Section 6
Other Recommendations

The previous section of this report presents the recommended Capital Improvement Program for the DSRSD wastewater collection system, which is based primarily on the hydraulic capacity requirements to serve existing and future development. This section summarizes other issues and recommendations to the District with respect to wastewater collection system regulations and criteria for sewer system operation and maintenance (O&M) and renewal and replacement. Specifically, the O&M and renewal/replacement criteria review discusses the use of closed circuit television (CCTV) inspection data to assess the condition of the collection system and utilization of those results to project renewal/replacement needs. More detailed discussion of these issues is presented in TM 8 – Review of O&M and System Replacement Criteria, included in the separately bound appendices to this report.

REGULATORY REQUIRMENTS

Until recently, regulation of public wastewater systems has focused primarily on wastewater treatment plants. While federal and State regulations prohibit discharge of untreated wastewater and impose fines for significant sanitary sewer overflows (SSOs), there have historically been no specific regulatory requirements addressing the operation, maintenance, and management of sanitary sewer collection systems. However, in recent years, increased awareness of the occurrence and potential impacts of SSOs throughout the U.S. has resulted in proposals to expand regulatory oversight to wastewater collection systems as well as treatment facilities.

In early 2001, the U.S. Environmental Protection Agency (USEPA) issued proposed regulations aimed at reducing SSOs throughout the U.S. A key element of the proposed regulations were requirements for sewer system owners/operators to develop and maintain a "Capacity, Management, Operation and Maintenance" (CMOM) program to control and mitigate the impacts of SSOs.

The State of California and several Regional Water Quality Control Boards (Regional Boards) have taken steps to implement CMOM-type requirements in California. These requirements have been given the designation of "Sewer System Management Plans" (SSMPs). The San Francisco Bay Regional Board, which has regulatory oversight over DSRSD, has already initiated its SSMP program, and the State Water Resources Control Board (SWRCB) has adopted a resolution indicating its intent to develop SSMP requirements which would take effect in about November 2005.

The components of an SSMP include the following ten elements:

1. Goals
2. Organization
3. Legal Authority
4. Measures and Activities
5. Design and Construction Standards

6. Monitoring, Measurement, and Program Modifications
7. Overflow Emergency Response Plan
8. Fats, Oils, and Grease (FOG) Control Program
9. System Evaluation and Capacity Assurance Plan
10. SSMP Audits

The District has many of the programmatic elements in place to respond to the new SSMP requirements, and many of the efforts and products of this Master Plan can be directly applied to the development of SSMP documentation. For example, the hydraulic model and 5-year updates of the collection system master plan provide the required measures and activities related to capacity assessment; and the recommended improvement projects developed in this Master Plan Update Report, together with the District's adopted CIP, fulfill the requirements of System Evaluation and Capacity Assurance Plan. This section of the report presents additional information and recommendations that address other elements of the SSMP, including measures and activities to provide for regular inspection of the collection system and prioritize and budget for needed system repairs, rehabilitation, and replacement.

It is recommended that the District carefully assess the new SSMP requirements and take proactive steps to ensure that it is developing or already has programs in place to meet those requirements. These steps should include establishing responsibilities for preparing the various elements of the SSMP, along with a schedule for their implementation that is consistent with the Regional Board and future SWRCB requirements.

OPERATION AND MAINTENANCE CRITERIA REVIEW

This subsection reviews and makes recommendations for potential enhancements to the District's current O&M criteria and practices, with specific focus on system inspection, condition assessment, and rehabilitation. A more comprehensive assessment of the District's collection system O&M resources, practices, and procedures was conducted as part of the 2000 Master Plan Update and is documented in that report.

Current Practices

The District's wastewater collection system currently includes over 170 miles of sewer pipelines, of which a significant portion is less than five years old. The oldest pipes in the system date to the early 1960s and are located primarily in central Dublin and San Ramon. The majority of the newer pipes are located in Eastern Dublin and Westside San Ramon.

The District's sewer system inventory is contained in the GBA Sewer Master® computerized maintenance management system (CMMS). Various attribute information about the pipes and manholes in the collection system is stored in the CMMS database. The CMMS also includes modules for generating work orders, maintaining system inventory and inspection information, rating sewers based on inspection results, and identifying needed sewer repairs based on inspection results.

The District currently has a two-year cycle for sewer cleaning, with a 1- to 6-month schedule used for specific known trouble spots that require more frequent cleaning. In addition, the sewers located west of Dougherty Road (i.e., not including the newer pipes in Eastern Dublin) are inspected by closed circuit television (CCTV) on an eight-year cycle.

CCTV observations are input to the District's GBA system using a system of codes that characterize observed defects into categories of cracks, joints, laterals, roots, debris/grease, I/I, alignment, and structure. Each defect is assigned a rating values (1 to 5) based on its severity. The CCTV reports and video are the basis for establishing needed system repairs, which are identified for defects with severity ratings of 3 or higher. To date, sewer repair work has consisted primarily of spot repairs and pipe and manhole joint sealing. The District has also completed one pipe bursting project, but no sewer lining or entire main replacements have been done.

