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Guidelines for the management of assets of water supply and wastewater systems —

Part 3: Wastewater collection networks

Lignes directrices pour la gestion d'actifs des systèmes d'eaux usées et d'eau potable —
Partie 3: Réseaux d'assainissement

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 224, *Service activities relating to drinking water supply systems and wastewater systems — Quality criteria of the service and performance indicators*.

A list of all parts in the ISO 24516 series can be found on the ISO website.

Introduction

This document is written within the overall concept of management of assets which is an activity all organizations undertake in some manner and to some degree. It focuses on the details of managing the physical assets at the operational level rather than the organizational (corporate management, structural or process) level.

Wastewater utilities are reliant on their assets to deliver their services to the resident populations in their jurisdictions. The assets (underground pipes, retention and detention tanks, treatment plants, etc.) collectively form the physical infrastructure of the wastewater utilities and are the consequence of the accumulated capital investments and operational expenditures on maintenance and rehabilitation over many years. In many of these utilities, the replacement value of these past investments will amount to many millions (even billions) of US dollars depending on the size of the community served. The infrastructure represents therefore a major societal investment in essential services contributing to public health and the protection of the environment.

In many countries, these assets have been identified as critical infrastructure, and programmes are in place to ensure their protection or their sustainability. Like many other organizations having assets, wastewater utilities undertake programmes of activities to manage the assets to ensure they continue to meet the needs of the community. These management activities can be at the strategic, tactical or operational level. The activities can be part of a formal management system, the result of specific legislative requirements, or simply the result of due diligence by the service operators and managers.

This document can serve as a supporting document for utilities operating an asset management system regardless of whether the utilities make use of any management system standard (e.g. ISO 55001).

In many countries, there is a recognized sustainability problem, sometimes referred to as the infrastructure gap, which recognizes that for various reasons, the infrastructure has not been maintained over the years on a truly sustainable basis, i.e. funding of rehabilitation programmes has been postponed, with a focus instead on short-term repairs or an allowed decrease in the level of service provided.

The condition of wastewater infrastructure greatly influences the adequacy of the wastewater service from aspects of quantity, quality, safety, reliability, environmental impact, degree of treatment and economic efficiency. System condition-based rehabilitation approaches serve to meet these requirements with a focus on a holistic approach of condition-based, risk-oriented maintenance.

As the installation and development of wastewater assets mature, the optimization of networks will become necessary in many places in order to respond to changing societal and economic conditions. Consequently, networks are subject not only to ageing as well as wear and tear but also to adaptation processes resulting from growth, new legislative requirements, or changing user service level expectations. This requires wastewater utilities not only to focus on maintenance and rehabilitation but also to keep future requirements and developments in mind. Rehabilitation will thus become essential in management of assets, with ever more stringent requirements on the design and execution of rehabilitation (partial replacement of specific sections of the entire network is also considered as rehabilitation).

In recent years, much effort has been applied to the whole issue of management of assets on two levels:

— What are the principles and structure of an asset management system?

— What are the good practices that can be implemented on a technical level to assess the condition of the assets and help decide when asset interventions (repair, renovation or replacement) take place?

This document describes the information required and how to collect and process reliable inventory, condition, operational and environment data about wastewater systems. Data on wastewater infrastructure notably include data on failure. These data serve mainly as a basis for systematic maintenance and can also contribute data needed for benchmarking.

Reliable failure statistics and the database description of the condition are of particular significance for establishing investigation, maintenance and rehabilitation priorities.

This document also provides guidance on how to define a strategy on management of assets with regard to the overall performance expected by the owner and other stakeholders. It includes several aspects of the operation and maintenance, including asset condition assessment and investment strategies (new assets and rehabilitation).

Guidance in Clauses 4, 5, 6, 7 and 9 is taken from EN 752. This document provides a framework for the design, construction, rehabilitation, maintenance and operation of drain and sewer systems outside buildings and also focuses on "integrated sewer system management" in which management of assets is a part.

The approaches offered in this document are intended to be universally applicable, regardless of the structure of a given wastewater system. Any empirical numeric values given are mere support values; concrete plans always need to rely on utility and/or object-specific values.

