SANITARY SEWER
STANDARD SPECIFICATIONS

Adopted by the Santa Rosa City Council
Resolution No. RES-2017-177
September 5, 2017
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SANITARY SEWER SYSTEM
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SANITARY SEWER SYSTEM
DESIGN STANDARDS

I. PURPOSE:

To provide guidelines for design of sewer utilities projects and thereby reduce the time required for processing the plans. These guidelines do not include, but may reference, additional conditions which may be promulgated by all other pertinent ordinances, codes and official policy set forth by the Water Department, other departments of the City of Santa Rosa, or other government agencies. These guidelines establish minimum acceptable design criteria. More stringent requirements may be imposed by the Director of Santa Rosa Water based on specific project conditions.

Wherever the approval, discretion or opinion of the Water Department Director, or any other City staff, is called for herein, the project applicant shall submit a written request for the same. Variance requests must clearly identify the unusual circumstance that would warrant an exemption or waiver from the standards or specifications. The project applicant shall be responsible for providing any calculations or studies needed to support the proposal and for resolving specific design problems with the appropriate agencies, departments or divisions. Any final decision by City staff may be appealed pursuant to the City Code, but may be first directed to the Board of Public Utilities for a recommendation.

II. REQUIREMENTS FOR IMPROVEMENT PLANS AND SUBDIVISION MAPS

K. Provide a detailed utility plan showing onsite and offsite sewer systems, and their connections to existing City maintained sewer facilities. Show any septic systems existing or to be abandoned.

B. For subdivisions, annotate the local agency information sheet of the Subdivision Map with information that is needed to notify property owners of requirements for connection to City Sewer System. These include, but are not limited to:

1. payment of fees prior to issuance of Building Permits;
2. lots requiring installation of sewer backflow protection;
3. private sewage grinder pumps; and
4. public sewer access requirements, such as gates or access roads.

The appropriate information may be obtained from the City of Santa Rosa Planning & Economic Development Department.

C. It is common for a project on one property to be dependent on the construction of sewer by another project or phase of the same project. Sewer system designs shall incorporate any off-site sewer that is required for the connection to an existing public main.
III. SANITARY SEWER MAINS – GENERAL

A. Sewer systems shall be designed in public streets whenever possible. When not in public streets, the following conditions shall be met:

1. Ductile iron pipe shall be used from manhole to manhole when outside of roadways;
2. In general, lateral connections shall not be allowed in easements, but where necessary, in the opinion of the Water Department Director, shall be easy to locate, and accessible to maintenance personnel and equipment;
3. Bolt-down lids are required on all manholes located in easements, on school grounds, through parks, and on any trunk sewers 24” in diameter and larger.

B. Private sanitary sewer systems vs. public sanitary sewer systems:

In general, public sewer shall be used only when they serve multiple lots and suitable access can be provided for maintenance reasons. Private sewer systems shall only be used when they serve single lots or when they serve multiple lots and adequate access cannot be provided for public maintenance purposes. (See the City of Santa Rosa Sewer and Water Utility Maintenance Policy adopted by City Council Resolution No. 14853 in Water Distribution System Design Standards Appendix “B”)

C. Extent of sewer main improvements shall be as follows:

1. Any offsite, downstream sewer system improvements needed to serve the project shall be shown on the improvement plans, including upgrades to existing mains that may be required as a result of an approved capacity study or modeling effort.
2. In general, sewer mains shall be designed at least across one-half of the property frontage or to the most upstream service connection, whichever is greater; or
3. Where the project is required to provide new street improvements over the sewer alignment and the sewer shall serve properties upstream of the project, the sewer main shall be designed across the full property frontage or to the limits of the street improvements, whichever is greater.
4. When a sewer main extension ends at a manhole and the sewer shall be extended further in the future, include in the design a 3’ long stub out of the manhole with a watertight plug or cap for future connection.

D. Streets with both water and sewer mains shall be at least 20 feet wide, face-of-curb to face-of-curb; one utility only: at least 16 feet wide; no water or sewer mains in alleys.

IV. CONNECTION TO AN EXISTING PUBLIC SANITARY SEWER MAIN.

A. Connect new mains to existing at existing manholes or by constructing a new manhole over the point of connection.
B. Where an existing sewer main is to be extended, remove the existing plug, cap, or mainline cleanout and install a manhole. The main may be extended without installation of a structure only if it is on the same line and grade, the pipe size and material are the same, and the manhole spacing is adequate.

C. Elevations of mains connecting to existing sewer mains shall be as follows:
   1. Side sewer mains connecting to an existing main at an angle of 30 degrees or greater shall be at least 0.1’ higher than the existing.
   2. Connect collector mains so that the crown of the smaller main is no lower than the crown of the larger main.
   3. Connections to trunk sewers shall be made so that the invert grade of the new main shall be no lower than the crown of the trunk sewer.

D. Where laterals are the same size as the main, connection shall be made with a manhole. Use a wye for all other lateral connections except as in “G” below.

E. For lateral connections to existing mains 12” and larger, use taps and saddles per City Standard 513.

F. Lateral connections to trunk sewers 15” and larger are prohibited unless first receiving written approval from the Director of Santa Rosa Water.

G. Approved alternatives for multiple connections, such as for grouped flag lots or multiple lots off private driveways are:
   1. Up to 2 joint trenched sewer laterals may be connected to the main using wyes at least 1’ apart. (Taps or saddles where allowed shall be a minimum 1’ apart from nearest outside edge of each pipe.)
   2. A private 6” main may be connected to the public main at a manhole and extend to the services onsite. This alternative requires a joint maintenance agreement or homeowner’s association.
   3. Up to 4 laterals may connect to a junction structure similar to Standard 502.

H. In most major streets, or where the street surface is less than 5 years old, installation methods other than open cutting may be required. The Encroachment Officer or the City Engineer / Director of Public Works shall determine the requirements based on the condition of the existing street.

