Guidelines for Preparing an Asset Management Plan (AMP) for Water Supply and Sanitation Authorities (WSSA's)

2011 Edition

TABLE OF CONTENTS

1 INTRODUCTION

1.1 What are assets?

An asset is an item of value - something that is “worth having”, because it is capable of delivering a stream of valuable services into the future. Some assets have a potential service life longer than one year, and are known as “non-current assets”. Non-current assets may be either a physical item (such as land or buildings) or intangible (such as computer software or intellectual property).

This document deals only with non-current, physical assets. In accounting terms, assets in this category are defined as physical items of significant value that:

(a) possess service potential or future economic benefits;

(b) are controlled by an entity; and

(c) originate as a result of past transactions or events.

This definition typically includes such items as land, buildings, infrastructure, plant and equipment, cultural collections, and natural resources. Assets are acquired to support the delivery of utility services to the community. When combined with other resources of the utility (such as financial and human resources), assets make the delivery of services possible. If assets do not contribute effectively to the utility’s service delivery objectives, they should not be held in or used by the utility. Decisions about assets must therefore be service driven. As the need for services changes, the demand for different types of assets will also change.

1.2 Rationale for Asset Management

All water and wastewater systems are made up of assets, some are buried assets and some are visible. These are the physical components of the water supply and sewerage system and can include: pipe, valves, tanks, pumps, wells, hydrants, treatment facilities, and any other components that make up the system. The assets that make up a water or wastewater system generally lose value over time as the system ages and deteriorate. Along with this deterioration, it may be more difficult to deliver the type of service that the utility’s customers want. Costs of operation and maintenance will increase as the assets age. Then, the utility may be faced with excessive costs that it can no longer afford. There is an approach to managing the assets of the system that can assist the utility with making better decisions on managing these aging assets. This approach is called asset management.

1.3 Relationship with Other Documents

The Asset Management Plan is a key component of WSSAs Business planning function. Financial projections from the AMP will support and justify the financial forecasts in the Long Term Financial Plan which is a major component of the Business Plan. This AMP guideline also makes reference to the Business Planning Guidelines. It is therefore advised to prepare/review the AMP alongside with the review of the Business Plan.

2. OVERVIEW OF AN ASSET MANAGEMENT PLAN

Asset management is maintaining a desired level of service at the lowest life cycle cost. Lowest life cycle cost refers to the best appropriate cost for rehabilitating, repairing or replacing an asset. Asset management is implemented through an asset management program and typically includes a written Asset Management Plan (AMP). The WSSA shall develop an AMP for all its infrastructure assets that combines technical and financial management techniques over the lifecycles of the assets to provide specific level of service in the most cost effective manner. Typically, existing assets have different lifecycles, which require technical and financial experts – based on the condition of each asset – to determine the need for rehabilitation or replacement. As such, AMPs incorporate preventive maintenance and risk management considerations. The preventive maintenance considerations are to ensure that day to day wear and tear of the assets are being dealt with to ensure the asset can reach its expected lifecycle. The risk management considerations ensure that administration anyhow manages the risk of early failure of the asset through proper provisions and due diligence.

3. BENEFITS OF AN ASSET MANAGEMENT PLAN

Developing an AMP has several benefits to the WSSA, which include:

a) Prolonging asset life and aiding in rehabilitation, repair, revaluation and replacement decisions through efficient and focused operations and maintenance;
b) Increased knowledge of the location of the assets;
c) Increased knowledge of what assets are critical to the utility and which ones aren't;
d) Meeting consumer demands with a focus on system sustainability;
e) Setting rates based on sound operational and financial planning;
f) Budgeting focusing on activities critical to sustained performance;
g) Meeting service expectations and regulatory requirements;
h) Improving response to emergencies; and
i) Improving security and safety of assets.

4. PREPARATION OF AN ASSET MANAGEMENT PLAN

The responsibility of preparing an AMP lies with the management of a WSSA. Since the key activity in the AMP is to prepare an overview of the state of all existing assets and a strategy for their renewal and replacement, the technical and the finance departments of the WSSAs are key players in developing the AMP.

Once a draft AMP has been completed by these departments a top level management meeting of at least the Chief Executive Officer and departmental heads shall be held to discuss all issues and decide on the final version of the plan. The final AMP shall then be submitted to the Board of Directors of WSSA for approval.

5. CONTENTS OF AN ASSET MANAGEMENT PLAN

In order for an AMP to fulfil the rationale of asset management, it should contain the following minimum sections.