Potential Enhancements to Current Practices

As the District's system increases in size and the sewers continue to age, there will be a need for a more efficient and systematic process for capturing and evaluating data from CCTV inspections. The following potential enhancements to current practices are suggested for the District's consideration.

Observation Coding System. The District continues to utilize its old system of defect descriptions because of staff familiarity with that system and in order to provide continuity with historical inspection data. The system has a somewhat rigid structure, in that it includes eight predefined classes of observations with up to 15 different letter codes under each class to describe various types and severity of defects. It is recommended that the District consider simplifying this coding structure, possibly by utilizing the system of defect descriptions, codes, and ratings built into the GBA program.

Data Capture Systems. District CCTV operators currently record data on paper forms and video on VHS tape. In general, the industry is now switching to computer data entry and digital video saved to CD or DVD (or in some cases, directly to removable computer hard drives). In the future, as part of the normal process of upgrading its CCTV equipment, the District should upgrade its current method of data capture by utilizing the GBA computerized data entry system or possibly one of the other commercially available CCTV software systems. Most of these systems also provide viewer software that allow users and reviewers of the CCTV data to easily access the observation information and view the associated still images and/or portion of the CCTV video. If capturing digital video, it may also be advisable to establish a file naming convention for video and still image files to facilitate storage and retrieval of video data on a network server.

Training and Quality Control. Accuracy and consistency in recording CCTV observations is critical to being able to use the data to assess the condition of a pipe, compare the condition of different pipes, and track the changes in a pipe's condition over time. Adequate training (including refresher training) of CCTV operators in observation coding and audio commentary, as

well as operation of the video equipment, including proper camera speed, lighting, and use of panning and zooming, are important for ensuring quality data and video. Aids such as a TV inspection manual and/or defect picture posters may be helpful to train new operators and ensure recording of consistent data by both new and experienced operators. A quality assurance/quality control (QA/QC) program should also be established to ensure adequate review of recorded data and video for quality and accuracy.

Condition Assessment. Condition assessment is a systematic process used to rate the relative condition of the various pipes in the sewer system in order to identify and prioritize needed repair/ replacement projects and track trends in system condition (deterioration) over time. The condition assessment is typically conducted by assigning points to each pipe defect observed during CCTV inspection based on its type and severity. The points may vary depending on whether the defect is considered structural (e.g., a crack) and/or primarily related to maintenance issues (e.g., grease) or I/I contribution. The total points for each specific pipe are then normalized (usually by dividing by the inspected pipe length) to calculate a score or rating that can be used to compare its condition to that of other pipes or to previous inspections of the same pipe.

The Television Inspection module of the District's GBA program includes the capability of calculating structural, cleaning (maintenance), and flow ratings for each pipe based on points assigned to various defects. The District is not currently using this system to assess its pipes. However, in the future, as the CCTV database expands and data for more pipes and inspections are added to the system, a more automated and systematic way of reviewing and analyzing the data may be needed. If the District decides to utilize this system in the future, these point values assigned to various defects should be reviewed and modified as needed to ensure that the resultant condition ratings are appropriate for the District' system and needs.

Prioritization of Rehabilitation and Replacement. The primary purpose of condition assessment is to identify needed repairs, rehabilitation, or replacement of system facilities and to prioritize those projects. Presently, the District's collection system is in very good condition, and relatively few needed repairs have been identified through previous CCTV inspections. Thus, the District has been able to fund and construct all needed repairs as they are identified.

As the system increases in size and ages over time, the number of defects found will no doubt increase. There may be a point in time when it will be necessary to prioritize repair projects to better match available funding or to balance expenditures over time. There may also be a need to assess the cost-effectiveness of various repair and rehabilitation methods. For example, a rehabilitation method such as lining, or even complete replacement, may be advisable for an old pipe with multiple defects, as opposed to simply spot repairing only the few isolated severe defects in the pipe.

Prioritization of sewer rehabilitation and replacement should consider not only the condition of the pipe (i.e., its probability of failure) but also the relative criticality of the pipe (the potential impact or severity of failure). For example, failure of a pipe located under a major roadway would have more severe consequences in terms of repair cost and impact to the community than one in a quiet residential street. Therefore, given similar condition, the pipe under the major roadway should have a higher priority for repair. Incorporating such risk factors into the

condition assessment process provides a means for an agency to make better decisions about capital expenditures. One simple method is to assign "impact factors" to each pipe based on its criticality, and to use those factors in conjunction with (e.g., as a multiplier of) the condition rating from CCTV inspection to compute a total "critical rating" for the pipe.

The above discussions are presented to suggest tools and concepts that the District may want to incorporate into its future sewer inspection and rehabilitation efforts. It is recommended that the District carefully evaluate these suggestions and take steps to develop a systematic approach to condition assessment that can be used to guide and prioritize collection system repairs and replacement in the future.

