

SECTION 7

SANITARY SEWER DESIGN

- 7-1 DESIGN CRITERIA - These criteria shall apply to the engineering design of any sanitary sewer system of up to 10 MGD PWWF capacity to be maintained by the County of Sutter or, with these exceptions as noted, to within private multiple ownership residential or multi-parcel commercial and industrial developments. A basic design criteria is each property owner is responsible for the installation of a collector sewer across his/her property frontage. Lacking such construction participation, the in lieu fee provisions of the appropriate sanitation or sewer maintenance district shall apply, unless otherwise approved by the Director.
- 7-2 AVERAGE FLOW DETERMINATION - Flow determination shall be based upon the most recent zoning. The minimum population density used shall be equivalent to that of single family zoning. The area shall be examined for trends toward population concentration greater than present zoning allows and/or more than five lots per acre and, if found, an estimate should be made of the probable extent of such concentration. This estimate shall be used as the basis for determining flow.
- A. Single Family Detached Units - Average Daily Flow shall be based on 300 gallons per residential unit (lot) per day, and a minimum of five lots per acre. However, if the number of lots per acre is known and is greater than five, the actual number shall be used.
 - B. Single Family Planned Unit Developments - Average Daily Flow per unit shall be 300 gallons per residential unit/day and the actual number of units per acre shall be considered. However, in the absence of known data, the density shall be assumed to be 12 units per acre.
 - C. Multiple Residential - Flows shall be determined from the curve on Standard Drawing No. S-6. However, if the type of improvements planned are known, they shall be used in the design, subject to approval of the Director. When the number of units is used to determine design flow, the value assigned to each unit shall be 300 gallons per day. Mobile home average daily flow shall be 300 gallons per day per unit.
 - D. Schools - The entire school area shall be assumed to contribute an average flow equivalent to 2,000 gallons per acre per day.

- E. Industrial and Commercial - A flow value of 2,000 gallons per acre per day shall be used for design purposes. The minimum diameter of sanitary sewer laterals for a commercial or industrial development shall be eight inches. Small, isolated commercial projects may be allowed to construct a six inch diameter lateral upon approval of the Director.

Special attention shall be given to any facilities with a magnitude or type of discharge that could be detrimental to the public system.

- F. Inflow/Infiltration - Inflow/infiltration was not considered in establishing the above discharge rates. It will be necessary to increase these rates to reflect inflow/infiltration at 1,000 gallons/day per gross acre excluding permanent lake areas.

7-3 DESIGN FLOW - Design flow (peak wet weather flow, PWWF) shall be calculated by multiplying the average daily flow for the upstream service area, as determined above, by the peaking factor obtained from the curve on Standard Drawing No. S-7 and then adding the flow for inflow/infiltration.

7-4 PIPE CAPACITY, SLOPE, VELOCITY, SIZE, DEPTH AND MATERIAL - Design criteria for the pipe are as follows:

- A. Size - The minimum size of laterals which serve single family development shall be six inches in diameter. Schools, commercial, industrial, and multiple residential shall be served by lines a minimum of eight inches in diameter. However, single commercial buildings which contribute negligible flow, when located among single family development, may be served by a lateral six inches in diameter, subject to the approval of the Director.

- B. Slope and Velocity - Manning's formula shall be used to determine the relation of slope, design flow, velocity, diameter, and "N" value. The "N" value shall be 0.013 for all pipe materials.

1. Following is a table of slopes and design flow capacities for various pipe diameters. Pipe slopes less than those listed in this table shall not be used without the approval of the Director. The slopes indicated are based on a velocity of two feet per second with the pipe flowing full.

Pipe Diameter (inches)	Slope (foot per foot)	Capacity at 0.7 depth (MGD)	Capacity when Flowing Full (MGD)
6	0.005	0.22	
8	0.0035	0.38	
10	0.0025	0.58	
12	0.002	0.85	1.03
15	0.0015	1.32	1.62
18	0.0012	1.95	2.35