5.1 **Introduction**

The introduction should describe briefly the objectives and contents of the Asset Management Plan and how it was prepared, emphasising the extent to which employees and other stakeholders have been involved in the process

5.2 Assets and Value of Assets

The first core component of asset management is the asset inventory. This component is probably the most straightforward of all. It is also, arguably, the most important as it underlies all other aspects of asset management. The types of questions that WSSAs will ask themselves in this component are: What do I own? Where is it? What condition is it in? What is its remaining useful life? And What is its value?

The best practices to address these questions include:

a) Preparing an asset inventory and system map.
b) Developing a condition assessment and rating system.
c) Assessing remaining useful life by consulting projected-useful-life tables or decay curves.
d) Determining asset values and replacement costs.

a) Asset Inventory and System Map

An asset inventory helps water systems identify what they own and where assets are located. In addition, creating or obtaining a map of the water supply and sewerage system is an important step in preparing an asset inventory. A system map can help operators and managers conceptualize the system as whole. A map should show everything that the water system owns, and identify where the assets are located.

In order to understand the current state of assets, every WSSA shall maintain an assets register which shall include the minimum of the following:

(i) Name and Location (with reference to the attached map of water and sewerage system and other assets ie offices);
(ii) Historical cost/value or Re-valued amount;
(iii) Estimated remaining useful life;
(iv) Annual depreciation;
(v) Accumulated depreciation;
(vi) Replacement cost;
(vii) Functional purpose;
(viii) Size and/or capacity;
(ix) Construction materials;
(x) Construction / Installation date; and
(xi) Manufacturer.

b) Conduct an assessment of the condition of each asset.

It is critical that utilities have a clear knowledge of the condition of their assets and how they are performing. All management decisions regarding maintenance, rehabilitation, and renewal revolve around these two aspects. Not knowing the current condition or performance level of an asset may lead to the premature failure of the asset, which leaves the utility with only one option: to replace the asset (generally the most expensive option).

There are many ways to assess the condition of the assets. For example, some assets can be visually assessed, water lines can be pressure tested, or leak tested, buildings can be monitored for energy efficiency, etc. Sometimes the only suitable way to assess an asset is to

compare its performance (repair history) to its expected life. This assessment will provide accurate information about the current as well as the expected future level of performance of the asset (e.g. of pumps, vehicles etc.);

c) Estimating remaining useful life;

All assets will eventually reach the end of their useful life. Some assets will reach this point sooner than other assets. In addition, depending on the type of asset, it will either reach that point through amount of use or length of service. For example, a pump will wear out sooner if it is used more and will last longer if it is used less. The actual age of the pump is not as important as the amount of work the pump has one. On the other hand, pipe assets wear out based more on the length of time in the ground. If a pipe is in the ground for decades it has had considerable time to contact the soil around it and the water within it and may start to corrode.

There are many additional factors that will affect how much life a given asset has.
Factors such as poor installation, defective materials, poor maintenance, and corrosive environment will shorten an asset's life, while factors such as good installation practices, high quality materials, proper routine and preventative maintenance, and non -corrosive environment will tend to lengthen an asset's life. Because of this site -specific characteristics, asset life must be viewed within the local context and the particular conditions of that utility. Cast Iron pipe may last 100 years at one facility and 30 years at another. It is best to make judgments on asset life based on past experience, system knowledge, existing and future conditions, prior and future operation and maintenance, and similar factors in determining useful life. In the absence of any better information, a system can use standard default values (life span of various assets) as a starting point.
However, over time, the system should use its own experiences to refine the useful lives.

d) Replacement Cost;

Generally, when utilities consider the value of assets, they think about the cost of initially installing the assets. This cost has no other importance than historical information or it can be used by a system that depreciates the costs of assets over time.

However, the installation cost does not have a direct bearing on what it will cost to replace that asset when it has reached the end of its useful life. The asset may not be replaced by the same type of asset (e.g., cast iron pipe may be re placed by PVC pipe) or it may be replaced by a different technology entirely (e.g., a chlorination system replaced by an ultraviolet disinfection facility). Furthermore, costs of various assets may change drastically over time, such that the cost of installing a pipe in 1966 in no way reflects the costs of installing a pipe 50 years later in 2016. Some prices may increase, such as materials, while technological advances may decrease other costs.

The real value of the assets is the cost it would be to replace the assets using the technology the system would employ to replace them. If the system has asbestos cement pipe now, but would replace the system with PVC pipe, the real value of the assets is the cost of replacement using PVC and the installation cost associated with PVC.

