

DIVISION II

DESIGN REQUIREMENTS

SECTION 1: DESIGN AND PLAN PREPARATION

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1.01 General

The design and plan preparation of water distribution systems and sanitary sewer systems shall conform to the specifications herein.

1.02 Licensed Professionals

- A. Water distribution system and/or gravity flow sanitary sewer system design and plan preparation for a residential subdivision or parts thereof on a Developer's property shall be performed by a Georgia Licensed Professional Engineer.
- B. Water distribution system and/or gravity flow sanitary sewer system design and plan preparation for property off-site of a Developer's property shall be performed by a Georgia Licensed Professional Engineer who has sufficient knowledge to properly perform the design.
- C. Water distribution system and/or gravity flow sanitary sewer system design and plan preparation for commercial/industrial property shall be performed by a Georgia Licensed Professional Engineer who has sufficient knowledge to properly perform the design.
- D. Force main and sanitary sewer lift station design and plan preparation shall be performed by a Georgia Licensed Professional Engineer who has sufficient knowledge to properly perform the design.
- E. The professional performing the design and preparing the plans shall seal each plan sheet with their stamp and sign their name across the stamp.

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1.03 Reference Documents and Standards

General methods of design and construction shall conform to the specifications herein and the following. When standards conflict with one another, the LGWSD Manager shall determine the applicable standard.

- A. Georgia EPD, Minimum Standards for Public Water Systems, May 2000.
- B. Georgia EPD, Rules and Regulations for Water Quality Control, Chapter 391-3-6, latest effective date.
- C. Water Environment Federation, Regulation of Sewer Use, WEF Manual of Practice No. 3, latest edition.
- D. Mississippi River Board of State Public Health and Environmental Managers, generally referred to as the "Ten (10) States Standards for Sewage Works".
- E. Gravity Sanitary Sewer Design and Construction, American Society of Civil Engineers Manuals and Reports on Engineering Practice No. 60, Water Environment Federal Manual of Practice No. FD-5, revised April 1982.
- F. Utility Accommodations Policy and Standards, Georgia Department of Transportation, Office of Utilities, latest edition.
- G. American Water Works Association Standards, latest editions.
- H. Soil Surveys of Henry County, Georgia, by the United States Department of Agriculture, Soil Conservation Service.
- I. American National Standards Institute Standards, latest editions.
- J. American Society for Testing and Materials Standards, latest editions.
- K. Occupational Safety and Health Administration regulations, latest editions.

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- L. Georgia Department of Transportation specifications and regulations, latest editions.
- M. American Society of Mechanical Engineers standards, latest editions.
- N. National Electrical Manufacturer's Association standards, latest editions.
- O. American Concrete Institute standards, latest editions.

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1.04 Plan Requirements

- A. Water distribution system and/or sanitary sewer system plans shall be comprised of the following sheets as required. Each sheet should be 24 inches by 36 inches in size.
1. Cover Sheet.
 2. Site Plan Sheet.
 3. Grading Plan Sheet.
 4. Storm Water System Plan Sheet.
 5. Water Distribution System Plan Sheet.
 6. Water Distribution System Details and Construction Notes Sheet.
 7. Sanitary Sewer System Plan Sheet.
 8. Sanitary Sewer System Profile Sheet.
 9. Sanitary Sewer System Details and Construction Notes Sheet.
 10. Sanitary Sewer Lift Station Plan and Cross-Section Sheet.
 11. Sanitary Sewer Lift Station Details and Construction Notes.
 12. Soil Erosion and Sedimentation Control Plan Sheet.
 13. Soil Erosion and Sedimentation Control Detail Sheet.
- B. Water distribution and/or sanitary sewer system plan sheets shall be prepared and include as a minimum the information detailed on the Technical Review Checklist included in Appendix D.
- C. Concurrent with the initial submittal of water distribution system and/or sanitary sewer system plans to the LGWSD, a completed Water Distribution/Sanitary Sewer Addition Submittal form shall be submitted. The LGWSD plan review process shall not commence until the Water Distribution/Sanitary Sewer Addition Submittal form is received. The Water Distribution/Sanitary Sewer Addition Submittal form is included in Appendix C.

1.05 Modifications to Plans

Water distribution system and/or sanitary sewer system plans approved by the LGWSD shall not be modified or deviated from during construction unless the LGWSD Manager approves modifications or deviations in writing.

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1.06 As-Built Drawings

- A. As-Built Drawings of the installed water distribution system and/or sanitary sewer system shall be prepared and sealed in accordance with Division II, Section 1.02.
- B. As-Built Drawings shall be completed upon connecting the development's water distribution system and/or sanitary sewer system to the LGWSD system.
- C. As-Built Drawings shall show all street names, right-of-way widths, related easements, lot number, location, size and material of all water distribution system and/or sanitary sewer system components.
- D. As-Built Drawings shall be prepared using a survey that ties the development's water distribution system and/or sanitary sewer systems horizontally and vertically to the following state plane coordinate system or as amended by the LGWSD.

Horizontal Control: North American Datum 83/94.

Vertical Control: National Geodetic Vertical Data 88.

Grid Zone: Georgia West 1002.

- E. The following certification shall be included on the As-Built Drawings and signed by the Design Engineer:

"I certify that the water distribution system and/or sanitary sewer system depicted by this As-Built Drawing was constructed in accordance with the plans approved by the LGWSD. The information submitted on this As-Built Drawing is to the best of my knowledge and belief, true, accurate and complete."

- F. The Developer's water distribution system and/or sanitary sewer system shall not be considered complete until the As-Built Drawings have been reviewed and approved by the LGWSD Manager. Note that two (2) reproducible set of the approved As-Built Drawings shall be submitted to the LGWSD Manager. The approved As-Built Drawings shall also be submitted to the LGWSD Manager in digital format (AUTOCAD Version 14 or newer version).

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SECTION 2: WATER DISTRIBUTION

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2.01 General

- A. The following section shall be used as a guideline for the design of water mains and service lines that will supply residential, apartment, commercial and industrial complexes.
- B. The LGWSD may require the above referenced complexes to have multiple connection points to existing force mains or water mains.
- C. The LGWSD will require a rain sensor shutoff on all irrigation systems that connect to LGWSD water lines.
- D. The following certification shall be made by the Design Engineer and included with Water Distribution System construction notes:

"I certify that the proposed water distribution system has been designed in accordance with the LGWSD Specification document titled "Standard Specifications for Water Distribution Systems and Sanitary Sewer Systems", Latest Edition including all amendments.

2.02 Design Usage Rates and Hydraulics

- A. Design shall be based on the following average daily domestic usage rates. Daily usage rates may be increased at the discretion of the LGWSD Manager.
 - 1. Residential House: 300 gallons per day per connection.
 - 2. Apartment and Mobile Home: 233 gallons per day per unit.
 - 3. Hotel and Motel: 126 gallon per day per room.
 - 4. Commercial and Industrial: Indicate as required.
- B. Indicate on plans whether structures require fire suppression systems. If so, then indicate the required fire suppression system usage rate (gallons per minute).
- C. The designed system shall provide for the following fire flow demands in the development.
 - 1. Residential Area: 750 gallons per minute.
 - 2. Commercial/Industrial Area: 1,000 gallons per minute.
- D. The following range of supply pressures shall be assumed when sizing system components. Pressure 20psi. to 150psi

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SECTION 2: WATER DISTRIBUTION

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2.03 Water Line Material and Size

- A. Water mains and associated fittings shall be ductile iron with a minimum diameter of eight (8) inches.
- B. Water main pipe assembly shall be push-on joint unless indicated otherwise.
- C. Water main pipe assembly in a bore casing shall be restrained joint unless indicated otherwise.
- D. Service line supplying a single fire hydrant within the right-of way shall be ductile iron with a minimum diameter of six (6) inches.
- E. Service line serving one (1) residential lot shall be copper with a minimum diameter of three-quarter ($\frac{3}{4}$) inch.
- F. Service line serving two (2) residential lots shall be copper with a minimum diameter of one (1) inch. The service line shall be fitted with a copper tee. The tee and service lines, coming from the tee, shall have a minimum diameter of three-quarter ($\frac{3}{4}$) inch.
- G. Service line serving commercial/industrial buildings shall be copper with a minimum diameter of three-quarter ($\frac{3}{4}$) inch and a maximum diameter of three (3) inches or ductile iron sized as necessary for the demand.

