City of San José

San José/Santa Clara Water Pollution Control Plant Master Plan

TASK NO. 4
PROJECT MEMORANDUM NO. 4
EXISTING ASSET MANAGEMENT PRACTICES DESCRIPTION

FINAL DRAFT
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CITY OF SAN JOSÉ

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1.0 PURPOSE

The purpose of this project memorandum (PM) is to provide conceptual background on asset management and to summarize past and current asset management efforts at the San José/Santa Clara Water Pollution Control Plant (WPCP). Specific recommendations on this topic will be made in PM 4.6.

2.0 INTRODUCTION

As described in its scope, the San José/Santa Clara Water Pollution Control Plant Master Plan (Master Plan) must address four major drivers and underlying considerations that impact the type and timing of future wastewater treatment facilities. The four drivers are:

- Overhaul of existing facilities through repair and replacement, while leveraging resources and investment.
- Growth and expansion needs.
- Regulations, including level of treatment, required today and in the future.
- Improvements to meet overall economic, quality of life, and management directives.

Arguably, all of the above "drivers" are addressed in the body of principles termed "asset management". While many definitions exist, asset management is described by the Environmental Protection Agency (EPA) as "a systematic integration of advanced and sustainable management techniques into a management paradigm with a primary focus on the long-term life cycle of the asset and its sustained performance, rather than on the short-term, day-to-day aspects of the asset." Asset management addresses rehabilitation and replacement (R&R) needs of existing assets in light of projects planned for growth and higher levels of treatment. This PM serves to summarize efforts to date in establishing this management paradigm at the WPCP.

The City of San José (City) is in the process of implementing an asset management program (AMP) for the WPCP. Stephane Lannoye was hired in February 2008 to serve as the WPCP's AMP Manager, and personnel from many different disciplines and organizational levels will participate in its ongoing implementation. The AMP will feature several projects to improve the WPCP's ability to maintain their level of service while optimizing expenditures across both capital and operations and maintenance (O&M) budgets. A few of these projects are currently underway, including the implementation of a computerized maintenance management system (CMMS). The City is also in the process of performing a condition assessment of corrosion control coating throughout the WPCP.

Although US water and wastewater utilities have yet to adopt a “standard approach” for the asset management process, the following steps characterize a typical process. The order of these steps can vary.

1. Develop strategic vision.
2. Develop asset inventory and criticality ranking.
3. Conduct condition assessments.
4. Determine the priority, timing, and costs of R&R projects.
5. Integrate O&M and capital improvement planning (CIP) planning.
6. Conduct strategic decision analysis.
7. Implement plan with continuous feedback and performance measures.

These steps will be described in further detail below, along with the status of the City’s existing AMP pertaining to each step. Previous asset management work performed for the City included the Facilities Condition Assessment Study by Black and Veatch, August 1997; the Electrical System Master Plan - Electrical System Improvement Study Project by Malcolm Pirnie, 2004; the Infrastructure Condition Assessment by CH2M Hill, January 2007; and the WPCP Process Piping Assessment by CH2M Hill, February 2008. Applicable findings from these efforts will be addressed.

3.0 STRATEGIC VISION

The strategic vision step of asset management entails the following objectives:

- Confirm mission and goals.
- Establish levels of service.
- Define organization - e.g., policies, integrated functions, desired communication plan.
- Establish risk management objectives.
- Determining strategies for efficient and educated decision making.
- Refine AMP user needs - e.g., financial/budgeting, R&R requirements, CIP planning, knowledge retention and institutional learning plan.

The City has not formalized a strategic vision for asset management, but the AMP Manager has been directed to develop a strategic vision for asset management.

4.0 ASSET INVENTORY

Developing an asset inventory includes establishing a classification system for assets. While the definition of “asset” varies among different water and wastewater agencies, the term typically applies to a functional component of the conveyance or treatment process. Thus, structures and machines mark the lowest level of detail in the inventory, not the individual parts comprising them. Assets are identified using one or more sources, such as field assessments, historical records, CMMS inventory, and any other available databases. The inventory is populated with available information on the assets, including equipment number, installation year, acquisition cost, and design specifications. At this or later stages, an agency must also establish the consequence of failure, or criticality, of each asset.