V. MATERIALS

A. Sewer service laterals shall be SDR 26 Polyvinyl Chloride (PVC) or Ductile Iron Pipe (DIP).

B. Gravity sewer mains up to and including 12” shall be SDR 26 PVC or epoxy lined DIP.

C. Materials for pipes larger than 12” shall be approved by the Director of Santa Rosa Water.

D. Sewer force mains shall conform to the material requirements for water mains. Ductile iron pipe force mains shall be epoxy lined.
E. If a gravity sewer main is installed outside of a paved roadway, ductile iron pipe is required.
F. In general, use the same pipe material from structure to structure.
G. Use of Asbestos Cement Pipe is not allowed under any circumstances.

VI. ALIGNMENT

A. Horizontal
2. Horizontal separation from storm drain or other sewer mains shall be minimum 5’ clear between pipes except at crossings.
3. Horizontal separation from other utilities, such as gas, underground electric, underground television cable, etc., shall be a minimum of 4’ clear between the pipes except at crossings.
4. In general, design public sewer mains in straight street sections to run parallel to the street centerline. All public mains shall be a minimum five feet clear from all structures, building overhangs, gutters, property lines or edge of easements and 3 feet clear from all monuments, and/or lips of gutters. The alignment shall be designed so that any 48” manhole shall be centered a minimum of 3 feet from the lip of gutter and any 60” manhole shall be centered a minimum of 4’ from lip of gutter.
5. In curved streets, design the sewer alignment generally on one side of the centerline to allow installation of other facilities such as water, storm drains, etc. without using transverse crossings. Provide an alignment such that no part of the sewer main is less than 1 foot from the lip of gutter. Structures shall be designed in accordance with subsection VI-A(4).
6. Horizontal curves in gravity sewer mains are not allowed.
7. All sewer main trenches that are parallel to and deeper than the footing of any adjacent structure shall be at least 45 degrees from the footing as required in the Uniform Plumbing Code. Any exceptions require a written approval by the Director of Santa Rosa Water and the Director of Building and Code Compliance.

B. Vertical
2. Generally, provide a minimum of six inches of vertical separation from storm drains or other utilities, such as gas, underground electric, underground television cable, etc. When the minimum cannot be maintained installation of felt expansion material or an approved equivalent between facilities shall be required per City Standard 517. To protect the sewer main from distorting under extreme loads,
other measures, such as controlled density fill or ductile iron pipe, may be submitted for approval by the Director of Santa Rosa Water.

3. Vertical curves in gravity sewer mains are not allowed.

VII. MAIN SIZING CRITERIA

A. Public mains shall be sized to serve the entire tributary area at buildout densities conforming to the General Plan. Engineers for large developments may be required to provide trunk or collection system calculations or have a wastewater model run performed.

B. The design flows shall be based on the following criteria:

1. Use population densities for various zoning on the chart “Sewage Contribution” in Appendix “D.” Average domestic flow shall be 125 gallons per person per day.

2. Multiply average flow as determined in VII-B(1), by Peak Load Factor from the graph “Sewage Peak Load Factor vs. Population,” also in Appendix “D,” to obtain the design flow.

3. Public sewers shall be designed to carry infiltrated water at the rate of 7% of the design flow in addition to the volumes above.

C. Design all gravity sewers to achieve a minimum velocity of 2 feet per second (fps) when the pipe is flowing full. Lesser velocities require the approval of the City Engineer. When analyzing the existing or proposed sewer systems, use Manning’s Formula to determine the design flow and velocity. Use “n = 0.013”.

D. The minimum size is 8” in diameter.

VIII. SLOPE OF SANITARY SEWER MAINS

A. The sewer shall be designed with a slope to be able to serve its entire tributary area. The preferred minimum slope for gravity sewers is 0.005. When conditions require, flatter slopes may be approved in accordance with the following:

   The minimum slope for an 8” sewer is 0.0035.
   The minimum slope for a 10” sewer is 0.0025.
   The minimum slope for a 12” sewer is 0.0020.
   The minimum slope for a 15” sewer is 0.0015.

B. The maximum slope for gravity sewers is 0.15, or 15’ per 100’. Considering relevant factors such as steep terrain, steeper sewers may be allowed with the following conditions:

   1. Use with restrained joints.
   2. Provide trench dams and drainage measures to prevent a buildup of hydrostatic pressure in trenches.
   3. When a sewer with a slope greater than 0.15 passes through a structure with a horizontal change of direction in excess of 30 degrees, a special design of the base
canalization is required to prevent overflows and yet allow for routine maintenance operations.

C. Slope through manholes:
   1. When sewers of uniform slope pass through a manhole, the slope shall be maintained through the manhole and both the incoming and outgoing invert elevations shall be given.
   2. When sewers change slope at a manhole, incoming and outgoing invert elevations shall be given.
   3. Provide sufficient drop through a manhole to compensate for energy loss caused by change of alignment. A minimum drop of 0.1’ is required for a change of alignment greater than 30 degrees.
   4. When pipe sizes change at structures, design the inlet crown at the same elevation or higher as the outlet crown on collector mains, and inlet inverts at the same elevation or higher as the outlet crown on trunk sewer.

IX. MAIN / LATERAL COVER
   A. Cover is the distance from the top of the pipe to final finished grade measured directly over the pipe.
   B. Minimum cover for all sewer mains and laterals shall be 36”. The Director of Santa Rosa Water may approve shallower installations but in no case shall cover be less than 24”.
   C. Where cover is less than 36”, special construction techniques must be approved such as the use of ductile iron pipe, a concrete cap over the trench, or the use of control density backfill.

X. MANHOLES AND MAINLINE CLEANOUTS
   A. A manhole is required at every horizontal or vertical change in alignment.
   B. Maximum distance between manholes is 300 feet.
   C. A manhole is required at the end of every main in excess of 200 feet in length.
   D. Mainline Cleanouts may be installed in lieu of manholes at the end of a sewer main where the distance is less than 200 feet to the nearest manhole and the main size is 10” or less.
   E. 60” diameter manholes are required for mains 18” or larger in diameter.
   F. The manhole shall be designed such that the angle in the horizontal plain between the downstream and any incoming sewer is a minimum of 90 degrees.
   G. Stubs provided out of manholes for future extension shall have a mainline cleanout provided when more than one length of pipe is installed or where service laterals are connected to the stub.
H. Private sewer mains shall connect to the public main at a manhole.