2.04 Water Line Location

- A. Situate water mains outside of pavement, within street right-of-way when possible, at five (5) feet beyond the back of curb or edge of pavement or at location approved by the LGWSD Manager.
- B. Situate water mains on the north and east sides of streets when possible.
- C. Water mains shall have a minimum ten (10) foot horizontal separation from any sewer.

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- D. Water mains constructed parallel to streams shall be located such that the nearest area of disturbed soil is greater than 25 feet from the stream bank.
- E. A service line supplying a single lot shall be located nearest a respective property boundary as practical.
- F. A service line serving two (2) lots, from the water main to the meter, shall be located in-line with the lots' common property boundary.
- G. No water main or service line shall be constructed on solid waste landfills.
- H. No water main or service line shall be constructed to serve a structure that is constructed on or to be constructed on a solid waste landfill.
- I. Each water main and service line shall be locatable.
- J. Use Detail Nos. 1.1, 2.1 and 2.2 when applicable.

2.05 Fire Hydrant Location and Spacing

- A. Hydrants shall be situated within the street's right-of-way adjacent to the right-of-way boundary.
- B. A hydrant shall be situated at the end of each cul-de-sac or dead end street.
- C. Fire hydrants servicing residential areas shall be spaced a maximum of 500 feet as measured along the edge of pavement. No lot shall be greater than 250 feet from a fire hydrant.
- D. Fire hydrants servicing commercial and industrial areas shall be spaced a maximum of 300 feet as measured along the edge of pavement.
- E. Use Detail Nos. 3.1, 4.1 and 5.1 when applicable.

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2.06 Valve Size and Location

- A. Valves shall be of the same size as the pipe in which the valve is situated, unless noted otherwise.
- B. A corporation valve shall be situated at the tap location into a water main of a three-quarter (3/4) inch or one (1) inch service line.
- C. A ball valve shall be situated downstream of tapping saddle or tapping sleeve when tapping into a water main or force main with a 1-1/2 inch or two (2) inch service line. The ball valve shall be situated within a meter vault.
- D. Gate valves shall be situated in-line with water mains as follows, unless noted otherwise. The placement of gate valves under pavement shall be allowed, unless noted otherwise.
 - 1. Attach tapping gate valve immediately downstream of tapping saddle or tapping sleeve when tapping into water main or force main with a smaller water main or service line.
 - 2. Situate gate valve immediately downstream of a tee when connecting into a water main.
 - 3. Situate gate valve on each immediate side of a three (3)-way connection or four (4)-way connection.
 - 4. Situate gate valve immediately upstream of a fire hydrant when hydrant is situated within street right-of-way.
 - 5. Situate gate valve within street right-of-way when fire service extends beyond right-of-way.
 - 6. Situate gate valve in water mains at a maximum spacing of 1,000 feet.
 - 7. Gate valve shall be situated outside of vault immediately upstream and downstream of three (3) inch and larger water meter/check valve assemblies.

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- 8. A slip type valve box shall be situated over a gate valve.
- E. A curb stop shall be situated inside of meter box immediately upstream of five-eighths (5/8) inch through two (2) inch water meter/check valve assemblies.
- F. Use Detail No. 6.1 when applicable.

2.07 Water Line Depth

- A. Water mains and service lines to fire hydrants shall have a minimum suitable soil cover of four (4) feet. The depth of four (4) feet from finish grade to top of pipe shall be determined as follows.
 - 1. As measured from edge of pavement (top back-of-curb) when the finish grade elevation of the pipe route is equal to or greater than adjacent pavement elevation.
 - 2. As measured from finish grade elevation of the pipe route when the pipe route elevation is less than the adjacent pavement elevation.
 - 3. Other depth approved by the LGWSD Manager.
- B. Water mains crossing under a creek or ditch shall have a minimum suitable soil cover of two (2) feet.
- C. Water mains shall have a minimum 18-inch vertical separation from any sewer.
- D. Service lines under pavement shall have a minimum suitable soil cover of 2.5 feet as measured from top of curb or top of pavement.
- E. Service lines outside of pavement shall have a minimum suitable soil cover of 1.5 feet as measured from the meter.
- F. Water mains 18 inches in diameter and larger shall be checked for buoyancy when submerged in groundwater or situated within the 100-year flood zone.
- G. Use Detail Nos. 1.1, 7.1 and 8.1 when applicable.

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2.08 Thrust Restraint

- A. Thrust restraint shall be installed at all fittings, hydrants, valves and other locations deemed necessary by the LGWSD Manager.
- B. Thrust restraints at hydrants and valves shall be accomplished by installing a minimum of two (2) eyebolts on the hydrant or valve and tying to an adjacent fitting or concrete tie-back using three-quarter (3/4) inch stainless steel threaded rod.
- C. Thrust restraint at fittings shall be accomplished by using one of the following methods.
 - 1. Cast-in-place concrete blocking installed to dimensions as shown on thrust block detail.
 - 2. Restrained joint pipe and fittings installed upon approval by LGWSD Manager.
- D. Use Detail Nos. 3.1, 4.1, 9.1 and 10.1 when applicable.

2.09 Water Meters and Backflow Prevention

- A. All water usage including fire and irrigation shall be metered and have backflow prevention devices.
- B. All water usage shall be metered using a single meter when possible.
- C. Meters shall be sized according to the anticipated demand and Division III, Section 7 of this document.
- D. Each meter shall have a backflow device consisting of double check valve assembly.
- E. Water meters and backflow devices shall be housed in boxes or vaults.
- F. Water meters and backflow devices shall be situated within the street right-of-way or in an easement area.
- F. Use Detail Nos. 11.1, 12.1, 13.1, 14.1, 15.1, 16.1 and 17.1 when applicable.

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SECTION 3: GRAVITY FLOW SEWERS

DESIGN REQUIREMENTS

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3.01 General

- A. The following section shall be used as a guideline for the design of gravity flow sanitary sewer systems.
- B. Sanitary sewer system design shall incorporate the following LGWSD Sewer Use Ordinances:
 - 1. Ordinance 13.12.150 – Grease Management Program.
 - 2. – Oil/Water and Sand/Grit Interceptors.
- C. The following certification shall be made by the Design Engineer and included with Sanitary Sewer System construction notes:

"I certify that the proposed sanitary sewer system has been designed in accordance with the LGWSD Specification document titled "Standard Specifications for Water Distribution Systems and Sanitary Sewer Systems", Latest Edition including all amendments.

3.02 Design Flow Rates

- A. Design shall be based in the following average daily flow rates for single-family and multi-family residences. Daily flow rates may be increased at the discretion of the LGWSD Manager.
 - 1. Residential House: 300 gallons per day per connection.
 - 2. Apartment and Mobile Home: 233 gallons per day per unit.
 - 3. Hotel and Motel: 126 gallon per day per room.
- B. Design of industrial and commercial sanitary sewer flow rates shall be a minimum of 1.5 times that of the design average daily water usage or as approved by the LGWSD Manager.
- C. A peaking factor of 3.0 shall be used when determining a "Peak Design Flow". The peaking factor may be changed at the discretion of the LGWSD Manager.