The usual and expected goal of the effective management of assets is to provide maximum life and value in a cost-effective manner. However, in some circumstances where the assets are being operated to satisfy a short-term goal, this will not be to maximize the life of the assets, but could, for example, be to minimize costs while meeting other objectives within the planned timeframe.

This document is intended to provide guidance on the assets typically owned or operated by wastewater utilities that are expected to meet users' needs and expectations over longer (multi-generational) periods.

Additional information on objectives and functional requirements of management of assets is provided in Annex A.

Guidelines for the management of assets of water supply and wastewater systems —

Part 3:
Wastewater collection networks

1 Scope

This document specifies guidelines for technical aspects, tools and good practices for the management of assets of wastewater networks to maintain value from existing assets.

This document does not apply to the management of assets of treatment plants, which are also physically part of the wastewater system and can influence the management of network assets.

NOTE 1 The management of the following individual assets will be covered by ISO 24516-4: wastewater pumping stations, retention and detention in the network, wastewater treatment plants and sludge treatment facilities.

This document includes examples of good practice approaches on the strategic, tactical and operational levels.

This document is applicable to all types and sizes of organizations and/or utilities operating wastewater networks, and all different roles/functions for the management of assets within a utility (e.g. asset owner/responsible body, asset manager/operator, service provider/operator).

NOTE 2 Depending on the size and structure of an organization, the utility can decide to what extent it applies the guidance in this document, but in any case, the philosophy of this document remains applicable to small and medium utilities.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at http://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
asset
capital-forming goods used for the provision of the *service* (3.23)

Note 1 to entry: Assets can be tangible or intangible. Examples of tangible assets are: land, buildings, pipes, tanks, treatment plants, equipment and hardware. Examples of intangible assets are: software, databases.

Note 2 to entry: Contrary to consumables, assets can be depreciated (tangible assets) or amortized (intangible assets) in accounting systems.

3.2
asset management
processes that enable a water utility to direct, control and optimize the provision, *maintenance* (3.13) and disposal of infrastructure *assets* (3.1), including the necessary costs for specified performances over their life cycle

3.3
asset system
set of *assets* (3.1) that interact or are interrelated

3.4
asset type
grouping of *assets* (3.1) with common characteristics that distinguish them as a group or class

Note 1 to entry: Examples of asset types include, but are not limited to, physical assets, information assets, intangible assets, critical assets, enabling assets, linear assets, information and communications technology (ICT) assets, infrastructure assets and moveable assets.

Note 2 to entry: Examples of physical asset types in the wastewater sector include pipes, manholes, pumps, valves, tanks and pipe bridges of the same type, size, material and function.

3.5
failure
local inadmissible impairment of the operability of an *asset system* (3.3) at a certain point in time on a certain asset

3.6
failure data
data characterizing the occurrence of a *failure* (3.5) event

3.7
failure rate
ratio of the number of *failures* (3.5) of a given category to a given unit of measure
EXAMPLE *Failures* (3.5) per unit of *assets* (3.1) and time; failures per number of actions.

Note 1 to entry: In the case of pipelines, expressed per kilometre per year.

Note 2 to entry: In the case of connections, expressed per kilometre per year.

3.8
inspection
process to identify the actual status of an *asset* (3.1) or *asset system* (3.3) by observation and judgement accompanied as appropriate by visual control, handling, measurement, testing or gauging

3.9
integrated sewer system management
coordinated management of the planning, design, construction, *rehabilitation* (3.18), *operation* (3.15) and *maintenance* (3.13) of all wastewater networks in a catchment area, taking into account all aspects of their performance

3.10
investigation
gathering of all information necessary for a decision-making process

Note 1 to entry: This should include both qualitative and quantitative information.

3.11
level of service
parameters, or combination of parameters, which reflect social, political, environmental and economic outcomes regarding the service to users that the water utility delivers

Note 1 to entry: The service to users can include any of the following parameters: health, safety, user satisfaction, quality, quantity, capacity, reliability, responsiveness, environmental acceptability, cost and availability.