RENEWAL/REPLACEMENT CRITERIA REVIEW

This subsection discusses recent methods the District has used to determine the expected timing and costs for collection system asset renewal/replacement. The key assumptions and considerations for projecting future renewal/replacement timing and costs and recommended enhancements to current practices are also presented here.

Collection System Inventory

There are currently over 906,000 feet of sewers in the DSRSD wastewater collection system. The system is divided into 144 sewer maintenance areas (basins). The majority of the sewers in system are comprised of vitrified clay pipe (VCP, 57%) or polyvinyl chloride pipe (PVC, 39%). The overall system is fairly young, with the oldest pipeline dating back to 1962, and an average pipeline age of approximately 20 years.

Methods Used to Project Renewal/Replacement Needs

As part of efforts conducted for the 2000 Collection System Master Plan Update and its 2002 Replacement Planning Model development, the District has used two slightly different methods for projecting the timing and costs of renewal/replacement of its collection system assets. Both methods utilized pipe attribute data (diameter, length, material, age) on a segment-by-segment basis from the District's CMMS/GIS inventory database. For both methods, the basic methodology involved estimating the remaining useful life of each pipe and the estimated cost for renewal or replacement of the pipe at the end of its useful life. The two methods differed somewhat in the assumptions used to determine useful life and the assumed construction methods and costs for renewal or replacement.

The purpose of both projection methods was to forecast long-term financial needs for system renewal and replacement. The 2000 Master Plan Update projection addressed only sewer system pipes, and extended the projection out to the latest projected service life of all existing pipelines in the ground at the time (approximately year 2100). The forecast identified a significant increase in projected funding needs starting in about year 2035, with a major increase after the year 2059. The Replacement Planning Model, however, addresses all utility assets (including structures, maintenance equipment, computers, vehicles, etc.). The study period is variable, but appears to

have been applied for a 30-year period (through the year 2032). Because of these differences, direct comparison of the results of the two methods cannot be made.

Neither the 2000 Master Plan Update nor the Replacement Planning Model incorporated a linkage between assumed or measured pipeline condition and the expected service life of a pipeline. In order to make the best use of pipeline CCTV inspection efforts, pipeline condition data should serve to refine the expected lives of individual pipes on an ongoing basis. Similarly, data on actual asset lives (time between installation and renewal/replacement) should be collected in order to refine the expected lives of other assets in the same area and/or of the same material or size.

Neither did either method incorporate any element of risk into the projected timing of asset renewal or replacement. Depending on the probability of asset failure (in part a function of age and condition), and the severity associated with that failure (e.g., potential public health or water quality impacts, community impacts, or liability costs), certain assets may warrant renewal or replacement prior to the expected end of their service lives. The District may want to place a higher priority on these "high risk" assets for earlier renewal/replacement (shorter projected useful lives) in order to minimize risk. The goal would be to set the "risk-based" renewal/replacement date at a point in time closer to where the avoided costs of mitigated risk would outweigh the increased costs of earlier asset replacement.

Potential Enhancements to Current Practices

The District should consider the following recommendations for enhancing its methodology for projecting future renewal and replacement costs.

- **Update Replacement Model Database with Better Age Data.** The District has relatively sound data on the age of its collection system assets. The age (year of construction) data in the GBA database should be verified and corrected as needed to improve the accuracy of the Replacement Planning Model.

- **Simplify Original Expected Life Assumptions and Refine with Data Over Time.** Each of the renewal/replacement methodologies previously used may be overcomplicating the projection of remaining useful life and under-utilizing the condition data that is currently being collected through the District's cyclic CCTV inspection program. A simpler approach would be to use a single expected service life of 75 years for all pipelines, with refinements to expected renewal and replacement dates only made based on actual field condition data and actual observed service lives of similar assets in the system.

- **Establish Direct Data Linkage Between Field Condition Data and Renewal/ Replacement Projections.** A common data source for the District's CMMS and its Replacement Planning Model would enable the model and resultant renewal/replacement projection data to be updated automatically with new field condition data entries. A translation would need to be established between pipeline condition rating scores and expected remaining service life. While no established formula for this translation currently exists in the industry, such an approach would more closely connect observed field

conditions to projected financial impacts. As actual service life data are collected over time, the relationship between historical observed field condition and remaining service life could be refined for specific areas and/or pipeline materials within the DSRSD system.

- **Adjust Projected Renewal/Replacement Timing According to Risk Factors.** The projected timing of renewal and replacement efforts should also incorporate the potential costs or impacts associated with a particular asset failing. A risk score, developed based on the severity of asset failure (e.g., an impact factor adjustment, as described previously) and the probability of failure (based on age/condition data) could be used to adjust the projected renewal/replacement timing such that higher risk assets are replaced sooner. Impact factors associated with each asset could be revisited on a periodic basis, and probability information could be updated automatically via age and condition data in the CMMS.

Figure 6-1 presents a schematic flow chart for developing and updating timing and cost projections for pipeline renewal and replacement. A similar methodology could be applied to other collection system or other utility assets.

Figure 6-1

Recommended Approach for Projecting Pipeline Renewal/Replacement Timing and Cost