Replacement cost is the cost of rebuilding the existing infrastructure using present day technology while maintaining the originally designed level of service. Assuming present technology ensures that any additional cost of outdated and expensive methods of construction is not reflected in the valuation. The straight-line method to estimate the annual cost of renewal and replacement is the simplest and most often used technique, in which the WSSA estimates the length of time over which an asset will be used (useful life), and will expense a portion of original cost in equal increments over that amount of time.

Over time, as assets are rehabilitated, repaired, re-valued or replaced, the WSSA's inventory will become more accurate.

Under this section WSSAs shall describe the different assets it owns under asset categories provided in Table No. 1 by giving details on the location, type, size, capacity, condition, age and estimated remaining useful life. More details have to be provided for pipelines by; (i) providing pipe material and pipe size distribution (in tabular or/ and graphic form) and (ii) providing remaining pipe life distribution as per example below;

Table: Remaining lives of pipes;

Pipe Material	Total Length (m)	1-5yrs (m)	6-10yrs (m)	11-15yrs (m)	16-20yrs (m)	20-30yrs (m)	Over 30yrs (m)
PVC							
CI							

WSSAs shall also fill the Table No. 1.

Table 1: Summarized Asset Register and Value of Assets

Asset	Quantity	Replacement Value(TZS)	Method of estimation
Production / Civil Assets			
Land			
Dam			
Treatment plant and Accessories			
Mains (including valves, hydrants etc.)			
Sub mains			
Reservoir and Tanks			
Wells			
Office Building			
Pumping & Conveyance			
Pumping Station Buildings			
Pumps			
Transmission & Distribution Network			
Pipelines (including valves, bulk meters and hydrants)			
Connections (boxes, Valves and meters)			
Miscellaneous			
Vehicles			
Computers/Software			
Electrical equipments			
Instruments and Control			
EXAMPLE: Computers	5nos	7,500,000	Knowledge of computer costs from previous purchases

5.3 Level of Service

A WSSA is bounded in its Level of Service by two criteria: the level of service should not go below the requirements of the regulator as specified in the Performance Agreement (the minimum level of service) and the water supply and sewerage system cannot go above the maximum capabilities of the assets (the maximum a system can provide.) Between these two boundaries, the WSSA can set any Level of Service it deems appropriate, acceptable to the public, management, and is affordable.

The levels of service determine the amount of funding that is required to maintain, renew and upgrade the water infrastructure in order to provide customers with the levels of service specified. Changes to the levels of service will impact on funding requirements. The WSSA is held responsible to provide information on its level of service in the quarterly and annual reports and the Majis Database.

The AMP can be prepared once the current as well as to projected future level of service the WSSAs is planning to achieve is known. The projected levels of service shall be the same as those which are projected in the Business Plan. Refer Annex B of the Guidelines for preparing a Business Plan.

In this section, WSSAs shall reproduce the projected level of service in their performance agreement /Business Plans.

5.4 Risk Management

Risk management process is defined as the systematic application of management policies, procedures and practices to the tasks of identifying, evaluating, managing, mitigating and monitoring those risks that could prevent a WSSA from achieving its strategic or operational objectives or plans or from complying with its regulatory and legal obligations including attaining its performance targets and quality of service levels.

As assets wear out/ fail due to passage of time and usage, managing the consequences of failure is vital for the WSSA. Not every asset presents the same failure risk, or is equally critical to WSSA's systems and operations. Therefore, it is important to know which assets are required to sustain a given water system's performance.

Critical assets are those that have a high risk of failing (old, poor condition, obsolete technologically etc.) and major consequences occur if they do fail (major expense, system failure, safety concerns, security failure etc).

As a first step in determining the risk of failure, a utility needs to look at what it knows about the likelihood that a given asset is going to fail. The data available to assist in this determination is: asset age, condition assessment, obsolete technology, failure history, historical knowledge, experiences with that type of asset in general, and knowledge regarding how that type of asset is likely to fail. An asset may be highly likely to fail if it is old, has a long history of failure, has a known failure record in other locations, and has a poor condition rating. An asset may be much less likely to fail if it is newer, is highly reliable, has little to no history of failure and has a good to excellent condition rating.

In terms of the consequence of failure, it is important to consider all of the possible costs of failure. The costs include: cost of repair, social cost associated with the loss of the asset, repair/replacement costs related to collateral damage caused by the failure, legal costs related to additional damage caused by the failure, environmental costs created by the failure, and any other associated costs or asset losses. The consequence of failure can be high if any of these costs are significant or if there are several of these costs that will occur with a failure.

