ultrasonic level indicator with local display.
4. All equipment and hardware in chemical buildings shall be PVC, FRP, or other chemical resistant materials.
5. For facilities with effluent phosphorus limitations, provide chemical feed system for phosphate precipitation, sized for ultimate peak flow. Provide two (2) peristaltic metering pumps, each rated for ultimate peak flow.
6. The use of methanol as a supplemental carbon source is not acceptable. Micro-C or other non-hazardous supplemental carbon sources shall be utilized, if required.
7. Provide concrete curb containment and floors with broom finish. Slope floors to recessed sump pits.
8. Provide interior and exterior ramp at entrance to each chemical room.
9. Provide non-freeze combination eyewash showers.
10. For fiberglass chemical buildings, reference GVSUD Standard Specification 13124.

Operations Building

1. Provide an insulated 12'x12' portable building with the following items:
 - a. Plywood interior.
 - b. Sink with potable water.
 - c. Window above sink.
 - d. 12' countertop and base cabinets.
 - e. Window A/C unit.

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- f. Portable floor heater.
- g. Lights.
- h. Receptacles.
- i. Door hardware with Best brand key system, construction cores, and control keys.

Site Improvements

1. Roads shall be a minimum of 16ft wide.
2. Fencing shall be designed to minimize noise impacts if necessary. Comply with TCEQ requirements. If chain link fencing is used, follow GVSUD standard details.

Electrical, Instrumentation, and Controls

1. Electrical work shall be installed in accordance with NEC.
2. 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; IMC conduit on top of ground would be acceptable (not buried). Provide interior and exterior layout details, schematics, and one-line diagrams for all control panels and MCCs.
3. Engineer to design grounding system for panels, generator, and metal structures. 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. Main electrical service shall be provided with a Transient Voltage Surge Suppressor (TVSS)/Surge Protection Device (SPD) including overcurrent protection on each leg.
6. Electrical service shall be 480V 3-phase. Phase converters are not allowed.
7. Provide a cellular auto dialer with email capability to monitor all equipment. Backup power supply shall be a 24V battery system with trickle charger. The battery system shall have sufficient capacity to power the auto dialer for a minimum of four (4) hours duration.
8. All floats shall have one NO and one NC set of contacts.
9. Provide full voltage non-reversing NEMA sized starters with a minimum size of 1. Half sized starters and IEC starters are not allowed. Provide these starters with solid state overload relays.
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 be tested in accordance with NFPA 70.
12. All components shall be labeled on the backplane with white adhesive tape type labels with black machine printed 3/16" block lettering.
13. All control panel and MCC control wiring shall be color coded as follows:
 - a. AC controls Red
 - b. DC controls Blue
 - c. DC (+) power Red
 - d. DC (-) power Black

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- e. AC hot Black
- f. AC neutral White

14. Phase colored tape is required for all conductors.
15. All 4-20mA signal wire shall be 20 AWG twisted shielded.
16. A separate neutral conductor is required for every 120VAC circuit.
17. A separate grounding conductor is required for every raceway, including electrical and I&C. Minimum size is 12 AWG.
18. Label wiring with Ideal pre-printed wire markers.
19. Enclosures in chemical areas shall be NEMA 4X FRP or PVC. In climate-controlled areas, provide NEMA 1A gasketed or NEMA 12 enclosures for starters, disconnects, enclosed circuit breakers, control panels, MCCs, and RTU cabinets. All other enclosures shall be NEMA 4. All enclosures shall be provided with external mounting lugs and lockable 3-point latch system. Mount all enclosures on vertical strut.
20. Provide type written panel directories and laminated as-built schematics and diagrams in all electrical panels.
21. Electrical panels shall have aluminum bus.
22. 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 cable. Label circuit numbers on all device covers with white adhesive tape type labels with black machine printed 3/16" block lettering.
23. All receptacles shall be ivory color duplex 110V 20A GFCI-WR. Outdoor locations shall have aluminum in-use covers.
24. Exposed/above ground conduit may be Sch 40 PVC (3/4" minimum). Duct banks may be IMC conduit on top of ground, not buried (1" minimum).
25. For flexible conduit, 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.
26. Use FRP hardware, strut, straps, and anchors in chemical areas. All electrical enclosures, devices, and light fixtures shall be mounted on strut.
27. Use grounding type Myers hubs with insulated throats for all enclosure entries.
28. Use aluminum seal-off fittings where required by NEC, seal with 3M-2123 re-enterable sealing compound.
29. Field bending of conduit shall be accomplished using the appropriate tools. Flame bending is not allowed.
30. Megger test load and line conductors of all power circuits and submit test reports.
31. Resistance to ground for site grounding shall be 5 Ohms or less. Contractor shall perform Fall-of-Potential three-point ground megger testing.

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32. All testing shall be performed by the contractor and witnessed by GVSUD. Test equipment must be calibrated within the previous 12 months.
33. Contractor shall perform operational demonstration testing. Contractor shall startup, test, and verify all equipment is operational prior to scheduling GVSUD to witness demonstration testing. Operator training shall be conducted on a separate day after demonstration testing. Contractor shall coordinate schedule with GVSUD at least two (2) weeks in advance.
34. The contractor shall provide for uninterrupted wastewater treatment at all times during construction. Any work involving power outages, bypass pumping, pump and haul, or any other wastewater process interruption must be performed between 8:00am and 5:00pm excluding weekends and GVSUD approved holidays. All necessary temporary power, bypass pumping, pump and haul, temporary plugs, etc., shall be furnished and performed by the contractor. Coordinate and schedule any such activities with GVSUD at least two (2) weeks in advance.

Emergency Generator

1. Provide a permanent emergency generator at each treatment plant.
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.
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 alarms shall be monitored via auto dialer.
6. Provide automatic transfer switch (ATS) with programmable exerciser (with and without load), NEMA 4X 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 GVSUD. 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 GVSUD to witness demonstration testing. Operator training shall be conducted on a separate day after demonstration testing. Contractor shall coordinate schedule with GVSUD at least two (2) weeks in advance.

PERMANENT WASTEWATER TREATMENT PLANTS

Minimum Standards for Permanent Wastewater Treatment Plants

The following standards are for the design of permanent conventional extended air process wastewater treatment systems to be dedicated to GVSUD and/or operated by GVSUD. Please review the following guidelines carefully and contact GVSUD for a consultation meeting to address any related variances or other construction related matters.

Design and Documents

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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 GVSUD review and approval.
 - a. Provide dedicated easements in the name of GVSUD. 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.
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 - d. Designs for any proposed alterations or crossings of GVSUD easements must be approved in writing by GVSUD and the installation of such must be inspected and approved by GVSUD.
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7. Provide the following materials prior to acceptance of facility by GVSUD. Provide one (1) hard copy and one (1) CD/PDF copy unless noted otherwise:

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- a. Engineer's certification of completion in accordance with approved plans, specifications, and permits.
- b. Engineer to provide TCEQ 217.16 plant operation and maintenance manual.
- c. Copies of all close-out submittals required by regulatory agencies (city, county, TCEQ, etc.).
- d. Spare Parts: Provide a spare for each single point of failure item. Provide one change of lubricants and filters for each piece of equipment.
- e. Provide CD backup copies of programming for PLCs, pump controllers, HMI and control room(s).
- f. 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" with Engineering Fold. 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 GVSUD review and approval prior to printing final copies. Submit at least two (2) weeks prior to operator training.
- g. Waiver of lien by contractor (and subcontractors, as appropriate).
- h. 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.
- i. Executed operating contract or bill of sale transferring facility to GVSUD.
- j. As-Built and Record Drawings: Provide complete project drawing sets including all sheets and all trades. Submit electronic preliminary copies for GVSUD 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 GVSUD 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.

General Requirements

1. Design and installation shall be in accordance with TCEQ rules and AWWA standards, and in accordance with GVSUD standards as further described in this document (see attachments).
2. Wastewater systems shall be designed shall be based on minimum 300 GPD/EDU average daily flow, 4.0 peak factor, and 300 GPD/acre inflow and infiltration.
3. Noise and odor impacts shall be considered in design.
4. Piping friction losses shall be calculated with a Hazen-Williams coefficient no greater than 130

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for plastic pipe, and no greater than 100 for concrete or metal pipe.

