

3.1 Asset Management Plan Development

The Milwaukee Metropolitan Sewerage District (MMSD or District) has prepared this Asset Management Plan (AMP) in response to a stipulation agreement (Stipulation) (1) entered into between the District and the State of Wisconsin in May of 2002. The AMP describes the measures and activities that the District will undertake to ensure proper function of the assets that provide conveyance, storage, and treatment of wastewater and conveyance and storage of storm water runoff.

In addition to the Stipulation requirements, the following areas were considered in the development of the AMP; 1) General principles of asset management; 2) The Business Process Gap Analysis conducted at the District; and 3) Capacity, Management, Operation, and Maintenance (CMOM) Program objectives.

Asset management principles were also proposed by the United States Environmental Protection Agency (USEPA) as a part of the draft Sanitary Sewer Overflow (SSO) rule (2) that was subsequently withdrawn. The withdrawn SSO rule, although never formally adopted, was considered, in the absence of other guidance, in the development of the District AMP.

This Asset Management Plan is a further development of the Asset Management Plan Strategy that was developed and documented in the *MMSD CMOM Readiness Review and Implementation Strategy Development (CMOM Strategic Plan)* (3) completed and submitted to the Wisconsin Department of Natural Resources (WDNR) in December 2005. There are many items that were identified during the readiness review and strategy development and documented in the *CMOM Strategic Plan* that have been partially or completely addressed as of the completion of this document. These items are still included to provide background information and continuity to the evolution of the Asset Management Plan from readiness review to strategy development to final plan. In addition, the strategies and tactics described in this Asset Management Plan will be subject to change and refinement as the District continues implementing and gains experience with the CMOM Program.

The Stipulation Requirements, withdrawn SSO rule, general asset management principles, District business process gap analysis, and CMOM objectives are discussed in more detail below.

3.1.1 Stipulation Requirements

The Wisconsin Department of Natural Resources (WDNR) has outlined certain requirements for the District CMOM program in the text of the Stipulation. WDNR will also be incorporating CMOM program requirements in their rules and in Wisconsin Pollutant Discharge Elimination System (WPDES) permits. The District CMOM Program has been developed to comply with the Stipulation requirements, but will also comply with the rule and permit requirements.

The Stipulation discusses asset management requirements in paragraph 7 A. The following text is taken from the Stipulation:

“7. While sanitary sewer overflows in the District’s system have been significantly reduced, there are still sanitary sewer overflows within the District’s and its satellite municipalities’ sanitary sewer systems. To continue the District’s program to reduce with the goal of eliminating all non-permitted sanitary sewer overflows, the District shall implement the regional Capacity, Management, Operation and Maintenance (CMOM) program. The regional CMOM shall be comprised of four integrated components:”

The first component listed is:

“A. *Management Plan.* A plan that outlines the goals of the CMOM, the organizational structure to manage it, the legal authority to control infiltration and inflow (I/I), design criteria, benchmarking data, and performance measures to attain the goals. A significant effort associated with the Management Plan shall be the development of an asset management (AM) program that provides for both programmed maintenance and tracking of the asset condition to enable early recognition of expansions or major rehabilitation necessary to avoid capacity limitations.”

Thus the Asset Management Program must have: 1) A system for ensuring programmed maintenance; and 2) A system for obtaining condition information and programming capital asset replacements to avoid capacity limitations.

3.1.2 Principles from Withdrawn SSO Rule

The USEPA proposed the draft SSO rule in 2001. Although the draft SSO rule was later withdrawn and never promulgated, in the absence of other guidance, the District has considered this withdrawn rule in developing its AMP. Within this withdrawn rule, there was a section on the measures and activities a utility must undertake that indicate CMOM compliance. The following is the text from § 122.42 (e) (2) (iv) of the withdrawn SSO rule:

- “(iv) Measures and Activities. Your CMOM program must address the following elements that are appropriate and applicable to your system and identify the person or position in your organization responsible for each element:
- (A) Provide adequate maintenance facilities and equipment;
 - (B) Maintenance of a map of the collection system;
 - (C) Management of information and use of timely, relevant information to establish and prioritize appropriate CMOM activities (such as the immediate elimination of dry weather overflows or overflows into sensitive waters such as public drinking water supplies and their source waters, swimming beaches and waters where swimming occurs, shellfish beds, designated Outstanding National Resource Waters, National Marine Sanctuaries, waters within Federal, State, or local parks, and water containing threatened or endangered species or their habitat), and identify and illustrate trends in overflows, such as frequency and volume;
 - (D) Routine preventive operation and maintenance activities;

- (E) A program to assess the current capacity of the collection system and treatment facilities which you own or over which you have operational control;
- (F) Identification and prioritization of structural deficiencies and identification and implementation of short-term and long-term rehabilitation actions to address each deficiency;
- (G) Appropriate training on a regular basis; and
- (H) Equipment and replacement parts inventories including identification of critical replacement parts.”

This information from the withdrawn rule was considered, in the absence of other guidance, in developing the District AMP.

3.1.3 General Asset Management Principles

There are various guides available that describe asset management principles, such as the *International Infrastructure Management Manual* (10) and *Managing Public Infrastructure Assets to Minimize Cost and Maximize Performance* (11). These guides describe the goals of an asset management plan and some of the means by which this can be accomplished. The principles described in these guides were used in the development of this asset management plan.

The key elements of asset management are:

- Taking a life-cycle approach.
- Developing cost-effective management strategies for the long-term.
- Providing a defined level of service and monitoring performance.
- Managing risks associated with asset failures.
- Using the physical resources of the agency in a sustainable manner.
- Continuously improving AM practices.

Asset management is practiced in different forms and at different levels by all owners of infrastructure assets. The level of asset management can be well defined or it can be as simple as rules of thumb and operator judgment. Regardless of the level of asset management practiced at a utility, defining and documenting the approach is one way to implement improvements.

Asset management can be defined as “Managing infrastructure assets to minimize the total cost of owning and operating them, while providing the desired level of service.” Sometimes added on to this definition is “at an acceptable level of risk.” However, risk can be calculated as a cost, so whether risk is mentioned separately depends on how the utility views risk, as a cost or as a separate factor to manage.

Within this statement, there is a great degree of variability as to the approaches that can be taken. Overall, though, it means that a utility must provide a structured approach for gathering, storing and analyzing costs related to the planning, engineering, design, construction, start-up, operations, maintenance, energy use, rehabilitation, refurbishment

and disposal of its assets. The structured approach is necessary to have the information available when making asset management decisions.

Another way of stating this is to say that an asset management plan is a defined system to improve the management of asset life-cycle costs such that:

- There is a defined and accepted Level of Service (The District uses the terms Level of Protection against overflows for its wastewater conveyance, storage, and treatment system (Wastewater System) and Level of Protection against flooding for its jurisdictional watercourse systems)
- The system organizes and allows easy visual access to all asset physical data (i.e. identification, location, dimensions, material, connectivity, construction method, environment)
- The system provides the ability to forecast operations (and operations costs), maintenance (and maintenance costs), repairs (and repair costs), refurbishments (and refurbishment costs), and replacements (and replacement costs) and compare predicted costs to realized costs for improved decision making.
- There is a standard procedure for approving capital project spending
- The system contains and allows easy visual access to the required cost data necessary for making decisions regarding asset spending.
- The plan provides a system to ensure personnel are trained according to documented procedures and that the procedures are regularly audited.

All of these ideas are incorporated into the District's asset management plan. Because doing things economically is at the core of asset management, some of its principles are also subject to cost-effectiveness and may be applied to a greater or lesser degree.