I. Standard drop manhole installations are required when the difference in elevation between the incoming and outgoing sewer is greater than 2 feet. While not encouraged, drop manholes may be required because of some physical restraints. They may not however, be used to merely avoid extra depth of trenching unless unusual circumstances exist. Upstream slope changes should be used to avoid the need for a drop manhole.

J. Drops installed outside of manholes are not allowed.

K. When one drop connection is required, use a 60” diameter manhole. When two or more drop connections are required, use a 72” diameter manhole.

L. Minimize the number of drop manholes.

XI. SANITARY SEWER LATERALS

A. Provide a separate lateral for each lot.

B. Two way cleanouts shall be installed on all service laterals per Standard 513A unless otherwise specified or unable due to field conditions and Standard’s requirements.

C. The minimum sewer lateral size is 4”.

D. Sewer laterals shall be sized as determined by the Design Engineer, in accordance with the requirements of the Uniform Plumbing Code (UPC), any amendments in the California Plumbing Code (CPC) and/or the City’s Design and Constructions Standards, and per final approval from the Engineer.

E. Sewer laterals shall be located on the property frontage, defined as either the front or side boundary line of a parcel which abuts on a street.

F. Laterals shall not be located in easements when gravity service can be provided to the property frontage.

G. When reasonable public vehicular access cannot be achieved, multiple lots may be served by a private main, providing approval by the Chief Building Official is received and appropriate maintenance agreements are approved by the City of Santa Rosa Planning & Economic Development Department.

H. The minimum slope of sewer laterals shall be 2% or 1/4" per foot for 4” laterals and 1% or 1/8" per foot for 6” laterals unless otherwise approved by the Building Department, and shall be designed at a depth sufficient to serve the entire building envelope of the parcel. Any Building Department approved slope, along with related depths, that vary from those specified shall be shown on the plans.

I. All sewer laterals, from property line or edge of easement to the point of connection with the main line or a manhole, shall be perpendicular to the curb alignment or easement unless otherwise approved. At no time shall any sewer lateral have an angle of intersection with the downstream section of sewer less than 90 degrees. No lateral alignments adverse to the flow of the main shall be permitted.
J. Locate sewer laterals outside of driveway area where possible and where driveway locations are known. In general, sewer laterals shall be in the center third of lots when driveway locations are unknown and a minimum of 10 feet from trees whenever possible. For hillside development, place sewer laterals on the low side of property frontage when not in proposed driveway.

K. Sewer laterals serving lots or buildings with plumbing fixtures below the nearest upstream sewer manhole rim require an approved backflow overflow device.

XII. ABANDONMENT OF SEWER MAINS AND SERVICES:

A. Any existing sewer mains and service laterals that will not be used shall be abandoned and the following shall be noted on the Improvement Plans:

1. Sewer mains that are to be abandoned shall be done per Standard 507.

2. Sewer laterals in streets that have been constructed or overlaid within the last 5 years shall be abandoned per Standard 507 behind the curb line or outside the edge of pavement and any cleanout removed.

3. Sewer laterals in streets that have not been constructed or overlain in the last 5 years shall be abandoned by excavating at the main, removing the wye, and repairing the main with a minimum 4’ section of approved pipe and couplers per current City of Santa Rosa Sanitary Sewer Construction Specifications. If the connection to the main is a tap or saddle, it shall be removed and a full circle repair clamp installed. When a wye is removed that is within 18” of a pipe joint, the repair shall be extended to include the joint. All pipe ends shall be abandoned per Standard 507 and any existing cleanout removed.

XIII. EASEMENTS

A. An easement shall be provided, in favor of the City, over any public sanitary sewer when it is installed outside a public right-of-way.

B. The easement shall be a minimum of 15’ wide if it only contains a sewer main or 20’ wide (or wider) if it contains another facility, such as water, storm drain, or other utility. The easement shall be dedicated as a “public sewer easement” if it contains sewer only. It shall be dedicated as a “public utilities easement” if it contains other facilities as well.

C. Easements shall be configured to encompass all publicly-maintained appurtenances, such as service laterals up to the cleanout, and shall be generally centered over the facility. Separate access easements may be required depending on site conditions. When sanitary sewers are to be installed along a property line the easement shall be wholly contained on one parcel.

D. All property restrictions placed as a result of dedication of easements shall be so noted on the supplemental sheet of the Subdivision Map, or on an Easement Deed if the easement is not dedicated as part of a subdivision. Typical required notes as applicable are:
1. No structures may encroach on, above, or below the surface of the ground in any public easement. This includes footings of foundations, eaves from the roof of any adjacent structure, pools, ponds or outbuildings on slabs or foundations. Decks, sheds, or other structures which may be easily removed for maintenance of the sewer system may be allowed at the discretion of the Director of Santa Rosa Water.

2. No trees may be planted in a public sewer easement without first obtaining approval of the Director of Santa Rosa Water. Trees may be allowed to the extent that damage to the sewer system does not occur from root intrusion and adequate access can be provided for maintenance and repair vehicles.

3. The Water Department shall take due caution when performing maintenance or repair of sewer systems in easements, but shall not be responsible for repairs or replacement of trees, landscaping or structures not specifically approved by the Director of Santa Rosa Water.

XIV. ACCESS ROADS

A. Clear access shall be provided and maintained to all structures on the sewer system:

1. All-weather vehicle access roads are required to every structure on the sewer system. Access roads shall be a minimum of 12’ in width and shall be provided with turnarounds per City Standard 206 when the back-up distance for any maintenance vehicle exceeds 100’.