5. All hydraulic structures and basins shall be of reinforced concrete construction.
6. Provide 1" minimum thickness calcium aluminate chemical resistant lining for lift station wet well, headworks, and primary treatment structures. Calcium aluminate material shall be SewperCoat, Refratta HAC 100, or approved equal. Proposed substitutes must be equal in composition and manufacturer warranty. Product must be installed by a manufacturer certified applicator. Prepare surface by sand blasting. Provide smooth trowel finish. Apply spray curing compound.
7. All equipment shall be designed to automatically reset after power outages.
8. All equipment shall have elapsed time meters.
9. All pumps shall be equipped with mechanical seals.
10. 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.
11. Supports and hardware for equipment and piping shall be Type 316 stainless steel (i.e. clamps, brackets, stanchions, etc.).
12. All fasteners shall be Type 316 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.
13. 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.
14. Cleanouts shall have cast iron frames and covers with concrete collars in accordance with GVSUD standard details.
15. 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.).
16. Provide color coded tracing wire (copper clad steel, 12-gauge, 30 mil HDPE jacket) for all buried piping.
17. Valve boxes, equipment, exposed piping and valves, and appurtenances shall be painted. Provide colors in accordance with TCEQ rules. Do not paint hot dip galvanized (except if immersed), stainless steel, brass, or aluminum items.
18. All exposed ferrous metals shall be painted with a minimum 3-coat system consisting of zinc-rich primer, white color high-build epoxy second coat, and polyurethane top coat. Immersed ferrous metals shall be coated with minimum two (2) coats of coal tar epoxy. Immersed hot dip galvanized items shall be coated with minimum two (2) coats of coal tar epoxy for a minimum of 12" above and below the normal water level. Install in accordance with manufacturer recommendations.
19. All submerged steel shall have a minimum thickness of 1/4".
20. Clarifier equipment, bridge support beams, and stairs shall be hot dip galvanized.

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21. Provide adequate workspace and walkways to access all in-plant equipment. All valves shall be readily accessible from the walkways. Centerline of valve operators shall be 24" maximum outside handrail.
22. All walkways shall be a minimum of 36" wide. Provide a minimum of 24" workspace on all sides of clarifier drive. Walkways shall be designed for a maximum deflection under 100 PSF live load of $L/360$.
23. All handrails shall be aluminum or stainless. All grating shall be aluminum. Galvanized and checker plate are not acceptable.
24. 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.
25. Provide aluminum access ladders from clarifier bridge into effluent launder trough for cleaning and maintenance purposes.
26. All submersible pumps and mixers shall have dual mechanical seals. All submersible pumps and mixers shall be provided with a hoist, mast, winch, and full length lifting chains (all these items shall be 316SS).
27. Air lift pumps shall be 3" minimum and hot dip galvanized with expansion box, air release vent pipe, top entry 316SS interior stinger air pipe thru 4" minimum flanged top cleanout with union, 316SS lever operated full port ball valve, and 316SS lifting chains. Centerline of cleanout shall be 24" maximum outside handrail.
28. The floor each in basin and clarifier shall be sloped to drain piping that penetrates the floor. Drain piping and valves shall be 4" minimum. Hose connections shall be aluminum 3" female camlock with plug.
29. Each basin and clarifier shall have gates or valves to allow it to be hydraulically isolated.
30. Gate valves are not allowed for wastewater use. Valves shall be round port plug valves, horizontal shaft, closing downward, with 316SS external bolts, nuts, and hardware by Crispin, GA, Milliken, or Pratt.
31. PVC ball valves shall be Sch 80 true union type by GF, Hayward, Nibco, or Spears.
32. PVC male adapters are not allowed.
33. Flange coupling adapters shall be Smith Blair Model 911. Flange adapters are not allowed within hydraulic structures.
34. Ductile iron pipe and fittings shall be epoxy lined.
35. Non-potable water (NPW) shall be used for all in-plant uses. Suction for NPW pumps shall be from the chlorine contact basin 24" above floor. Install pumping systems within buildings designed for human occupancy, reference "Equipment Buildings" below for additional requirements. Provide basket strainers, flanged mag meter, and minimum 250-gallon pressure tank. NPW system shall be designed to maintain 80 PSI minimum working pressure. Reference "Reuse" below for pump types, manufacturers, and additional requirements. Provide a 1" hose station 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. At ground level, provide 1" Woodford Y1 non-freeze yard hydrants. In elevated locations, provide insulated 316SS 1" hose bibbs. Clearly label as non-potable.

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36. For potable water service, 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.
37. Provide open channel effluent flow metering with staff gauge, primary and secondary measuring devices, for both the chlorine contact basin and for plant discharge after the final treatment unit. Provide a 10" diameter, seven (7) day chart recorder for each flow meter. Install flow meter displays and chart recorders inside the Operations Building. Staff gauges shall be painted aluminum displaying feet, tenths, and hundredths. Flow meters shall be HydroRanger 200 or Greyline SLT 5.0 flow monitor. All flow meter data shall be logged via the SCADA system.
38. 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 316 stainless steel.
39. All exposed vertical and horizontal concrete edges shall be formed with 3/4" chamfer strips.
40. Hydraulic structures must pass leakage testing prior to application of any coatings or linings. Fill with clean water to overflow level. Allow minimum 24-hour saturation period. Test duration is 1-hour. No allowable leakage. Test each basin or chamber separately. Any areas of visible moisture shall be repaired and retested.
41. All testing shall be performed by the contractor and witnessed by GVSUD.
42. Contractor shall perform operational demonstration testing. Contractor shall startup, test, and verify all equipment is operational prior to scheduling GVSUD to witness demonstration testing. Operator training shall be conducted on a separate day after demonstration testing. Contractor shall coordinate schedule with GVSUD at least two (2) weeks in advance.
43. The contractor shall provide for uninterrupted wastewater treatment at all times during construction. Any work involving power outages, bypass pumping, pump and haul, or any other wastewater process interruption must be performed between 8:00am and 5:00pm excluding weekends and GVSUD approved holidays. All necessary temporary power, bypass pumping, pump and haul, temporary plugs, etc., shall be furnished and performed by the contractor. Coordinate and schedule any such activities with GVSUD at least two (2) weeks in advance.
44. Explosives and blasting are not allowed.
45. Reference "GVSUD Design Guidelines for Developer Utilities" for inspection requirements, survey staking, piping, manholes, testing requirements, etc. All work shall be in accordance with GVSUD standards as published at the following website: <http://www.gvsud.org/>

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Headworks

1. Provide mechanical screens with backup manual bypass bar screens. The screening area shall be fabricated of 316SS or aluminum. Hot dip galvanized or painted steel are not acceptable. Mechanical screens shall be Lakeside Equipment Raptor Micro Strainer or Huber Technology Rotamat Micro Strainer Ro9. Manual and mechanical screens shall have maximum ½” openings. Manual bar screens shall have drying decks. Size screens and decks to be removable by one person. Minimum thickness shall be 3/16”.

Anaerobic/Anoxic Zones

1. For systems utilizing an internal recycle of MLSS, provide ability to control recycle rate proportional to plant influent flow.
2. If submersible mixers or pumps are utilized for mixing or internal recycle, all submersible pumps and mixers shall have dual mechanical seals. All submersible pumps and mixers shall be provided with a hoist, mast, winch, and full length lifting chains (all these items to be 316SS).
3. Provisions shall be made for initial low flows. Provide an anoxic zone that can be utilized as aeration during initial low flow phases.