2. The maximum depth of flow at design conditions in any lateral (12 inch diameter or less) shall be 0.7 diameter. Lines 15 inches in diameter or larger may be designed to flow full unless direct service sewer connections are planned, in which case the 0.7 diameter maximum depth shall govern.
- C. Capacity - Pipe capacity, in all cases, shall be adequate to carry the design flow from the entire tributary area, even though said area is not within the project boundaries.
 - D. Depth - In the design of a system, one of the controlling conditions shall be that the lateral system will be at sufficient depth to provide a minimum slope for the service sewer of 1/4 inch per foot, at the same time maintaining a minimum cover of 12 inches at any buildable location within the properties to be served, and a minimum of four feet of cover at the right-of-way line, except the depth shall be increased to five feet when water main is installed at the back of sidewalk.
 - E. Material - Pipe material shall be as approved by the Director and shall conform to the requirements of the Standard Specifications. Pipe materials which will normally be considered are as follows:
 1. Vitrified Clay Pipe - Vitrified clay pipe and fittings shall conform to and meet all of the requirements of ASTM Designation: C700, Standard Specifications for unglazed vitrified clay sewer pipe, extra strength, and shall conform to all materials data contained in the current Clay Pipe Engineering Manual published by the National Clay Pipe Institute. A certification of compliance with these requirements shall be furnished by the pipe manufacturer.

Joints in vitrified clay pipe shall be of a factory applied resilient-type plastic compression type which conforms to ASTM Designation: C425.

2. Ductile Iron Pipe - Ductile iron pipe shall conform to ANSI A21.51 (AWWA C151) for a minimum working pressure of 150 psi unless otherwise specified. Ductile iron castings shall conform to and be tested in accordance with ASTM A536. Casting grade for pipe shall be 60-42-10. Laying length shall be the manufacturer's standard length, normally 18 feet. Shorter lengths may be used when required for closures and proper location of special sections.

The interior surface of all ductile iron pipe shall be cement-mortar lined and seal coated in conformance with AWWA C104, and the exterior surface shall have a bituminous coating of either coal tar or asphalt base, approximately 1 mil thick.

Fittings shall be push-on, mechanical, or flanged-type ductile iron or cast iron and shall conform to ANSI 21.10 (AWWA C110) or ANSI 21.11 (AWWA C111) designed for a working pressure of 250 or 350 psi. Coating and lining requirements shall be the same as specified for pipe.

Joints shall be push-on or mechanical type and shall conform to ANSI 21.11 (AWWA C111) with rubber gasket unless otherwise specified.

3. Polyvinyl Chloride Pipe (PVCP) Sewer Force Main and Extra Strength Gravity Sewer -
 - a) 4-Inch Through 12-Inch Diameter Sizes - Polyvinyl chloride pipe shall have a maximum dimension ratio (DR) of 18 (minimum Pressure Class 150), unless otherwise specified and shall conform to AWWA Standards C900. Outside diameter (OD) pipe dimension shall be manufactured to cast iron pipe (CIP) equivalent. Pipe shall be furnished in minimum standard lengths of 20 feet.
 - b) 14-Inch Through 36-Inch Diameter Sizes - Polyvinyl chloride pipe shall have a maximum dimension ratio (DR) of 25 (minimum Pressure Rating of 165), unless otherwise specified and shall conform to AWWA Standards C905. Outside diameter (OD) pipe dimension shall be

manufactured to cast iron pipe (CIP) equivalent. Pipe shall be furnished in minimum standard lengths of 20 feet.

- c) Joints - Polyvinyl chloride pipe shall have integral wall-thickened bell ends designed for joint assembly using elastomeric-gasket seals. The minimum wall thickness of the integral wall-thickened bell, at any point between the ring groove and the pipe barrel, shall conform with the DR requirements for the pipe barrel. The minimum wall thickness in the ring-groove and bell entry sections shall equal or exceed the minimum wall thickness of the pipe barrel. The elastomeric-gasket seals shall conform to ASTM F477.

The pipe shall have a pipe stop indicated on the barrel that will accurately position the pipe end within the joint. The pipe in place shall permit thermal expansion and contraction of the pipe ends.

- d) Fittings -
Pressure Applications - Fittings for polyvinyl chloride pipe shall be those specified by the pipe manufacturer. All pressure pipe fittings for 12-inch diameter PVC and smaller shall be ductile iron compact fittings conforming to AWWA C153 Class 350. Fittings for PVC 14 inches in diameter and greater shall be standard mechanical joint connections conforming to AWWA Standard C110 or restrained to the satisfaction of the Engineer. Adapter "O" rings are not acceptable.

7-5 SEWER LOCATIONS AND ALIGNMENT REQUIREMENTS - Location and alignment criteria are as follows:

- A. General - All sanitary sewers shall be placed within rights-of-way dedicated for public streets unless the use of easements is specifically approved by the Director. In some streets dual laterals may be required. There shall be a minimum horizontal clearance of ten feet clear between parallel water and sanitary sewer lines and the water main shall be higher than the sewer. On crossings the water line shall be at least 12 inches above the sewer line. If a sanitary sewer force main must cross a water main, the requirements of Section 6-10 shall apply.