2. The design of access roads shall be included with the sewer system design plans. At a minimum, the design shall conform to the requirements of Standard 216. Include adequate drainage measures in the design to prevent damage to the access roads from storm water.

3. Gates shall be provided for access through any fence crossing a public sewer easement. Where vehicular access is required for maintenance, minimum 14’ wide gates shall be provided with sliding gates preferred. Where vehicular access is not required, 4’ wide gates for pedestrian access shall be provided and shall be located to permit visual access between sewer structures.

4. The maximum grade allowed at any point on an access road is 15%. The maximum cross-slope for any access road is 5%.

XV. SEWER FORCE MAINS

A. Locator boxes shall be placed at every horizontal change in alignment or a maximum of every 500’. Tracer wire shall be laid on top of and along the entire length of all pipe and shall be extended to the surface at all box locations and manholes sufficiently for locator equipment to be attached. Fasten the wire to the top of the pipe so as not to be displaced or broken during backfilling, such as by affixing the wire to the pipe with duct tape at approximately 10 feet intervals. Tracer wire shall be 12 AWG solid copper wire with a green type Underground Feeder (UF) 60 mil insulation that is designed for use in the detection of underground utilities. Where splicing is required only watertight connectors shall be used, and shall be either Copperhead Sharkbite, 3M DBR, or an approved equivalent.
B. Boxes shall conform to valve box requirements per Standard 877 with the lids clearly marked “sewer”.

C. Private force mains shall connect to the City sewer system per Standard 515, and may not discharge directly into sewer manholes. Public force main connections shall be detailed on the plans, but also may not discharge directly into sewer manholes.

D. Provide details for a swab launching station for force main preventative maintenance. Launching facility shall be detailed on lift station plans and shall accommodate the use of lift station pumps for propulsion. Provide necessary valving. All swab launching station designs must be reviewed and approved by the Water Department Director or their designee.

XVI. INDUSTRIAL WASTE DISCHARGE PERMITS

A. Most commercial uses require Industrial Waste Discharge Permits which may be obtained from the Environmental Services Division of the Water Department.

B. Grease traps, grease and sand traps, grease interceptors, and sampling structures as may be required by the Division of Environmental Services shall be shown on the plans submitted for permit approval, or referred to appropriate City Standard Plans.

C. Trash enclosures and other outdoor pad areas used for washing shall be plumbed to the sanitary sewer system at grease interceptor or other connection point approved by Environmental Services. Preventive measures shall be taken to eliminate the intrusion of any rainwater or surface runoff.

D. Wash pad areas shall be diked and/or sloped so that the smallest area possible drains to the sewer.

E. A fixed roof shall be installed over the wash area. The City’s Environmental Compliance Section may consider alternatives to a roof where it is not feasible.

XVII. LIFT STATIONS

A. General Requirements
   1. Lift stations shall not be allowed where an acceptable alternative gravity route exists.
   2. Design the lift station to serve the entire tributary at build-out densities conforming to the General Plan, and in accordance with City peaking standards and I & I allowance.
   3. Lift stations may be submersible pumping stations, package wet well / dry well stations or site designed vertical, dry pit, non-clogging, centrifugal pumping stations, depending on station size, head requirements and motor horsepower.
4. Interior surfaces of wet well shall have an approved epoxy coating, or other material, to protect against inflow and infiltration and corrosion. Coating thicknesses shall be per manufacturer’s recommendations.

5. Material and color samples shall be provided to the Engineer who will coordinate with the Water Department for approval and use on all items specified to be painted and/or coated.

See Table 1 for an outline of the allowable design criteria for each type of pump station, listed in order of preference:

**TABLE 1
PUMPING STATION DESIGN CRITERIA**

<table>
<thead>
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<th>Station Type</th>
<th>Influent Flow Range (gpm)</th>
<th>Maximum TDH*</th>
<th>Maximum Motor</th>
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<tbody>
<tr>
<td>Packaged wet well / dry well</td>
<td>Up to 3000 gpm</td>
<td>Up to 45 feet</td>
<td>100 HP @ 1450 rpm</td>
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<tr>
<td>Vertical centrifugal</td>
<td>No restrictions</td>
<td>No restrictions</td>
<td>No restrictions</td>
</tr>
<tr>
<td>Submersible</td>
<td>Up to 2000 gpm</td>
<td>Up to 160 feet</td>
<td>100 HP @ 1800 rpm</td>
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* TDH = Total Dynamic Head. Submittal of calculations required.

6. Tandem pumping may be allowed where low flow, high TDH conditions exist, with expressed written permission from the Director of Santa Rosa Water.

7. All pumps, regardless of station type, shall be non-clogging, capable of passing a minimum 3” diameter sphere. All pumps, regardless of station type, shall be single speed.

8. Lift stations are not allowed within the street right-of-way.

9. Provide a 12-foot paved access road with a 14-foot wide rolling gate preferred where possible, to allow service vehicles to be parked off the street and clear of the sidewalks. Turnarounds are required for stations constructed along heavily traveled streets. Provide service vehicle access to wet well.


11. Provide a single surface pad over site that incorporates lift station access, wet well / dry well access and supporting generator and fuel supply tanks, as necessary.

12. Provide restrained flexible couplings on all outlet piping within 2 feet of the station wall.

13. Provide reinforced concrete supports for pipes between wet well and dry well, where appropriate.
14. Wet well to be circular, and a minimum 72” in diameter with 4-hour capacity or as necessary to accommodate pumping equipment for submersible stations. For all other station designs wet well size shall be based on good sanitary engineering practices. Provide resilient-seat gate valve on-line into wet well.

15. Provide 6” epoxy lined ductile iron pipe emergency by-pass system consisting of a suction line and a discharge line and a standpipe equipped with a cap and cam-lock connector. Bypass shall be located in a vault. Standpipe connects to force main through an AWWA resilient seat gate valve with stainless steel trim and check valve. The suction and discharge lines shall have gate valves for isolation. Adequately support all piping.