Note 2 to entry: A defined level of service can include any combination of the aforementioned parameters deemed important by the *asset* (3.1) owner, users or relevant stakeholders.

3.12
life cycle cost
total cost of an *asset* (3.1) or its parts throughout its life cycle

Note 1 to entry: Total cost can include planning, design, construction, acquisition, operation, maintenance, rehabilitation and disposal costs.

Note 2 to entry: Total cost should exclude any residual value obtained during disposal.

3.13
maintenance
combination of all technical, administrative and managerial actions during the life cycle of an *asset* (3.1) intended to retain it in, or restore it to, a state in which it can perform the required function

3.14
management of assets
all processes during the life cycle of an *asset* (3.1)

Note 1 to entry: This encompasses all necessary activities for planning, design, procurement, construction/installation, *operation* (3.15), *maintenance* (3.13), *rehabilitation* (3.18) and disposal of *assets* (3.1) of water supply and wastewater systems as a functional activity, including review.

3.15
operation(s)
action(s) taken in the course of normal functioning of drinking water or *wastewater systems* (3.27)

EXAMPLE Monitoring and regulation or diversion of drinking water or wastewater.

3.16
operational plan
documented collection of procedures and information that is developed, compiled and maintained in readiness for the conduct of *operations* (3.15)

3.17
performance indicator
parameter, or a value derived from parameters, which provides information about performance

Note 1 to entry: Performance indicators are typically expressed as ratios between variables. These ratios can be commensurate (e.g. %) or non-commensurate (e.g. $\$/m^3$).

Note 2 to entry: Performance indicators are means to measure the efficiency and effectiveness of a water utility in achieving its objectives.

3.18
rehabilitation
measures for restoring or upgrading the performance of existing *asset systems* (3.3), including *renovation* (3.20), *repair* (3.22) and *replacement* (3.21)

3.19
rehabilitation rate
percentage of entire inventory which is rehabilitated or to be rehabilitated annually

3.20
renovation
work incorporating all or part of the original fabric of an *asset* (3.1) by means of which its current performance is improved

3.21
replacement
installation of a new *asset* (3.1), which incorporates the function of the old asset

3.22
repair
rectification of a local damage

3.23
service
result of a process

Note 1 to entry: Adapted from the definition of "product" in ISO 9000:2005.[1]

Note 2 to entry: Services are one of the four generic categories of products with software, hardware and process materials. Many products comprise elements belonging to different generic product categories. Whether the product is then called "service" depends on the dominant element.

Note 3 to entry: Service is the result of at least one activity necessarily performed at the interface between the provider of the service and, in the first place, its user and, in the second place, a stakeholder. Service is generally intangible. Provision of a service can involve, for example:

— activity performed on a tangible product supplied by the user, e.g. wastewater;

— activity performed on an intangible product coming from the user, e.g. processing new connection requests;

— delivery of an intangible product, e.g. delivery of information;

— creation of ambience for the user, e.g. reception offices.

Note 4 to entry: The word "service" in common English can also refer to the entity providing the actions related to the subject in question, as is implicit in such phrases as "bus service", "police service", "fire service" and "water or wastewater service". In this context and usage, "service" implies the entity that is delivering the service, e.g. "the public transport of passengers", "the provision of public security", "fire protection and response", and "delivering drinking water or collecting wastewater". If "service" can be understood in this way, "water service" becomes synonymous with "water utility"; hence, in this document, in order to avoid confusion, only the definition in 3.23 applies.

3.24
service life
period of time after installation during which an *asset* (3.1) or an *asset system* (3.3) meets or exceeds the technical and functional requirements

3.25
strategic plan
document identifying goals and objectives to be pursued by an organization over a long-term period in support of its mission and being consistent with its values

3.26
tactical planning
identification of objectives to be pursued by an organization over the medium term on the basis of priorities derived from influencing factors/indicators on performance, costs, risk and failure probability and scale of failure

3.27
wastewater system
system providing the functions of collection, transport, treatment and discharge of wastewater and wastewater residues

4 Principal aspects of the management of assets

4.1 Objectives and requirements

4.1.1 Objectives

The key generic objectives for asset management of wastewater systems are identified from ISO 24510 and ISO 24511 as:

— protection of public health and safety;

— meeting users' reasonable needs and expectations;

— occupational health and safety;

— promoting the sustainability of the wastewater utility;

— providing services under usual and emergency situations;

— protection of the environment;

— promoting sustainable development of the community.