- B. Location of New Subdivisions - In new residential subdivisions, sewers shall preferably be located six feet south or east of street centerlines within minor and primary streets. Sewers located in arterial street shall be located as approved by the Director.
- C. Location in Existing Streets - When sanitary sewers are to be installed in an existing street, factors such as curbs, gutters, sidewalks, traffic conditions, traffic lane conditions, pavement conditions, future street improvement plans, and existing utilities shall all be considered. The approval of the County shall be obtained in every instance.
- D. Easements - Permanent easements shall be a minimum of 15 feet wide for sewers up to 36 inches in diameter and as determined by the Director for larger diameter sewers.

Temporary working easements of adequate dimensions shall be provided to allow the construction within the permanent easement to be completed in a safe and reasonable manner. Easements shall be granted to the appropriate district or, if a maintenance district is involved, to the County of Sutter.

- E. Water Well Clearance - No sanitary sewer interceptor, trunk line, lateral, or service shall be placed nearer than 50 feet to any water well, public or private, unless the well has been abandoned in full accord with the County Environmental Health Department and Public Works Department or the location otherwise approved, in writing, by the appropriate health agencies. If a clearance of less than 50 feet is approved, all pipe within 50 feet distance from the well shall be of material approved by the Director of Environmental Health.
- F. Alignment - Alignment of all sewer pipe and structures shall be designed to provide a minimum six inch clearance from all other utilities and/or improvements, unless otherwise approved by the Director.
 - 1. Horizontal alignment shall be parallel to the street centerline wherever possible. Minimum radius for sanitary sewers 6 inches through 12 inches in diameter shall be 200 feet. A larger radius shall be used wherever practicable or where necessary to avoid joint deflection in excess of the pipe manufacturers' recommended maximum. For pipe 27 inches in diameter or larger, manholes shall be utilized to accomplish alignment changes.

2. Vertical alignment shall provide a constant slope between manholes. If a change in grade is necessary, construction of a manhole shall be required. Vertical curves shall not be used.

7-6 TRENCH LOADING CONDITIONS AND PIPE DESIGN - The loading condition and pipe design criteria for conduits are as follows:

- A. Rigid Conduit Loading - On rigid conduits, Marston's formula shall be used to determine the load placed on the pipe by the backfill. The procedure for rigid pipe is described in the ASCE Manual and Report of Engineering Practice No. 60, the Clay Pipe Engineering Manual, and in similar handbooks. In the absence of specific soils data, as determined by a Soils Engineer, a soil weight of 120 p.c.f. and a Ku factor of 0.110 shall be used.
- B. Bedding and Initial Backfill - Bedding types and factors shall be as per Standard Drawing No. S-8. Bedding and initial backfill type shall be as necessitated by height of cover over the pipe, trench width, pipe strength, and other factors used to determine safe pipe loading. Special attention shall be given to backfill requirements for pipe located in State rights-of-way and for pipe placed in areas where trench width is excessive, such as in the vicinity of bore pits. See Section 7-12 regarding this condition. Any special requirements shall be noted on the plans.

Unless otherwise noted on the plans, bedding and initial backfill for 10 inch diameter and smaller rigid conduit shall be Type I and for 12 inch and larger Type II, with trench widths subject to limitations set forth in Standard Drawing No. S-8 and in the Standard Specifications. The minimum trench width shall be pipe O.D. plus 12 inches.

- C. Special Pipe Strength Requirements - Ductile iron or other high-strength pipe approved by the Director shall be used whenever cover is greater than 25 feet or extra support strength is required. Ductile iron pipe, Class 200 (DR-14) or other high-strength pipe approved by the Director shall be used whenever cover is less than three feet, or insufficient clearance exists between the sewer pipe and rigid or load transmitting structures.
- D. Design Guide - Tables which relate cover, pipe diameter, trench width, and bedding and initial backfill type for vitrified clay, according to the

procedures contained in these Standards are provided on Standard Drawing No. D-25 and S-8.