Aeration Zone

1. All diffusers shall be 316SS wide band diffusers (e.g. Sanitaire D-24, or of equivalent quality). Guaranteed oxygen transfer efficiency shall be 9% minimum at the design diffuser submergence at design air flow rate. Oxygen transfer efficiency shall be guaranteed and substantiated by submission of test data compiled by a nationally recognized independent testing laboratory.
2. Each diffuser assembly shall be easily removable from tank manually by one person.
3. All aeration drop pipes shall be aluminum or light-wall 316SS pipe. PVC is not acceptable for aeration drops. Each diffuser drop pipe assembly shall consist of a union to allow for ease of removal, a lever operated 316SS ball valve accessible from the walkway for the purpose of shut off and regulation of air supply, and the necessary pipe and fittings. All valves shall be readily accessible from the walkways. Centerline of valve operators shall be 24” maximum outside handrail.
4. Provisions shall be made for initial low flows. Provide an anoxic zone that can be utilized as aeration during initial low flow phases.

Aeration Blowers

1. Provide a hot dip galvanized roof structure over blowers. Provide wall(s) as necessary to reduce noise.
2. Maximum allowable sound level shall be 75 dBA at 10 feet. Provide insulated housings if necessary to meet this requirement.

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3. Aeration blowers shall be one of the following:
 - a. Positive displacement blowers, operating at a speed less than 1780 rpm; by Aerzen, Gardner Denver, or Kaeser.
 - b. High speed turbo blowers by Hoffman or HIS.
 - c. Multi-stage centrifugal blowers by Gardner Denver, Hoffman, or HIS.
4. Provide the following items for each blower:
 - a. Isolation valves.
 - b. Check valves.
 - c. Adjustable pressure relief valves.
 - d. Inlet and discharge silencers and separate inlet filter. Combined inlet filter/silencers are not acceptable. Provide inlet air filter monitor gauges.
 - e. Secure blowers to equipment pad with vibration isolators and 316SS anchor bolts.
5. Provide a pressure gauge and transmitter assembly on the common discharge header, in accordance with GVSUD standards, for monitoring and to provide low pressure alarm via SCADA.
6. PVC piping is not allowed for aeration piping.

Clarifiers

1. Clarifiers shall be circular design.
2. Clarifiers, including piping, inlet, feedwell, and sludge scrapers, shall be in accordance with recommendations of WEF MOP-8.
3. Minimum sidewater depth in clarifier shall be 10'-0", with a minimum floor slope of 1:12.
4. Clarifier drives shall utilize SEW Eurodrive gearmotors.
5. Provide dual scum skimmers and a rotating pipe scum collection trough that extends the full radius of the clarifier, from the scum baffle at the outside, to the torque tube on the inside, thereby eliminating any possibility of scum escaping the system. Scum piping shall be provided to allow discharge to either the digester or the aeration basin.
6. Provide scum spray system with brass nozzles and an isolation valve at each nozzle and a master valve to isolate the entire system. Use Sch. 80 PVC pipe, valves, and fittings.
7. Weirs and scum baffle shall be 316SS or aluminum, with 316SS fasteners for adjustment.
8. RAS/WAS pumping
 - a. Air-lift pumps are acceptable for RAS and WAS pumping, but shall be provided with sludge measurement box and weir. RAS piping shall be minimum 6" diameter with maximum 45-degree bends. Reference "General" above for additional requirements.
 - b. If mechanical pumps are utilized, they shall be positive displacement type by Gorman-Rupp, Hayward-Gordon, or Wemco; and shall be capable of passing 2" solids. Provide belt drive or VFD (adjustable sheaves are not allowed). Provide a magnetic flow meter monitored by SCADA (insertion type is not acceptable).

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Aerobic Digesters, Sludge Dewatering and Disposal

1. Provide telescoping valve, air lift, or other means of decanting digester and returning supernatant to plant headworks.
2. Provide a staff gauge in each digester extending from floor to top of wall. Staff gauges shall be painted aluminum displaying feet, tenths, and hundredths with minimum 4" tall numbering at every foot increment.
3. Provide a high-level float alarm for digesters.
4. Liquid sludge disposal is not allowed. Provide equipment for sludge dewatering and disposal as follows:
 - a. For facilities up to 200,000 GPD AADF, provide two (2) sludge dewatering boxes.
 - b. For facilities up to 300,000 GPD AADF, provide three (3) sludge dewatering boxes.
 - c. For facilities greater than 300,000 GPD AADF, provide belt presses.
5. For sludge dewatering boxes, provide the following:
 - a. Equipment building/room for pumps.
 - b. Two (2) rotary lobe VFD pumps, each capable of 80 to 150 GPM.
 - c. Sludge suction piping shall be minimum 6" diameter with maximum 45-degree bends.
 - d. Flanged magnetic flow meter.
 - e. Polymer injection system with two (2) peristaltic metering pumps, each capable of 0.1 to 5.0 GPH.
 - f. Sludge dewatering boxes installed on a sloped concrete drainage pad, with perimeter curb walls, trench drain, and embed tracks for wheels. Provide 3 feet minimum clearance around boxes. Provide gravity drains or two (2) sump pumps, each capable of 60 GPM minimum.
6. For belt presses, provide the following:
 - a. Comply with TCEQ redundancy requirements.
 - b. Roof structure over all equipment.
 - c. Belt presses by Alfa Laval Ashbrook Simon-Hartley.
 - d. Polyurethane coated sludge disposal boxes installed on a sloped concrete drainage pad, with perimeter curb walls, trench drain, embed tracks for wheels, and electric winch to slide boxes. Provide 3 feet minimum clearance around boxes. Provide gravity drains or two (2) sump pumps, each capable of 60 GPM minimum.

Filtration (if required)

1. Filters shall be required for any facilities with permit limitations requiring phosphorus removal, for facilities with effluent TSS limits less than or equal to 5 mg/L, or where required by TCEQ.
2. Filters shall be Fluidyne FFP, or GVSUD approved equal with no submerged moving parts.
3. Provide two (2) independent filter basins, each with independent controls, and each rated for ultimate peak flow with one (1) element out of service.
4. Metal components shall be aluminum or 316SS.
5. Design overflow piping to accommodate ultimate peak flow.
6. Algae covers shall be aluminum or 316SS and removable by one person.

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7. Provide chlorine injection upstream of filters.
8. Provide hoist and access platform. Access platform shall be of sufficient size to lay a filter element flat on the platform with 18" minimum clearance on all sides to facilitate replacement of cloth media.

UV Disinfection (if utilized)

1. Provide minimum of two (2) channels of UV equipment, each with independent controls, and each rated for ultimate peak flow with the largest bank out of service.
2. Flow-pace UV system to reduce energy consumption.

Chlorination (if utilized)

1. All equipment and hardware in chlorination rooms shall be PVC, FRP, or other materials resistant to chlorine gas.
2. Chlorination equipment shall be gas type by Hydro Instruments or Superior. Provide automatic flow pacing, cylinder scales, automatic switchover, brass wye strainer, and manual bypass piping and valves around solenoid valve.
3. 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.
4. Provide an intake fan and exhaust louver. The intake fan shall automatically shutdown when a chlorine leak is detected.
5. Provide concrete floors with smooth trowel finish and concrete sealer. Install cast iron floor drains with brass strainers and slope floors to drains.
6. Provide sidewalk and ramp at entrance to chlorination rooms.
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.
11. Provide a potable water hose bibb in the chlorination room for backup supply during NPW maintenance and repair. Provide a hose connection point and isolation valve on the NPW supply piping in the chlorination room.
12. For fiberglass chemical buildings, reference GVSUD Standard Specification 13124.

Chemical Feed (if required)

1. Provide automatic flow pacing for each chemical feed system.
2. Provide redundancy for each chemical feed system.

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3. Each chemical storage tank shall be equipped with an ultrasonic level indicator with local display.
4. All equipment and hardware in chemical buildings shall be PVC, FRP, or other chemical resistant materials.
5. For facilities with effluent phosphorus limitations, provide chemical feed system for phosphate precipitation, sized for ultimate peak flow. Provide two (2) peristaltic metering pumps, each rated for ultimate peak flow.
6. The use of methanol as a supplemental carbon source is not acceptable. Micro-C or other non-hazardous supplemental carbon sources shall be utilized, if required.
7. Provide concrete curb containment and floors with broom finish and concrete sealer. Slope floors to recessed sump pits.
8. Provide sidewalk and interior and exterior ramp at entrance to each chemical room.
9. Provide non-freeze combination eyewash showers.
10. For fiberglass chemical buildings, reference GVSUD Standard Specification 13124.