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SECTION 3: GRAVITY FLOW SEWERS

3.03 Hydraulics

- A. Gravity sewer pipe should be designed to carry "Peak Design Flow" at one-half full.
- B. Gravity sewer pipe shall have straight alignment and consistent grade change between manholes.
- C. Sewers shall yield mean velocities of not less than 2.0 feet per second based on the Manning Formula using an "n" value of 0.013.
- D. Recommended and absolute minimum pipe slopes for gravity sewer based on the size of pipe to be installed are summarized in the following table.

Slope Requirements

<u>Diameter</u>	<u>Absolute Minimum</u>	<u>Recommended Minimum</u>
8-inch	0.40%	0.70%
10-inch	0.29%	0.50%
12-inch	0.22%	0.40%
14-inch	0.22%	0.40%
15-inch	0.15%	0.30%
16-inch	0.15%	0.30%
18-inch	0.12%	0.24%
20-inch	0.12%	0.24%
21-inch	0.10%	0.20%
24-inch	0.08%	0.16%
27-inch	0.07%	0.14%
30-inch	0.06%	0.12%
36-inch	0.05%	0.10%

- E. Sewers with slopes less than the recommended minimum may be accepted on a site by site basis.
- F. The over sizing of pipe to meet minimum grade requirements shall be prohibited.

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SECTION 3: GRAVITY FLOW SEWERS

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- G. A tangent at a terminal manhole shall have a minimum slope of 1.00 %.
- H. The maximum slope of a gravity sewer shall be 15.0%. When approved by the LGWSD Manager, slopes between 15.0% and 20.0% may be used with the addition of concrete anchors (dead man). The Developer's Engineer shall determine the size and spacing of anchors. The LGWSD Manager shall approve all anchor designs.
- I. When increasing the size of gravity sewer pipe, pipe crowns shall be matched at manholes.
- J. Angle formed by alignment of influent and effluent sewer pipe at manhole shall be greater than (>) or equal (=) to 90° and less than (<) or = to 270°.
- K. The surcharging of manholes shall be prohibited.

3.04 Sewer Material and Size

- A. Sewer outfall, sewer main and lateral pipe and associated fittings shall be ductile iron or PVC.
- B. Sewer pipe assembly shall be push-on joint unless indicated otherwise.
- C. Transition coupling used to connect pipes of differing material shall be rigid and made of steel and/or ductile iron or other material approved by the LGWSD Manager.
- D. Sewer outfalls and sewer mains shall have a minimum diameter of eight (8) inches.
- E. Laterals shall have a minimum diameter of six (6) inches.
- F. Sewers of PVC shall not exceed eighteen (18) inches in diameter.
- G. Sewers eighteen (18) inches in diameter and larger shall be checked for buoyancy when submerged in groundwater or situated within the 100-year flood zone.

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SECTION 3: GRAVITY FLOW SEWERS

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3.05 Sewer Location

- A. Situate sewer outfalls and mains at the centerline of a right-of-way when possible or at the centerline of an easement.
- B. Sewer outfalls and mains shall have a minimum ten (10) foot horizontal and eighteen (18) inch minimum vertical separation from any water main.
- C. Lateral from the sewer main to the structure being served shall be located nearest the center of the property as practical. A separate lateral shall service each property.
- D. When possible, route laterals to manholes rather than direct connection into sewer main and as follows.
 - 1. Lateral connections into an in-line manhole shall be limited to two (2).
 - 2. Lateral connections into a terminal manhole shall be limited to three (3).
 - 3. Invert of a lateral connection at a manhole shall be installed at an elevation not greater than (2) two feet above the invert of the manhole.
- E. Sewer outfalls, mains and laterals constructed parallel to streams shall be located such that the nearest area of disturbed soil is greater than 25 feet from the stream bank.
- F. Sewers shall not be installed under or over any lake, reservoir or detention pond.
- G. No sewer system component shall be constructed on solid waste landfills.
- H. No sewer system component shall be constructed to serve a structure that is constructed on or to be constructed on a solid waste landfill.
- I. Each sewer outfall, sewer main and lateral shall be locatable by means of mylar tape, wire or other method approved by the LGWSD Manager.
- J. Use Detail No. 1.1, 2.2 and 2.3 when applicable.

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SECTION 3: GRAVITY FLOW SEWERS

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3.06 Sewer Depth and Structural Integrity

- A. Sewer outfalls and mains shall have a minimum suitable soil cover of four (4) feet or other depth approved by the LGWSD Manager.
- B. Sewer main shall be situated at a depth as to allow lateral to be constructed at a minimum two (2) percent slope from sewer main to probable structure location on each lot to be served assuming lateral is three (3) feet in depth at probable structure location.
- C. Vertical connection of a lateral into a sewer main shall be prohibited.
- D. Top of pipe shall be two (2) feet below any stream or ditch when crossed or paralleled.
- E. DIP shall be used for the following conditions.
 - 1. Where depth of soil cover is less than four (4) feet before or after sewer installation.
 - 2. Where depth of soil cover is greater than fifteen (15) feet before or after sewer installation.
 - 3. Where sewer crosses over or under a storm drain pipe.
 - 4. Where sewer crosses over or under a water main.
 - 5. Where sewer crosses over or under a stream or ditch.
 - 6. Other locations deemed necessary by the LGWSD Manager.
- F. When a sewer crosses under a stream, a minimum of two (2) cast-in-place concrete collars shall be installed on the pipe, down gradient from the stream.
- G. Sewers shall have a minimum 18-inch vertical separation from any water main.
- H. Use Detail Nos. 18.1, 19.1 and 20.1 when applicable.

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SECTION 3: GRAVITY FLOW SEWERS

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3.07 Manhole Location and Spacing

- A. Provide a manhole at each change in grade, pipe size, alignment, intersection and at terminal point of sewer.
- B. Space manholes a maximum of 400 feet of continuous run for pipes 16 inches in diameter and smaller.
- C. Space manholes a maximum of 500 feet of continuous run for pipes 18 inches in diameter and larger.
- D. Manholes situated within the 100-year flood elevation zone shall have top of cover elevations above the 100-year flood elevation or cover shall be with gasket and bolted down.
- E. Manholes situated within the 100-year flood elevation zone and/or the groundwater table shall be checked for buoyancy.
- F. Manhole inverts shall be constructed to provide a smooth transition between influent and effluent piping.
- G. Manholes situated in pavement shall have top of covers level with finished grade.
- H. Manholes situated in non-paved areas shall have top of covers a minimum of twelve (12) inches above finished grade.
- I. Use Detail No. 21.1 when applicable.

DIVISION II
SECTION 4: FORCE MAINS

DESIGN REQUIREMENTS

Page II-4.1

4.01 General

The following section shall be used as a guideline for the design of sanitary sewer force mains.

4.02 Hydraulics

- A. Force mains shall be sized to allow for a minimum velocity of 2 ft/s and a maximum velocity of 5 ft/s.
- B. Sanitary sewer force mains shall not flow down grade into a receiving manhole.
- C. Combination air release/vacuum valves shall be installed in force mains at all high points of elevation and spaced along apparent flat routes as determined by the LGWSD Manager.

4.03 Force Main Material and Size

- A. Force mains and associated fittings shall be ductile iron with a minimum diameter of four (4) inches.
- B. Water main pipe assembly shall be push-on joint unless indicated otherwise.
- C. Water main pipe assembly in a bore casing shall be restrained joint unless indicated otherwise.