In the risk management plan the WSSA shall:

(a) identify and highlight those assets that could cause a major system breakdown;
(b) evaluate their risk of failure either as high, medium or low;
(c) list major technical data such as age and condition of the asset;
(d) list the history of failure of these assets; and
(e) outline strategies and measures in place to prevent failure and to minimize disruption if the asset fails (including insurance).

EWURA will only need a summarized table (Table 2) outlining the main assets that are anticipated to be of high risk of failure within five years. Strategies to prevent failure and strategies to mitigate failure shall be an input in the Lifecycle Management Plan, Table. 3.

Table 2: Risk Management

Asset	Risk of Failure (high, medium, low)	History of failure or others likely causes	Expected Consequence of Failure	Strategy to Prevent Failure	Strategy to Mitigate Failure
Production / Civil Assets					
Asset 1					
Asset 2					
Asset 3					
Pumping & Conveyance					
Asset 1					
Asset 2					
Asset 3					
Transmission & Distribution Network					
Asset 1					
Asset 2					
Miscellaneous					
Asset 1					
Asset 2					

5.5 Lifecycle Management

Assets have a life cycle as they move through from the initial concept to the final disposal. Depending on the type of asset, its lifecycle may vary from 5 years to over 100 years.

Life cycle management has a direct impact on the provision of water and sewerage services to the customer. Section 4.3, identifies the levels of service that utility are committed to delivering for the customer. The lifecycle management plan (Table 3) identifies the measures that require to be implemented to achieve and maintain these levels of service. The adoption of this approach allows WSSAs to clearly identify both the short and long-term requirements of the water and sewerage system ensuring that a cost effective service is delivered to the customer.

5.5.1 Key stages in the asset life cycle are:

(a) Asset planning; when the new asset is conceived. Decisions made at this time influence the sustainability of the asset, the cost of operating the asset and the lifespan of the asset. Alternative, non asset solutions must also be considered.

(b) Asset creation or acquisition; when the asset is purchased, constructed. Sustainability, capital cost, designs and construction standards, commissioning the asset, and guarantees by suppliers influence the cost of operating the asset and the lifespan of the asset.

(c) Asset operations and maintenance; when the asset is operated and maintained. Operation relates to sustainability, efficiency, power costs, throughput etc, and is usually more applicable to mechanical plant rather than static assets such as pipes. Maintenance relates to preventative maintenance where minor work is carried out to prevent more expensive work in the future and reactive maintenance where a break is fixed.

(d) Asset condition and performance monitoring; when the asset is examined and checked to ascertain when and how an asset will fail, what corrective action is required and when (i.e. maintenance, rehabilitation or renewal).

(e) Asset rehabilitation and renewal; when the asset is restored to ensure that the required level of service including sustainability can be delivered.

(f) Asset disposal and rationalization. Where a failed or redundant asset is sold off, put to another use, or abandoned

5.5.2 Options for Dealing with Assets Over Time

There are four basic options for dealing with the actual assets over time:
(a) Operate and maintain the existing assets
(b) Repair the assets as they fail
(c) Rehabilitate the assets
(d) Replace the assets

These options are intimately connected to each other. Choosing to do more or less of one impacts how much of the others is done, whether or not the other is done at all, or the time frame in which one of the others is done. For example, choosing to spend more on operating and maintaining assets will decrease the need to repair the asset and will increase the amount of time until the asset is replaced. Choosing to rehabilitate an asset will eliminate the need to replace the asset in the short term and will increase the amount of time until the asset ultimately needs to be replaced. The rehabilitation will also reduce the amount of operation and maintenance that needs to be done and reduce the need for repairs.

Each of these options has its own costs and considerations. The expenditure of funds becomes a balance between monies spent in each of these four categories. The purpose of asset management is to try to determine the optimal way to spread the money between each of these categories, while maintaining the levels of service desired.

Generally, the most expensive option is replacement of the assets. Therefore, keeping the assets in service longer, while still meeting levels of service conditions, will usually be the most economical for the utility over the long term. The three other options: maintenance of the asset, repair of the asset, and rehabilitation are options that can be used to keep the asset in service longer.

a) Asset Operation and Maintenance

Operation and maintenance (O&M) functions relate to the day -to-day running and upkeep of assets and are particularly relevant to short -lived dynamic assets (such as pumps) where deterioration through lack of regular maintenance may result in rapid failure.
Properly operating and maintaining assets is critical to the success of the overall program. Operation and maintenance is directly linked to Level of Service and Critical Components.

