INTERNATIONAL STANDARD

**ISO 24511**

First edition
2007-12-01

# Activities relating to drinking water and wastewater services — Guidelines for the management of wastewater utilities and for the assessment of wastewater services

*Activités relatives aux services de l'eau potable et de l'assainissement — Lignes directrices pour le management des services publics de l'assainissement et pour l'évaluation des services fournis*

Reference number
ISO 24511:2007(E)

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Published in Switzerland

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# Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 24511 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*.

ISO 24511 is one of a series of standards addressing water services. The full series consists of the following International Standards:

— ISO 24510, *Activities relating to drinking water and wastewater services — Guidelines for the assessment and for the improvement of the service to users*

— ISO 24511, *Activities relating to drinking water and wastewater services — Guidelines for the management of wastewater utilities and for the assessment of wastewater services*

— ISO 24512, *Activities relating to drinking water and wastewater services — Guidelines for the management of drinking water utilities and for the assessment of drinking water services*

# Introduction

NOTE Words in bold are key terms which are defined in Clause 2.

## 0.1 Water issues: global context and policies framework

Water constitutes a worldwide challenge for the 21st century, both in terms of the **management** of available water resources and the provision of access to **drinking water** and sanitation for the world's population. In 2000, the United Nations (UN) recognized that access to water is an essential human right, and in conjunction with national governments, it set ambitious goals (the "Millennium Development Goals") to increase access to **drinking water** and **wastewater services,** including safe disposal or reuse of **residues** (hereinafter jointly referred to as "water **services**"), particularly in developing countries. International conferences on **sustainable development** and water (e.g. the World Summit on Sustainable Development in Johannesburg in September 2002, the third World Water Forum in Kyoto in March 2003 and the fourth World Water Forum in Mexico City in March 2006) have highlighted this issue, and UN agencies (including WHO and UNESCO) have developed recommendations and programmes to establish a framework in which to advance.

The United Nations' Commission on Sustainable Development (CSD13) has emphasised that governments (referred to as "**relevant authorities**" in this International Standard) have a primary role in promoting improved access to safe **drinking water** and basic sanitation through improved governance at all levels and appropriate enabling **environments** and regulatory frameworks, with the active involvement of all **stakeholders**. This **process** should incorporate institutional solutions to make the water sector more productive and the **management** of water resources more sustainable. In this respect, the Ministerial declarations from the Third and Fourth World Water Forum recommended that governments endeavour to reinforce the role of parliaments and local public authorities, particularly with regard to the provision of adequate water **services**, and recognized that an effective collaboration with and between these actors is a key factor for meeting water-related challenges and goals.

Examples of key issues for efficient **drinking water** and sanitation services policy frameworks are:

— clear definition of the roles of the different **stakeholders**;

— definition of sanitary rules and organization for **assessment** of compliance;

— processes to assure consistency between the policies regarding urban development and **water utility infrastructure**;

— regulation for water withdrawal and **wastewater** discharge;

— information to the **users** and to the **communities**.

## 0.2 Water utilities: general objectives

In addition to public health protection, sound **management** of the **drinking water** and **wastewater utilities** (hereinafter jointly referred to as "**water utilities**") is an essential element of integrated water resources **management**. When applied to these utilities, sound **management** practices will contribute, both quantitatively and qualitatively, to **sustainable development**. Sound utility **management** also contributes to social cohesion and economic development of the **communities** served, because the **quality** and **efficiency** of water **services** have implications for virtually all activities of society.

As water is considered a "social good" and activities related to water **services** support the three aspects (economic, social and environmental) of **sustainable development**: it is logical that the **management** of **water utilities** be transparent to and inclusive of all **stakeholders** identified in accordance with the local context.

There is a broad array of types of **stakeholders** that can play a role in activities related to water **services**.

Examples of such **stakeholders** include:

— governments or public agencies (international, national, regional or local) acting with legal or legislative authority;

— associations of the utilities themselves (e.g. international, regional/multinational and national **drinking water** or **wastewater** associations;

— autonomous bodies seeking to play an overview role (e.g. organizations concerned, such as non-governmental organizations);

— **users** and associations of water **users**.