4.04 Force Main Location

- A. Force mains shall be situated outside of pavement within a street right-of-way near the boundary of the right-of-way or centered within an easement.
- B. Water distribution and raw water force mains shall be located on the opposite side of pavement from a sewer when possible and/or shall have a minimum ten (10) foot horizontal separation from any sewer.
- C. Force mains constructed parallel to streams shall be located such that the nearest area of disturbed soil is greater than 25 feet from the stream bank.

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- D. No force main shall be constructed on solid waste landfills.
- E. No force main shall be constructed to serve a component that is constructed on or to be constructed on a solid waste landfill.
- F. Each force main shall be locatable by means of detection tape or wire as approved by the LGWSD Manager.

4.05 Force Main Depth

- A. Force mains shall have a minimum suitable soil cover of four (4) feet. Depth from finish grade to top of pipe shall be determined as follows.
 - 1. As measured from edge of pavement when pipe route existing/finish grade elevation is equal to or greater than adjacent pavement elevation.
 - 2. As measured from pipe route existing/finish grade elevation when the route elevation is less than the adjacent pavement.
 - 3. Other depth approved by the LGWSD Manager.
- B. Force main crossing under a creek or ditch shall have a minimum suitable soil cover of two (2) feet.
- C. Water distribution force mains shall have a minimum eighteen (18) inch vertical separation from any sewer.
- D. Force mains eighteen (18) inches in diameter and larger shall be checked for buoyancy when submerged in groundwater or situated within the 100-year flood zone.
- E. Use Detail Nos. 7.1 and 8.1 when applicable.

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4.06 Thrust Restraint

- A. Thrust restraint shall be installed at all fittings and other locations deemed necessary by the LGWSD Manager.
- B. Thrust restraint at fittings shall be accomplished by using one of the following methods.
 - 1. Cast-in-place concrete blocking installed to dimensions as shown on thrust block detail.
 - 2. Restrained joint pipe and fittings installed upon approval by LGWSD Manager.
- C. Use Detail No. 9.1 when applicable.

4.07 Combination Air Vacuum/Release Valves

- A. Combination air vacuum/release valves shall be sized according to the manufacturer's recommendations.
- B. Valves designated for use with water or sewage shall be used on the respective system.
- C. Valve shall be housed in a "dog house" style manhole.
- D. Use Detail No. 22.1 when applicable.

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SECTION 5: AERIAL PIPE

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5.01 General

- A. This section shall be used as a guideline for the design of aerial pipe that pertains to water distribution piping and sanitary sewers.
- B. Requirements of Division II, Sections 2, 3 and 4, where applicable, shall apply to the design of aerial piping.
- C. A pipe that crosses over a perennial or annual stream must not cause an impedence to navigation or cause water to pool upstream of the pipe.

5.02 Aerial Pipe Material

- A. Aerial pipe shall be ductile iron or steel.
- B. Aerial pipe assembly shall comply with manufacturers' recommendations.
- C. Aerial pipe fittings shall comply with manufacturers' recommendations and specifications herein.

5.03 Aerial Pipe Support

- A. Aerial pipe supports shall be situated on suitable soils. Prior to support design, soils beneath proposed aerial pipe route shall be examined by a soils testing company for bearing capacity and suitability for construction. A soils report shall accompany the proposed aerial route.
- B. Aerial pipe support spacing shall not exceed 40 feet. Aerial pipe support spacing shall be based on results of the soil's bearing capacity and spacing recommendations of the pipe and fitting manufacturers.
- C. Aerial pipe supports shall be comprised of concrete piers set atop concrete spread footings. Spread footing size shall be based on results of the soil's bearing capacity and reactive forces within the aerial pipe.
- D. Minimum pier diameters and footing sizes shall be as summarized in Detail No. 23.1.
- E. Pipe shall be secured to piers as indicated on Detail No. 23.1.
- F. Use Detail No. 23.1 when applicable.

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SECTION 6: LIFT STATIONS

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6.01 General

- A. This section shall be used as a guideline for the design of lift stations.
- B. Pumps, motors and associated components that produce a complete lift station shall be furnished as a package by a single manufacture.
- C. A backup power system shall be provided for each lift station.
- D. Lift stations shall be monitored from remote location via SCADA. A single supplier shall furnish all components of the SCADA system.
- E. Material requirements specific to lift stations, stand-by power and SCADA are included in this section.
- F. A minimum of two (2) sets of operational and equipment manuals for each component of the lift station, backup power system and SCADA system shall be provided prior to final acceptance.
- G. The following information shall be submitted and approved prior to plan approval.
 - a) 100-year flood elevation contour; electrical and mechanical components shall be situated above the 100-year flood elevation.
 - b) Total Dynamic Head (friction loss through force main, static head, friction loss through pumps and suction piping).
 - c) Pump Net Positive Suction Head available and required.
 - d) Pump operating system curve plotted onto manufactures' pump curve.
 - e) Pump cycle time.
 - f) Wet well buoyancy calculation.
 - g) Radio communication path survey.

6.02 Lift Station Package

- A. Pumps
 - 1. A minimum of two (2) pumps shall be provided with capability to pump peak flows with one pump out of service.

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SECTION 6: LIFT STATIONS

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2. Pumps shall be generally as follows.
 - a) Pump shall be submersible.

3. Pumps shall be sized so that the operational system curve intersects the middle one-third portion of the pump operational curve. Each pump shall have the discharge capacity to overcome the development's peak discharge. Components shall be sized to provide two (2) to five (5) pump cycles per hour at average daily flow conditions.

4. Each pump shall be equipped with discharge pressure gauges mounted on a resilient panel. Pressure gauges shall be as follows.
 - a) Four (4) inches in diameter.
 - b) Glycerin filled for "no shock".
 - c) Graduated from a 0-inch to 70-inch water column.
 - d) Equipped with brass shut off valves and fittings.

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5. LGWSD will determine list of spare pump parts that shall be provided for each lift station upon submitting.

Acceptable Manufacture - Model

Flygt submersible.

Other Approved.

B. Electrical

1. Each pump shall be equipped with a motor sized so that the pump operational system curve intersects the middle one-third portion of the pump operational curve. Motor shall not be overloaded at the design condition or at any head in the operational system curve.

Acceptable Manufacturer

Other Approved.

2. Electrical control components shall be housed in a NEMA 3R stainless steel panel enclosure.
 - a) Control components shall be mounted to a removable back panel that is secured to the enclosure.
 - b) Enclosure door shall be gasketed with neoprene, hinged and equipped with captive closing hardware.

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3. A circuit breaker shall be provided for each pump motor.
 - a) A padlocking operating mechanism shall be installed on each motor circuit breaker.
 - b) Operator handles for the mechanism shall be located on the exterior of the control compartment door, with interlocks which permit the door to be opened only when circuit breakers are in the "Off" position.
4. A NEMA rated magnetic motor starter shall be provided for each pump motor.
 - a) Power contacts shall be double-break and made of cadmium oxide silver.
 - b) Motor starters shall be equipped to provide under voltage release and overload protection on all three phases.
 - c) Motor starter contacts shall be easily replaceable without removing the motor starter from its mounted position.
 - d) Motors having a 20-horse power rating or larger shall be equipped with soft start.
5. Motor overload relays shall be provided and have visual trip indication with trip-free operation. Reset buttons shall permit resetting of each motor without opening control panel door.
6. Control circuits shall be protected by a circuit breaker which shall be connected in such a manner as to allow control power to be disconnected from all control circuits.
7. A Hand-Off-Auto switch shall be provided for each pump to permit manual start and stop of each pump individually and to select automatic operation of each pump under control of the level control system.
8. A three position sequence selector shall be provided to select the automatic alternation of the pumps or to select pump number 1 to be the lead pump for each pumping cycle or to select pump number 2 to be the lead pump for each pumping cycle.
9. A run indication light for each pump shall be mounted on the panel enclosure. Light shall indicate that the motor is or should be running.