7-7 MANHOLE CRITERIA - The design criteria for manholes are as follows:

- A. General - Manholes shall be placed at the intersections of all sanitary sewer lines, at the end of any line terminating with a cul-de-sac at the end of all permanent lines and at the end of any temporary line more than 50 feet in length. All manholes from which sewer line extensions are anticipated shall have a pipe stub installed at the grade and in the direction of the anticipated extension. Summit manholes connecting two sewer laterals are not acceptable.
- B. Spacing - Maximum spacing of manholes shall be 400 feet for all straight lines of ten inch diameter or less. A line with a radius greater than 400 feet shall be considered as straight for purposes of this section. Manhole spacing on lines which are on a continuous curve of 200 foot radius (minimum allowable) shall be 200 feet. Manhole spacing on curved lines of radius between 200 and 400 feet, or where only a portion of the line is curved, shall be adjusted proportionately. Reverse curves require a manhole at the point of tangency between the curves. A manhole shall be required at any change in vertical alignment. A manhole shall also be placed at any change in horizontal alignment.
- C. Elevation Criteria - When two lines of the same size enter a manhole and the flow of one must change direction by more than 20 degrees or if flow in a single line must change direction more than that amount, the invert grade at the exit shall be at least 0.10 foot below that of the entrance pipe or, as a maximum, the crown of the exit pipe shall match the invert of the entrance pipe. If the pipes entering and exiting any manhole are not of the same size, the minimum invert elevation differential shall be when the pipes are matched crown to crown and the maximum invert elevation differential shall be based on the invert of the entering pipe matching the crown of the exit pipe. Drop connections are not governed by the above elevation requirements.
- D. Construction Requirements - Manhole construction shall conform with the provisions of Standard Drawing No. S-3. Lock-type or pressure-type manhole covers shall be used on manholes located in areas subject to flooding. Where the manhole depth is less than four feet, an 18 inch high cone, as shown on Standard Drawing No. S-4, may be used. The plans shall note the frame on manholes located in unimproved areas shall be set

12 inches above existing ground level. Pipe material which does not provide adequate bonding between pipe and manhole may similarly require special designs.

- E. Vacuum Testing Manholes - All sewer manholes shall be vacuum tested for leakage.

The sewer manholes shall be tested for leakage by the following method:
Manhole vacuum test: All lift holes and inside and outside joints shall be plugged with an approved non-shrink grout. All pipes entering the manhole shall be plugged, taking care to securely brace the plug from being drawn into the manhole. The test head shall be placed at the inside of the top of the cone section and the seal inflated in accordance with the manufacturer's recommendations. A vacuum of 10 inches of mercury (approximately 5 psi) shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to 9 inches. The manhole shall pass if the time is greater than 60 seconds for 48 inch diameter manholes, 75 seconds for 60 inch manholes, and 90 seconds for 72 inch and greater manholes. If the manhole fails the initial test, necessary repairs shall be made with a non-shrink grout while the vacuum is still being drawn. Retesting shall proceed until a satisfactory test is obtained.

Payment for testing of manholes and appurtenances shall be included in the price paid for each manhole and shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals and for doing all the work involved in testing as specified in these Design Standards and the Standard Specifications and as directed by the Director.

- F. Manhole Coating - The Contractor shall furnish all labor, tools and equipment necessary to epoxy coat the interior of all manholes indicated on the plans with a corrosion clad, trowel-applied, polymer, monolithic lining and to perform any work incidental thereto. The epoxy coating material shall be Sauereisen Cements Company Corrosion-Clad Polymer Lining No. 210 or Polymorphic Polymers Corporation Quantum Polymorphic Resin, or approved equal. The Contractor shall follow the manufacturer's recommendations for application, including but not limited to, materials, condition of working area, inspection, surface preparation, and curing.

Payment for epoxy coating manholes shall be included in the price paid for each "Epoxy Coated Manhole" and shall include full compensation for

furnishing all labor, materials, tools, equipment and incidentals and for doing all the work involved in installing the manhole complete in place, including the epoxy coating as specified in these Design Standards and the Standard Specifications and as directed by the Engineer.

7-8 DROP CONNECTION CRITERIA - A drop connection shall be required whenever a pipe enters a manhole higher than as specified in Section 7-7. Drop connections shall conform to Standard Drawing No. S-9. The outside drop connection shall be used for all diameter laterals and services. If an elevation difference of at least three feet is not available, the slope of the incoming line shall be increased to eliminate the need for the drop.

7-9 FLUSHING BRANCH CRITERIA - A flushing branch may be used in lieu of a manhole at the end of any temporary line less than 50 feet in length. If a line extends to a subdivision boundary, is planned for definite extension, and has no service sewer connections, a flushing branch may be used. Flushing branches shall conform to Standard Drawing No. S-1A.