16. Provide 1-inch minimum water service with reduced pressure backflow preventer and piping insulation.

17. Provide re-keyable Almont locks for all padlock applications.

18. Provide Simplex keyless push button access control systems for all buildings.

19. Provide fall protection device for ladders that include winch and center post. Winch shall be Miller M 52-50SS or approved equal. Center post shall be Uni-Hoist Arm #UH 504-24 with top and back rollers or approved equal. Provide non-skid surface on ladder.

20. Provide a spare pump and air release valve prior to acceptance.

21. Provide calculations to determine the need for hydrogen sulfide suppression in force main.

B. Wet Well Lid and Hatch

1. The Contractor shall provide all the necessary materials, equipment, parts and labor required to design and install the concrete wet well lid. The Contractor shall provide to the Engineer structural calculations stamped, sealed and signed by a Structural engineer licensed in the State of California for the wet well lid which shall indicate that it is capable of supporting all real and potential loads it may encounter. These loads include, but are not limited to traffic loading, the wet well access cover, concrete and backfill material.

2. The wet well lid shall be rated for AASHTO H20-44 direct traffic loading.

3. The concrete used in construction of the wet well lid shall be Portland cement concrete conforming to the acceptable standards of Section 90 of the City of Santa Rosa Standards and Specifications. Mix submittal is required for City review and approval.

4. The lid shall be poured in a single monolithic pour

5. The circumference of the lid shall be notched to fit the barrel of the wet well.

6. The wet well lid shall not be constructed or delivered to the project until the design submittal has been accepted.

7. The wet well shall be provided with an aluminum access hatch with safety grating, AASHTO H-20 load rating, with a 4’ x 6’ clear inside opening when open.
8. Access hatch frame shall be cast into and supported by the concrete as required by the hatch cover manufacturer.

9. The access hatch shall be equipped with hold open arm(s), recessed lift handles, recessed slam-lock, lift spring on safety grates, stainless steel slam-lock, stainless steel hardware, recessed padlock clip, black paint on exterior of frame, ¼” diamond plate.

10. The manufacturer shall provide structural calculations showing that the cover hatch design meets the loading requirements of AASHTO H20.

11. The access hatch shall be designed to combine covering the opening, fall through protection per OSHA Standard 1910.23 and controlled confined space entry per OSHA Standard 1910.46.

12. The safety grate shall be made of 6061-T6 aluminum and designed per the “Specifications for Aluminum Structures” by the Aluminum Association, Inc 5th Edition, Dec 1986 for Bridge Type Structures.

13. Each door and grate shall be provided with 316 stainless steel hold open arm which shall lock the door or grate in the 90-degree position opened. Design shall assure that the safety grating is in place before the doors can be closed.

14. The grating shall be designed to withstand a minimum live load of 300 pounds per square foot. Deflection shall not exceed 1/150th of the span.

15. Grate openings shall allow for visual inspection, limited maintenance and adjustments while the safety grate fall through protection is left in place.

16. Each aluminum safety grate shall be epoxy coated with a safety orange color.

17. Install shall be in accordance with ANSI/AWS D1.2-90 Structural Welding Code for Aluminum.

18. Access cover shall be “Safe Hatch” FLED-17HDAOSHRPC, as manufactured by Flygt Corporation.

C. Pumping Equipment

1. Provide a minimum of two pumps and controls to alternate lead and lag pumping. Where required by Director of Santa Rosa Water, three or more pumps may be required in a lead, lag, standby arrangement.

2. For each type of pump, provide one spare rotating mechanism to replace each pump type.

3. Provide one set of routine service replacement parts such as wear rings, bearings, and seals for the pumps.

4. Provide calculations used to determine the capacity of the wet well and the specifications for the pump.

5. Provide hour meters for each pump that records pump run time, only if the motor is operating.

6. Provide a magnetic flow meter on the discharge of the pump station. Meters may be in an approved vault. Display shall be installed in pump station.
7. Packaged wet well / dry well stations
   a. Above ground lift station is preferred.
   b. Lift station standard is 7’ – 6” diameter, Fiberglass Reinforced Plastic underground lift station by Gorman-Rupp with above ground controls and underground pump shut-offs.
   c. All pumps, motors, internal valves and piping, level indicators, control switches, ladder, alarms, blower and dehumidifier shall be manufactured and assembled as a package. Supply and warranty shall be through one company.
   d. The pumps shall be self-priming, horizontal, centrifugal, sewage pumps. Pumps shall pass a maximum solid, 3” diameter sphere.
   e. All motors shall be totally enclosed, fan cooled with premium efficiency.

8. Vertical centrifugal stations
   a. The lift station shall employ vertical, dry pit, single stage non-clogging centrifugal sewage pumps.
   b. Pumps with mechanical grease seals shall be provided with a grease reservoir.
   c. All motors shall be totally enclosed, fan cooled, premium efficiency.
   d. Pumps shall include an individual air bleed system from each pump to the wet well.
   e. Seal water piping systems, where necessary, shall be schedule 80 PVC or Type “K” hard temper copper. Seal water systems shall be designed with drains.
   f. Design of lift station enclosure for vertical centrifugal stations shall be coordinated with the City Building and Fire Departments with respect to occupancy class and electrical and HVAC system design.

9. Submersible pumping stations
   a. The lift station shall consist of a minimum of two submersible centrifugal sewage pumps, guide rails, wet well access, discharge seal and elbow, motor control center, starters, liquid level control system and all hardware necessary to make a complete working system. Supply and warranty shall be through a single company. Standards are ITT Flygt, Gorman Rupp Company or an approved equivalent.
   b. The pumps shall be electric, submersible, centrifugal non-clogging units capable of passing a 3” sphere. Pump and motor shall be suitable for continuous operation at full name plate load while the motor is completely submerged, partially submerged or totally non-submerged. All electrical equipment / panels shall be above ground.
c. Each pump shall be furnished with a discharge connection system, which shall permit removal and installation of pump without the need for the operator to enter the wet well.

d. All hardware in wet well, chains, cables and slide rails shall be 316 stainless steel.