Operations Building and Equipment Buildings

1. 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 and trim. 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. Interior light fixtures shall be 48" strip LED, vapor tight, 4000K and 4,000 lumens.

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9. 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.
10. Pre-wire for Ethernet.
11. Buildings shall have appropriately sized HVAC system capable of maintaining an appropriate working environment within the building.
12. Bathroom shall be provided with hot water, sink, countertop, rolled paper towel dispenser, cabinets, mirror, toilet, toilet paper dispenser, walk-in shower, towel bars, towel hooks, heater, and exhaust fan. Bathroom shall be handicapped accessible.
13. Laboratory facilities shall be provided. The following minimum capacities shall apply: 150 SF floor area, 60 CF base cabinets, 30 CF wall cabinets, 12 LF and 24 SF countertops.
14. Countertops and sinks shall be 1" thick black epoxy resin with sinks 10" deep.
15. Base and wall cabinets shall be ¾" thick plywood with red oak veneer.
16. Buildings shall be ADA compliant.
17. Provide signs and/or labels for all buildings and rooms.

Effluent Storage and Reuse (if required)

1. Provide a minimum of two (2) storage tanks. Total storage capacity shall be designed to provide 24-hours minimum storage. Any volume below pump minimum suction requirements shall not be used in calculations.
2. Effluent storage tanks shall be welded steel or prestressed concrete and shall comply with applicable AWWA standards.
3. Tank foundations shall be cast-in-place reinforced concrete.
4. 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 by SCADA.
5. Overflow piping shall be connected to plant discharge piping and meter.
6. Provide buried bypass piping to allow for tank maintenance and repair and water quality issues.
7. Provide open channel effluent flow metering, chart recorders, and appurtenances for common inlet and common outlet at tanks in accordance with "General" above. Metering for inlet shall occur after the final treatment unit. Metering for outlet shall occur prior to plant discharge.
8. Tank pump suction pipe shall be 24" above floor of tank with anti-vortex protection.
9. Install pumping systems within buildings designed for human occupancy. Buildings shall have appropriately sized HVAC system capable of maintaining an appropriate working environment within the building. Reference "Equipment Buildings" above for additional requirements.
10. Provide hoisting provisions for pumps and motors.
11. Pumping systems shall be certified for municipal service for 20-years minimum service life. Agricultural grade systems are not allowed.

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12. Provide basket strainers for pumping systems.
13. Suction and discharge air release valves shall be 2" A.R.I. Model D-040-L.
14. All pumps shall be equipped with mechanical seals and elapsed time meters.
15. 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.
16. Impellers shall be low-zinc bronze, stainless steel, or nickel-aluminum-bronze. Zinc content shall be less than 5%.
17. Provide lead/lag/standby pump operation and first on/first off alternation.
18. Provide a flanged mag meter to measure pump discharge in accordance with GVSUD Standard Specification 13442.
19. Packaged skid-mounted pumping systems shall be manufactured by Fairbanks-Morse, Flowserve, or Goulds.
20. Vertical turbine pumps shall be manufactured by Fairbanks-Morse, Flowserve, Peerless, or Sulzer.
21. Horizontal split-case pumps shall be manufactured by Fairbanks-Morse, Flowserve, or Peerless.
22. 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 compressor shall be 60 GAL, 5 HP, 150 PSI, with automatic drain valve; engineer to evaluate additional capacity requirements.
23. Exposed gate valves shall be rising stem American Flow Control Series 2500, or GVSUD approved equal.
24. Reuse water distribution systems shall be designed to provide 55 PSI minimum at customer meters.

Site Improvements

1. Access road and parking areas shall be asphalt or concrete. Roads shall be 16ft wide.
2. Provide at least one handicap-accessible parking space.
3. 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.
4. Fencing shall be designed to minimize noise impacts if necessary. Comply with TCEQ requirements. If chain link fencing is used, follow GVSUD standard details.
5. Provide signs in accordance with TCEQ rules and as further described herein. Signs shall be 0.080" thick aluminum with painted background and painted block lettering. Attach with aluminum rivets and/or 316SS hardware, flat washers, and lock nuts.

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Electrical, Instrumentation, and Controls

1. Electrical work shall be installed in accordance with GVSUD standard details (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. Main electrical service shall be provided with a Transient Voltage Surge Suppressor (TVSS)/Surge Protection Device (SPD) including overcurrent protection on each leg.
6. Electrical service shall be 480V 3-phase. Phase converters are not allowed.
7. 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.
8. Provide a centralized climate-controlled environment for electrical panels and control system. Any panels installed in outdoor locations shall be equipped with a roof and single wall shelter. Orientation of shelter shall be such that panels face east or north with wall on west or south side.
9. Interior light fixtures shall be 48" strip LED, vapor tight, 4000K and 4,000 lumens.
10. 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.
11. 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.
12. All treatment 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.
13. All PLCs shall be of the same communication type. This applies to the entire site and all equipment.
14. Plant main 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 GVSUD staff to determine service area, site specific requirements, and appropriate radio and controller. SCADA system shall be designed and installed in accordance with GVSUD standards. Reference GVSUD Standard Specification 13428 for additional requirements.

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15. 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.
16. 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.
17. Provide hinged UV protective covers for all OITs that are installed outdoors. Provide Shade Aide, or GVSUD approved equal.
18. All floats shall have one NO and one NC set of contacts.
19. Provide full voltage non-reversing NEMA sized starters with a minimum size of 1. Half sized starters and IEC starters are not allowed. Provide these starters with solid state overload relays.
20. 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.
21. Allowable manufacturers for SSRV's and VFD's are ABB, Eaton/Cutler Hammer, GE, and Schneider/SQD. Substitutions are not allowed.
22. 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.
23. All components shall be labeled on the backplane with white adhesive tape type labels with black machine printed 3/16" block lettering.
24. Indicator lights shall be LED push-to-test type (red/run/open, green/stop/closed, amber/fault, white/power).
25. Alarm beacons shall be LED and red color. Do not penetrate tops of panels.
26. 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.
27. 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
28. All other conductors shall be stranded copper XHHW-2.
29. Phase colored insulation is required for all conductors.
30. All 4-20mA signal wire shall be 20 AWG twisted shielded.
31. A separate neutral conductor is required for every 120VAC circuit.
32. A separate grounding conductor is required for every raceway, including electrical and I&C. Minimum size is 12 AWG.

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33. Label wiring with yellow heat shrink type markers with black machine printing. Labels shall be Raychem or Panduit.
34. Enclosures in chemical areas shall be NEMA 4X FRP or PVC. In climate-controlled areas, provide NEMA 1A gasketed or NEMA 12 enclosures for starters, disconnects, enclosed circuit breakers, control panels, MCCs, and RTU cabinets. All other enclosures shall be NEMA 4X 316SS. All enclosures shall be provided with external mounting lugs and lockable 3-point latch system. Mount all enclosures on vertical strut.
35. Provide type written panel directories and laminated as-built schematics and diagrams in all electrical panels.
36. Electrical panels shall have tinned copper bus and bolt-on type circuit breakers.
37. 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 316SS cable. Label circuit numbers on all device covers with white adhesive tape type labels with black machine printed 3/16" block lettering.
38. All surface mounted device boxes shall be FD type sand cast aluminum with 316SS cover screws.
39. All receptacles shall be ivory color duplex 110V 20A GFCI-WR. Outdoor locations shall have aluminum in-use covers.
40. 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.
41. Duct banks shall be steel reinforced red-dyed concrete in accordance with GVSUD standard details.
42. 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.
43. For flexible conduit, 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.
44. Use FRP hardware, strut, straps, and anchors in chemical areas. All other locations shall be 316SS. All electrical enclosures, devices, and light fixtures shall be mounted on strut.
45. All conduit fittings shall be Form 7 sand cast aluminum with aluminum covers and 316SS screws. Snap-on covers are not permitted.
46. Use aluminum grounding type Myers hubs with insulated throats for all enclosure entries.
47. Use UNY and UNF aluminum unions. Galvanized unions are not permitted.
48. Use aluminum seal-off fittings where required by NEC, seal with 3M-2123 re-enterable sealing compound.
49. Use Noalox or other comparable anti-oxidizing agent on all conduit threads.