3.1.4 District Business Process Gap Analysis

A set of specific business processes has been defined that characterizes a good asset management program. These specific processes are grouped into business areas and are shown in Appendix 3-1. These processes were all rated by the District (through the Asset Management Work Team, AMWT) and the Consultant during the readiness review for the current level of implementation at the District. The difference between the current and desired level of implementation is termed a gap. The size of the gap and the criticality of the business process were considered in determining a score for each process. This resulted in the business areas being grouped into actions that needed immediate attention, actions to be completed in the near term (2-5 years) and actions to be completed in the long term (5-10 years).

In summary, the AMWT completed the following work:

- Evaluated District performance in twelve major areas and 81 specific topic areas related to AM.
- Compared District performance in each area to "best practices" as provided by the consulting team.
- Reviewed current performance and defined desired performance in each area, calibrating the vision against what seems reasonably achievable over the next five to ten years.

- Prioritized the major AM areas in terms of “immediate,” “near-term,” and “long-term.”

The Evaluation Matrix, provided in Appendix 3-1 shows the results of this “gap analysis”. The matrix showed that the most significant gaps were present in the following areas:

- *Vision and support* – Gaining Commission and top management support, establishing goals and measurable objectives.
- *Organization* – Establishing the asset management team (AMT) and allocating the resources necessary to carry the AM plan forward.
- *Plan communication* – Identifying stakeholders and stakeholder groups, defining stakeholder interests, and developing and maintaining communication vehicles to educate stakeholders and keep them informed of progress in AM.
- *Plan development* – Assessing current practices, developing an AM vision, performing a gap analysis, and preparing an AMP to improve practices.

Because these business areas are essential to having an asset management plan, the actions necessary to close these gaps were placed in the immediate category. For this reason, much of the work described in the *CMOM Strategic Plan* has already been completed for these areas.

3.1.5 District CMOM Program Objectives

The CMOM objectives that are supported by the asset management plan are:

CMOM conveyance objective 4, treatment objective 5 and watercourse objective 4 – Continue to establish and document level of protection, design, and performance standards for new conveyance, treatment plant, and watercourse assets constructed in the District service area (Management Plan – 2.2.1.2.4, 2.2.1.3.5, and 2.2.1.4.4).

CMOM conveyance objective 5, treatment objective 6 and watercourse objective 5 – Minimize the cost of conveyance, treatment plant, and watercourse asset ownership while maintaining necessary stewardship of assets and achieving defined protection levels (Management Plan – 2.2.1.2.5, 2.2.1.3.6, and 2.2.1.4.5).

The CMOM objectives are worded generally, but all point to the same idea of achieving the defined level of protection while minimizing the costs of asset ownership necessary to achieve the level of protection.

3.1.6 Components of the Asset Management Plan

The actions defined in the *CMOM Strategic Plan* were grouped by their urgency. To remain consistent and provide for continuity, the same groupings of actions are followed in the AMP. They are as stated below.

Foundation Work (titled Immediate Actions in the *CMOM Strategic Plan*)

- Vision and Support (3.2.1.1)
- Program Organization (3.2.1.2)
- Program Communications (3.2.1.3)

Program Planning (3.2.1.4)

Near-term Actions

Asset Knowledge (3.2.2.1)

Asset Planning (3.2.2.2)

Asset Refurbishment and Replacement (3.2.2.3)

Long-term Actions

Asset Development (3.2.3.1)

Asset Operations and Maintenance (3.2.3.2)

Asset Condition Monitoring (3.2.3.3)

Asset Financing (3.2.3.4)

Asset Financial Reporting (3.2.3.5)

For each of these twelve business process areas, the District has determined various objectives to close the identified gaps and improve upon the existing asset management system. Each objective is discussed in more detail in the Asset Management Plan.

3.2 The Asset Management Plan

As discussed in detail in the *CMOM Strategic Plan* and mentioned above, a gap analysis was performed on existing District practices. The gap analysis covered 81 specific topics in 12 categories. A summary of the gap analysis is included in Appendix 3-1. From the gap analysis, the *asset management strategic plan* was prepared and is documented in the *CMOM Strategic Plan*.

Many of the items that were identified during the readiness review and strategy development and documented in the *CMOM Strategic Plan* have been addressed with the completion of this Asset Management Plan (AMP). The items described in Foundation Work (section 3.2.1), and some of the items described in Near-Term Actions (section 3.2.2) and Long-Term Actions (section 3.2.3) have been partially or completely addressed. These items are still included in this plan to provide background information and continuity to the evolution of the AMP from readiness review to strategy development to final plan. Therefore, this asset management plan documents the activity that has already occurred and spells out the future activities that the District will undertake to have a system for achieving its objectives related to asset management.

3.2.1 Foundation Work

Four areas emerged from the gap analysis in the *CMOM Strategic Plan* as needing immediate attention. These areas were:

- I. Vision and Support (3.2.1.1)
- II. Plan Organization (3.2.1.2)
- III. Plan Communication (3.2.1.3)
- IV. Plan Development (3.2.1.4)

In addition, it was determined necessary to provide some immediate gains through asset management practices. The immediate gains would provide additional impetus to implementation of the plan and are discussed below in section 3.2.1.5.

The objectives that were listed for filling the gaps in each of these five areas in the *CMOM Strategic Plan* are included below along with the actions that have been completed. The items in this section have been completely addressed and are considered complete as of the preparation of this document. Besides any actions necessary to maintain their status, there will be no further actions taken under these objectives.

3.2.1.1 Vision and Support

There are two objectives under the Vision and Support heading.:

1. Obtain Understanding and Support from District Executive Management and Commission
2. Establish Relationships Between Levels of Protection and Costs

3.2.1.1.1 Vision and Support Objective 1

Objective

Obtain Understanding and Support from District Top Management and Commission

There are three major items that show the level of support for implementing an asset management plan at the District. First is the District Mission Statement. Second is the additional staff that has been added and third is the support of the asset management team.

District Core Mission

The District has the following mission statement:

To cost-effectively protect public health and the environment, prevent pollution and enhance the quality of area waterways

Visible in this statement are the level of service that the District desires to provide, as well as the term “cost-effectively.” These concepts are the core of asset management programs.

A specially formed subcommittee of the District Commission submitted a report titled “Milwaukee Metropolitan Sewerage District Commission Subcommittee for Future Financial Planning – Final Report” in November of 2006. Included in this report are the concepts of providing the required level of protection while minimizing major financial commitments. This is a self-speaking commitment of the Commission in support of asset management principles. This document is available as a link from the District Commission web page (<http://www.mmsd.com/about/commission.cfm>).

Asset Manager/Asset Management Database Coordinator position funding

The position of Asset Manager (in conjunction with the CMOM program manager position) was funded and has been filled since June 2006. In addition, the position of Asset Management Database Coordinator was funded and has been filled since October 2006. In reviewing the funding requirements for these two positions, the District Commission and Executive Management were informed of the importance of the positions for the success of the AMP.

Asset Management Team

The District has organized an asset management team (AMT) and has utilized this team to develop and document the AMP. The District will continue to utilize this team to implement the actions listed in the plan, as well as audit and make changes to the plan.

The commitment to fund and fill the two positions and organize the AMT indicates that the Commission and Executive Management support the development and implementation of the Asset Management Plan.

3.2.1.1.2 Vision and Support Objective 2

Objective:

Establish Relationships Between Levels of Protection/Levels of Service and Costs.

Level of Protection (LOP) is defined for the District’s Wastewater System as the wastewater recurrence interval that can be conveyed, stored and treated without causing a

sanitary sewer overflow in the conveyance system. LOP is defined for the District watercourse system as the flood flow recurrence interval that can be conveyed without causing surface or structure flooding.