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10. A thermostat shall be mounted on each pump to detect high temperature. Should excessive temperature exist, protection circuitry shall override level control system and turn off pump motors to protect against excessive temperatures. An indicator light shall be located on front of control panel. Pump shall remain locked out until pump motor is manually reset.
11. Elapse time indicator shall be mounted on each motor to indicate total run time in hours and tenths of hours.

C. Liquid Level Control

1. Liquid Level in wet well shall be monitored via "Electronic Pressure Switch 2000" (EPS-2000 controller) and shall include integral components to sense pressure conditions. The controller shall be equipped as follows.
 - a) Level control electrical enclosure: NEMA 1 stainless steel.
 - b) EMI and RFI suppression.
 - c) DC-current power supply and 108 – 132/60/1 AC-current.
 - d) Function in temperature range of 0° F through 131° F.
 - e) Control range from zero (0) to twelve (12) feet with a repeat capacity of +/- 0.1 feet.
 - f) Equipped with pump start delays preset at a fixed time delay of five (5) seconds to prevent simultaneous motor starts.
2. Provide high water alarm visible indicator on control panel. Maintain alarm signal until manual reset.
3. Provide high water alarm audio indicator. Maintain alarm signal until manual reset of silence circuit.
4. Discrete output signal wiring shall be installed on pre-wired terminal blocks for SCADA monitoring. The signal output shall be for wet well high level, pump motor temperature and pump operation status.
5. Provide the following liquid level elevations on design drawings: Lead Pump "On", Lead Pump "Off", Lag Pump "On", Lag Pump "Off", High Water Alarm.

D. Discharge Piping

1. Piping shall be minimum 4-inch diameter, flanged, ductile iron.
2. Discharge pipe shall include flow meter capable of reading gallons per minute and capable 4-20mamp output.

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6.03 Backup Power System

- A. Each lift station shall be equipped with one (1) preassembled (factory built), skid-mounted, weatherproof, backup power system.
 - 1. The backup power system shall monitor the incoming electrical utility and, should power from the utility be interrupted, supply the power required to operate all lift station pump motors and required controllers.

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2. Backup power system shall perform using a maximum 85% of its rated capacity to operate two (2) motors in series or four (4) motors in staged series based on the pump motor's calculated load. System shall provide for a 10 to 15 second delay for start-up of the second motor(s); a 20 kw generator is a minimum.
 3. Backup power system within 100 feet of an occupied structure shall be equipped with a sound attenuation device to reduce noise levels to less than 80 decibels.
 4. A five (5) year warranty shall be provided for the backup power system.
- B. The backup power system shall supply three-phase power and be generally equipped as follows.
1. Enclosure; enclosure shall house all components of the backup power system and shall include as a minimum the following.
 - a) Seamless fiberglass cowling as follows.
 - 1) Fiberglass shall have a gel coating of suitable thickness and density to provide durability, abrasion resistance, color fastness, gloss retention and shall be impervious to sewage, grease, oil, diesel or other common chemicals.
 - 2) Walls and ceiling shall be solid fiberglass having minimum 3/16 inch thickness and constructed in accordance with ASTM D-579.
 - 3) Enclosure shall be capable of withstanding a wind load of 85 miles per hour. The roof shall be capable of withstanding a minimum loading of 30 psf. All beams and trusses shall be fiberglass.
 - 4) Exterior color of enclosure shall be approved by LGWSD.
 - 5) Tip-up design equipped with mounted gas cylinders such that operator shall not exert more than 25 pounds of lifting force to tip the enclosure to the full open position.
 - 6) Enclosure shall be hinged securely at one end to a steel base. Hinges shall be for heavy duty use, cadmium plated and epoxy coated.
 - b) Steel base as follows.
 - 1) Base shall of size to accommodate fiberglass cowling.
 - 2) Base shall be constructed of steel channel with transverse mid beams supporting a ¼ inch thick steel deck.

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- 3) All steel surfaces shall be prepared to a SSPC –SP6 condition and finished with an epoxy coating system.
- 4) Steel base shall be fitted with an integral doubled wall fuel tank having such capacity as to supply engine/generator set for a 24-hour continuous operation period. Diesel fuel tank shall be furnished with a bacteria inhibitor to prevent bacteria buildup.
- c) Louvers as follows.
 - 1) Engine intake and exhaust louvers sized to provide sufficient air for both cooling and combustion.
 - 2) Louvers shall be 2 inch multi-blade, minimum 12-gauge anodized aluminum, 6063-T5 alloy with removable 5/8 inch aluminum mesh.
 - 3) A duct assembly shall be provided between the engine radiator and the exhaust louver.
 - 4) Louvers and duct assemblies shall be factory installed.
2. Engine/generator; engine/generator set shall be manufactured by Onan/Cummings and include as a minimum the following.
 - a) Electric starter.
 - b) Positive displacement full pressure, lubrication oil pump with full flow lubrication oil filters.
 - c) Engine speed governor.
 - d) Battery and battery charging alternator with solid state regulator.
 - e) Fuel system as follows.
 - 1) No.2 diesel fuel.
 - 2) Replaceable dry element air cleaner, air supply, return and vent lines.
 - 3) Fuel filter with replacement element.
 - 4) Engine driven displacement fuel pump.
 - 5) Fuel system piping. Piping shall be black iron.
 - f) Engine mounted thermostatically controlled water jacket heaters.
 - g) Engine cooling system as follows.
 - 1) Engine mounted radiator system.
 - 2) Belt driven pusher fan.
 - 3) Coolant liquid and pump.
 - 4) Thermostat temperature control.
 - 5) Radiator with duct adapter flange.

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- h) Exhaust system as follows.
 - 1) Spiral type exhaust muffler. Muffler weight shall not be supported by the engine.
 - 2) Exhaust piping shall be routed through the side wall of the backup power system's base and terminated outside enclosure.
 - 3) Piping outside enclosure shall be insulated with a minimum 2-inch thick calcium silicate thermal insulation with aluminum shroud.
 - 4) Provide sound attenuation as required.
- i) Engine protective devices to indicate alarm and engine shutdown as follows. Provide as discreet outputs for SCADA monitoring.
 - 1) Low coolant temperature alarm.
 - 2) Low coolant level shutdown.
 - 3) Low lubrication oil pressure alarm and shutdown.
 - 4) High coolant temperature alarm and shutdown.
 - 5) Over speed shutdown.
 - 6) Over crank lockout.
 - 7) Transfer switch off.
 - 8) External warning light. (outside cowling).
- j) Alternator shall be as follows.
 - 1) 3-phase, broad range, reconnectable with 12 leads.
 - 2) Single bearing and directly coupled to the drive engine through a flexible coupling for self alignment.
 - 3) 4-pole, revolving field type with static exciter and magnetic amplifier voltage regulator. Voltage regulation shall be within +/- 5% of the rated voltage. Sustained voltage dip shall be less than 12% of rated voltage when full load and rated power factor is applied. Recovery to stable operation shall occur within two (2) seconds.
 - 4) Alternator, exciter and voltage regulator shall be manufactured by the same manufacturer as the engine/generator.
- k) The following set controls shall be included on a lighted unit mounted control module.
 - 1) Oil pressure gauge.
 - 2) Coolant temperature gauge.
 - 3) Running time meter.
 - 4) Charge rate ammeter.
 - 5) Manual reset field circuit breaker.
 - 6) Manual selector switch (Run-Stop-Remote).