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50. Field bending of conduit shall be accomplished using the appropriate tools. Flame bending is not allowed.
51. Megger test load and line conductors of all power circuits and submit test reports.
52. Resistance to ground for site grounding shall be 5 Ohms or less. Contractor shall perform Fall-of-Potential three-point ground megger testing.
53. All testing shall be performed by the contractor and witnessed by GVSUD. Test equipment must be calibrated within the previous 12 months.
54. Contractor shall perform operational demonstration testing. Contractor shall startup, test, and verify all equipment is operational prior to scheduling GVSUD to witness demonstration testing. Operator training shall be conducted on a separate day after demonstration testing. Contractor shall coordinate schedule with GVSUD at least two (2) weeks in advance.
55. The contractor shall provide for uninterrupted wastewater treatment at all times during construction. Any work involving power outages, bypass pumping, pump and haul, or any other wastewater process interruption must be performed between 8:00am and 5:00pm excluding weekends and GVSUD approved holidays. All necessary temporary power, bypass pumping, pump and haul, temporary plugs, etc., shall be furnished and performed by the contractor. Coordinate and schedule any such activities with GVSUD at least two (2) weeks in advance.

Emergency Generator

1. Provide a permanent emergency generator at each treatment plant.
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 alarms shall be monitored via SCADA.
6. Provide ASCO or Russelectric automatic transfer switch (ATS) with programmable exerciser (with and without load), NEMA 4X 316SS 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 GVSUD. Test equipment must be calibrated within the previous 12 months.

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10. Contractor shall perform operational demonstration testing. Contractor shall startup, test, and verify all equipment is operational prior to scheduling GVSUD to witness demonstration testing. Operator training shall be conducted on a separate day after demonstration testing. Contractor shall coordinate schedule with GVSUD at least two (2) weeks in advance.

LIFT STATIONS

Minimum Standards for Lift Stations

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

Design and Documents

1. If construction has not commenced within one (1) year of GVSUD design approval, that approval is no longer valid.
2. GVSUD 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 GVSUD review and approval prior to bidding. Include master plan, plats, easements, design calculations, process flow diagrams, drawings, and specifications. Provide three (3) half-size hard copies and one (1) CD/PDF format copies. Allow 15 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 GVSUD review and approval.
 - a. Provide dedicated easements in the name of GVSUD. 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 GVSUD easements.
 - d. Designs for any proposed alterations or crossings of GVSUD easements must be approved in writing by GVSUD and the installation of such must be inspected and approved by GVSUD.
 - 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 GVSUD easements; gates must be centered across GVSUD 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 GVSUD 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 facility by GVSUD. 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.

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- 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" with Engineering Fold. 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 GVSUD 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 GVSUD.
- i. As-Built and Record Drawings: Provide complete project drawings sets including all sheets and all trades. Submit electronic preliminary copies for GVSUD 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 GVSUD 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.
- j. Recorded plats and easements.
- k. Title Company review for release of all liens.

General Requirements

1. Design and installation shall be in accordance with TCEQ rules and AWWA standards, and in accordance with GVSUD standards as further described in this document (see attachments).
2. Wastewater systems shall be designed shall be based on minimum 300 GPD/EDU average daily flow, 4.0 peak factor, and 300 GPD/acre inflow and infiltration.
3. Noise and odor impacts shall be considered in design.
4. Piping friction losses shall be calculated with a Hazen-Williams coefficient no greater than 130 for plastic pipe, and no greater than 100 for concrete or metal pipe.
5. Surge control shall be considered in design. Evaluate loss of power while all pumps are running.

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6. Pumps and control panels shall be ABS, Flygt, or KSB; substitutions are not allowed. Grinder pumps are not allowed. Each pump shall be equipped with a mix/flush valve or equivalent mixing device. Provide full length 316SS lifting chains and chain grip eye. Pumps shall have minimum 4" diameter suction and discharge openings. Provide non-clogging impellers. Lift station design and pump selection shall incorporate the future ability to increase impeller one size without changing pump bases, motors, electrical, or controls. Pumping systems shall be selected based on maximum wire-to-water efficiency. Field draw down testing is required to demonstrate the specified flow rate for each pump.
7. Guide rails with intermediate brackets, hoists, and hatches are required for stand-alone mixers. Materials of construction, components, and accessories shall be the same as for pumps.
8. All guide rails, brackets, anchors, and supports shall be 316SS.
9. All motors shall be Premium Efficiency with minimum 1.15 service factor. All motors driven by variable frequency drives shall be inverter-duty rated.
10. All equipment shall be designed to automatically reset after power outages.
11. All equipment shall have elapsed time meters.
12. Every lift station shall be equipped with a permanent mounted electric hoist. All components shall be corrosion resistant.
13. Wet wells and manholes shall be precast concrete. The interior of the structures shall be lined with SewperCoat, Refratta HAC 100, or approved equal calcium aluminate material. Proposed substitutes must be equal in composition and manufacturer warranty. Product must be installed by a manufacturer certified applicator. Prepare surface by sand blasting. Provide smooth trowel finish. Apply spray curing compound. Minimum thickness for manholes shall be ½". Minimum thickness for wet wells shall be 1".
14. The first riser and floor of the wet well shall be pre-cast integrally. Where this is not feasible, Adeka P-201 waterstop shall be used to seal the walls to a cast-in-place floor slab. Provide rubber O-ring gaskets at all riser joints.
15. All exposed vertical and horizontal concrete edges shall be formed with ¾" chamfer strips.
16. 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.).
17. Provide color coded tracing wire (copper clad steel, 12-gauge, 30 mil HDPE jacket) for all buried piping.
18. Valve boxes, equipment, exposed piping and valves, and appurtenances shall be painted. Provide colors in accordance with TCEQ rules. Do not paint stainless steel, hot dip galvanized, brass, or aluminum items.
19. Lift station wet well and valve pad piping shall be epoxy lined flanged ductile iron. Wet well piping shall be coated with minimum two (2) coats of coal tar epoxy. Paint for valve pad piping and valves shall be white color high-build epoxy with topcoat of polyurethane in Grey Pantone #431-U color. Do not paint stainless steel, hot dip galvanized, brass, or aluminum items. Install in accordance with manufacturer recommendations.
20. Gate valves are not allowed for wastewater use. Isolation valves shall be round port plug valves with horizontal shaft closing downward by Crispin, GA, Milliken, or Pratt. Plug valves

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and check valves shall have 316SS external bolts, nuts, fasteners, and hardware. Valve assembly shall be installed above ground on concrete slab/pad.

21. Flange coupling adapters shall be Smith Blair Model 911. Flange adapters are not allowed within hydraulic structures.
22. Provide an emergency bypass pumping port at lift station valve pad with check valve, plug valve, and aluminum female camlock with plug. Size to match pump discharge flange.
23. All influent lines penetrating the wet well walls shall be shown in both plan view and sections. Seal wall penetrations with PSX direct drive boots, or GVSUD approved equal, and non-shrink grout.
24. Wet wells shall have 4" minimum cast-in-place 316SS gooseneck vents with welded waterstop rings on pipe at penetrations. Provide flanged 316SS screens located 24" above top of roof slab.
25. Wet well hatch assemblies shall be aluminum with frames, safety grates, and covers rated for 300 PSF live load. Covers shall be equipped with padlock staples. Hardware, fasteners, and hinges shall be 316SS. Hatch assemblies shall be EJ Safe Hatch, or GVSUD approved equal. Provide 2ea hatch keys.
26. All fasteners shall be Type 316 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.
27. 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.
28. Pipe bells shall be installed in upstream direction.
29. Air release valves shall be A.R.I. Model D-025. ARV vent piping to be Schedule 80 PVC with 316 stainless steel anchors and strut supports. Install a PVC ball valve below air release valve. Install union in vent piping adjacent to ARV.
30. PVC ball valves shall be Sch 80 true union type by GF, Hayward, Nibco, or Spears.
31. PVC male adapters are not allowed.
32. 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 316 stainless steel.
33. Provide 1" Woodford Y1 non-freeze yard hydrant 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,

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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.