The LOP is applied to the system as a whole (conveyance and treatment together or watercourse). The various elements of the system (sewers, pump stations, treatment plant unit processes, channels, culverts, etc.) have capacity, effluent requirement, operating restrictions, and other limitations (Levels of Service) that figure in to the ability of the system to provide the LOP.

The 2020 Facilities Plan documents the analysis of Level of Protection for the conveyance and treatment system. Included in the analysis are costs for having 5-year and 10-year Levels of Protection and the recommended Level of Protection (5-year) for future facilities. For additional information, see Chapter 9 of the Conveyance Report of the 2020 Facilities Plan.

The Level of Protection identified for the watercourse systems (100-year flood flow) is documented in the District's Watercourse Management Plans (WMP). For further discussion of the WMP, see the system evaluation and capacity assurance plan, Chapter 5, section 5.2.3 of this document.

3.2.1.2 Plan Organization

Organizing and implementing an asset management plan, similar to CMOM program organization, involves setting up a structure where asset management is a focus of District activity. The District has gone about this by creating the position of Asset Manager to work with the AMT.

The AMT is a cross-functional and formally recognized team that has provided the input to develop the District AMP. The AMT will also have to implement the details of the AMP, ensure they are carried out, audit the plan and make changes to it in the future. The Asset Manager works with the AMT to ensure asset management principles are understood, incorporated in regular activities and audited to evaluate their effectiveness.

There are two objectives under the Plan Organization heading:

1. Establish the Position of Asset Manager and Formally Charter the AMT
2. Gain the Resources necessary to conduct the AMT work

3.2.1.2.1 Plan Organization Objective 1

Objective:

Establish the Position of Asset Manager and Formally Charter the AMT

As previously described, this objective has been fully completed by the District. The AMT consists of personnel across the District. Table 3-1 lists the representation of the team.

Table 3-1 Representation of the AMT

Function	Organization/Division
Asset Manager	MMSD – Technical Services
Contract Compliance	MMSD – Technical Services
O&M	Contract Operator
Project Management/Design	MMSD – Technical Services
Accounting	MMSD – Accounting
Budget Planning	MMSD – Budget Planning
Project Management/Scheduling	MMSD – Technical Services
Geographic Information Systems	MMSD – Technical Services

3.2.1.2.2 Plan Organization Objective 2

Objective:

Gain the Resources Necessary to Conduct the AMT Work through the First Full Year

The Asset Manager and Asset Management Database Coordinator positions are fully funded. Besides these two positions, the remainder of the AMT is committed to participating as a part of their employee accountabilities. There are no additional resources necessary to continue the work of the AMT

3.2.1.3 Plan Communication

Communication with stakeholders will be one key to successful implementation of the AMP. To communicate with stakeholders requires determining the information that is most important to the stakeholder. For this reason, the stakeholder groups were identified by the primary information relating to CMOM and Asset Management that they are concerned with.

There is one objective under the Plan Communication heading.

3.2.1.3.1 Plan Communication Objective 1

Objective:

Identify Key AM Stakeholder Groups and Identify Their Interests

Tactics:

- Convene an AMT meeting to identify District stakeholders
- Identify stakeholders primary interests
- Identify means to communicate with stakeholders
- Develop the communication methods

The AMT has identified the key stakeholder groups by their main interest, as well as the method for communicating with that group regarding their key interest. The information is shown in Table 3-2.

The purpose of identifying the groups in this manner is to identify a suitable communication medium applicable to the groups' main interest.

The details of the communication medium through which information about the asset management plan will reach the stakeholder groups is work that is currently in development by the AMT.

Table 3-2 Stakeholder Groups, Key Information and Communication Methods

Stakeholder group	Primary Interest related to CMOM and Asset Management	District Information to be Provided	Main Communication Method	Additional Communication Method
Environmental Groups, Regulators, General Public	Overflows/Level of Protection	SSO locations and volumes	Real-time MMSD Storm Update Website Historical Discharge Monitoring Reports Compliance Maintenance Annual Report	MMSD Public Web Site
Satellite system owners, Industrial customers	Level of Service (Sewer capacity, connections)	Availability of sewers, limitations on connections, peak flow	TAT meetings	MMSD Public Web Site
O&M Contractor, Consultants, Construction Contractors	Ability to profit	Changes to typical contract language that affect their costs	Annual Consultant/Contractor meetings	
Internal Staff	Impact on job function	Tasks, Deliverables, Deadlines	Division Meetings Staff Meetings	MMSD Internal Web Site
Service area property owners, Commission, Executive Management	District Cost-effectiveness	Discussion of Costs and Benefits of CMOM Program and Asset Management	CMOM Program Annual Report	

3.2.1.4 Plan Development

As discussed above, the gap analysis and asset management strategic plan have previously been completed and documented in the *CMOM Strategic Plan*. With the completion of this document, the asset management plan is considered developed. This work has all been completed by and/or with the input of the AMT (formerly known as the Asset Management Work Team - AMWT). The AMT will continue implementing, auditing and improving the AMP per the details provided in this document.

3.2.1.5 Immediate Gains

To validate the concept of AM and encourage the adoption of improved AM practices throughout the District, the AMWT recommended that some actions be taken to generate immediate gains through AM. The main action was to examine lower-priority projects in the proposed capital improvement program (CIP) to determine if the projects can be re-cast, delayed, or replaced by more cost-effective alternatives.

The AMWT recommended using the business case analysis technique (BCA). A BCA provides a powerful, analytical framework aimed at expressing benefits and costs arising from projects from the customers' point of view. A BCA goes beyond traditional cost-benefit analyses in the following ways:

- BCAs carefully examine the perceived problems that are addressed by specific CIP projects or combinations of projects.
- BCAs propose alternative approaches to addressing the problems. These approaches may be far-ranging and quite different from the approach currently planned.
- BCAs always carefully consider the “do-nothing” alternative.
- Staff, not outside consultants, typically perform BCAs. A BCA is a “business” review, not an “expert” review.
- Organizations should periodically repeat BCAs throughout the plan/design cycle so that projects are always under review at a fundamental level and so that projects cannot “take on lives of their own.”
- An attempt is made to quantify costs and benefits in three areas; economic, social, and environmental.

In some cases, staff can perform the analysis as complete benefit/cost analyses, giving immediate guidance for management decisions. In other cases, staff will be unable to quantify costs and benefits completely. In such cases, staff can directly compare the residual net cost of a project with an unquantifiable benefit; this often expresses clearly the true cost of achieving policy or regulatory goals and facilitates more focused and effective capital decisions. Within the District, the Technical Services Division would perform the BCA on any given capital project.

There is one objective under the Immediate Gain heading:

3.2.1.5.1 Immediate Gain Objective 1

Objective:

Achieve Immediate Gains through the Practice of AM Techniques

Tactics:

- Review existing methods of analyzing projects done for the Water Pollution Abatement Program, 2010 Facilities Plan, and Central MIS projects.
- Review the District CIP and select a lower-priority project for analysis
- Define objectives and drivers for each project
- Define alternative approaches to meet the objectives
- For each approach, define cost and benefit categories. Where necessary, make assignments to specific staff to gather or estimate needed cost and benefit data
- Compile data and perform analyses
- Review BCA at AMT meeting
- Prepare recommendations

A District team has completed a BCA on a selected project that was in the District CIP. The BCA was presented to Technical Services management. Further details on how to incorporate the BCA process into preparing the CIP and in Project Management are presently being developed by the AMT.