7-10 SERVICE SEWER DESIGN - The design criteria for service sewers are as follows:

- A. General - Service sewers shall conform to Standard Drawing No. S-5 and shall be constructed normal to the lateral unless otherwise approved by the Director. The service sewer shall extend from the lateral sewer to the edge of public right-of-way or edge of easement unless a water main is to be installed at back of sidewalk as part of the subdivision improvements. In such cases, service shall be extended to seven feet back of sidewalk. The cleanout to grade shall remain within two feet of back of sidewalk. See Note A of Standard Drawing No. S-5 for cover requirements. Service sewers shall extend one foot beyond edge of pavement of any private road and easements of adequate width to accommodate the services shall be obtained. A plan and profile of any service sewer shall be supplied to the Director upon request.

The cleanout to grade required at the termination of service sewers shall be constructed by the building plumber at the time the building sewer connection is made. Unless otherwise noted on the plans, construction of the cleanout to grade is the responsibility of the plumbing contractor for the building improvements. The Consulting Engineer shall indicate on the plans for a 4" x 4" green painted post shall be placed at the end of the service sewer, extending from the pipe invert to not less than 12 inches above ground surface. Deferral of cleanout will not be allowed where water main will be installed at the back of sidewalk.

- B. Sizing – Normal residential service sewer size is four inches. Schools and other developments expected to contribute high sewage flows shall be served by six inch or larger service sewers. In addition, service sewers shall be sized according to requirements of the Uniform Plumbing Code, and determinations by the Consulting Engineer. If the service sewer and lateral are of the same size, a manhole shall be constructed; if the lateral is larger than the service sewer, a factory fitting at the connection is satisfactory. Connection to trunk lines will not be permitted.
- C. Connection Limitations – Service sewers shall not directly connect to 14 inch diameter or larger pipe (trunk lines) or to lines more than 14 feet in depth without the approval of the Director. A parallel sewer lateral will be required for all service sewer connections whenever the main lateral is more than 14 feet in depth. In areas of high groundwater, the service sewer shall be parallel to main laterals.
- D. Material – If the service has less than three feet of cover measured from the gutter flowline, ductile iron pipe shall be used. In all other cases, the service shall be of the same material as the lateral to which it connects.
- E. Location – When sanitary sewers are constructed as part of new subdivision improvements, a service sewer shall be constructed to each lot. In new subdivisions or development areas, unless specifically requested otherwise in writing by the property owner or Consulting Engineer, service sewers shall be placed on the low side of any typical subdivision lot or similar parcel with two percent or greater slope across the front or shall be placed in the center of lots of lesser slope. Consideration shall be given to trees, improvements, etc., so as to minimize interference when the service sewer is extended to service the house.

If the property is located with service available both to a line located in an easement and also in right-of-way, service shall be to the latter location unless otherwise approved by the Director. No service sewer shall be located where future on-site construction will result in the line being in close proximity to a water well or water main or service and applicable health standards will be violated.

- F. Depth – The Consulting Engineer shall verify the adequacy of the normal service sewer depth at the edge of easement or right-of-way to serve the intended parcel. A depth of four feet to crown of pipe measured from

existing ground surface or edge of adjacent roadway, whichever is lower, shall be considered normal service sewer depth. Whenever greater depth is required, the Consulting Engineer shall designate the invert elevation of the service sewer at the edge of the right-of-way or easement on the construction plans. If a joint trench is being utilized for other utilities, the Consulting Engineer shall indicate on the plans a joint trench will exist and shall adjust service elevations as necessary. It shall be the responsibility of the Consulting Engineer to arrange for coordination of the grade of utilities located in the trench and the service sewers.

- G. Special Requirements in Developed Areas - In developed areas, a service sewer shall be provided each parcel participating in the project which contains a source of sewage less than 200 feet from a lateral. A property owner's request for service location shall be honored whenever practicable. Parcels which have two or more sources of sewage shall have an independent service sewer provided each sewage source which can be separated from the rest of the parcel and sold. A service sewer shall be provided each subdivision lot or lot similar as to size and possible development. At an early stage of design the Consulting Engineer shall send every property owner affected by the proposed work a questionnaire requesting in writing the owner's preferred service sewer location. In absence of a response to the questionnaire, the Consulting Engineer shall provide a service sewer as required by this section. In addition, when service sewers are staked immediately prior to construction, each property owner shall be given notice to give consideration to the staked location of his service sewer and, if not satisfactory, immediately notify the Consulting Engineer. The date of notification, nature of change, and other pertinent information shall be recorded. Compilation of information shall be recorded. Compilation of this information shall be the responsibility of the Consulting Engineer and the information shall be furnished to the Director upon request.

