

APPENDIX A

SAUSALITO-MARIN CITY SANITARY DISTRICT

STANDARDS FOR THE DESIGN AND CONSTRUCTION OF SEWERS IN BAY MUD

1) Purpose, Application, and Variances

- a) Purpose - The Sausalito-Marin City Sanitary District is responsible for the long-term operation and maintenance of the public sewers within its service area. Sewers constructed in or over bay mud can be problematic and require more stringent design and construction provisions in order to minimize the occurrence of conditions that cause sanitary sewer overflows. These provisions are also intended to mitigate the need for frequent inspection and maintenance and will assist the District in its effort to control the cost of service to its customers.
- b) Application – These design and construction standards are required for all public sewers that are constructed in or over bay mud where the thickness of the bay mud exceeds five (5) feet. The District will not allow the installation of private sewers, other than laterals, in any area where the thickness of the bay mud exceeds five (5) feet.
- c) Variances for these Standards – The District will give consideration to requests for variances from these standards; however, the developer must demonstrate compelling reasons in support the request for a variance. The reasons for the variance must include significant long term benefit to the District. The cost of construction will not be considered as a sufficient reason for granting a variance from these standards.

2) Definitions – For the purpose of this section the following additional definitions shall be used:

- a) Design Engineer – The engineer hired by the developer who is responsible for the project design and preparation of the plans, specifications and details. The Design Engineer shall be a Registered Professional Engineer in the State of California and shall be responsible for the project design and all construction staking.
- b) Project Geotechnical Engineer – The engineer hired by the developer who is responsible for evaluating the geotechnical aspects of the project, recommending appropriate design criteria related to soils and settlement, and providing geotechnical engineering oversight on the construction work. The Project Geotechnical Engineer shall be a Registered Professional Engineer and a Registered Geotechnical Engineer in the State of California.

3) Definition of Bay Mud - Property shall be considered to be underlain by bay mud if any one of the following criteria apply:

- a) The District Engineer so reports, unless an approved geotechnical engineer reports in writing, together with substantiating evidence in the form of test boring logs, to the contrary; or
 - b) It is located less than 10 feet above mean sea level, unless an approved geotechnical engineer reports in writing, together with substantiating evidence in the form of test boring logs, to the contrary. -
- 4) Submittal Requirements – If a development is underlain by bay mud as defined above the applicant shall submit the following items to the District for review in addition to those items specified in the District Standard Specifications:
- a) Map of the proposed development layout drawn to an appropriate scale showing existing and proposed elevation contours, the overall relationships to adjacent properties and historic physical features.
 - b) All geotechnical reports together with soil boring logs, settlement tests of the bay mud and a map showing the contours of the bottom of the bay mud and calculated subsidence over a 50 year period under existing conditions and for alternative heights of new fill.
 - c) Updated geotechnical reports which incorporate any changes in the project design since the pre-design submittal including calculations of new settlements if there has been any surcharging or wicking.
 - d) Plan and profiles of all sewer mains which show the as-installed profiles of the new sewers together with the predicted profiles of the sewers after 50 years of settlement. The Project Geotechnical Engineer shall stamp and sign the plans as attesting to the accuracy of the predicted profiles.
 - e) Details of all connections to structures and manholes.

Note: The District reserves the right to hire a third party engineer and/ or geotechnical engineer to review the developer's reports, sewer design, plan, specifications and details. The cost to the District of the third party engineer(s) shall be reimbursed by the developer.

- 5) Sewer System Design – The Design Engineer shall follow these principals in the design of a sewer system on land underlain by bay mud:
- a) Gravity sewers shall be designed to slope toward areas of maximum predicted settlement.
 - b) Pump stations, if required, shall be located as close as possible to the area of maximum predicted settlement and shall not be pile supported.