3.2.2 Near-term actions

After establishing the foundation for the AMP by having worked through the immediate actions identified in the *CMOM Strategic Plan*, the AMT has shifted its focus to defining and implementing the near-term and long-term actions. These actions deal more with the assets themselves, whereas the foundation dealt mostly with establishing the plan. The near-term and long-term actions are focused on improving asset information and using this information to increase the efficiency and effectiveness of decision making regarding assets. Portions of the objectives under near-term and long-term actions have been addressed by the AMT as of the completion of this document and are discussed individually.

The District is a mature agency that has largely constructed its wastewater conveyance, wastewater treatment and watercourse systems. The capital improvement programs existing now are mainly intended to:

- Improve the existing system to serve additional lands within the District's ultimate service area
- Provide additional capacity to reduce or eliminate combined sewer and sanitary sewer overflow volumes and frequencies
- Reduce watercourse-related flooding
- Provide rehabilitation and upgrades that maintain or improve the usefulness of existing assets.

With this state of the system in mind, the AMWT recommended addressing items that will close the gaps in three AM areas:

- I. Asset Knowledge (3.2.2.1)
- II. Asset Planning (3.2.2.2)
- III. Asset Refurbishment and Replacement (3.2.2.3)

Details on the objectives, strategies, and tactical actions specific to each area of improvement are discussed below, beginning with asset knowledge.

In addition to developing the asset management plan, the District began developing an Asset Information Management System (AIMS), with the goal of completing it along with other near-term actions. Information is provided below in section 3.2.2.4 on the development of the AIMS.

3.2.2.1 Asset Knowledge

Asset knowledge is that quantified asset information which is readily available for AM purposes. Having this information for all the District assets is the foundation for good-decision making. The definition implies that the information is organized and readily available in a clear and structured way.

Asset knowledge has five objectives:

1. Define the minimum level of detail for an asset (what assets to track)
2. Establish a uniform asset enumeration scheme (asset organization)
3. Identify existing assets and related attributes (asset data)
4. Identify the probability and consequence of failure of an asset (asset risk)

5. Establish the level of AM performed (asset management strategy)

Each of these objectives is discussed in more detail below.

3.2.2.1.1 Asset Knowledge Objective 1

Objective:

Define the minimum level of detail for an asset

Tactics:

- Review existing District information regarding capital assets
- Use the AMT to determine and document the District definition of an asset.

The District AMT has agreed on the following guidelines for what an asset is, how to fit an asset in the asset hierarchy, and to what level of detail District assets are to be tracked:

1. All parts grouped together into an asset at its lowest level must be able to share a replacement value and rehab/renewal schedule (not necessarily maintenance schedule)
2. Failure of any one part of the asset is not more critical than failure of any other regarding:
 - a. Costs incurred due to failure
 - b. Drop or disruption in Level of Protection
 - c. Health & safety implications
 - d. Regulatory violations
 - e. Public relations
3. Parts of the asset may be considered a child to the overall asset as a parent. These parts may be called out separately for maintenance (e.g. valves in a piping system), for custodial responsibility (e.g. spare parts), for criticality (e.g. a specific section of piping could fail that would spill to a sensitive area, whereas the remainder of the piping would spill to a safe area) or other reasons. This parent-child relationship can continue further down into the asset hierarchy, where a child becomes the parent to another part of the asset that is called out.

The appropriate level of detail to break an asset into will be checked by examining the purposes of tracking the costs at that level of detail. Examples include:

1. Historical costs
 - a. Planning
 - b. Design
 - c. Construction
 - d. Operating & Energy
 - e. Maintenance
 - f. Rehabilitation
 - g. Disposal
2. Predicting future operating & maintenance costs
3. Predicting future rehabilitation costs & timing
4. Predicting future renewal costs & timing

5. Monitoring asset stewardship
6. Decision making/analysis (optimizing expenditures)

Whatever the level of detail that an asset is broken into, the benefit of tracking at that level of detail must be greater than the additional cost from tracking one level up.

Along with the above definition, the District uses a minimum of 1) \$5,000 purchase price and 2) Useful life of 3 years or greater to define an asset. Any single piece of equipment that is not part of a larger asset and does not meet both of these requirements is considered a supply and is not listed in the fixed asset register.

In the future, this definition will be employed to refine the fixed asset register, to complete appropriate hierarchies of assets that roll up to the entire District, to correct any discrepancies between other asset source databases and to identify future assets.

3.2.2.1.2 Asset Knowledge Objective 2

Objective:

Establish a uniform asset enumeration system

Tactics:

- Review the documentation regarding asset location and asset class descriptions and hierarchies.
- Review the location hierarchies of the two treatment plants for consistency.
- Update hierarchy documentation.
- Update Project Management Manual.

The District plans on using two asset enumeration systems simultaneously. One system is by location, and the other is by class. They are independent of each other. Classifying assets in a hierarchical manner by location allows management at different levels and facilitates accumulation of costs by asset, by facility, by infrastructure segment, etc. Maintaining class hierarchies allows the comparison of maintenance, operations, construction cost and life histories of asset types. This can improve the gathering of data necessary to make life-cycle planning decisions.

The District and the contract operator currently utilize a hierarchical asset enumeration system for the treatment plants and for equipment in the conveyance and watercourse systems. However, the application of it may be improved by ensuring consistency across all areas, as well as across the two treatment plants. The existing asset enumeration system will be examined and documented by the AMT. The documentation will reside in AIMS.

Documentation will provide for the ability to name future assets, ensure the assets are added to all relevant asset source databases and begin tracking costs early in their life. This requirement will be built into the design contracts and will be addressed by including procedures in the District's Project Management Manual.

As an example, design consultants may be able to assign asset numbers during the design process and reflect these numbers on their drawings. Construction contractors can then accumulate costs and provide final billing by asset in the same manner. This will greatly

improve the ability to manage new facilities effectively and to report financial results accurately.

3.2.2.1.3 Asset Knowledge Objective 3

Objective:

Continue to Identify Existing Assets and Related Attributes

Tactics:

- Review asset databases for conformity with the defined level of asset detail, hierarchical numbering system, and asset class assignments. Reinventory, renumber, and add/change class assignments as required.
- Investigate and determine which assets should be physically tagged with asset numbers. Review the existing tagging system to ensure it adequately addresses the needs of the AMP.
- Define identifying, parametric, and maintenance data required for each asset class. Review databases and add the required data where it is not present.

The District will review and update its asset management source databases to be reconciled with each other and in accordance with the minimum asset detail and asset enumeration guidelines described above.

The conveyance system will be updated using the latest “leg maps,” combined with the record drawings. The leg maps have been kept up to date and provide a view of large branches of the system.

The District is currently in the process of updating its conveyance geographical information system (GIS). At the end of this two year project, the District will have all of its conveyance facilities included in the new GIS system. With the new GIS will be improved access to facility data.

The plant equipment computerized maintenance management system (CMMS) database, (MAXIMO), and District accounting database (Great Plains) will be reconciled and updated according to an inventory that is being completed for the close-out of the current 10-year operation and maintenance (O&M) contract.

These systems all have existing information, but need to be updated and expanded to include any additional information that is deemed necessary per the details provided in this document.

In parallel with this effort, the District will record appropriate asset data if it is not recorded already. Such asset data will fall into three sets:

- Identifying information, such as serial number, date installed, and original cost.
- Parametric information, such as horsepower, flow capacity, length, and diameter.
- Maintenance history, such as types and frequencies.

The District will define the required information by asset class to ensure that a consistent set of data is achieved. This effort will be ongoing.