The relationships between **stakeholders** and **water utilities** vary around the world. In many countries, there are bodies that have responsibility (in whole or in part) for overseeing the activities related to water **services**, whether the utilities are publicly or privately owned or operated and whether they are regulated by **relevant authorities** or acting in a system of technical self-regulation. Standardization and technical self-regulation are possible ways of ensuring involvement of all **stakeholders** and meeting the subsidiarity principle.

The aim of **water utilities** is logically to offer **services** to everybody in the area of responsibility of the utility, and to provide **users** with a continuous supply of **drinking water** and the collection and treatment of **wastewater**, under economic and social conditions that are acceptable to the **users** and to the utility. **Water utilities** are expected to meet the requirements of **relevant authorities** and the expectations specified by the **responsible bodies** in conjunction with the other **stakeholders**, while ensuring the long-term sustainability of the service. In a context of scarcity of resources, including financial resources, it is advisable that the investments made in installations be appropriate and that necessary attention be paid to proper maintenance and effective use of the installations. It is advisable that water **tariffs** generally aim at meeting cost-recovery principles and at promoting **efficiency** in the use of the resources, while striving to maintain affordable basic access to water **services**.

It is advisable that the **stakeholders** be involved in both setting **service** objectives and assessing the adequacy and **efficiency** of **service.**

## 0.3 Objectives, content and implementation of this International Standard

The objective of this International Standard is to provide the relevant **stakeholders** with guidelines for assessing and improving the **service** to **users**, and with guidance for managing **water utilities**, consistent with the overarching goals set by the **relevant authorities** and by the international intergovernmental organizations noted above. This International Standard is intended to facilitate dialogue between the **stakeholders**, enabling them to develop a mutual understanding of the functions and tasks that fall within the scope of **water utilities**.

The series of standards addressing water services consists of ISO 24510 (**service**-oriented), this International Standard and ISO 24512 (both **management**-oriented).

ISO 24510 addresses the following topics:

— a brief description of the components of the **service** relating to the **users**;

— core objectives for the **service**, with respect to **users**' needs and expectations;

— guidelines for satisfying **users**' needs and expectations;

— **assessment** criteria for **service to users** in accordance with the provided guidelines;

— examples of **performance indicators** linked to the **assessment** criteria that can be used for assessing the **performance** of the **service.**

This International Standard and ISO 24512 address the following topics:

— a brief description of the physical/infrastructural and managerial/institutional components of **water utilities**;

— core objectives for **water utilities**, considered to be globally relevant at the broadest level;

— guidelines for the **management** of the **water utilities**;

— guidelines for the **assessment** of the water **services** with **service assessment** criteria related to the objectives, and **performance indicators** linked to these criteria.

The **performance indicators** presented in this International Standard, ISO 24510 and ISO 24512 are simply for purposes of illustration, because assessing the **service** to **users** cannot be reduced to a single or universal set of **performance indicators**.

The scope formally excludes the installations inside a user's premises. However, attention is drawn to the fact that the **quality** of the supplied water (or discharged **wastewater**) can be adversely impacted between the **point-of-delivery** (or, in the case of wastewater, the **point-of-collection)**, and the **point-of-use** (or, in case of wastewater, the **point-of-discharge**) by the installations inside the premises. Some **stakeholders**, e.g. **relevant authorities**, owners, contractors and **users,** can have a role to play regarding this issue.

Because the organization of **water utilities** falls within a legal and institutional framework specific to each country, this International Standard does not prescribe the respective roles of various **stakeholders**, nor does it define required internal organizations for local, regional or national bodies that can be involved in the provision of water **services**. In particular, this International Standard does not interfere with the free choice of the **responsible bodies** regarding the general organization and the **management** of their **utilities**. This International Standard is applicable to publicly and privately owned and operated **utilities** alike, and does not favour any particular ownership or operational model.