7-11 CREEK CROSSING DESIGN - Advance approval of the Director and of other appropriate agencies is necessary prior to initiating design. The criteria for creek crossing design is as follows:

- A. General - In all cases the proposed future creek bed elevation shall be used for design purposes. Crossing details of pipe, piers, anchorage, transition couplings, etc. shall be shown upon a detail sheet of the plans in large scale.
- B. Construction and Material - For line sizes ten inches and smaller, ductile iron pipe or other pipe material as approved by the Director shall be used

under the full creek width, plus ten feet each side, unless the pipe is four feet or more below the creek bed elevation. For line sizes twelve inches and larger, pipe used shall be as directed by the Director. Special care shall be taken to provide a firm base for the pipe bedding. The plans shall specify all soft or organic material within the creek banks shall be replaced with select imported backfill. In addition, a layer of four inch to eight inch cobbles shall be placed and compacted on the top surface of the trench area for the full width of the creek. Unless otherwise directed, a clay plug will be required at the downstream side of the crossing. The plug shall be a minimum of four feet in length, shall extend the full width of the trench, and shall extend twelve inches above and below the pipe.

If the pipe must cross above the creek bed, ductile iron or welded steel pipe shall be used. Steel pipe may be cement lined and coated, fusion epoxy lined and coated, or glass lined; the Director shall approve the type of coating and lining specified and the gauge, class, or thickness of the pipe. The Director may specify the pipe material to be used.

Reinforced concrete piers of adequate depth shall be located as necessary for adequate support of the pipe. The pipe shall be held in cylindrical cradles, formed in the pier tops, by galvanized steel straps, with galvanized anchor bolts of adequate size. Cushion material shall be placed between the pipe, clamps, and support, the invert elevation at the point of maximum deflection of the suspended pipe shall be higher than the invert of the pipe at its downstream support.

- C. Design - Calculations shall be submitted which clearly indicate the design of the pipe and supports regarding impact, horizontal and vertical forces, overturning, pier and anchorage reactions, etc.

7-12 BORING AND JACKING REQUIREMENTS - Where use of conductor casing is specified, the casing shall be corrugated steel pipe, reinforced concrete pipe, or welded steel pipe. The casing shall be of sufficient diameter to allow dry sand to be blown into the void between the carrier and the conductor and to allow adjustment of the carrier pipe to grade. Normally, an inside diameter six inches greater than the outside diameter of the couplings of the carrier pipe is sufficient. Welded steel conductor pipe shall have a minimum wall thickness of 1/4 inch for sizes up to and including 24 inches in diameter and 5/16 inch for sizes 27 inches to 36 inches in diameter. Corrugated steel pipe conductor shall not be less than 0.138 inches thick for sizes up to 36 inches, and 0.168 inches thick for diameters to 60 inches. Reinforced concrete pipe conductor shall be designed for the loading condition and, if jacked, the additional loading imposed by the jacking operation.

Direct dry boring of reinforced concrete pipe and the portion of sewers and service sewers which pass beneath curbs and gutter, sidewalks, and other obstructions, up to a maximum length of 15 feet, is permissible. Six inch and smaller pipelines may be installed by wet boring where approved by the Director. Pipe material used in the small size dry and wet bores shall be ductile iron pipe. Installation and other material specifications shall conform to the requirements of the Standard Specifications.

Backfill in bore pits shall be given special attention with respect to preventing structural failure of the pipe entering or exiting the conductor, and adequate bedding and initial backfill shall be specified.

- 7-13 PUMP STATION AND FORCE MAIN REQUIREMENTS - Every phase of pump station design, including force mains, shall be closely coordinated with and shall be under the direction of Sutter County. The plans shall show the testing required prior to acceptance of the pump station.

Unless otherwise approved by the Director, "fee title" shall be granted to the County or to the appropriate district for the pump station site and any access road thereto.

- 7-14 SEWER IMPROVEMENT PLAN REQUIREMENTS - Plans for the construction of sanitary sewers whether in conjunction with other improvements or for a sewer project only, shall conform to the following standards, as well as other standards contained in the General and Plan Sheet Requirements of these Design Standards.

A. Study Map - A study map may be required prior to review of the sewer design if there is a possibility upstream or adjacent areas might require service through the subject property. The map should show the entire service area including upstream tributary and adjacent areas, and all other data necessary to determine anticipated sewage flows. The method of sewerage the entire service area, including pipe sizes and slopes, shall be shown to the extent necessary to determine the requirements within the subject property.