The District contract operator currently places equipment tags on all assets. The tag number is a sequential number that is also entered into MAXIMO with the asset information. This action is important to ensure information is recorded against the proper asset. There are many locations at the treatment plants and at conveyance pump stations where multiple pieces of identical equipment can create tracking difficulties without the use of asset tags.

Asset classes will have documented descriptions in the AIMS reference library. Present asset descriptions also need to be expanded and descriptive enough to allow future personnel to know what the asset is and be able to physically identify it.

3.2.2.1.4 Asset Knowledge Objective 4

Objective:

Identify the Consequence of Failure for Assets

Analysis of the consequence and probability of failure (risk = consequence x probability) has been completed for all District assets by asset class. This includes conveyance, treatment plant and watercourse assets. The consequence and probability of failures are multiplied together and then adjusted based on a redundancy factor. The result is a Risk Management Priority (RaMP) number. This RaMP number is used to prioritize assets by criticality and determine an appropriate management method (discussed in section 3.2.2.1.5 below).

There are currently 175 classes of assets in the District AIMS system for the three service areas of conveyance, treatment and watercourse. The factors that went into determining the consequence and probability of failure for each asset class, as well as the resulting RaMP number are provided in Appendix 3-2.

3.2.2.1.5 Asset Knowledge Objective 5

Objective:

Continue to Establish the Level of AM Performed

Tactics:

- Review asset listings and assign preliminary numerical cut-off points for the management strategies.
- Review assets assigned to each management strategy. Note assets that have special requirements (e.g., remote monitoring of condition via predictive maintenance for cost reasons even where condition-based monitoring is not indicated by criticality).
- Based on the second review, establish additional management strategies if substantial groups of assets need management methods different from those discussed above.
- Formalize the reviews by documenting the management strategies used and the criteria for determining the strategy.

- Establish procedures to ensure that assets are being managed according to the appropriate modes.

Once the District has identified, enumerated, and determined criticalities for assets, assets can be assigned to appropriate levels of management. The intent is to assign the most critical (highest risk) assets to the more intensive management modes, so that resources can be focused where they will have the greatest effect.

Intensity of management is in theory a continuum, however, cut-off points for the RaMP numbers will be established to create practical management modes. The three modes that the District will use are:

Condition monitoring-based management – These assets are so critical that unplanned failures will have serious consequences in level of service or regulatory violations. The District will base condition monitoring, maintenance, refurbishment and replacement schedules on minimizing the risk associated with these assets.

Economic-based management – These assets are less critical in that they can experience unplanned failures that do not have an adverse impact on service delivery and will not cause a regulatory violation. For these assets, condition monitoring, maintenance, refurbishment and replacement schedules will be based on economic analysis. Capturing reliable cost information by asset is a key to managing these assets.

Operate to failure-based management – These assets are not critical in that a failure will not have an impact on service delivery and will not cause a regulatory violation. For these assets, it is not economically practical to complete some or all of the monitoring and maintenance activities, but is cheaper to replace the asset when it fails.

Figure 3-1 shows this management mode concept graphically.

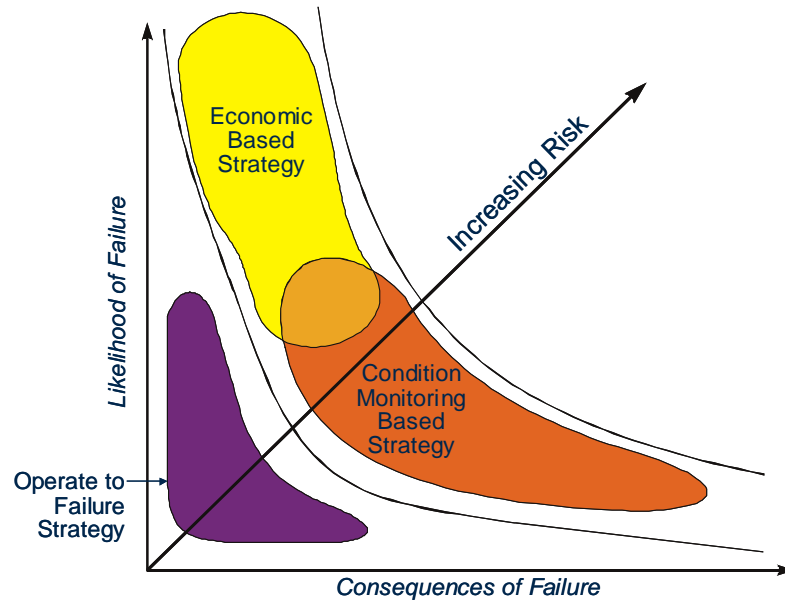


Figure 3-1: Asset Management Maintenance Strategies

Assigning assets to the various management modes in a way that matches Level of Service and Level of Protection requirements helps ensure that the District can meet those requirements at the least cost.

As assets are inspected and predictive maintenance is completed, useful lives can be updated. This information all feeds in to the calculation of the RaMP number, upon which management modes will be based. Therefore, condition monitoring efforts will be integral to updating management modes. For further information on condition monitoring, see section 3.2.3.2 below.

Asset knowledge is one of the bigger tasks to tackle. While there is much valuable information available for the existing assets, it is not all organized and concentrated in a way that is quickly and readily accessible. The District's GIS is in the process of being upgraded and expanded. The new GIS will include conveyance, treatment plant and watercourse assets to varying extents and is being designed to work with AIMS for data compatibility. The vision of the new system is to fulfill the needs of users of asset information and is a big part of completing asset knowledge objectives.

3.2.2.2 Asset Planning

Asset planning refers to the preparation of the expected life-cycle costs of ownership of an asset. Such costs typically include short-interval activities (operations, maintenance, energy, condition monitoring), and long-interval activities (refurbishment, replacement, disposal).

The District O&M budget reflects the short-interval costs and job plans in MAXIMO shows the scheduled short-interval activities.

Presently, the District's capital budget reflects some long-interval costs. This budget is presently projected for a 6 year future. The District is planning to expand this out further

in future budgets. The capital budget also includes the larger expenditures for acquisition, refurbishment, and replacement of assets.

Asset planning is important for two reasons:

- i. A key goal of AM is reducing asset ownership costs. An AM Program accomplishes this through the classical plan/act/measure/control cycle. AM works by preparing plans for assets, carrying out the plans, measuring the results, and updating the plans accordingly.
- ii. Having cost of ownership plans for all significant assets means that the District can accurately forecast aggregate ownership costs well into the future, giving a solid foundation for long-range funding plans.

Asset planning will start with asset plans developed by asset class. The District will then modify these plans for assets that are known to have different requirements than the typical asset in that class.

Asset Planning has three objectives:

1. Establish Short-Interval Portions of Asset Plans
2. Establish Long-Interval Portions of Asset Plans
3. Develop Procedures to Update Asset Plans

3.2.2.2.1 Asset Planning Objective 1

Objective:

Continue to Establish Short-Interval Portions of Asset Plans

Tactics:

- Review MAXIMO to ensure that all preventive maintenance (PM) activities are represented at the appropriate level and with standard costs.
- Add condition monitoring activities when they are defined (according to section 3.2.3.2.1 below).
- Review procedures for gathering costs at the asset level.
- Review capability for extracting both plan and historical cost data from MAXIMO for further analysis (MAXIMO has limited analytic capabilities).

MAXIMO already contains the defined short-interval activities (primarily preventive maintenance) for many District assets. These activities will be reviewed to ensure that they are asset-specific and properly allocate costs in accordance with the asset hierarchy. Where necessary, the contract operator can add and perform additional activities (primarily condition monitoring) and record the data in MAXIMO.