D. Lift station piping and valving

1. When not included with package stations, all internal main lift station piping shall be flanged, except as discussed in No. 2.

2. All main lift station pipes shall have flexible connections (Victaulic or Dresser) to allow for disassembly.

3. All main piping shall have manual vents and drains to allow draining of sewage prior to piping disassembly.

4. Resilient seat gate valves in manholes shall be used for station wet-well isolation.

5. Ductile iron, non-lubricated eccentric plug valves with worm gear operators shall be used for pump isolation valves. Valves shall have stainless steel bearing, nickel seats, neoprene faced plugs and nitrile-butadiene packing. For package wet well / dry well stations, if space does not permit isolation valves for each pump use 3-way valves.

6. Main Pump Check Valves shall be Swing Flex Check Valves. Check valve shall not be installed in the vertical.

E. Electrical Equipment

1. Free standing electrical service and transfer switch shall be heavy duty electrical weatherproof enclosure securely mounted, per approved submittal, in a manner acceptable to the Director of Santa Rosa Water. Enclosure shall be mounted a minimum of 24” above the ground or per an approved pedestal design. Provide a concrete pad around steel supports. Enclosure and equipment to be provided by Tesco, Cutler-Hammer, or Square D. Provide 110-volt duplex, GFI, receptacle in a weatherproof box. The enclosure shall be constructed of stainless steel or hot dipped galvanized sheet metal, and shall have 316 stainless steel hinges and hardware, and a factory applied powder coated finish in a color approved by the Water Department. Where a Water Department approved color cannot be obtained, the powder coated enclosure shall be installed as required and then, by a licensed coater, properly prepared and spray coated in a manner and with a material that is approved by the Water Department.

2. Provide Killark connector for mobile generator with manual transfer switch. Generator plug shall be a minimum of 36-inches above ground. See attached single-line diagram for wiring manual transfer switch.
3. If the lift station dry well is a confined space, provide explosion proof dry well lighting adequate to illuminate the ladder and the floor of the dry well.

4. Provide an exterior light in accordance with STD #601. Provide 12-inch diameter pole-mounted luminaires at 120V, 50W LED with Bi-Level option.

5. Provide OSHA approved rubber mat in front of all indoor control panels.

6. Provide waterproof local control in dry well to operate pumps for testing. i.e. Auto/Manual selector switch, spring return to “Auto”.

7. Provide 25% additional spare wire and 2” conduits or oversize conduits to meet ultimate station capacity. Label all wires at both ends with heat shrink labels.

8. Reduced Voltage Soft Starter (RVSS) shall be Allen Bradley SMC-Flex with built in by-pass.

F. Telemetry

1. Control Panels

All control panels shall have the following general features.

a. Panels and enclosures shall have NEMA ratings as shown on the drawings. In general, NEMA ratings shall be:
   1) NEMA 3R/12 for outdoor installation. Installation shall include custom gasketed doors and sun/rain shield.
   2) NEMA 12 for protected installations inside buildings.

b. Panel design shall incorporate the following features:
   1) Provide a lamp with door switch.
   2) Provide a 120 VAC GFI protected duplex convenience outlet.
   3) Provide heating and cooling, in each outdoor cabinet section, to maintain internal components within operating tolerances and to avoid condensation.
   4) Provide 120 VAC uninterruptible power supply (UPS) or an equivalent DC voltage subsystem sized for 150% of peak load for all internal panel components for a minimum of 8 hours run time.
   5) Provide radio communications system compatible with CITY’S current SCADA system. See City personnel for specific frequency and any changes.
   6) Provide a high temperature switch (alarm) for the control panel.
   7) Provide an automatic alarm dialer to annunciate critical alarms. (per Water Department approval)

2. Programmable Logic Controller (PLC)
Provide Allen-Bradley CompactLogix 5370 or Tesco L3000 PLC, or approved equivalent, to perform monitoring and control of the facility. Provide PLC as shown on the Drawings and/or as specified in other Contract Documents.

a. Product Description;
   1) The PLC shall be intelligent, modular unit, capable of both data acquisition and local data processing.
   2) It shall be capable of monitoring and controlling local equipment in stand-alone mode, as well as being an intelligent node in a distributed system.
   3) It shall be suitable for installation in outdoor environments. Programs shall be capable of being downloaded either directly to the unit using RS-232 interface cable, remotely through the communication network.
   4) The operator interface shall be a sealed membrane keypad suitable for corrosive atmospheres with eight-character alphanumeric display.

b. All PLC’s shall utilize the following features
   1) All analog inputs shall be isolated with 4-20 mA current signal isolators.
   2) All analog outputs shall be isolated with 4-20 mA current signal isolators.
   3) Provide two serial communication interfaces running MODBUS RTU mode.
   4) Provide an operator interface panel.
   5) Provide input and output points as defined in the specifications and drawings.
   6) Provide 20% spare analog and digital I/O’s.
   7) Provide Heartbeat Alarm to external dry contacts for PLC failure alarm.

3. 150MHz Radio Subsystem
   a. Provide radio system components at Lift Station, including radio, antenna, antenna mast, antenna cable, system grounding, lightning protection and physical connections for a complete operating system.
      1) Provide a 150MHz band radio for PLC. Select specific frequencies to match the City’s existing radio system.
      2) The radio shall be the Dataradio Integra-TR 242-4018-551 wireless data modem.
3) Provide antenna appropriate to site:
   a) Yagi antenna with 9dbi gain. Antenna shall be cut at the factory for the assigned frequencies. KATHREIN SCALA YA7-155 150-164Mhz or approved equivalent.

4) Antenna Mast: Polyester powder-coated steel or anodized aluminum with 2 – 3/8” diameter tenon rated for 80 MPH wind, Valmont DS2000 or equal with weatherhead on top of tenon.

5) Antenna cable: 1/2” foam filled 50-ohm heliax, Times Microwave Systems LMR-600-DB

6) Antenna grounding kit: Andrew SGPL4-06B2 Sure Ground Plus.