The City has several databases containing partial asset inventories, but no comprehensive inventory has been developed at the level of detail desired for the AMP. These partial inventories include data from a preventive maintenance program (Tooltime), a corrective maintenance program (Work Order), an inventory management program for rolling stock (Vertex), and a fixed asset program from the finance department (Mitchell Humphrey). Also, as part of their 2007 condition assessment, CH2M Hill developed a database of major process areas in the WPCP. The database included photographs and the physical location of the process areas, but no list of individual assets. For their February 2008 process piping assessment, CH2M Hill developed a database of all process pipes greater than eight inches in diameter at the WPCP. This inventory amounted to approximately 56 miles of piping and 1,000 valves.

5.0 CONDITION ASSESSMENT

Condition assessments may be conducted in-house or by independent evaluators. They typically involve a multi-discipline engineering team who examine the condition, performance, and operational history of assets. Findings are often reported using an industry-standard condition ranking scale. If warranted based on risk analyses, diagnostic tests may be conducted, such as vibration analysis, concrete coupon sampling, and infrared thermography. For buried pipes, condition assessments may be conducted by pressure testing, closed caption television (CCTV) inspection, or other methods. Assessments typically rely heavily on the institutional knowledge available from senior O&M personnel, who are interviewed throughout the assessment, as well as the professional judgment of the assessment team. The condition assessment process also results in estimates of the remaining useful life of the assets, as well as criticality, vulnerability, and cost factors.

Malcolm Pirnie conducted an electrical condition assessment and project priority list for medium- and high-voltage electrical systems. This assessment resulted in recommendations to replace several engine-generators. Five of eight engine-generator sets were over 40 years old and nearing the end of their useful lives, based on typical industry

standards. The sets were found to be functioning reasonably well and meeting current air permit requirements, but they were not expected to be capable of complying with future regulations. Malcolm Pirnie also noted that the manufacturers of the engine-generator sets at the WPCP were no longer in that business, making the acquisition of non-routine or non-standard spare parts for repairs more challenging.

As part of their 2007 effort, CH2M Hill conducted a week-long condition assessment of the above-ground process areas within the WPCP boundary. This included field inspections and interviews with key personnel. Interviews with operators focused on discussions of assets in danger of failure, assets that have required excessive maintenance, and assets that were out of service. Field inspections consisted of visual assessment only and did not include testing or sampling. The assessment focused on process areas and was sufficient to highlight areas of concern due to deteriorating condition, but it did not include baseline condition information for individual assets, as described above in the Asset Inventory section.

A combined risk score was calculated for all process areas and disciplines to create a prioritized list of R&R projects. Factors contributing to the risk score were likelihood of failure, other factors contributing to asset replacement, and the impact of asset failure. Likelihood of failure was defined as being dependent upon condition, standard operating procedure, past performance, and redundancy. Impacts from asset failure were assessed in the categories of service reliability, the environment, public health and operator safety, service disruption, and finances. In consultation with WPCP staff, risk factors were weighted on a scale from 1 to 10 representing a negligible impact and catastrophic impact, respectively.

The assets that were determined to be in the worst condition and to present the highest risk are listed below:

- High-voltage and medium-voltage power distribution systems.
- Anaerobic digestion system.
- Mechanical piping and equipment throughout the WPCP including air handling units, boilers, and HVAC equipment at many facilities. Valves and valve operators for the tertiary filters and return activated sludge systems were also found to be in poor condition.
- Structures with seismic vulnerabilities (most constructed prior to 1980), particularly, the Blower Generator Building, the Tertiary Blower Building, and water-holding basins/structures.
- Corroded structures including the basement of the Secondary Blower Building, the headworks area, the disinfection building, and the metal mechanisms in the secondary clarifiers and the digesters.

For the February 2008 process piping assessment, CH2M Hill did not conduct condition assessments.

Currently, the WPCP is conducting an assessment of corrosion coating throughout the facility. A comprehensive, multi-disciplinary condition assessment will not be conducted until more elements of the AMP are in place.

6.0 R&R PROJECTS

Determining the R&R projects includes evaluation of the priority, timing, and costs of these projects. To aid in this planning, repair, maintenance, replacement, and salvage costs are estimated. The value of the assets is estimated using varying financial valuation methods (straight-line approach, modified approach). These cost factors combined with the prioritized projects and their timing are then used to determine the appropriate level of R&R funding.

Malcolm Pirnie identified different operational and acquisition scenarios for the engine generator replacements. The capital costs associated with the different scenarios ranged from $9.4 to $10.3 million in 2004 dollars.

In their 2007 effort, CH2M Hill prepared order-of-magnitude cost estimates for assets in poor condition only. These estimates were made without detailed engineering data and are accurate within plus 50 percent to minus 30 percent of the estimated cost. Contingency factors for engineering, permitting, and legal services were included.