In conjunction with this effort, the asset enumeration system will be checked in MAXIMO to ensure that the GIS and Great Plains databases also use the same numbers for the same assets. Equipment numbers should also be incorporated as they are used by present planners and designers for Process and Instrumentation Diagrams (must be used for tying supervisory control and data acquisition (SCADA) information and control information to the central control system (CCS)).

3.2.2.2.2 Asset Planning Objective 2

Objective:

Establish Long-Interval Portions of Asset Plans

The District will use AIMS to prepare and maintain plans for long-interval activities, including refurbishment, replacement and disposal.

Tactics:

- Prepare generic long-interval plans using asset classes. Enter these plans into the AIMS system.
- Modify the “generic” plans where specific timing and/or costs of long-interval activities are known, e.g., planned asset replacements.
- Ensure preventive maintenance (PM), predictive maintenance (PdM), and corrective maintenance (CM) information is being recorded appropriately to enable remaining useful lives to be estimated.
- Review PdM data, PM and CM trends and compare to asset plans.
- Tie together long-interval plans and short-interval plans to eliminate duplication of efforts, minimize unnecessary expenditures, increase coordination of efforts, and complete asset replacement in a timely fashion.

3.2.2.2.3 Asset Planning Objective 3

Objective:

Develop Procedures to Update Asset Plans

Tactics:

- Review current procedures to ensure that the contract operator is maintaining the asset database to accurately reflect assets in service.
- Analyze asset histories versus plans so that plans can be updated to reflect best current knowledge on maintenance frequencies and activities as well as expected R&R needs.

The District will update asset plans based on changes in the asset inventory, improved ownership cost knowledge, and maintenance information (including PM, PdM, and CM) either at the class level or the individual asset level. Improved knowledge will become available through regular reviews of asset condition, criticality, performance, and ownership costs.

3.2.2.3 Asset Refurbishment & Replacement

One of the focuses of AM is the improvement of asset refurbishment and replacement (R&R) decisions. R&R goals may vary from risk avoidance, in the case of highly critical assets, to risk management for less critical assets, where unplanned failures can be accepted. Improved asset knowledge is the key to better R&R decisions. Therefore, the District will need to consider criticality, condition, cost, and performance in the analysis.

Improved R&R decisions may go well beyond questions of timing, however. Where the District performs any major re-investment in an asset, the entire process for asset development may need to be revisited (needs analysis, alternatives formulation, etc).

Improved R&R planning arising from asset knowledge greatly improves the quality of capital funding strategies.

Asset R&R has three objectives

1. Improve R&R Planning
2. Improve R&R Analysis
3. Ensure R&R Actions are properly reflected in financial reporting

Each of these is discussed below.

3.2.2.3.1 Asset R&R Objective 1

Objective:

Improve R&R Planning

Tactics:

- Review current data and methods to project R&R needs.
- Compare data and methods to experience recorded in MAXIMO.

The District will be developing and updating long-interval asset plans (see section 3.2.2.2.2 above). To improve R&R planning requires consistent, accurate, up-to-date information about existing assets. The requirements of the existing and future agreements with the contract operator include their providing accurate and consistent maintenance information. This includes PM, PdM and CM. For CM, failure modes must be included. Costs for materials and labor must be included for all maintenance.

The AIMS system provides the ability to view and analyze all of this information. With this analysis capability, better predictions can be made of future R&R needs. To the extent that the long-range portions of the asset plans reflect good asset knowledge, then there will be dependable R&R plans for individual assets and for assets in aggregate. This dependability will support maintenance of adequate reserves or other funding mechanisms for upcoming R&R costs.

3.2.2.3.2 Asset R&R Objective 2

Objective:

Improve R&R Analysis

Tactics:

- Require contract operator to perform preliminary analysis on asset replacement requests

Proper R&R analysis requires the same type of investigation as when creating an asset. R&R analysis and business case analysis are done simultaneously to determine the appropriate time to replace an asset.

3.2.2.3.3 Asset R&R Objective 3

Objective:

Ensure R&R Actions are properly reflected for Financial Reporting

Tactics:

- Prepare guidelines for classifying R&R transactions for financial reporting purposes.
- Prepare procedures for analyzing and reporting R&R transactions as retirements, replacements, and improvements. In the case of the latter, the procedure should involve increasing the cost basis of the asset rather than adding a new asset.
- For refurbishments that affect the useful life of the underlying asset, procedures should ensure that the fixed asset register is updated to reflect the new remaining useful life.
- Prepare procedures for assigning costs to R&R actions so that the District is including appropriate internal costs in the R&R costs that are transferred to the fixed asset register. Organizations typically use a standard percentage for this purpose.
- All of the above should be reflected in the standard operating procedures (SOPs) for fixed assets.

Many organizations improperly record refurbishment, and sometimes replacement, actions in the fixed asset register (Great Plains). Since this register is used to report asset value and depreciation, these errors can result in inaccurate financial statements. Common problems include failure to remove retired assets and failure to extend the life of the refurbished assets.

There was no gap determined in this area. However, the AMT may determine that some additional action is required to avoid future problems in this area.

3.2.2.4 Asset Information Management System

The AIMS is a system put in place to organize and allow analysis of cost information for District assets. The system is operating, but is being continually developed to provide additional value to the District. The following goals in the areas of analysis and reporting have been set for the AIMS.

Analyses:

- Estimate total installed cost and schedule for assets anticipated to need refurbishment or replacement for a given planning horizon.
- Trend PM and CM work order frequency per asset class.
- Estimate modified remaining asset life based on use, condition, and maintenance history.
- Gather, store, and analyze data for BCA of CIP projects.
- Evaluate the risk of failure for assets to determine criticality.
- Forecast maintenance costs related to planned capital assets.

Reports:

- Report status of critical asset condition monitoring – planned and actual – and retrieve historic condition monitoring data.
- Report near-term (next 7 days) PM and CM work orders as scheduled in MAXIMO.
- Report PM and CM work order ages per asset, asset criticality group, asset class, system (location), and facility.
- Identify assets anticipated for replacement, based on useful life, and planned for replacement through scheduled CIP project.
- Display status of active construction projects, including the project phase, cost, and estimated completion.
- Report on asset failures by class, location, and criticality group according to root cause of failure analysis standard.
- Report CM and PM cost per asset class or per facility for comparison to and support for design assumptions.
- Display downtime for assets, facilities, or asset classes.
- Report planned versus actual project cost.
- Find asset data in a variety of ways (by facility hierarchy, search, asset class, project, etc.).

The AIMS will forecast long-range R&R. It will draw upon the Great Plains fixed asset reporting system, MAXIMO, the Watercourse CMMS, the Watercourse GIS and the Conveyance GIS databases. AIMS will help the District effectively address several of the areas identified for gap closure in the *CMOM Strategic Plan*.

3.2.3 AM Plan: Long-Term Actions

Following the near-term actions, the next steps will focus on improving asset knowledge and using this knowledge more effectively to manage the infrastructure. Long term AM activities will include the following five areas:

- I. Asset Development (3.2.3.1)
- II. Asset Condition Monitoring (3.2.3.2)
- III. Asset O&M (3.2.3.3)
- IV. Asset Financing (3.2.3.4)
- V. Asset Financial Reporting (3.2.3.5)

3.2.3.1 Asset Development

The role of AM in asset development is to assure that the District optimizes its investment in new infrastructure. That means that the alternative that best meets the identified needs, meets the required level of service/level of protection, and that has the lowest anticipated life-cycle costs is implemented. Asset development is a critical role for AM because the greatest opportunity for savings exists when making the choice to build new infrastructure.