Wastewater utilities in undertaking management of assets should aim to manage their facilities systematically and efficiently in order to sustain their functions, through establishment of clear objectives, based on assessment and forecasting of the condition of their, often extensive and complex, facilities.

The objectives of the management of assets will help to ensure that a wastewater utility complies with an agreed sustainable level of service while also exerting a major influence on its economic performance. The level of service should be well defined, communicated, tied to risk, and current as customized to a particular wastewater utility. The objectives for the management of assets should be determined from functional requirements of wastewater networks.

For further information on objectives of management of assets for wastewater networks, see Annex A.

4.1.2 Functional requirements

Functional requirements should be established to aid the achievement of objectives. Functional requirements cover the wastewater networks (as part of the wastewater system) including the effects of their discharges on receiving surface water bodies and receiving wastewater plants. The functional requirements should be considered in respect of the whole system to ensure that additions or modifications to the system do not result in failure to meet the target.

Functional requirements should be established which, while taking into account sustainable development and whole life costs including indirect costs (e.g. traffic congestion, military aid provided to the civil authorities), ensure that wastewater networks convey and discharge their contents without causing unacceptable environmental nuisance, risk to public health, or risk to personnel working therein.

Each functional requirement can relate to more than one objective. An indication of the relevance of each of the functional requirements to the achievement of the objectives is shown in Table 1.

Table 1 — Relationship between objectives and functional requirements

Functional requirements	Objectives						
	Public health and safety	Occupational health and safety	Protection of the environment	Meeting users' reasonable needs and expectations	Promoting sustainability of the wastewater utility	Providing service under usual and emergency situations	Promoting sustainable development of the community
Protection from flooding	XXX	XX	XXX	XXX	X	XXX	XXX
Maintainability	XX	XXX	XX	XX	XX	XX	XX
Protection of receiving surface water bodies	XXX	X	XXX	XX	XX	XX	XX
Protection of groundwater	XXX	—	XXX	XXX	XX	X	XXX
Prevention of odours and toxic, explosive and corrosive gases	XXX	XXX	XXX	XXX	XX	XXX	XXX
Prevention of noise and vibration	XX	XXX	X	XXX	X	XX	X
Sustainable use of products and materials	—	—	XX	XX	XXX	X	XXX
Sustainable use of energy	—	—	XX	XX	XXX	X	XXX
Structural integrity and design life	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Maintaining the flow	XXX	—	XXX	XXX	XX	XXX	X
Watertightness	XXX	X	XXX	XX	XXX	X	XX
Not endangering adjacent structures and utility services	XXX	XXX	X	XX	XXX	XX	XX
Inputs quality	XX	XXX	XXX	XXX	XX	XXX	XX
NOTE The number of X gives guidance on the importance of the requirement in achieving the objectives.							

4.1.3 Performance requirements

In order to evaluate the performance of the network and to allow development of design criteria, measurable performance requirements should be determined from each functional requirement.

The process for determining performance requirements is illustrated in Figure 1.