The guidelines given in this International Standard, ISO 24510 and ISO 24512 focus on **users'** needs and expectations and on the water **services** themselves, without imposing a means of meeting those needs and expectations, the aim being to permit the broadest possible use of this International Standard, ISO 24510 and ISO 24512 while respecting the cultural, socio-economic, climatic, health and legislative characteristics of the different countries and regions of the world. It should therefore be understood that, in the short term, it might not always be possible to meet the expectations of local **users**. This can be due to factors such as climate conditions, resource availability and difficulties relating to the economic sustainability of the water **services**, particularly regarding financing and the **users'** ability to pay for improvements. These conditions can limit the achievement of some objectives or restrict the implementation of some recommendations in developing countries. However, this International Standard is drafted with such constraints in mind and, for example, allows for differing levels of fixed networks and the need for on-site alternatives. Notwithstanding the need for flexibility in terms of engineering and hardware, many recommendations in this International Standard, such as consultation mechanisms, are intended to apply universally.

In order to assess and improve the **service to users** and to ensure proper monitoring of the improvements, an appropriate number of **performance indicators (PIs)** or other methods for checking compliance with **requirements** can be established. The use of **PIs** is only one of the possible support tools for continuous improvement. Stakeholders can select **PIs** from the examples given or develop other relevant **PIs**, taking into account the principles described in this International Standard, ISO 24510 and ISO 24512. The **PIs** logically relate to the objectives for which they are defined through the **assessment** criteria, and are used to measure **performance**. They can also be used to set required or targeted values. This International Standard does not impose any specific **indicator** or any minimum value or **performance** range. It respects the principle of adaptability to local contexts, facilitating local implementation.

While it is in no way intended that this International Standard, ISO 24510 and ISO 24512, and more specifically the **performance indicators** given as examples, be considered as a prerequisite or condition for

the implementation of a water policy or for the financing of projects or programmes, they can serve to assess progress towards policy goals and the objectives of financing programmes.

The objective of this International Standard, ISO 24510 and ISO 24512 is not to lay down systems of specifications supporting direct certification of conformity, but to provide guidelines for the continuous improvement and for the **assessment** of the **service**. Use of this International Standard, ISO 24510 and ISO 24512 is voluntary, in accordance with ISO rules.

This International Standard, ISO 24510 and ISO 24512 are consistent with the principle of the "plan-do-check-act" (PDCA) approach: they propose a step-by-step process, from identifying the components and defining the objectives of the utility to establishing **performance indicators**, with a loop back to the objectives and to the **management**, after having assessed the **performances**. Figure 1 summarizes the content and application of this International Standard. Implementation of this International Standard, ISO 24510 and ISO 24512 does not depend upon adoption of the ISO 9000 series and/or the ISO 14000 series of standards. Nevertheless, this International Standard, ISO 24510 and ISO 24512 are consistent with those **management systems** standards. Implementation of an overall ISO 9001 and/or ISO 14001 **management system** can facilitate the implementation of the guidelines contained within this International Standard, ISO 24510 and ISO 24512; conversely, these guidelines can help to achieve the technical provisions of ISO 9001 and ISO 14001 for organizations choosing to implement them.