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- 7) Remote two (2) wire start control.
- 8) Automatic engine shutdown.
- l) The following set control indicator lamps shall be on a mounted control module.
 - 1) Run.
 - 2) Fault.
 - 3) Overcrank.
 - 4) Overspeed.
 - 5) Switch Off.
 - 6) Low Engine Temperature.
 - 7) Low Oil Pressure.
3. Automatic transfer switch shall be manufactured by the same engine/generator set manufacture and include as a minimum the following.
 - a) Switch shall be rated for.
 - 1) Continuous operation over an ambient temperature range of -25° to 125 ° Fahrenheit.
 - 2) All classes of load, both inductive and noninductive at 600 volts and tungsten lamp loads at 250 volts.
 - 3) To close on an inrush current up to and including 20 times the continuous rating of the switch without welding or excessive burning of the contacts.
 - 4) To switch loads up to and including its interrupting current capacity.
 - 5) To endure 6,000 cycles of operation at rated current at a rate of 6 cycles per minute without failure; one cycle shall consist of one complete opening and closing of both sets of contacts on an inrush current 10 times the continuous rating of the switch.
 - b) Switch shall have the following mechanical characteristics.
 - 1) Terminal lugs for either copper or aluminum wire with cadmium oxide contacts.
 - 2) Mechanical and electrical interlocks to prevent simultaneous energizing of both normal and emergency services.
 - 3) Mechanically held on both normal and emergency sides.
 - 4) 3-pole with solid neutral
 - 5) 25-amp rated auxiliary contacts, two (2) on the line side, three (3) on the emergency side.

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- c) Switch shall have the following control logic.
 - 1) Signals engine/generator set to start in the event of a power interruption. A solid state time delay start shall be provided adjustable from 0 to 6 seconds.
 - 2) Monitors each ungrounded line with an adjustable voltage, solid state under voltage sensor to sense a decrease of voltage below a set point or a loss of voltage on any phase of the normal power source.
 - 3) Retrainsfers the load to the line after normal power restoration.
 - 4) Signals engine/generator set to stop after load retransfer to normal source.
 - 5) Provides a battery float charger to maintain fully charged cranking batteries.
 - 6) Provides test switch to simulate an interruption of power from the normal source.
 - 7) Provides an exerciser clock and selector switch (Load/Without Load) to automatically start the engine/generator set at regular intervals and allows it to run for a preset time period with load or without load.
- d) Indicating lamps and meters shall be mounted for easy reading without opening doors.
 - 1) Indicating lamps shall include Green lamp (normal) and Red lamp (emergency) to indicate which source is supplying power to the load.
 - 2) Meter shall include Charge Meter to monitor battery charger output current.
- e) The complete automatic transfer switch shall be mounted in a NEMA 1 rated enclosure, installed within the backup power system enclosure and wired to the engine/generator set at the manufacturer's facility.

Acceptable Manufacturer

- 1. Approval by LGWSD.

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6.04 Telemetry

A. General

1. The lift station shall be equipped with a functioning radio-based telemetry system that is compatible with the existing LGWSD SCADA system.
2. The central computer system (CS) for the LGWSD SCADA system is situated at the WPCP located at 1116 Locust Road in Locust Grove, Henry County.
3. The lift station SCADA system design shall be completed in two (2) phases.
 - A. Phase One. A radio survey shall be performed to determine the feasibility and scope of the radio communication path from the CS to the Lift Station site. The radio survey shall be submitted to and approved by the LGWSD prior to LGWSD approval of the development's proposed sewer system design.

Acceptable Supplier

1. J K Duren Co. Inc., Roswell, GA (770) 992-5405.
2. Loudoun Communications Inc., Austell, GA (770) 948-9566

- B. Phase Two. One Process Instrumentation and Control System Supplier shall provide a complete SCADA system including but not limited to a remote telemetry unit (RTU), radio communication equipment, and necessary accessories. The system supplier shall provide all necessary hardware modifications and software programming of all computers and RTUs associated with SCADA system including necessary program modifications at the CS.

Acceptable Supplier

1. J K Duren Co. Inc., Roswell, GA (770) 992-5405.

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B. Radio Survey – Phase One

1. Complete a radio survey to determine communication path from central LGWSD SCADA system to lift station site. Coordinate site activities with the LGWSD.
 - a) Record coordinates at each site and identifies their specific location on topography mapping software.
 - b) Generate terrain and radio path analysis profiles. Profiles shall be used to calculate the line-of-site radio path between the desired locations including projected tower height. Profiles shall then be used to identify potential interference and/or the feasibility of each potential radio path.
2. Transmit controlled radio signals between potential sites of interest and measure the quality and strength of the received signal. Use the specific radio to be used in the actual application using the same power level that will be used under normal operating conditions.
3. Provide results of radio survey and recommendations in the form of a report to the LGWSD for review. Include the following items (as a minimum) in the report.
 - a) Topographic map showing central LGWSD SCADA system site, proposed lift station site and radio path including repeaters (if necessary).
 - b) Test Methods.
 - c) Site Coordinates.
 - d) Test Equipment and Recommendations.
 - e) Radio Paths Measured.
 - f) Antenna Height Recommendations
 - g) System Recommendation
4. The LGWSD shall approve the radio survey's results and recommendations prior to proceeding with the design of the lift station SCADA system.

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C. Remote Telemetry Unit – Phase Two

1. Remote Telemetry Unit (RTU) shall provide the interface between field signals and the CS. The RTU shall distribute communication, acquire data and control functions for the SCADA system. The following is a minimal list of functions required to be monitored; more functions may be required (i.e. for series staged station) or at the discretion of the LGWSD.
 - a) Generator Fail: Alarm if the generator is in a failed condition.
 - b) Pumps 1 and 2 Run Status: Display the pump ON or OFF status. Calculate the pump elapsed runtime. Allow the runtime to be manually reset at the operator workstation.
 - c) Pumps 1 and 2 Remote Run/Stop: Provide for the pump to be remotely started and stopped. The remote start and stop function shall operate only in the pump local selector switch is in the AUTO position.
 - d) Pumps 1 and 2 High Temperature: Alarm on pump high temperature.
 - e) Pumps 1 and 2 Pressure: Display continuous and discharge pressures.
 - f) Lift Station Level: Display continuous lift station wet well liquid level. Alarm on Low Level in wet well (Less than 4.25mA dc signal).
 - g) High Water Level Alarm: Display if the High Water Level switch is activated.
 - h) RTU Power Monitoring: Alarm on AC power failure or Low Battery Power.
 - i) Discharge meter monitoring; display gallon per minute output
2. Performance.
 - a) RTU shall operate as a subordinate to the CS. RTU shall have all data acquisition, communication and control function necessary to interface with CS.
 - b) RTU shall support full or partial scan by the CS.
 - c) Data acquisition functions shall include but are not limited to the following.
 - 1) RTU shall scan all input points at least every second for current value.
 - 2) Store in buffer memory: currents values of all I/O, pulse input accumulations and filtered values of analog inputs.
 - 3) RTU response to interrogations shall use the buffer memory contents.
 - d) All analog inputs have first order exponential digital filtering with programmable filter constants downloaded from the CS.
 - 1) Default values for filter constants stored in ROM.