- c) Force mains shall be designed with uniform slope upward toward the point of discharge. The uniform grade shall be demonstrated after the predicted 50 year settlement has occurred. The force mains shall not have air release valves. They shall be designed to carry the projected peak flows together with any accumulation of air that may occur as the result of settlement.
 - d) The installed grade of all sewers shall be a minimum of 150% of the allowable slope per the District Standard Specifications.
 - e) The predicted grade of all sewer mains after 50 years shall be 150% of the allowable slope per District Standard Specifications.
 - f) All sewers in bay mud shall be installed on bedding consisting of a minimum of 12" of crushed rock $\frac{3}{4}$ " or 1-1/2" placed over geofabric laid at the bottom of the trench and extending up each side of the trench to be wrapped over the top of the pipe zone material a minimum of 12" above the top of the pipe.
 - g) The depth of cover over the pipe shall not be less than 3 feet or greater than 10 feet.
 - h) Public sewers shall have a minimum diameter of 8 inches.
 - i) The clearance between the sewer and adjacent buried utilities or other underground features (e.g. sheet piling) shall be one (1) foot plus three times the predicted settlement of the sewer at that location.
 - j) All pressure lines connecting to a pump station structure shall exit the structure through a suitable flexible joint or ball joint.
 - k) Gravity sewers shall connect to pump stations or manholes through a PVC high deflection coupling located no more than one foot outside the structure.
 - l) The invert elevation of any sewer connecting to a pump station shall be a minimum of six (6) inches lower than the invert elevation of the nearest upstream manhole.
 - m) All sewer lines connecting to a pile supported structure shall connect through a flexible telescoping or rotational type of joint, which is designed to remain watertight through the predicted range of movement over 50 years of settlement between the structure and soil.
 - n) All sewer laterals under pile-supported structures shall not be buried but shall be positively fixed to the pile supported grade beams so they will remain fixed with the structure.
- 6) Materials – The following are minimum standards for materials to be used for sewers to be installed in areas underlain by bay mud:

- a) All sewer pipe material for both gravity and pressure sewers shall be PVC AWWA - 900 or C-905 DR=18.
 - b) Lateral sewers shall be PVC Schedule 40 with solvent-welded joints.
 - c) Geofabric shall be Mirafi 700 or approved equal.
 - d) All metal to be buried underground shall be Type 316L stainless steel.
- 7) Construction Methods – The following special construction methods shall be employed for sewer systems being installed in bay mud.
- a) Sewers shall only be installed after all new fill has been placed and contoured to final subgrade.
 - b) Sewers shall not be installed during the months of December, January, February or March unless specifically authorized by the District Engineer. Sewers shall not be installed during or within three days following daily rainfall of greater than 0.5 inches
 - c) Trenches shall be dug in the bay mud and shored in a manner to minimize any destabilization of the trench bottom.
 - d) If, in the opinion of the District Engineer or the Project Geotechnical Engineer, the trench bottom has been disturbed or is not stable all trenching and/or pipelaying shall immediately cease and the Project Geotechnical Engineer shall propose to the District for favorable review a method of trench stabilization. Under no circumstances shall rock larger in size than “approved bedding rock” be used to stabilize the trench bottom.
 - e) During trench excavation all excavated materials shall either be hauled off site or stored a minimum of 50 feet away from the edge of the trench.
 - f) All excavations deeper than five (5) feet shall be backfilled and compacted as recommended by the geotechnical engineer.
- 8) Standards for Construction Inspection
- a) The contractor shall notify the District each morning that it intends to work.
 - b) The contractor shall provide ready and safe access to the construction for the District Engineer, Inspectors or agents.
 - c) The Project Geotechnical Engineer shall inspect the construction at least weekly and shall furnish the District with a brief written opinion concerning compliance with the Project Geotechnical Engineer’s recommended method of construction. The written opinion shall be faxed to the District by close of work on the day of the inspection.

- d) The Project Geotechnical Engineer shall inspect the construction and shall make recommendations regarding mitigation measures immediately following these events:
 - i. Rainfall greater than 0.5 inches
 - ii. Discovery of changed soil conditions
 - iii. Trench wall failure
 - iv. Trench bottom failure
 - v. Other events that may effect the long term performance of the sewer system.
- 9) Performance Standards –The as built sewer system shall meet the performance standards per the District’s Standard Specifications prior to acceptance in addition to the following:
- a) All sewers constructed in bay mud shall be inspected using closed circuit television. The contractor shall clean and ball the sewer prior to calling for the inspection. A sewer line is unacceptable and shall be re-laid if it is found to have a sag greater than 0.1 feet deep for a distance of ten (10) feet or longer or a sag greater than 0.15 feet for any distance.
 - b) A sewer line is unacceptable and shall be re-laid if it shows greater than three (3) percent deflection over the actual internal diameter of the pipe.
 - c) A manhole is unacceptable and shall be reconstructed if it fails to pass a vacuum test.
 - d) A manhole is unacceptable and shall be reconstructed if the invert varies from the design sewer grade more than 0.1 feet.
 - e) A pump station/force main is unacceptable if it fails to pump its rated capacity using fresh water. The flow rate shall be measured using the rate of draw down of the wet well.
- 10) Warranty – The developer shall warranty the work to be free from defects. The warranty should cover a period of five (5) years from the original date of acceptance by the District. The developer will provide the District with a bond during the warranty period. The amount of the bond shall be \$200 per foot of sewer and force main, \$5,000 per manhole, and \$200,000 per pump station in 2004 dollars. The bond amounts may be revised based on the ENR construction cost index to account for inflation.