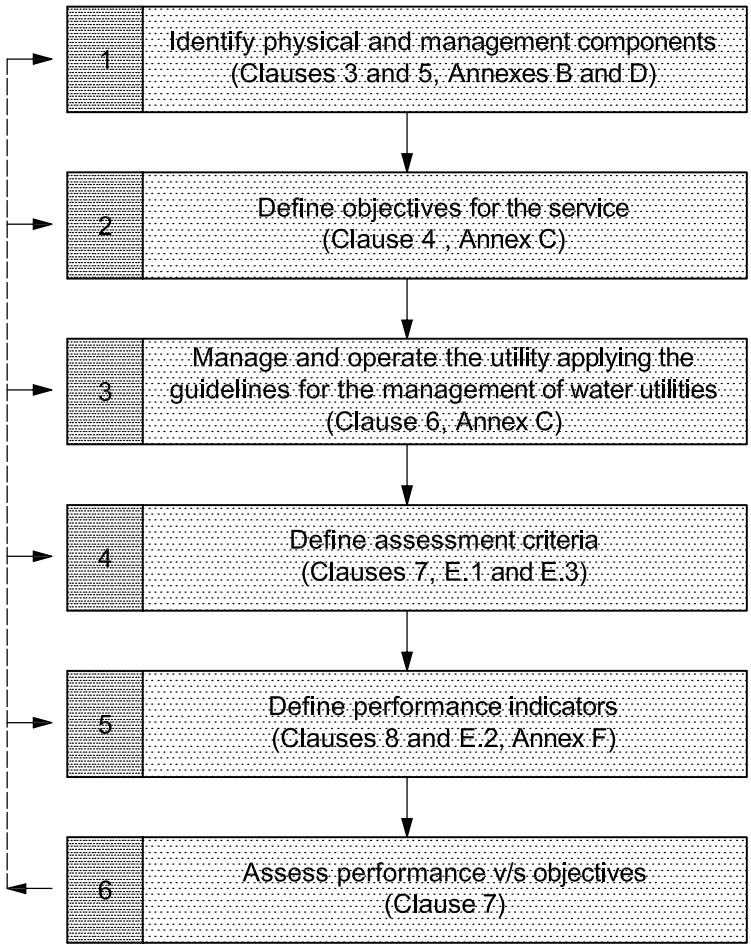


**Figure 1 — Content and application of this International Standard**

## 0.4 Wastewater services

**Wastewater systems** are built and operated mainly to protect public health and the **environment**. The type of **wastewater system** needs to be chosen and adapted in context with the density of the population, climatic conditions, environmental **requirements** for treatment and the technical/socio-economical ability of the **responsible body** to implement it, operate it and maintain it. It needs to be cost effective and sustainable, as well as permitting phased development to overcome the financial constraints while not compromising the stated objectives.

Operationally, the broad objectives of a utility are to provide **wastewater** collection **services** on a continuous or at least intermittent basis (depending on the service mechanism chosen), meeting the related capacity **requirements**. Methods of **wastewater** treatment and/or disposal need to correspond to the chosen collection system.

Appropriately treated **wastewater** is eventually returned to the **environment** and can have significant impact on both quantity and **quality** of natural water resources.

Effective and safe management of **residues** resulting from **wastewater** treatment, including their final disposal or reuse, is becoming increasingly important due to concerns about both environmental protection and resource conservation.

Since it often has a lifetime stretching over several human generations, **wastewater infrastructure** needs to demonstrate intergenerational equity. Consequently, a **wastewater utility**, regardless of ownership, is public in nature and will be subject to public scrutiny and policy. Other criteria, such as cost/**affordability** and **service** sustainability, are addressed in appropriate clauses of this International Standard.

# Activities relating to drinking water and wastewater services — Guidelines for the management of wastewater utilities and for the assessment of wastewater services

## 1 Scope

This International Standard provides guidelines for the management of wastewater utilities and for the assessment of wastewater services.

This International Standard is applicable to publicly and privately owned and operated wastewater utilities, but does not favour any particular ownership or operational model.

NOTE 1 Wastewater is always generated when water is used or consumed. Accordingly, sources of wastewater can be residential, industrial, commercial or institutional. Collected storm water or (melted) snow can also be considered as wastewater, as it often carries contaminants and pathogens picked up from air or ground surfaces on its way to a collection system. In certain circumstances, especially in undeveloped areas, sanitary waste is collected in an undiluted form.

This International Standard addresses wastewater systems in their entirety and is applicable to systems at any level of development (e.g. pit latrines, on-site systems, networks, treatment facilities).

The following are within the scope of this International Standard:

— the definition of a language common to different stakeholders;

— objectives for the wastewater utility;

— guidelines for the management of wastewater utilities;

— service assessment criteria and related examples of performance indicators, all without setting any target values or thresholds.

The following are outside the scope of this International Standard:

— methods of design and construction of wastewater systems;

— regulation of the management structure and the methodology of wastewater service activities of operation and management;

— regulation of the content of contracts or subcontracts;

— topics related to the systems inside buildings, between the point-of-discharge and the point-of-collection.

NOTE 2 This International Standard, ISO 24510 and ISO 24512 comprise a series of standards addressing water services. It is therefore advisable to use these three International Standards in conjunction with each other.

NOTE 3 The list of terms and definitions in Clause 2 is common to this International Standard, ISO 24510 and ISO 24512.