34. Hydraulic structures must pass leakage testing prior to application of any coatings or linings. Fill with clean water to overflow level. Allow minimum 24-hour saturation period. Test duration is 1-hour. No allowable leakage. Test each basin or chamber separately. Any areas of visible moisture shall be repaired and retested.
35. All testing shall be performed by the contractor and witnessed by GVSUD.
36. Contractor shall perform operational demonstration testing (see attached procedure). Contractor shall startup, test, and verify all equipment is operational prior to scheduling GVSUD to witness demonstration testing. Operator training shall be conducted on a separate day after demonstration testing. Contractor shall coordinate schedule with GVSUD at least two (2) weeks in advance.
37. The contractor shall maintain service to existing wastewater systems at all times during construction. Any work involving power outages, bypass pumping, pump and haul, or any other interruption of flow must be performed between 8:00am and 5:00pm excluding weekends and GVSUD approved holidays. All necessary temporary power, bypass pumping, pump and haul, temporary plugs, etc., shall be furnished and performed by the contractor. Coordinate and schedule any such activities with GVSUD at least two (2) weeks in advance.
38. Explosives and blasting are not allowed.
39. Reference “GVSUD Design Guidelines for Developer Utilities” for inspection requirements, survey staking, piping, manholes, testing requirements, etc. All work shall be in accordance with GVSUD standards as published at the following website: <http://www.gvsud.org/>

Site Improvements

1. Access road and parking areas shall be asphalt or concrete. Roads shall be 16ft wide.
2. 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.
3. Fencing shall be designed to minimize noise impacts if necessary. Comply with TCEQ requirements. If chain link fencing is used, follow GVSUD standard details.

Electrical, Instrumentation, and Controls

1. Electrical work shall be installed in accordance with GVSUD standard details (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, electrical rack, generator, RTU, antenna, etc. Resistance to ground for site grounding shall be 5 Ohms or less.

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4. All equipment shall be designed to automatically reset after power outages.
5. Main electrical service shall be provided with a Transient Voltage Surge Suppressor (TVSS)/Surge Protection Device (SPD) including overcurrent protection on each leg.
6. Electrical service shall be 480V 3-phase. Phase converters are not allowed.
7. Provide a Power Quality Meter (PQM) in its own separate enclosure 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 amperage readings of all three phases to the applicable control room(s) via SCADA.
8. Provide roof and single wall shelter for control panels installed outdoors. Orientation of shelter shall be such that panels face east or north with wall on west or south side.
9. Provide two, external receptacles at lift station for temporary loads, power tools, etc.
10. 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.
11. All lift stations shall have a SCADA system, appropriate for the applicable service area.
12. Equipment control panels shall have an aluminum dead-front inner door. Panels shall be tested in accordance with NFPA 70.
13. Lift station pump controllers and pump control panels shall be provided by the pump manufacturer. Provide an OIT touch screen for local system monitoring and adjustment of setpoints. Mount the OIT on the exterior door of the pump control panel with a hinged UV protective cover by Shade Aide, or GVSUD approved equal. Furnish a spare pump controller, backup programming CD, and one spare I/O module of each type.
14. For lift stations located at a plant site, pump controllers shall be connected to the plant main RTU via serial MODBUS connection. For remote lift stations, depending on service area, provide MDS iNet-900 or Banner Engineering DX80DR9M-H1C radio for communication to applicable control room(s). Coordinate with GVSUD staff to determine service area, site specific requirements, and appropriate radio. SCADA system shall be designed and installed in accordance with GVSUD standards. All SCADA points inside the pump control panel shall be landed on terminal strips mounted on the backplane. Reference GVSUD Standard Specification 13428 for additional requirements.
15. All PLCs shall be of the same communication type. This applies to the entire site and all equipment.
16. The primary level control shall be a Dwyer Model PBLTX (0-15psi) submersible level transmitter. Provide stilling well for transmitter. Provide staggered lead/lag/standby pump operation and first on/first off alternation. Backup level control shall be two floats. Provide one high level float and one low level float. Both floats, when either is activated, shall disengage primary transmitter control and provide alarms to SCADA and provide local horn and beacon alarms. High float shall provide alarms and turn all pumps on. Low float shall provide alarms and turn all pumps off, regardless of HOA position. Pumps shall remain in backup control until manually reset locally. System in backup alarm shall latch in until manually reset locally; including horn, beacon, and SCADA.

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17. All floats shall have one NO and one NC set of contacts.
18. Provide start delay relay timers for each pump to stagger starts in hand and auto, primary and backup control modes, regardless of power source whether normal or emergency.
19. At a minimum, the following points shall be monitored in the control room(s):
 - a. Pump run status for each pump.
 - b. Pump auto status for each pump.
 - c. Common pump fault for each pump (seal fail, over temp, fail to start, motor overload).
 - d. Generator run.
 - e. Generator fault.
 - f. Power fail.
 - g. ATS in emergency.
 - h. High float.
 - i. Low float.
 - j. System in backup.
 - k. PQM ampacities.
 - l. Daily pump run time hour meters (display on control room screens, reset daily at noon).
 - m. Intrusion alarms (pump control panel and RTU).
 - n. Submersible transmitter level.
 - o. Communications fail.
20. 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.
21. Provide full voltage non-reversing NEMA sized starters with a minimum size of 1. Half sized starters and IEC starters are not allowed. Provide these starters with solid state overload relays.
22. 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.
23. Allowable manufacturers for SSRV's and VFD's are ABB, Eaton/Cutler Hammer, GE, and Schneider/SQD. Substitutions are not allowed.
24. All components shall be labeled on the backplane with white adhesive tape type labels with black machine printed 3/16" block lettering.
25. Indicator lights shall be LED push-to-test type (red/run/open, green/stop/closed, amber/fault, white/power).
26. Alarm beacons shall be LED and red color. Do not penetrate tops of panels.
27. 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.
28. 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

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- e. AC hot Black
- f. AC neutral White

29. All other conductors shall be stranded copper XHHW-2.
30. Phase colored insulation is required for all conductors.
31. All 4-20mA signal wire shall be 20 AWG twisted shielded.
32. A separate neutral conductor is required for every 120VAC circuit.
33. A separate grounding conductor is required for every raceway, including electrical and I&C. Minimum size is 12 AWG.
34. Label wiring with yellow heat shrink type markers with black machine printing. Labels shall be Raychem or Panduit.
35. Wet well junction box shall be NEMA 4X 316SS with external mounting lugs, 24"x30"x12" minimum, with backplane, terminal strips, piano hinge, and 1/4-turn latches. All components shall be labeled on the backplane with white adhesive tape type labels with black machine printed 3/16" block lettering.
36. All other enclosures shall be NEMA 4X 316SS with external mounting lugs and lockable 3-point latch system. Mount all enclosures on vertical strut.
37. Provide type written panel directories and laminated as-built schematics and diagrams in all electrical panels.
38. Electrical panels shall have tinned copper bus and bolt-on type circuit breakers.
39. 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 316SS cable. Label circuit numbers on all device covers with white adhesive tape type labels with black machine printed 3/16" block lettering.
40. All surface mounted device boxes shall be FD type sand cast aluminum with 316SS cover screws.
41. All receptacles shall be ivory color duplex 110V 20A GFCI-WR. Outdoor locations shall have aluminum in-use covers.
42. 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.
43. Duct banks shall be steel reinforced red-dyed concrete in accordance with GVSUD standard details.
44. For flexible conduit, 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.
45. Use 316SS hardware, strut, straps, and anchors. All electrical enclosures, devices, and light fixtures shall be mounted on strut.