B. General Requirements - Plans for sewer improvement projects should include a layout sheet, plan and profile of each sewer line, and any necessary detail drawings. The plans shall be clearly legible and conform to accepted practice with respect to drafting standards. All information which in the opinion of the Director is necessary for the satisfactory design, review, construction and maintenance of a project shall be provided and, where applicable, shall be shown on the plans.

- C. Layout Sheet - All sewer improvement plans shall include an overall map which shows the project boundaries, sewer lines, manholes, flushing branches, and other important items of the work. Where pavement will be cut in several locations, the pavement replacement requirements shall be shown on the layout sheet.

A parcel or area which benefits from and financially participates in a sewer construction project, but is not included within the project boundaries, shall have a note to effect placed on the layout map and on the plan and profile sheet if the parcel appears thereon. Parcels which make use of those facilities may be subject to additional fees at the time of connection, if the participation has not been so noted.

- D. Plan and Profile Sheets - Sewers which will be maintained by a district shall be shown in both plan and profile views on approved plan and profile sheets. The following standards, with respect to drafting and the information to be included on the plan and profile sheets, generally apply to projects in developed areas. In new subdivision, only the requirements which are applicable shall apply.

1. Sewer lines to be constructed shall be indicated on the profile by parallel lines spaced the pipe diameter at the pipe invert for ten inch diameter and smaller lines only. Manholes shall also be indicated by parallel lines spaced according to scale. Slope shall be printed 1/8 inch above and preferably parallel to the pipe line, or between the parallel lines. The length, size, and type of pipe material between each manhole shall be printed parallel to the horizontal grid lines and approximately halfway between the ground surface and pipe line. All pipe inverts at manholes and other structures shall be indicated on the profile. The invert elevations shall be printed parallel to the horizontal grid lines and shall be under scored by a line which then runs at a 45 degree angle to the corresponding pipe invert. When manholes, manholes with drop connections, flushing branches, or other appurtenances will be constructed, the profile shall be so noted. Existing facilities shown on the profile shall be cross-hatched. Manhole identification on the plan view may be oblique. Stationing shall appear at the lower edge of the profile grid directly under the manhole.
2. In approved areas, the location of each service sewer proposed to be constructed shall be indicated on the plans by stationing or by reference to a permanent, well-defined structure, if available. In new subdivisions the service sewers shall be located by stationing

unless the situation exists, such as at the end of a cul-de-sac, where stationing is not an adequate description of location. In such cases, a dimension to a lot line may be used. The invert elevation of the service sewer at its upstream end shall be shown on the plans whenever the standard depth is inadequate to serve the property. Standard depth shall conform to the conditions set forth on Standard Drawing No. S-2.

Improvements or lots shown on a plan sheet but served to a line shown on another plan sheet shall have the direction of service shown by a small triangle and letter "S". "As-built" plans shall also show the service sewer location measured from the nearest downstream manhole.

3. Both permanent and working easements shall be shown to scale on the plans. Easement dimensions shall be given and each easement shall be tied to both the property line and the sewer line. Each permanent easement shown on the plans shall be identified by a box or table, on the same plan sheet, which gives the property owner's name and the book and page number in which the easement is recorded. The Consulting Engineer shall provide the book and page number.
4. Indicate the limiting maximum trench width as measured at the top of the pipe on the plans between well-defined points of application; the pipe material and class, if more than one class is available; and the bedding-backfill type. Type I bedding when used and unlimited trench width when allowed need not be shown on the plans. If more than one combination of pipe material or class, maximum limiting trench width, or bedding type is available, a practical range of such combinations shall be shown on the plans.
5. Proposed sewer lines shall be adequately dimensioned from street centerline. If the sewer is to be located in an easement, sufficient dimensions and bearings from physical features to locate the line in the field shall be shown on the plans.
6. Gas, water, storm sewers, and all other main utility lines above or below ground shall be determined and shown on the plans with accuracy as great as practicable. The location of any utility line which is parallel to and within five feet of the sewer line or which crosses the sewer line at an angle of 30 degrees or less shall be determined with an accuracy of ± 1.0 foot and the clearance shown

on the plans. Service lines such as water and gas normally shall not be shown.