NOTE 4 Annex A contains three tables of correspondence between equivalent terms in English, French and Spanish.

## 2 Terms and definitions

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

**2.1**
**accuracy**
closeness of agreement between a measure and the accepted reference value

NOTE 1 The term “accuracy”, when applied to a set of measures, involves a combination of random components and a common systematic error or bias component.

NOTE 2 Adapted from ISO 5725-1:1994.

**2.2**
**affordability**
ability to be economically bearable for the **users** (2.50)

NOTE The affordability can be estimated through the degree to which charges for **services** (2.44) can be paid by targeted social groups of users without significant adverse economic or social impact, taking into account allowances for subsidies and payment assistance programmes for low-income users.

**2.3**
**assessment**
**process** (2.31), or result of this process, comparing a specified subject matter to relevant references

**2.4**
**asset**
capital-forming goods used for the provision of the **service** (2.44)

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

NOTE 2 Contrary to consumables, assets can be depreciated in accounting systems.

**2.5**
**asset management**
**processes** (2.31) that enable a **water utility** (2.53) to direct, control and optimize the provision, **maintenance** (2.19) and disposal of **infrastructure** (2.17) **assets** (2.4), including the necessary costs for specified **performances** (2.24), over their life-cycle

**2.6**
**availability**
extent to which the **infrastructure** (2.17), **assets** (2.4), resources and employees of a **water utility** (2.53) enable effective provision of **services** (2.44) to **users** (2.50) according to specified **performances** (2.24)

**2.7**
**community**
one or more natural or legal persons and, in accordance with national legislation or practice, their associations, organizations or groups, having interests in the area where the **service** (2.44) is provided

**2.8**
**confidence grade**
**assessment** (2.3) of the **quality** (2.32) in terms of **accuracy** (2.1) and **reliability** (2.37)

**2.9**
**connection**
set of physical components ensuring the link between a **point-of-delivery** (2.26) and the local water main or the **point-of-collection** (2.25) and the sewer

NOTE 1 For **drinking water systems** (2.12), the term “service pipe” is currently used, but the connection can include components other than the service pipe, such as valves, meters, etc.

NOTE 2 In English speaking countries, for **wastewater systems** (2.52), the term “drain” can also be used; the connection can also be equipped with ancillaries.

**2.10**
**coverage**
extent to which the **assets** (2.4) of a **water utility** (2.53) allow **services** (2.44) to **users** (2.50), within its defined area of responsibility

**2.11**
**drinking water**
water intended for human consumption

NOTE **Requirements** (2.40) for drinking water **quality** (2.32) specifications are generally laid down by the national **relevant authorities** (2.36). Guidelines are established by the World Health Organization (WHO).

**2.12**
**drinking water system**
tangible **assets** (2.4) necessary for abstracting, treating, distributing or supplying **drinking water** (2.11)

**2.13**
**effectiveness**
extent to which planned activities are realized and planned results achieved

[ISO 9000:2005]

**2.14**
**efficiency**
relationship between the result achieved and the resources used

[ISO 9000:2005]

**2.15**
**environment**
surroundings in which an organization operates, including air, water, land, natural resources, flora, fauna, humans, and their interrelation

NOTE 1 Surroundings in this context extend from within an organization to the global system.

[ISO 14001:2004]

NOTE 2 For the application of this International Standard, environment is considered as a specific **stakeholder** (2.47). The interests of this specific **stakeholder** (2.47) can be represented by **relevant authorities** (2.36), by the **communities** (2.7) or by other groups, such as non-governmental organizations (NGOs).

**2.16**
**indicator**
parameter, or a value derived from parameters, which provides information about a subject matter with a significance extending beyond that directly associated with a parameter value

NOTE 1 Adapted from OECD works on “Core sets of indicators for environmental performance reviews”[9].

NOTE 2 Indicators can refer to context, conditions, means, activities or **performances** (2.24).

**2.17**
**infrastructure**
system of tangible fixed **assets** (2.4) needed for the operation of a **water utility** (2.53)

NOTE 1 Adapted from ISO 9000:2005.