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46. All conduit fittings shall be Form 7 sand cast aluminum with aluminum covers and 316SS screws. Snap-on covers are not permitted.
47. Use aluminum grounding type Myers hubs with insulated throats for all enclosure entries.
48. Use UNY and UNF aluminum unions. Galvanized unions are not permitted.
49. Use aluminum seal-off fittings where required by NEC, seal with 3M-2123 re-enterable sealing compound.
50. Use Noalox or other comparable anti-oxidizing agent on all conduit threads.
51. Field bending of conduit shall be accomplished using the appropriate tools. Flame bending is not allowed.
52. Megger test load and line conductors of all power circuits and submit test reports.
53. Resistance to ground for site grounding shall be 5 Ohms or less. Contractor shall perform Fall-of-Potential three-point ground megger testing.
54. All testing shall be performed by the contractor and witnessed by GVSUD. Test equipment must be calibrated within the previous 12 months.
55. Contractor shall perform operational demonstration testing. Contractor shall startup, test, and verify all equipment is operational prior to scheduling GVSUD to witness demonstration testing. Operator training shall be conducted on a separate day after demonstration testing. Contractor shall coordinate schedule with GVSUD at least two (2) weeks in advance.
56. The contractor shall maintain service to existing wastewater systems at all times during construction. Any work involving power outages, bypass pumping, pump and haul, or any other interruption of flow must be performed between 8:00am and 5:00pm excluding weekends and GVSUD approved holidays. All necessary temporary power, bypass pumping, pump and haul, temporary plugs, etc., shall be furnished and performed by the contractor. Coordinate and schedule any such activities with GVSUD at least two (2) weeks in advance.

Emergency Generator

1. Provide a permanent emergency generator at each lift 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 with all pumps starting simultaneously.
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 alarms shall be monitored via SCADA.

LIFT STATIONS

6. Provide ASCO or Russelectric automatic transfer switch (ATS) with programmable exerciser (with and without load), NEMA 4X 316SS 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 GVSUD. 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 GVSUD to witness demonstration testing. Operator training shall be conducted on a separate day after demonstration testing. Contractor shall coordinate schedule with GVSUD at least two (2) weeks in advance.

GENERIC SCADA POINTS LIST

(Additional SCADA points requirements will be evaluated by GVSUD during design review based on the equipment proposed.)

OIT - ONSITE AT WWTP
DISPLAY ALL STATUSES AND ALL PROCESS VALUES FOR ENTIRE PROJECT.
PROCESS SETPOINTS SHOULD BE OPERATOR ADJUSTABLE ON THE OIT.
DISPLAY MAIN PQM (AMPACITIES, VOLTAGES, KWH).
DISPLAY EACH LIFT STATION PQM (AMPACITIES ONLY).

TOP END - OFFSITE AT CONTROL ROOM
DISPLAY EACH LIFT STATION WET WELL LEVEL.
DISPLAY RUN STATUS FOR EACH LIFT STATION PUMP.
DISPLAY RUN STATUS FOR EACH BLOWER.
DISPLAY INSTANTANEOUS FLOW RATE FOR EACH CONTACT BASIN METER.
DISPLAY INSTANTANEOUS FLOW RATE EACH FOR EFFLUENT DISCHARGE METER.

ALARMS	WWTP OIT	TOP END
WWTP COM FAIL ALARM		*
PLANT POWER FAIL		*
MCC MAIN POWER FAULT		*
GENERATOR RUNNING		*
GENERATOR GENERAL FAULT ALARM	*	*
ATS IN EMERGENCY POSITION	*	*
OPS BUILDING AC UNIT ALARM	*	*
OPS BUILDING SMOKE DETECTOR	*	*
INFLUENT LIFT STATION PUMP FAIL (EACH SEPARATELY)	*	*
INFLUENT LIFT STATION LOW LEVEL	*	*
INFLUENT LIFT STATION HIGH LEVEL	*	*
INFLUENT LIFT STATION IN BACKUP FLOAT CONTROL	*	*
HEADWORKS GENERAL ALARM	*	*
HEADWORKS HIGH LEVEL ALARM	*	*
CHEM PUMP GENERAL ALARM (EACH SEPARATELY)	*	*
CLARIFIER NOT RUNNING (EACH SEPARATELY)	*	*
BLOWER 1 GENERAL ALARM	*	*
BLOWER 2 GENERAL ALARM	*	*
BLOWER 3 GENERAL ALARM	*	*
BLOWER HEADER LOW PRESSURE	*	*
DIGESTER HIGH LEVEL	*	*
CL2 LEAK ALARM	*	*
FILTER SYSTEM AIR LOW PRESSURE	*	*
FILTER SYSTEM HIGH LEVEL (EACH SEPARATELY)	*	*
NPW LOW SUCTION PRESSURE	*	*
NPW LOW DISCHARGE PRESSURE	*	*
NPW HIGH DISCHARGE PRESSURE	*	*
EFFLUENT LIFT STATION PUMP FAIL (EACH SEPARATELY)	*	*
EFFLUENT LIFT STATION LOW LEVEL	*	*
EFFLUENT LIFT STATION HIGH LEVEL	*	*
EFFLUENT LIFT STATION IN BACKUP FLOAT CONTROL	*	*

Generic Spare Parts List

Provide a spare for each single point of failure item and the following typical items as applicable. Additional spare parts requirements will be evaluated by GVSUD during design review based on the equipment proposed.

- 1) Electrical, Controls & SCADA
 - a) One (1) radio of each type.
 - b) One (1) antenna of each type and size.
 - c) One (1) PLC of each type.
 - d) One (1) CD backup copy of programming for each PLC, HMI, and controlroom.
 - e) One (1) I/O module of each type.
 - f) One (1) communication module of each type.
 - g) One (1) circuit breaker of each type and size.
 - h) Relays (30% of each type and size).
 - i) Fuses (30% of each type and size).
 - j) Lamps for push-to-test indicator lights (30% of eachtype).
- 2) Lift Stations
 - a) One (1) chain grip eye for each lift station.
 - b) Two (2) hatch slam lock keys for each lift station.
 - c) One (1) float.
 - d) One (1) submersible level transmitter.
 - e) One (1) pump controller of each type.
 - f) One (1) PLC of each type.
 - g) One (1) CD backup copy of programming for each PLC and HMI.
 - h) One (1) I/O module of each type.
 - i) One (1) communication module of each type.
 - j) One (1) circuit breaker of each type and size.
 - k) Relays (30% of each type and size).
 - l) Fuses (30% of each type and size).
 - m) Lamps for push-to-test indicator lights (30% of eachtype).
- 3) Headworks
 - a) One (1) maintenance kit (e.g. brushes, wear plates, hardware,etc.).
 - b) One (1) float of each type and size.
 - c) One (1) PLC of each type.
 - d) One (1) CD backup copy of programming for each PLC and HMI.
 - e) One (1) I/O module of each type.
 - f) One (1) communication module of each type.
 - g) One (1) circuit breaker of each type and size.
 - h) Relays (30% of each type and size).
 - i) Fuses (30% of each type and size).
 - j) Lamps for push-to-test indicator lights (30% of eachtype).
- 4) Blowers
 - a) Two (2) sets of belts and/or couplings.
 - b) Oil and/or grease for one (1) change for each blower.
 - c) One (1) air inlet filter for each blower.
 - d) One (1) circuit breaker of each type and size.
 - e) Relays (30% of each type and size).
 - f) Fuses (30% of each type and size).
 - g) Lamps for push-to-test indicator lights (30% of eachtype).