b) Repair of Assets

In addition to operating and maintaining the assets, systems will need to plan for the repair of assets as they fail. Systems need to consider how long they will keep an asset in service prior to replacement of the asset. To some extent, these two items – repair and replacement - are off-setting. If more resources (personnel and money) are spent on repair, there will be a decreased need for replacement. On the other hand, if greater resources are applied to replacing the assets, fewer resources will be applied to repair.
There is a balance between how much to spend in each category: maintenance, repair, and replacement to achieve the most efficient system.

c) Rehabilitation of Assets

When an asset fails, or approaches failure, the typical thought process is that of replacing the asset with a new asset. There is another option for some water or wastewater system assets; assets may be rehabilitated rather than an outright replacement. Rehabilitation brings the assets back to a useable condition without actually replacing them. In many cases, it may be cheaper to rehabilitate the asset rather than replacing it, it may extend the life span of the asset considerably and may reduce other impacts related to asset replacement. An example of a rehabilitation approach is slip lining a wastewater pipe that is nearing the end of its useful life. The pipe can be lined without having to dig the original pipe out of the ground, thus possibly reducing the costs of installation and the inconvenience of the construction.

d) Replacement of Assets

Eventually, all assets will need to be replaced. There will reach a point where the asset can no longer be kept in service through maintenance or repair or where the asset is no longer capable of meeting the level of service, either economically or at all. At that point, the asset will need to be replaced. Replaced assets can either be part of a replacement schedule or a capital improvement plan.

In both cases, the assets are replaced. The main difference is that the replacement schedule includes those items that are routinely replaced, smaller value replacements, and items replaced using the water or wastewater system revenues or reserve funds.

The capital improvement plan indicates items that are major expenditures that do not routinely occur and that generally require outside funding for at least a portion of the project.

The WSSAs shall prepare a detailed lifecycle Management Plan as shown in Table 3.

Table 3: Summarized Assets Lifecycle Management Plan

Re	Anticipated Asset Lifecycle (in Years)	Condition of the Asset**	Estimated Remaining Useful Life (in years)	Operation, maintenance and repair activities and their recurrence rate and costs	Rehabilitation and Replacement Criteria	Rehab. and Replacement Strategy	Estimated Rehabilitation and Replacement Cost	Estimated time of Rehabilitation and Replacement
Production / Civil Assets								
Asset 1								
Asset 2								
Asset 3								
Asset								
Pumping & Conveyance								
Asset 1								
Asset 2								
Asset 3								
Asset								
Transmission & Distribution Network								
Asset 1								
Asset 2								
Asset ...								
Miscellaneous								
Asset 1								
Asset 2								
Asset ...								

**Condition assessment ranks assets on a five step scale as follows:

Very Good:	Very good condition, where only normal maintenance is required.
Good:	Minor defects only where minor maintenance is required to approximately 5% of the asset.
Fair:	Maintenance required to return to accepted level of service where significant maintenance is required to 10-20% of the asset.
Poor:	Requires renewal where significant renewal or upgrade is required to 20-40% of the asset.
Very Poor:	Asset unserviceable where over 50% of the asset requires replacement.

It is not necessary to assess all assets immediately. It is only necessary to assess those that are going to become unserviceable in the next 10 years.

5.6 Funding of the Asset Management Plan

Funding for the Asset Management Plan is incorporated in the overall funding of the Business Plan as follows;

(a) The timing of operation, maintenance and repair activities of various assets and corresponding costs in Table 3 above are an input to the forecasting operation and maintenance in section 7 of the Long term financial planning guidelines.

(b) The timing of the rehabilitation and replacement of various assets and corresponding costs in Table 3 above is an input to the forecasting of rehabilitation/renewal and replacement on section 6 of the Long term financial planning guidelines and section 5.8 of the Business Planning Guidelines.

5.7 Monitoring and Improvement

The effectiveness of the AMP will be monitored in various ways, including statutory external audit, internal audit and benchmarking. Customer surveys will be carried out to monitor the attainment of minimum and targeted service levels and the customers' perception of the service being provided. Compliance with Level of Service will be monitored by internal audit system on daily basis.

The annual capital and renewal works programme will be monitored through performance audits to be carried out by EWURA or an appointed auditor and shall be reported through the Annual Report. WSSAs should ensure that the works are completed as per designs, on time and within the budget.

The carrying out of the maintenance works will be monitored to ensure that the works are carried out within the required response times, to the required standard, and in a cost effective manner.

5.8 Review of the Asset Management Plan

The Asset Management Plan will be reviewed and updated annually to incorporate progress on achieving goals, changing technical requirements, and updated information on asset condition.

The Asset Management Plan will be revised at least every three years in line with the revision of the Business Plan. It will update progress on achieving goals, changing technical requirements and re-valuations.