NOTE 2 It may also be necessary for the **water utility** (2.53) to use technical equipment for transport which is not fixed (e.g. trucks, vans, bottles) on a permanent or occasional basis, or in emergency situations. It is advisable to reserve the term “infrastructure” for fixed equipment and installations.

**2.18**
**interruption**
situation where the **service** (2.44) is not available

NOTE Interruptions can be planned or unplanned.

**2.19**
**maintenance**
combination of all technical, administrative and managerial actions during the life cycle of an **asset** (2.4) intended to retain it in, or restore it to, a state in which it can perform the required function

**2.20**
**management**
coordinated activities to direct and control an organization

NOTE 1 In English, the term “management” sometimes refers to people, i.e. a person or group of people with authority and responsibility for the conduct and control of an organization. When “management” is used in this sense, it should always be used with some form of qualifier to avoid confusion with the concept “management” defined above. For example, “management shall…” is deprecated whereas “top management shall…” is acceptable.

[ISO 9000:2005]

NOTE 2 The term “management” can be qualified by a specific domain it addresses. Examples are: public health management, environmental management, risk management, etc.

**2.21**
**management system**
system to establish policy and objectives and to achieve those objectives

[ISO 9000:2005]

NOTE A management system of a **water utility** (2.53) can include different management systems, such as a **quality** (2.32) management system, a financial management system or an environmental management system.

**2.22**
**on-site system**
set of physical **assets** (2.4) necessary for supplying **drinking water** (2.11) or collecting and treating **wastewater** (2.51) without physical **connection** (2.9) to centralized installations from a **water utility** (2.53)

**2.23**
**operator**
person or organization performing day-to-day **processes** (2.31) and activities necessary for the provision of the **service** (2.44)

NOTE 1 There can be one or several operators for a given **water utility** (2.53), e.g. distinct operators for installations operation, billing and recovering **service** (2.44). Their missions are determined by the **responsible body** (2.42). An operator may subcontract some of its operations to other contractors, if allowed by the responsible body.

NOTE 2 The operator(s) can be legally distinct, or not, from the **responsible body** (2.42). They can be public or private. Examples where responsible body and operator are not legally distinct: a technical department in a municipality, a

specific division of a regional authority. Examples of legally distinct entities: a public organization, a private corporate company, a small contractor, an NGO, a cooperative.

NOTE 3 In the context of this International Standard, an “operator” is not a person employed within an organization to operate a piece of equipment or **process** (2.31).

**2.24**
**performance**
achievements of an activity, a **process** (2.31) or an organization

**2.25**
**point-of-collection**
⟨wastewater⟩ physical fixed interface, upstream of which the **water utility** (2.53) does not have the overall legal responsibility for the **service** (2.44) or **infrastructure** (2.17)

EXAMPLE The limit boundary between private and public property.

NOTE 1 The point-of-collection is generally defined in the **service agreement** (2.45).

NOTE 2 In general, the water utility employees have no legal empowerment for obtaining direct physical access to the installations upstream of the point-of-collection.

**2.26**
**point-of-delivery**
⟨drinking water⟩ physical fixed interface, downstream of which the **water utility** (2.53) does not have the overall legal responsibility for the **service** (2.44) or **infrastructure** (2.17)

EXAMPLES A **connection** (2.9) box, a meter, the limit boundary between public and private property.

NOTE 1 The point-of-delivery is generally defined in the **service agreement** (2.45).

NOTE 2 In general, water utility employees have no legal empowerment for obtaining direct physical access to the installations downstream of the point-of-delivery.

**2.27**
**point-of-discharge**
physical fixed interface where the **user** (2.50) normally discharges **wastewater** (2.51) for its collection and disposal

EXAMPLES A sink, a toilet.

**2.28**
**point-of-use**
physical fixed interface where the **user** (2.50) normally takes the water for the intended use

EXAMPLES A tap, a public drinking fountain.

NOTE 1 The point-of-use can be in private or public property.

NOTE 2 The point-of-use can be the same as the **point-of-delivery** (2.26), e.g. in the case of a public drinking fountain.

**2.29**
**price**
counterpart in money or alike paid for the supply or provision of a product or **service** (2.44)

NOTE When relevant, price is expressed relating to a unit of product or service.