- 5) Clarifier
 - a) One (1) complete set of inside and outside scum rakerubber.
 - b) One (1) shear pin.
 - c) One (1) oil change for drive unit.
 - d) One (1) circuit breaker of each type and size.
 - e) Relays (30% of each type and size).
 - f) Fuses (30% of each type and size).
 - g) Lamps for push-to-test indicator lights (30% of eachtype).
- 6) Peristaltic Pumps
 - a) One (1) pump head or five (5) pump tubes, whichever is applicable.
- 7) Digesters
 - a) One (1) float.
- 8) Chlorine
 - a) One (1) Chlorine Institute Emergency Kit.
 - b) One (1) standard PM kit for each component chlorinator, injector, and vacuum regulator.
- 9) Filter System
 - a) Complete filter media replacement (i.e. everyelement).
 - b) One (1) float of each type and size.
 - c) Oil and/or grease for one (1) change for each pump.
 - d) One (1) PLC of each type.
 - e) One (1) CD backup copy of programming for each PLC andHMI.
 - f) One (1) I/O module of each type.
 - g) One (1) communication module of each type.
 - h) One (1) circuit breaker of each type and size.
 - i) Relays (30% of each type and size).
 - j) Fuses (30% of each type and size).
 - k) Lamps for push-to-test indicator lights (30% of eachtype).
- 10) Air Compressor
 - a) One (1) belt.
 - b) One (1) change of oil.
 - c) One (1) filter.
 - d) One (1) circuit breaker of each type and size.
 - e) Relays (30% of each type and size).
 - f) Fuses (30% of each type and size).
 - g) Lamps for push-to-test indicator lights (30% of eachtype).
- 11) NPW
 - a) Oil and/or grease for one (1) change for each pump.
 - b) One (1) pump controller.
 - c) One (1) pressure transmitter of each type and size.
 - d) One (1) PLC of each type.
 - e) One (1) CD backup copy of programming for each PLC andHMI.
 - f) One (1) I/O module of each type.
 - g) One (1) communication module of each type.
 - h) One (1) circuit breaker of each type and size.
 - i) Relays (30% of each type and size).
 - j) Fuses (30% of each type and size).
 - k) Lamps for push-to-test indicator lights (30% of eachtype).

GVSUD Lift Station Demonstration Testing
Procedure Updated 01/30/2018

Pull Pumps

- 1) Pull each pump. Verify make, model, mix/flush valves, guiderails, supports, hoist, and rotation.

Level Setpoints

- 2) Verify transducer model, range, installation height, cord grip, hook, controller parameters.
- 3) Verify high float installation height, cord grip, hook.
- 4) Verify low float installation height, cord grip, hook.

Transducer Normal Operation

- 5) Turn all HOA switches to off, verify run status and HOA status via SCADA.
- 6) Adjust setpoints to conserve test water if necessary.
- 7) Acknowledge/clear all panel, controller, and SCADA alarms.
- 8) Fill wet well above pumps off setpoint, but below lead onsetpoint.
- 9) Turn all HOA switches to auto, verify run status and HOA status via SCADA.
- 10) Fill wet well to lead on setpoint, verify lead pump starts (first pump), verify run status and HOA status via SCADA, verify pumps off setpoint.
- 11) Fill wet well to lead on setpoint, verify lead pump alternation (second pump), verify pump starts, verify run status and HOA status via SCADA, verify pumps off setpoint.
- 12) Fill wet well to lead on setpoint, verify lead pump alternation (back to first pump), verify pump starts, verify run status and HOA status via SCADA, verify pumps off setpoint.
- 13) Turn all HOA switches to off, verify run status and HOA status via SCADA.
- 14) Fill wet well above lag on setpoint, but below highfloat.
- 15) Turn all HOA switches to auto, verify staggered starts, verify both pumps running, verify run status and HOA status via SCADA, verify pumps off setpoint.

Low Float First

- 16) Turn all HOA switches to off, verify run status and HOA status via SCADA.
- 17) Fill wet well above lag on setpoint, but below highfloat.
- 18) Turn all HOA switches to auto, verify staggered starts, verify both pumps running, verify run status and HOA status via SCADA.
- 19) Drop low float, verify both pumps stop, verify switch to backup controls latched in, verify low alarm horn and beacon and SCADA, verify run status and HOA status via SCADA.
- 20) Lift low float, wait for start delay timers, verify pumps do not start, verify backup controls latched in, verify system in backup alarm latched in horn and beacon and SCADA, verify run status and HOA status via SCADA.
- 21) Lift high float, verify both pumps start, verify staggered starts, verify backup controls latched in, verify high alarm horn and beacon and SCADA, verify run status and HOA status via SCADA.
- 22) Drop high float, verify both pumps still running, verify backup controls latched in, verify system in backup alarm latched in horn and beacon and SCADA, verify run status and HOA status via SCADA.
- 23) Drop low float, verify both pumps stop, verify backup controls latched in, verify low alarm horn and beacon and SCADA, verify run status and HOA status via SCADA.
- 24) Lift low float, wait for start delay timers, verify pumps do not start, verify backup controls latched in, verify system in backup alarm latched in horn and beacon and SCADA, verify run status and HOA status via SCADA.
- 25) Reset to transducer control, both pumps should start to complete previous transducer auto cycle, verify staggered starts, verify backup control cleared local and SCADA, verify high/low/system in backup alarms cleared horn and beacon and SCADA, verify run status and HOA status via SCADA, verify pumps off setpoint.

High Float First

- 26) Fill wet well above pumps off setpoint, but below lead onsetpoint.
- 27) Lift high float, verify both pumps start, verify staggered starts, verify switch to backup controls latched in, verify high alarm horn and beacon and SCADA, verify run status and HOA status via SCADA.
- 28) Drop high float, verify both pumps still running, verify backup controls latched in, verify system in backup alarm latched in horn and beacon and SCADA, verify run status and HOA status via SCADA.
- 29) Drop low float, verify both pumps stop, verify backup controls latched in, verify low alarm horn and beacon and SCADA, verify run status and HOA status via SCADA.
- 30) Lift low float, wait for start delay timers, verify pumps do not start, verify backup controls latched in, verify system in backup alarm latched in horn and beacon and SCADA, verify run status and HOA status via SCADA.
- 31) Reset to transducer control, verify pumps do not start, verify backup control cleared local and SCADA, verify high/low/system in backup alarms cleared horn and beacon and SCADA, verify run status and HOA status via SCADA.

High Float Stuck Raised

- 32) Fill wet well above pumps off setpoint, but below lead onsetpoint.
- 33) Lift high float, verify both pumps start, verify staggered starts, verify switch to backup controls latched in, verify high alarm horn and beacon and SCADA, verify run status and HOA status via SCADA.
- 34) With high float still lifted drop low float, verify both pumps stop, verify backup controls latched in, verify low alarm horn and beacon and SCADA, verify run status and HOA status via SCADA.
- 35) Lower high float.
- 36) Lift low float, wait for start delay timers, verify pumps do not start, verify backup controls latched in, verify system in backup alarm latched in horn and beacon and SCADA, verify run status and HOA status via SCADA.
- 37) Reset to transducer control, verify pumps do not start, verify backup control cleared local and SCADA, verify high/low/system in backup alarms cleared horn and beacon and SCADA, verify run status and HOA status via SCADA.

Hand Operation

- 38) Verify each pump starts and stops in handmode.

Draw Down Testing

- 39) Perform wet well draw down testing for each pump separately. Start and stop within normal operating range shown on construction drawings. Record static and dynamic discharge pressures for each pump. Record vertical distance from pump discharge flanges to pressure gauge. Verify specified TDH and flow rates for each pump.
- 40) Verify size, make, model, flow direction, and function of plug valves, check valves, and air release valves.

Power Loss

- 41) Turn all HOA switches to off, verify run status and HOA status via SCADA.
- 42) Fill wet well above lag on setpoint, but below highfloat.
- 43) Turn all HOA switches to auto, verify staggered starts, verify both pumps running, verify run status and HOA status via SCADA.
- 44) While the wet well level is still above lag on setpoint, simulate a loss of normal power by opening the service main disconnect switch. Verify loss of normal power and emergency power supply via SCADA. Verify that the station automatically returns to primary transducer level control mode. Verify staggered starts, verify both pumps running, verify run status and HOA status via SCADA.
- 45) Restore normal power. Verify that the station automatically returns to primary transducer level control mode.

Other

- 46) Verify intrusion alarms via SCADA (pump control panel and RTU).
- 47) Verify PQM ampacities via SCADA.
- 48) Turn generator HOA to off position. Open the service main disconnect switch. Verify SCADA backup power. Verify power fail alarm via SCADA.