Asset development includes the following five objectives:

1. Develop a systematic approach to creating assets
2. Consider constructability, maintainability, and operability in the design process
3. Require that enumeration schemes be followed by designers and contractors
4. Maximize contractor contribution to asset development
5. Prepare asset plans coincident with asset delivery

Each of these objectives is discussed further below.

3.2.3.1.1 Asset Development Objective 1

Objective:

Develop a Systematic Approach to Creating Assets

Utilities adhering to the Australian/New Zealand approach to AM (described in the *International Infrastructure Management Manual*) have developed procedures to ensure that capital investments match up with required levels of service. Typically, all new projects require life-cycle benefit/cost analyses. While these analyses may not be able to quantify some sorts of benefits, such as regulatory or safety benefits, they can highlight the residual costs of such benefits and thus facilitate a rational approach to capital investment.

Tactics:

- Ensure the Business Case Analysis technique is developed in a method that is applicable for District-wide implementation.
- Prepare guidelines for determining when a Business Case Analysis should be performed.
- Incorporate the guidelines in the Project Management Manual and, if possible, in the budget preparation procedures.

- Require that consultants and the contract operator, if they perform such analyses, follow District standards.

3.2.3.1.2 Asset Development Objective 2

Objective:

Continue to Consider Constructability, Maintainability, and Operability in the Design Process

One key to controlling life-cycle costs of ownership is to stress constructability, maintainability, and operability (CMO) during the design process. Knowledgeable personnel from the affected parts of the organization normally do such an evaluation early in the project and frequently review these aspects as the project develops.

Tactics:

- Ensure that during the design of new District assets, the input of the contract operator, construction management personnel, and Contract Compliance personnel is being obtained.
- Include guidelines in the Project Management Manual outlining the personnel to contact and specific items to be addressed.

3.2.3.1.3 Asset Development Objective 3

Objective:

Require that Enumeration Schemes be Followed by Designers and Contractors

The District will refine the hierarchical asset enumeration scheme that all asset-based systems will share as describe above. Doing so will allow analysis by process, facility, and infrastructure segment. Consultants and contractors should use asset numbers during design and construction, where it is feasible to obtain the numbers prior to commencing design.

Tactics:

- Define and document the asset enumeration system
- Add asset enumeration requirements to the standard language for design contracts.
- Add asset enumeration requirements to construction contracts.

3.2.3.1.4 Asset Development Objective 4

Objective:

Maximize Contractor Contribution to Asset Plan Development

For new or refurbishment facilities, contractors can substitute for District or consultant labor in providing asset planning and related information. The main information that can be obtained from the contractors is the asset identification and parametric information. To obtain this information consistently, standardized forms (with electronic versions available) should be developed that must be completed by the contractor prior to

acceptance. There are numerous benefits of having standardized forms for capturing asset information to enable transfer to the asset-based information systems.

Tactics:

- Review existing asset data
- Determine additional data capture requirements
- Prepare forms for contractors to complete and submit. Contractors should organize all data elements by asset and number assets per the asset hierarchy. Required data elements might include:
 - Identifying information
 - Parametric information
 - Maintenance information (activity, frequency, parts and materials, for each preventive maintenance type).
 - Estimated useful life of the asset (note that the District may need to issue a legal release to protect the contractor against premature, but out-of-warranty, failure).
 - Purchase and installed cost of the asset.
 - Nameplate information.
 - Warranty information.
- Add language to construction contract boilerplate to require that contractors provide the information in the appropriate form.
- Require that contractors deliver all O&M manuals and similar documentation in hard copy and electronic copy.

3.2.3.1.5 Asset Development Objective 5

Objective:

Prepare Asset Plans Coincident with Facility Delivery

Contractors must provide O&M manuals at the time of substantial completion. District staff and the contract operator will need to review the requirements in the O&M manuals to create short-interval asset plans and long-interval asset plans. This will require a criticality analysis of the new facility in accordance with the hierarchy.

Tactics:

- Prepare procedures governing hierarchical criticality analysis of new facilities and assigning assets to appropriate AM strategies.
- Ensure PM, PdM, and the long-term asset plans are updated to reflect the result of the criticality analysis.

3.2.3.2 Asset Condition Monitoring

Asset Condition Monitoring has three objectives:

1. Define Condition Monitoring Methods
2. Define the Condition Monitoring Program
3. Integrate Condition Monitoring with Other Business Processes

3.2.3.2.1 Asset Condition Monitoring Objective 1

Objective:

Define Condition Monitoring Methods

Tactics:

- Review existing condition monitoring methods used in each of the three District service areas.
- Prepare cost-effective recommendations for condition monitoring of District assets
- Include recommendations for condition monitoring in the new agreement being prepared for O&M services

Condition Monitoring methods vary for different assets. Discussion of the methods for the conveyance, wastewater treatment plants, and watercourse systems is provided below.

Conveyance

Inspection procedures have been developed for condition monitoring of the sewer system (pipes and structures). These procedures have been included in the language of the draft agreement for the O&M contract that will begin in 2008. The procedures require the contract operator to have a person certified by the National Association of Sewer Service Companies (NASSCO) performing the inspections, use NASSCO standardized defect coding, enter and store the information in an electronic database, and provide the District with a condition rating for each pipe and structure. With current condition monitoring information the remaining useful life can be updated. RaMP numbers, future inspections, maintenance, rehabilitation and reconstruction work will be based on the updated remaining useful life.

Treatment Plants

For the treatment plants, for which the majority of the assets are machinery and equipment, the contract operator is and will continue to be required to use predictive maintenance to minimize failures and maintain or extend the service life of the system. The following methods are to be included:

- vibration analysis
- tribology (lubricant) analysis
- temperature monitoring
- motor current analysis
- infrared thermography of electrical equipment
- acoustic emission analysis
- static motor winding testing
- dynamic motor winding testing
- comparison of pump and blower recorded performance with predicted performance curves

The method(s) used for a particular class of assets will initially be based on past experience. As the information available in MAXIMO and AIMS increases regarding asset failures, additional reviews and analyses will be conducted to determine whether particular tests should be added or removed.

The 2020 Facilities Plan is recommending a geotechnical and structural analysis be completed at the treatment plants. This will provide updated condition information on the majority of the remaining assets at the treatment plants.

Watercourse System

Watercourse inspection procedures have been established and documented in the Watercourse Inspection and Maintenance Plan. The District is in the process of defining inspection responsibilities. Regardless of the entity that will be performing the inspections, the system employed will be the same. The information will be returned to the District in a form similar to the conveyance system. River reaches will be videotaped, pictures taken of defects, standard defect codes will be used and a condition rating will be returned. This information will be used to update the remaining useful life of the asset, for which future inspections, maintenance, rehabilitation and reconstruction work will be based upon.

Inspection of box culverts in the watercourse system will be completed separately from the previously mentioned inspections. These inspections must include more detail on structural integrity. The District is planning to do these inspections in-house and currently has the technical expertise to do so. The field crews will be trained in 2007, with the inspections to begin after the training is completed. The data will be returned to and reviewed by a structural engineer for a final condition rating. This information will again be used to adjust the remaining useful life of the asset, for which future inspections, maintenance, rehabilitation and reconstruction work will be based upon.

3.2.3.2.2 Asset Condition Monitoring Objective 2

Objective:

Define Condition Monitoring Program

Tactics:

- Review existing short-term asset plans by asset class, ordered by criticality.
- Analyze the ability of the existing condition monitoring system to predict the failure of an asset
- Review the costs involved in the condition monitoring program and the benefit provided
- Complete an analysis, using BCA techniques as appropriate, to modify asset plans to meet service levels, while minimizing costs

Defining an appropriate condition monitoring program is fundamental to establishing a cost-effective AM Program. The District must use condition monitoring economically to protect the Level of Service or Level of Protection as determined by the management strategy.