CH2M Hill noted that approximately $996 million in capital improvements had been identified throughout the WPCP to maintain the current level of service. High-risk projects (including those they recommended) that could be implemented over the next 5 years had a planning level cost estimate of $249 million and included high risk assets from each area of the WPCP. The 5-year list represented immediate need projects that must be implemented to maintain wastewater service. The long-term improvements list may be revised in conjunction with the ongoing Master Plan.

For the February 2008 process piping assessment, CH2M Hill made recommendations for condition assessments for the highest risk piping, but did not make recommendations for R&R projects.

7.0 O&M AND CIP INTEGRATION

The integration of O&M and CIP planning often utilizes data sources such as CMMS, geographical information systems (GIS), and Supervisory Control and Data Acquisition (SCADA) systems to help make decisions on whether to repair, rehabilitate, or replace an asset. Evaluating O&M and capital expenditures together also aids utilities in determining

their ideal ratio of corrective versus preventive/predictive maintenance. Ultimately, costs are to be optimized across O&M and capital expenditures.

While no specific analysis has been conducted for optimizing O&M versus CIP expenditures, CH2M Hill performed a financial analysis of the City's capital and maintenance investments for the period of 1995-2005. The City's investment rates were compared with those recommended by the Congressional Budget Office (CBO) for water and wastewater infrastructure. CH2M Hill determined the capital value of the WPCP to be $2.1 billion (in 2005 dollars). Noting that the CBO report recommends 2.7 percent to 3.3 percent reinvestment of the total capital value of a facility, CH2M Hill calculated the expected rate of reinvestment as $56 - $69 million annually, compared to the City's actual annual capital reinvestment in the WPCP of $4.1 - $35.1 million, with an average of $11.3 million. The $35.1 million investment was for the construction of the new Headworks and Wet Weather Facility, and has "heavily depleted capital reserves and funding for other rehabilitation and replacement projects." CH2M Hill found that maintenance investments were used to replace aging assets and did not increase the capacity of the WPCP or provide higher levels of treatment, with the exception of the South Bay Water Recycling (SBWR) system. CH2M Hill concluded that on average, actual investments were $45 to $57 million per year lower than the depreciation rate assumptions used by the CBO.

8.0 STRATEGIC DECISION ANALYSIS

Strategic decision analysis aims at making more efficient and educated decisions in many aspects of the business enterprise, namely:

- Financial planning.
- Risk management.
- Regulatory compliance.
- Annual budgeting.
- Rate impacts.
- Business case analyses using triple bottom line considerations (financial, social, and environmental).

Formal strategic decision analysis has not yet been conducted as part of the AMP. The CH2M Hill report, however, provided several considerations on the topics of overall expenditures and rate setting. The report compared the City's wastewater service fees with those of the 20 largest U.S. cities and three large utilities in the San Francisco Bay area. The results of this comparison were as follows:

1. Adjusting for inflation, the City's wastewater service rates have decreased by 16.2 percent in the last ten years.

2. The City's service fees are 32 percent to 86 percent of the total fees charged by other San Francisco Bay area utilities.

3. The City's service fees are 44 percent of the average total fees charged by the 20 largest U.S. cities.

4. The average sewer rate for separated sewer systems (among the 20 largest U.S. cities) is $567 annually. The average sewer rate for combined and separated systems (among the 20 largest U.S. cities) is $564 annually. The City's (separated) sewer rates are $248 annually.

9.0 IMPLEMENTATION PLAN

AMPs rely on continuous feedback, refinement, and improvement to the asset management process. Therefore, AMPs usually involve phased implementation, and the ongoing risk management and R&R prioritization activities are refined with each cycle. CH2M Hill recommended that the City implement an asset management program through an integrated planning process that includes the following steps:

1. Estimate assets' remaining useful lives through periodic condition assessment.

2. Evaluate risks associated with asset failure such as impacts on level of service, public health, operator health and safety, the environment, and financial impacts.

3. Develop repair and replacement protocols to optimize useful life and capital and maintenance expenditures.

4. Develop information, including via rate studies, to justify capital investments and rate increases, if necessary.

The WPCP is at the early stages of implementing an asset management plan. The current CMMS and corrosion coating assessment projects mark the beginnings of this phased implementation, which is recommended for long-term program success.

10.0 CONCLUSION

The WPCP's AMP Manager is leading efforts in many of the steps of asset management presented above. Further analysis will tie considerations of the Master Plan with the AMP, and subsequent PMs will address prioritization and costs of R&R projects as well as AMP implementation needs.