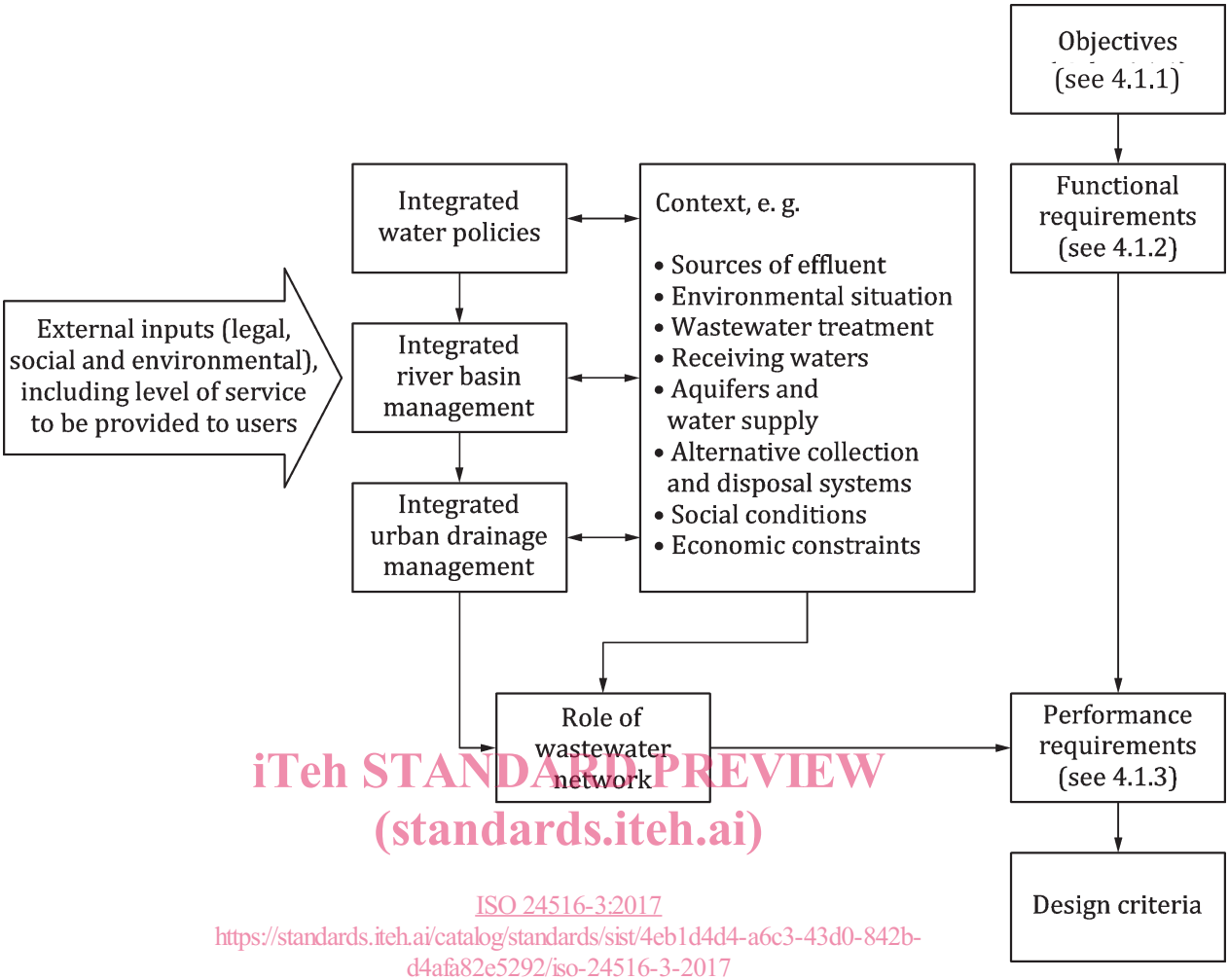

Figure 1 — Process for determining performance requirements

For each functional requirement, there can be legal requirements, public expectations and financial constraints which will influence the performance requirements. Public expectations should be reflected in the levels of service set by the utility to provide to its users.

For each aspect of performance, different levels can be required, for example:

a) trigger levels which justify early upgrading action according to priority;

b) target levels to aim for in upgrading, which should be equal to the requirements for new construction, but which sometimes can only be achievable or necessary in the longer term.

Performance requirements should be reviewed periodically and updated, if necessary. The performance requirements for the network should be updated after major extension, maintenance or rehabilitation.

In principle, the performance requirements for a rehabilitated network should be the same as those for a new network.

Performance indicators are an essential tool in understanding a utility's infrastructure conditions and needs and, in parallel, enable indicator-supported infrastructure planning and decision making. Properly implemented indicators provide information on the condition of the assets and the level of their contribution to the achievement of the utility's objectives.

Performance indicators should be defined at strategic, tactical and operational levels. They should make clear how actions at the operational level contribute to achieve strategic level objectives. Strategic level