One of the main concepts incorporated in the condition monitoring program is to return an overall condition value or rating. This information can then be easily stored with other asset information, analyzed and trended over time. Discussion of this was included in section 3.2.3.2.1 above.

3.2.3.2.3 Asset Condition Monitoring Objective 3

Objective:

Integrate Condition Monitoring with Other Business Processes

Tactics:

- Use condition monitoring information to update probability of failure values, evaluate overall risk, and revise or prioritize maintenance schedules.
- Prepare procedures for using trend analysis of assessed condition, along with criticality and performance measures, to analyze and forecast R&R needs, timing, and costs.

The AIMS system is set up to use a condition monitoring rating in the risk matrix. As condition monitoring information is entered, the RaMP number for an asset is updated to reflect it. Since the strategy for managing an asset will depend on the RaMP number, the system is already built to incorporate condition monitoring into the cycle. The asset plans for those assets that are in the economic-based management strategy will be reviewed by the contract operator for determining maintenance schedules. It is in their interest to do this to increase their profit, provided they do not let the service level drop. The District will also review these asset plans as determined necessary to ensure proper stewardship of District assets.

Organizations practicing AM normally use condition assessments and trends in assessments to support maintenance scheduling, prediction of R&R timing, and R&R decisions. For condition monitoring to make its best contribution, the District also needs to use it for these purposes.

3.2.3.3 Asset O&M

The business process areas in the operations and maintenance group scored very strong at the District (see page 2 of Appendix 3-1). There were no gap closure requirements identified in the following areas:

- Defining required PM activities.
- PM scheduling – Performing defined PM activities at the prescribed intervals.
- Using indirect condition assessment (PdM) where cost-effective.
- Performing CM on a timely basis.
- Management of maintenance using the PM/CM balance—Measuring the balance between PM and CM and managing the maintenance process to achieve the optimum ratio between the two.
- Maintenance cost recording—Recording maintenance costs on an activity basis, by asset.
- Consideration of operational requirements—Management of operational methods to minimize the combined costs of O&M.

These areas will be kept as strong with the new O&M agreement as they are with the existing agreement.

There were, however, two items identified that could be improved, which became the following two objectives of Asset O&M:

1. Track Asset Failures Consistently
2. Prioritize Work Order Backlog by Risk

Each of these is discussed below.

3.2.3.3.1 Asset O&M Objective 1

Objective:

Track Asset Failures Consistently

Tactics:

- Include in the new agreement for O&M services that failure modes and information related to failures be input into the CMMS for tracking over time.
- Complete a review of failure codes that are presently used to ensure that they provide sufficient information for the desired purpose. Include additional failure codes as required.
- Complete a root cause failure analysis (RCFA) for asset failures (overflows, level of service failures, structural collapses).
- Document RCFAs and ensure that the documentation is included in AIMS, in the GIS, or in another main data source for future reference.
- Implement corrective actions recommended from RCFAs.

In AM, most learning comes from asset deterioration and failure. Experience in these areas, if properly recorded over time and analyzed, helps refine maintenance programs and improves prediction of R&R timing. The same experience can support pilot programs to extend service intervals in some cases.

3.2.3.3.2 Asset O&M Objective 2

Objective:

Prioritize Work Order Backlog by Risk

Tactic:

- Ensure that the contract operator prioritizes the maintenance backlog.
- Develop procedures as necessary to specify the method of determining risk involved with maintenance backlogs.

It is often the case that many maintenance work orders are open simultaneously, some for extended periods of time. Supervisors may be inconsistent in prioritizing this backlog. In general, supervisors should prioritize backlog by criticality of the underlying asset. While supervisors can do such a prioritization automatically if assets have criticality attributes, they will need to manually review the priorities. For example, a certain pump may be highly critical, but if it has been physically removed from service while putting a reliable spare in its place, the supervisor may lower its default maintenance priority.

3.2.3.4 Asset Financing

The only significant gap in the area of asset financing is knowledge of short- and long-term refurbishment and replacement needs. The District has a systematic approach in

place for this and produces a 6-year capital financing plan. However, this plan must frequently be revised as new projects are identified.

The AIMS system has been set up to enable the District to more easily identify its R&R needs. The system does not have all of the information to be able to adequately produce results yet. As more condition monitoring information is received by AIMS, the asset knowledge base is increased, and asset hierarchies are improved, the prediction of R&R needs will become more accurate. Therefore, the tactics employed under other objectives serve to close this gap and there are no additional objectives under this category.

3.2.3.5 Asset Financial Reporting

Financial reporting, especially fixed asset reporting, is an important element of AM. In 2001, the District implemented Government Accounting Standards Board – Statement 34 (GASB 34) and regularly reviews internal cost controls to ensure continued compliance with GASB 34. Given that the District is in compliance with the depreciation approach of GASB 34, it is important to continue to represent asset value and depreciation accurately and based on best asset knowledge.

To maintain compliance, the asset database has to accurately reflect the District assets. To make sure it does, reconciling the asset database with MAXIMO, the conveyance GIS, and the watercourse CMMS will be completed. When the reconciliation is complete, the consistent application of procedures for adding and removing assets from the database will ensure it remains as an accurate accounting of District assets.

To address these issues, asset financial reporting has the following two objectives:

1. Improve the Consistency of the Accounting Asset Database
2. Improve Change Management Procedures in the Great Plains Fixed Asset Records

Each of these objectives is discussed below.

3.2.3.5.1 Asset Financial Reporting Objective 1

Objective:

Improve Consistency of the Accounting Asset Database

Tactics:

- Review the Great Plains fixed asset list, MAXIMO, the Conveyance GIS, Watercourse GIS and Watercourse CMMS databases.
- Review the completed inventory (June 2007) to determine how to compare asset listings for completing a reconciliation
- Complete a reconciliation of the database asset listings

The District has taken steps to coordinate its financial reporting database with MAXIMO asset records. Asset change procedures are in place to keep the two synchronized. However, there are still inconsistencies in conveyance assets where records in the Great Plains fixed asset list exist in varying degrees of detail.

An inventory that is being completed to close out the existing O&M contract will be used to update and reconcile both MAXIMO and the Great Plains fixed asset database. The inventory is to be completed by mid-2007 and the reconciliation of the databases should be completed by the end of 2007.

3.2.3.5.2 Asset Financial Reporting Objective 2

Objective:

Improve Change Management Procedures in the Great Plains Fixed Asset Records

For accurate financial reporting, the fixed asset inventory (Great Plains) must be kept current. Keeping current means accurately reflecting in the records all additions, retirements, partial retirements, augmentations, and improvements to capital assets.

Tactics:

- Review the existing SOPs regarding addition and removal of fixed assets.
- Determine the positions responsible for carrying out actions required by the fixed asset SOPs
- Ensure that these positions have the ability to complete the actions (are trained in the procedures and able to carry them out)
- Audit some initial asset changes to ensure the procedures are being appropriately followed
- Audit the SOPs
- Document the process and include the results in the Asset Management reporting mechanism.
- Prepare a procedure for situations related to asset impairment. An impairment might arise from the way the District uses an asset or possibly from a reduction in value due to change in system configuration or regulatory action. In most cases, staff may need to make a judgment call whether to reduce the asset's cost basis, reduce its useful life, or both. Finance Department staff should prepare a procedure that would define impairment, state a definition of impairment, state how to calculate the financial ramifications, and define how to track the impaired asset within the financial database, with the underlying database record flagging the asset as impaired.