7. Trees and other objects within 10 feet of construction centerline shall have their correct location shown on the plans and the clearance from construction centerline shown. The diameter of tree trunks and interfering heavy tree branches shall be noted. Removal of a tree or object, or other special handling shall be noted on the plans. The Consulting Engineer shall assume full responsibility for such notes as it is assumed he has made all necessary arrangements with the owner of the object to be handled. Written documentation of any special arrangements regarding preservation of property made between property owners and the Consulting Engineer shall be supplied to the Director if no easement document is involved. If an easement is negotiated, all special arrangements shall be included in the easement document. Tree removal within public rights-of-way or easements shall be approved by the Director.
 8. Culverts shall be shown on both plan and profile when crossed by the construction or when parallel and within 20 feet of the construction line. The size and type of all such culverts shall be indicated and when the culvert crosses or is perpendicular or nearly so and within 20 feet of the construction line, the invert of the culvert end nearest the construction line shall be shown.
 9. Address of buildings shall be shown on the plan view, within the outline of the building. Only the front line and indication of side lines of buildings need be shown.
- E. Detail Drawings – Items of a special nature shall be shown with detail drawings, either on the plan sheet or on a separate detail sheet.
- F. Connection to existing facilities where bypassing or stoppage of existing flow will be required – When improvement plans require connection to an existing facility which will require bypassing or stoppage of existing flows, a note shall be placed on the plans which provides an estimate of the existing flow to be bypassed (in gpm), or the times between which the flow may be stopped. Coordination with Sutter County is required in developing these numbers. The note shall also require the contractor to contact the Department of Public Works at least two working days prior to initiating the bypass/stoppage operation so the temporary facilities and equipment can be evaluated for adequacy. Where the bypassing/stoppage operation will be accomplished on a major trunk line,

submittal of a work plan for review will be required prior to initiation of the operation.

7-15 DESIGN OF ONSITE SEWER SYSTEMS FOR PRIVATE MULTIPLE OWNERSHIP RESIDENTIAL DEVELOPMENTS - The following design requirements shall apply to the portion of the sanitary sewer system within a privately owned multiple ownership development which is "onsite" and is not an outfall sewer for an upstream area, will be considered a public system and subject to maintenance by County/District forces. Sanitary sewers shall be contained in a public sewer easement.

- A. Planned Unit Developments and Townhouses - Residential developments where separate lots and structures are sold and adjacent land is owned in common and maintenance is performed by a homeowner's association.
1. General - Sanitary sewers shall meet all requirements for public sewers contained in these Design Standards, except as specified below.
 2. Manhole Spacing - Maximum spacing of manholes on laterals shall be 300 feet for all straight runs of pipe.
 3. Wyes - Wyes shall be used for all service sewers connecting to the "onsite" laterals. Tees as shown on standard Drawing No. S-5 will not be allowed.
 4. Minimum Depth - All lines located within vehicular traffic areas shall have a minimum cover of three feet to finish grade. Additionally, if the cover over the pipe at any location may be less than two feet at any time after the pipe is installed, ductile iron pipe shall be installed.
 5. Plan and Profile Sheets - "Onsite" improvement plans may be prepared without the sanitary sewer profile which is required by these Design Standards, unless otherwise instructed by the Director. However, the final "onsite" grades and drainage facilities shall be shown on the plans on the same sheet as the plan view of the sanitary sewers. Plan sheet sizes shall be as specified in Section 3-1 of these Design Standards. All approved improvement plans shall be submitted to the Director on 3-1/2" diskette and AutoCAD environment.

6. Backwater Valves - Backwater valves shall be installed on all service sewers.
 7. Location - Wherever possible, laterals shall be located in areas to be paved.
 8. Review and Approval - Plans shall be reviewed and approved by the Department of Public Works.
 9. Review and Approval - Plans must be reviewed and approved by the Water Quality Division of the Department of Public Works.
- B. Condominiums or Cooperative Developments - Attached residential homes where shares of the total development are sold.

The "onsite" sanitary sewers shall be constructed as required by the most current edition of the Uniform Plumbing Code (UPC) adopted by the Board of Supervisors. These plans will require the approval of the Plumbing Section of the Building Inspection Division of the Department of Public Works in addition to the standard approvals required. The developer may elect the option of designing the "onsite" sanitary sewers under the requirements of Section 7-15A. If "onsite" sewers are designed in accordance with the standards for Planned Unit Developments, the plans will be reviewed and approved as set forth in Section 7-15A. Approval will be subject to compliance with those standards.

7-16 MULTI-PARCEL COMMERCIAL AND INDUSTRIAL DEVELOPMENTS - The "onsite" sanitary sewers for all new commercial and industrial developments containing more than one parcel shall be designed in accordance with the requirements contained in Section 7-15A of these standards unless otherwise specified by the Director. Each separate parcel within a multi-parcel commercial or industrial development shall have its own separate connection to the public sewer system.

This section shall be applied to all commercial/industrial developments which are initially approved as a single parcel development and are subdivided after the date of adoption of these Design Standards.