7) Crimp-style lug: Andrew 244456 or approved equivalent.

8) Cold shrink weatherproof tubing: Andrew 241474-4 or approved equivalent.

9) Antenna down conductor: #6 AWG bare tinned solid copper, Microflect B1961 or approved equivalent.

10) Lighting arrestor: Bulk-head style, Polyphasor VHF-50HN or approved equivalent.

11) Hardware: Stainless Steel

4. Panel Mounted Devices
   a. 12/24 VDC Power supplies: Power supplies shall be linear, open frame supplies with a minimum capacity of 3.0 Amp manufactured by Acopian, Power One, or Solo.
   b. Relays: Relays shall be SPDT with a minimum 10 Amp rating by Idec, Potter & Brumfield, Turck, or Allen-Bradley.
   c. Signal Isolators: Current isolators and converters shall be by M-Systems, Wago, or Wilkerson.
   d. Terminal Block System: Terminal blocks, fuse blocks, and disconnect blocks shall be by M-Systems, Wago, Wilkerson, or Allen-Bradley.
   e. Temperature Switch: Temperature switch shall be used to monitor internal panel temperature for high temperature conditions. Range shall be 0 – 120 degrees F. Provide cooling fans.
   f. Interior Lighting: Provide all control panels with a LED interior light of the same approximate width of the control panel located along the top of the panel. Provide light with an integrated door switch on latch side of opening.
   g. UPS: Provide an uninterruptible power supply sized for 150% of calculated load with sufficient battery backup time for 30 minutes of operation. Provide American Power Conversion or Best Power Products.
h. Selectors and Pushbuttons: Provide corrosion resistant selectors and pushbuttons by Allen-Bradley.

5. Pressure Transmitter
a. Pressure measuring Systems shall be of two-wire, differential pressure cell type and produce a signal directly proportional to and linear with input pressure. The pressure transmitter shall be a Rosemount 3051CG4A22A1AM5B4.

b. The microprocessor-based signal converter/transmitter shall have the following attributes:
   1) Covert signal from the d/p cell to a standardized 4-20mA signal into a minimum of 700 ohms.
   2) A 2-line LCD display for value on top line and units on the bottom line.
   3) NEMA 4X aluminum housing sealed with O-rings.
   4) Self-diagnostics and automatic data checking.
   5) Tolerate ambient temperature operating limits of -20 to +140 degrees F.

c. Process connection: ¼ NPT

d. Performance: the pressure metering system shall conform to the following requirements:
   1) Accuracy: 0.20% of calibrated span
   2) Ambient Temperature effect: less than +/- 0.5 of calibrated span at maximum span for 100-degree F change.

6. Wet Well Measurements
a. Provide continuous (analog) wet well level measurement by use of bubbler system. Mount bubbler system components (compressors, Rosemont pressure transmitter, valves, etc.) in control panel. Mount air cell 6 inches above the wet well floor. Use 304 or 316 SS tubing for all piping.

b. Use differential pressure transmitter for pressure (level) measurement on the bubbler system. Use Rosemont model 3051CG4A22A1AM5B41151 smart pressure transmitter. Provide 0.5 inch NPT block and shutoff valves. Provide 0.5 inch NPT manifold for calibration.

c. Use duplex air compressors with manual alternation with receptacle inside the cabinet. Use WISA model 110 compressor or approved equivalent capable of supplying 5 psi air at 100 cfm.

d. Use King Instruments rotameter part number 74C-111G082-5-2-1-5-1-4 or an approved equivalent for flow loss alarm.

e. Provide float for high-high level alarm contact.
7. Record Drawings and Operations & Maintenance Documentation

a. As-Built Drawings: Provide as-built drawings showing physical location of components. Provide loop drawings (end-to-end wiring diagrams) meeting the ISA S5.4 standards with minimum required items plus optional items. Provide three (3) copies of all drawings and an electronic version in AutoCAD latest version.

b. Provide O & M Manuals for hardware.

1) Cover equipment comprising the system in the hardware instruction manuals for all equipment including third party equipment, provided as part of the SCADA system. Provide instructions for operation and maintenance of the installed system, as well as operation and maintenance instructions for the individual equipment units comprising the system.

2) Cover equipment comprising the system in the hardware instruction manuals for all equipment including third party equipment, provided as part of the SCADA system. Provide instructions for operation and maintenance of the installed system, as well as operation and maintenance instructions for the individual equipment units comprising the system.

3) Standard hardware manuals shall be acceptable, provided that errata sheets are included to reflect the specific equipment provided.

4) Electronic CD-ROM hardware manuals are acceptable.

5) Provide three (3) COPIES OF O&M manuals plus an electronic copy when available.

c. Provide O&M Manuals for software.

1) Provide complete, organized, and standardized documentation for operations center, RTUs, PLCs, and other software provided as part of the SCADA system. In general, structure the documentation such that each level develops a different degree of detail. Begin with a broad approach (Systems Manual), focus on smaller pieces of the overall system (Subsystem Documentation) and finally pinpoint the finest detail (Program Documentation).

2) Fully annotate and document every PLC program.

3) Provide three copies of software O&M manuals plus an electronic copy when available.

8. Testing Requirements

a. Factory Acceptance Test (FAT): Fully test all SCADA components at the Manufacturer’s, facilities prior to shipping, installing, programming, or
reconfiguring the City’s SCADA equipment. The purpose of the testing is to verify compliance with the specifications and correct deficiencies at the Contractor’s facility and not in the field. Insofar as practical, test the functional, performance, and interface requirements. Test each control loop from terminal strips to the PLC.

b. Site Acceptance Test (SAT): After installation, fully test all SCADA components to verify compliance with the specifications. Insofar as practical, test the functional, performance, and interface requirements. Test each control loop from the instrument or terminal strip, through the PLC, to the City’s central SCADA system. Tune all control loops. Test all control strategies.

c. Operational Availability Demonstrations (OAD): The OAD is a 90-day period of time during which the SCADA system shall be utilized by the CITY in day-to-day operations. Its purpose is to test the SCADA system stability and completeness over time. Start the OAD upon written notice from the CITY and after successful completion of field testing. The OAD is considered successful if the system availability is 99.8 percent or better. The OAD shall be restarted or repeated if availability is less than 99.8 percent. Final Completion shall not be granted until OAD is passed.