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- 2) Filter constants expressed as time constants, range from 10 to 100 seconds with corresponding sample intervals ranging from 1 to 10 seconds.
 - 3) As a minimum, filter constants individually adjustable by RTU.
 - 4) Individual filter constants not required per analog input point.
 - a) RTU shall utilize real-time, multitasking firmware to implement system communication protocol, local data acquisition and control functions.
 - 1) Shutdown due to loss of power shall not result in the loss of programs.
 - 2) Startup after restoration of power shall not require manual or CS intervention.
 - 3) Upon startup, RTU shall configure itself for its connected inputs and outputs and use default values for all initializations. RTU shall indicate its power reset condition to the CS in its reply to the first scan after reset. The CS shall then download all revised initialization constants. Firmware design utilizes a watchdog timer to monitor proper operation.
 - b) All integrated circuits are second sourced.
3. Interfaces
- a) Types
 - 1) With communication circuits to the CS.
 - 2) With lift station input and output signals.
 - 3) With power source.
 - b) RTU shall use a radio communication link utilizing a modem suitable for interface with the radio. Radio shall operate at a 4800 or 9,600 baud with characteristics to match limitations of the radio channel. The RTU communicates with the CS at 9,600 baud in a asynchronous or synchronous format in a half-duplex mode over a party line channel.
- a) Input/Output
 - 1) All Input/Output (I/O) points shall be in accordance with ANSI C37.90.
 - 2) Discrete Inputs (DI) shall be external with normally open or normally closed contacts. RTU impresses a dc voltage on the contact to read their status. Internal RTU logic optically isolated from external contacts. Provide means to limit read current to 100 mA maximum.

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Noise filters or other techniques shall be utilized to reject short time constant noise, contact bounce and 60-Hz pickup.

- 3) Analog Inputs (AI) shall be 4 to 20 mA dc signals in accordance with ISA S50.1 and be fully isolated with a maximum impedance of 250 ohms. Accuracy shall be +/- 0.25% of full scale under all operating temperature conditions. Common mode rejection is at a 100 dB minimum. Normal mode noise rejection is at a 40 dB minimum for frequencies of 60Hz and above.
 - 4) Discrete Outputs (DO) shall have interposing relays with SPDT contact. Relays shall have a 5-amp rating and suited for 100,000 operations at 25° C. DO shall be Latch Type or Momentary Type. Latch Type Output shall not change state on loss of power by RTU. Momentary Type Output shall be single pulse with an adjustable duration ranging from 0.2 to 2 seconds.
 - 5) Analog Outputs (AO) shall be 4 to 20 mA dc signals in accordance with ISA S50.1, Type 2, Class L and be fully isolated. Accuracy shall be +/- 0.25% of full scale under all operating temperature conditions. Resolution shall be 0.1% of full scale or better.
- d) Power
- 1) RTU shall operate on 117-volt rms. The RTU shall have internal power On/Off switch and an On status LED.
 - 2) Power supply shall have an ac/dc converter, a battery charger and dc/dc converters. Power supply shall trickle charge battery when ac power is On and fail over to battery when ac power is Off.
 - 3) Provide batteries sufficient to power RTU for a minimum of four (4) hours after loss of 117-volt ac power. Battery shall be of the sealed lead acid/calcium gelled electrolyte maintenance free type with rated trickle charge life in excess of two (2) years.
 - 4) RTU shall have an ac power fail detection circuit relay. A Discrete Input shall be created upon detection of an ac power failure.

Acceptable Manufacturer – Product

1. Industrial Control Link – Etherlogic L C
2. Approval by LGWSD.

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D. Panel Fabrication – Phase Two

1. Panel including all components (i.e. instruments, wiring and enclosure) shall be fabricated at the Process Instrumentation and Control System Supplier's factory.
2. Provide temperature control as follows.
 - a) Panel shall be sized to adequately dissipate heat from components mounted inside panel or in panel face.
 - b) Panel shall have thermostatically controlled space heater to maintain internal panel temperature above dew point.
3. Provide electrical as follows.
 - a) Feeder circuits.
 - 1) One or more 120V ac, 60Hz.
 - 2) Provide for feeder circuit conduit entry.
 - 3) Provide terminal board for termination of wires.
 - b) Panel Power.
 - 1) Provide main circuit breaker and a circuit breaker on each individual branch circuit distributed from panel.
 - 2) Branch circuit shall blow only branch breaker and not trip main breaker.
 - 3) Breakers shall be located to provide clear view and accessibility when panel door is opened.
 - c) Circuit Wiring.
 - 1) A maximum of 20 devices shall be on a single circuit.
 - 2) Multiple units shall perform parallel operations.
 - 3) Provide for panel lighting and service duplex outlet on separate 15-amp 120V ac branch circuit.
 - d) Signal Distribution.
 - 1) 4 to 20 mA dc signals may be distributed as 1 to 5V dc within panel.
 - 2) 4 to 20 mA dc signals shall be isolated outside panel.
 - 3) Signal wiring shall be twisted, shielded pairs.
 - e) Signal Switching.
 - 1) Use dry circuit type relays or switches.
 - 2) 4 to 20 mA loops shall not be interrupted during switching.
 - f) Relays.
 - 1) General: Plug-in type socket to rail mounting.
 - 2) General: Provide dust cover and hold-down clips with relay enclosure.

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- 3) Signal switch relay with gold or silver contact material having an expected mechanical life of 10,000,000 operations and expected electrical life at rated load of 100,000 operations with an LED or neon indicator lamp.
- 4) Control circuit switch relay (non-latching) with silver cadmium oxide alloy contact having an expected mechanical life of 10,000,000 operations and expected electrical life at rated load of 100,000 operations with an LED or neon indicator lamp and push-to-test button.
- 5) Control circuit switch relay (latching) with silver cadmium oxide alloy contact having an expected mechanical life of 500,000 operations and expected electrical life at rated load of 50,000 operations with an LED or neon indicator lamp.
- 6) Control circuit switch relay (time delay) with silver cadmium oxide alloy contact having time delay set point and mode of operation with an integral potentiometer adjustment with knob external to dust cover.

Acceptable Manufacturer

1. Potter and Brumfield
 2. Allen Bradley.
 3. Omron.
- g) Power supply.
- 1) Provide as required to power instruments requiring external dc power including two-wire transmitters and dc relays.
 - 2) Convert 120V ac, 60Hz power to dc power of appropriate voltage so that instruments will operate within required tolerances.
 - 3) Provide output over voltage and over current protection devices.
 - 4) Enclosure shall be NEMA 1 rated.
 - 5) dc supply line to each individual two-wire transmitted shall be fitted with an indicating type fuse mounted for easy replacement.
- h) Internal Light and Service Outlet.
- 1) Provide 100-watt incandescent light operated by switch.
 - 2) Mount inside and in the top of back of panel.
 - 3) Provide protective metal shield for light.
 - 4) Provide three-wire, 120V, 15 amp duplex receptacle.

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- i) Use following table for standard pushbutton colors and inscriptions. Use black colored lettering on white and yellow buttons. Use white colored lettering on black, red and green buttons.

Tag Function	Inscription	Color
O/O	On / Off	Red / Green
O/C	Open / Close	Red / Green
O/C/A	Open / Close / Auto	Red / Green / White
O/O/A	On / off / Auto	Red / Green / White
M/A	Manual / Auto	Yellow / White
S/S	Start / Stop	Red / Green
Reset	Reset	Red
Emergency Stop	Emergency Stop	Red

- j) Use following table for standard light colors and inscriptions. Use black colored lettering on white and amber lenses. Use white colored lettering on red and green lenses.