9. Programming and Configuration Services

a. Configure the PLCs based on the configuration drawings, P&IDs, the Process Control Narratives and functionality as specified in other sections. Include all necessary constant and variables required to meet the Specifications whether shown on the drawings or not. Provide a fully functioning control system.

b. The Contractor shall conduct coordination meetings at the City’s site during the configuration and programming program on a periodic basis as needed but at least twice during the project. The purpose of the meetings is to solicit input from and coordinate activities with City personnel and the Engineer. The Contractor shall provide samples of PLC programs and present an update of current activities, a forecast of future activities, and discuss any problem areas.

c. Use diagrams in ladder rung format for the PLC program documentation system. Show all input devices near the left “power rail” and all outputs near the right “power rail.” The diagrams shall show all device codes and functional descriptions shown on the Drawings and shall also show PLC reference codes and I / O assembly codes, module numbers, and terminal numbers. Provide source code for all operator interface programming, amply annotated to explain the operation. Include I / O tag numbers in rung or device annotations. Use control strategy numbers to identify PLC program sections. Alternative programming techniques may be used if approved in writing by the Water Department Director.

d. Organize and structure all PLC programs to aid in software maintenance and modification. Organize each PLC program into a three-level “outline” structure consisting of strategies, equipment items (or sub-strategies), and
“functions.” Each PLC strategy consists of the logic required by one strategy in the Process Control Narratives. Each PLC equipment item (or sub-strategy) shall consist of the logic associated with one piece of mechanical equipment (or associated with a logical subsection of a strategy). “Functions” shall be the smallest subdivision of programs and shall consist of functions, subroutines, or short algorithms requiring roughly five to ten rungs of ladder logic. Ladder logic shall be used for all PLC programming unless otherwise approved in writing by the Water Department Director.

e. PLC programming shall be thoroughly documented. Each contact, coil, timer, function block, or other rung item shall be annotated in the program listing with: the internal item number (i.e., coil number, contact number, etc.); the external tags (where applicable); and a brief description of the item’s function. External tags shall be the input or output tag number from the PLC I / O schedule or, for points created in a PLC and transmitted to (or from) the central computer system, the tag number used in the central computer.

10. Provide a dial-up telephone list for use by the automatic alarm dialer. Provide a wall mounted telephone using the same dial-up line for operator convenience.

G. Standby Generator

1. Provide permanently installed, natural gas fueled Kohler or approved equal generator with automatic transfer switch, manual transfer switch, and load bank connection. Provide Crouse Hinds E0400-1686 Posi-lock load bank receptacles to test generator for output and generator break in (3 phase 4 wire). The Design Engineer shall verify gas pressure with P.G.&E. and fuel demand with generator manufacturer prior to review of submittal. The engine manufacturer shall certify that the engine is designed to operate on natural gas and propane. Generator shall be shipped from the factory with Santa Rosa Water Department approved color. See attached single-line diagram for wiring.

2. Submit generator sizing calculations for City approval. Sizing calculations shall assume loading based on lead pump running, lag pump starting and full operation of all electrical equipment at the site. Generator shall run at 100% of name plate current for 4 hours on primary fuel supply using City owned load bank.

3. Provide automatic back-up propane fuel capability and 24-hour supply of fuel. Propane tank to be factory-painted with Santa Rosa Water Department approved color.

4. Obtain Fire Department approval for site of back-up fuel tank.

5. Provide instrumentation:
   a) Generator voltage, frequency, and amp meters.
   b) Oil pressure gauge.
c) Battery volt meter.
d) Temperature gauge.
e) Hour meter.
f) External battery with trickle charge.
g) Dry contacts for telemetry – showing generator running.

6. Provide automatic shut-off and alarms:
   a) Low engine oil pressure.
   b) High engine temperature.
   c) Over speed.
   d) Over crank.

7. Locate exhaust away from dry well ventilation and provide stainless steel rain cap. Insulate exhaust stack form generator enclosure or roofing material.

8. Provide sound attenuation as necessary to meet or exceed City noise standards for location. Attenuation may include silencers, insulation and/or enclosure. Provide ambient noise measurements and calculations demonstrating compliance.

H. Gas Monitoring System (if required)

1. Provide a permanent gas monitoring system in the dry well.

2. Monitoring system shall monitor for lack of oxygen, lower explosives limit, and hydrogen sulfide.

3. The monitoring system shall be tied to the telemetry system alarms.

4. Manufacturer shall be MSA or an approved equal.

I. Details Required on Improvement Plans:

1. Site Plan: Locations of power pole, transfer switch, emergency generator, emergency fuel supply, control panel, wet well, dry well, ground slab, driveway, fencing, water service, emergency suction/discharge boxes. Provide site grading and drainage details.

2. Wet well: Influent piping (standard inside drop manhole); suction piping (min. 6” off bottom of manhole); emergency suction line; bubbler line including connection hardware; water / alarm levels (pump on, pump off, low level, high level), redundant high water float switch.

3. Dry well: Pumps and piping; safety ladder, ladder light.
4. **Emergency Power:** Electrical details specified to include size and material of conduit, switch gear, telemetry compatibility. Electrical details shall include power source, meter location, cabinetry. Wiring diagrams shall depict connection to and between PG&E, transfer switch, emergency generator and dry well as shown in the attached single-line diagram.

5. **Force main discharge details.**

**J. Record Drawings and Manuals:**

1. Provide three “red-lined” copy of record drawings and an electronic copy in a pre-approved AutoCAD version.

2. Provide three copies of O & M Manuals plus an electronic copy when available.
K.

EXAMPLE SINGLE-LINE DIAGRAM
NOT TO SCALE