Tag Function	Inscription	Color
On	On	Red
Off	Off	Green
Open	Open	Red
Closed	Closed	Green
Low	Low	Green
Fail	Fail	Amber
High	High	Red
Auto	Auto	White
Manual	Manual	Amber
Local	Local	White
Remote	Remote	Amber

4. Panel enclosure shall be as follows.
- a) NEMA 4X rated and constructed of fiberglass. Size shall be 28"H x 20"W x 10"D.

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- b) Enclosure shall have a rubber-gasket door with a continuous hinge. Door shall be secured to enclosure with stainless steel lockable quick-release clamps.

Acceptable Manufacturer

1. Hoffman Engineering Co.
2. Vynckier.

E. Radio Communication Equipment – Phase Two

1. Transceiver

- a) Transceiver shall contain FM transmitter and FM receiver suitable for operation in the 451.3625 MHz UHF.
- b) Transceiver shall operate from power provided by the RTU; provide solid-state circuitry throughout.
- c) Designate transmitter emission in accordance with FCC Rules and Regulations.

Acceptable Manufacturer – Product

1. Data Radio Integra TR.

2. Transmission Cable

- a) Cable shall have performance characteristics suited for overall system functional requirements.
- b) Cable shall have a minimum bend radius of 10 inches
- c) Cable shall have a dielectric jacket and be suited for direct burial and other outdoor design environments.

Acceptable Manufacturer – Product

1. 1 Beldon RG8.

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- 3) Antenna
 - a) Antenna shall be suited for outdoor environments.
 - b) Antenna shall provide a low resistance dc path to ground for lightning protection.

Acceptable Manufacturer – Product

- 1. Omni (Antennex) – Model FG4503, 3dB Omnidirectional Antenna.
- 2. Yagi (Astron) – Model 460-6, 9dB Yagi Antenna.

- 4) Tower and Mast
 - a) Tower and mast shall support antenna at an elevation to achieve functional requirements.
 - b) Tower shall be self-supporting (without guide wires).
 - c) Lightning arrestors shall be provided and connected to ground rods by cable.
 - d) Use Detail No. 25.3 when applicable. Provide “as required” dimensions.

Acceptable Manufacturer

- 1. Tylon Tital.
- 2. Rohn Industries.

6.05 Wet Well

- A. A wet well shall be provided with each lift station. Wet well shall have a minimum 6-foot inside diameter (or equivalent rectangular area).
- B. Wet well shall be sized in conjunction with pump level control to provide 2 to 5 pump cycles per hour at average daily flow conditions.
 - 1. Wet well shall resist floatation during construction.
 - 2. Access to the wet well shall be provided via a 2-foot diameter manhole ring and light weight cover situated two (2) feet centered from inside edge of wet well.

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6.06 Equipment Pads

- A. Backup power system shall be secured by expansion or cast-in anchors to a monolithically poured steel reinforced concrete slab. The slab shall have a minimum depth of eight (8) inches. The slab shall extend a minimum of six (6) inches beyond all sides of enclosure.

6.07 General Electrical Requirements

- A. Electrical service to lift station site area shall be 3-phase, AC current.
- B. Service Entrance, main disconnect, mini-power center and SCADA panel shall be secured to a fabricated steel (galvanized) stand.
- C. Service entrance shall meet the requirements of the local electric utility.
- D. Main Disconnect and mini-power center shall be sized to meet NEC code.
- E. Service wire to all components shall be stranded copper cable sized to meet NEC code and placed in conduit. Service wire within fenced site area shall be underground except where entering equipment.
 - 1. Below grade conduit shall be rigid, schedule 40, PVC meeting requirements of NEMA TC-3 and UL 651. Joints shall be slip-on and glued in accordance with manufacturers instructions.
 - 2. At-grade, above-grade and/or concrete encased conduit shall be rigid galvanized steel meeting the requirements of ANSI C80.1 and UL 6. Joints

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shall be threaded with galvanized fittings meeting the requirements of UL 514B. Set screw and thread less compression fittings shall not be permitted.

3. At-grade or above-grade conduit shall not have horizontal runs greater than 12 inches. Horizontal runs of conduit shall be supported by a minimum of two concrete anchored uni-struts (galvanized).
- F. Area security light shall consist of a photocell having a minimum 150 watt metal halide fixture. The light shall be installed at a minimum height of 15 feet above finished grade. The light pole shall be tubular steel and factory finished with a dark bronze color coating. The light pole shall be anchored in accordance with the manufacturer's recommendations.
- G. All components shall be grounded to copper grounding rods in accordance with NEC code.
1. Ground rods shall be copper-clad having minimum diameter of 5/8-inch with a length of 10 feet.
 2. Ground conductors shall be stranded copper.
 3. Ground connections shall be of the exothermic weld type suitable for exposure to elements or direct burial.
- H. Provide electrical site plan with design submittal.
- I. Use Detail No. 25.5 when applicable.

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6.08 Property and Site Area

- A. A minimum 60-foot by 60-foot area of property, to be donated to the LGWSD, shall be provided for each lift station. The lift station and associated components shall be situated within 40-foot by 40-foot site area; a larger property/site area may be required.
- B. A 12 (twelve) foot wide access drive situated within a 20 foot wide strip of property, to be donated to the LGWSD, shall be provided for each lift station. The access drive shall intersect a public right-of-way. Road material may be changed as approved by the LGWSD Manager.
- C. The property boundary shall be situated no closer than fifty (50) feet from the nearest structure.
- D. Corners of lift station site area shall be at same elevation.
- E. Lift station site area shall be sloped away from slab covering the wet well at a minimum 1.0% slope.
- F. Potable water and a non-freeze yard hydrant shall be provided at each lift station.
- G. Provide plug valve in force main at a maximum distance of 20 feet from lift station.
- H. Site area (minimum 40-foot by 40-foot) shall be fenced.
- I. That portion of the lift station site area not in concrete shall be covered with stone (size R2) at a minimum depth of six (6) inches. Stone shall be placed atop a geotextile fabric liner.
- J. Property area outside fenced area shall be landscaped.
- K. Use Detail Nos. 25.7 and 25.8 when applicable.

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6.09 Fence and Landscaping

- A. A minimum 5-foot clearance shall be provided from fence to major components (i.e. lift station, generator, SCADA tower, electrical stand)
- B. Fence shall have height of six (6) feet with three (3) stands of galvanized barbed wire atop posts.
 - 1. Fence mesh shall be 9-gauge wire (galvanized).
 - 2. Top rail shall be 1-5/8 inch diameter schedule SS40.
 - 3. Intermediate post shall be 2-inch diameter schedule SS40.
 - 4. Corner and gate posts shall be 3-inch minimum diameter schedule SS40.
 - 5. Gate shall have a width of twelve (12) feet, two 6-foot swing gates positioned in location approved by the LGWSD.
 - 6. Gate shall be secured by the LGWSD with a keyed lock conforming to the LGWSD standard; and
 - 7. "No Trespassing" signs to include lift station name, address and emergency phone numbers shall be installed on all fenced sides by the LGWSD conforming to the LGWSD standard.
- C. Property outside of the fenced area shall be landscaped.
 - 1. Install weed barrier fabric over all areas to receive landscaping.
 - 2. Install evergreen shrubbery spaced not greater than five (5) feet apart around the fenced area. Shrubby shall have a minimum height of three (3) feet at the time of planting and shall have a mature height of at least six (6) feet. Prepare soil in accordance with shrubby planting instructions.
 - 3. Install wood mulch, clean of dirt, around shrubby and to the edge of the easement area. Mulch shall have a depth of three (3) inches.
- D. Use Detail Nos. 26.1 and 27.1 when applicable.