EXAMPLE Price of a cubic metre of **drinking water** (2.11**)**, price of a **connection** (2.9) of xx metres in length.

**2.30**
**procedure**
specified way of carrying out an activity or a **process** (2.31)

NOTE Procedures can be documented or undocumented.

**2.31**
**process**
set of interrelated or interacting activities which transforms inputs into outputs

[ISO 9000:2005]

**2.32**
**quality**
degree to which a set of inherent characteristics fulfils **requirements** (2.40)

[ISO 9000:2005]

NOTE There is a clear distinction between quality of the product [**drinking water** (2.11) or treated **wastewater** (2.51)] and quality of the **service** (2.44). This International Standard does not give specifications for product quality.

**2.33**
**rate of return**
percent measure of project profitability, equal to project income divided by project investment

NOTE The time period of measurement can be annual or over the lifetime of the investment.

**2.34**
**registered user**
customer
**user** (2.50) for whom relevant information is recorded by the **responsible body** (2.42) or **operator** (2.23)

NOTE The term “customer” can be considered as a synonym, given that a customer has a commercial relationship, e.g. a **service agreement** (2.45), with the **water utility** (2.53). The term “customer” is currently used in such expressions as “customer relations”.

**2.35**
**rehabilitation**
operation on an **infrastructure** (2.17) that restores it to a defined level, or improves it to a higher level of **performance** (2.24)

**2.36**
**relevant authority**
public body entitled to set general policies, plans or **requirements** (2.40), or to check compliance with these rules, concerning all the **water utilities** (2.53) included in its area of jurisdiction

EXAMPLES National, regional or local governments, public agencies, regulators.

NOTE For a given water utility, there can be several relevant authorities, which have jurisdiction in different domains.

**2.37**
**reliability**
〈information〉 degree of confidence in the information for representing or for qualifying the relevant subject matter

NOTE Information can be data, **indicators** (2.16) or estimations.

**2.38**
**reliability**
⟨asset, process⟩ probability that a device, system, or **process** (2.31) will perform its prescribed function without failure for a given time when operated correctly in a specified environment

**2.39**
**repair**
action on a non-conforming product, equipment or facility to make it acceptable for the intended use, but not changing the original parameters of the product, equipment or facility

NOTE 1 Adapted from ISO 9000:2005.

NOTE 2 Repair includes remedial action taken on a previously conforming product to restore it for use, e.g. as part of **maintenance** (2.19).

NOTE 3 Repair can affect or change parts of the non-conforming product.

NOTE 4 Repair can be planned [e.g. preventive **maintenance** (2.19)] or unplanned (e.g. in the case of damage).

**2.40**
**requirement**
need or expectation that is stated, generally implied or obligatory

[ISO 9000:2005]

NOTE "Generally implied" means that it is custom or common practice for the drinking water or wastewater utilities, the **users** (2.50) of the **service** (2.44) and other interested parties, that the need or expectation under consideration is implied.

**2.41**
**residues**
subproducts resulting from the different **processes** (2.31) applied to **drinking water** (2.11) or **wastewater** (2.51)

NOTE Residues can be liquid, solid, gaseous or mixtures.

EXAMPLES Sludge, septage, sand or grit, grease, debris.

**2.42**
**responsible body**
body that has the overall legal responsibility for providing **drinking water** (2.11) or **wastewater** (2.51) **services** (2.44) for a given geographic area

EXAMPLE A local or municipal government (i.e. for a village, town or city), a regional government, or a national or federal government through a specified agency, or a private company.

NOTE 1 The responsible body can be public or private.

NOTE 2 The responsible body acts within a framework of law and governance established by the **relevant authorities** (2.36); it generally establishes the strategy, the specific policies adapted to the characteristics of its area of responsibility and the general organization of the relevant **water utility** (2.53).

NOTE 3 The responsible body can operate the water utility directly with its own means through an internal **operator** [direct or internal **management** (2.20) or "in house"] or entrust one or several **operators** (2.23) for the operations ("outsourced" or contracted management).

**2.43**
**restriction**
situation where the **service** (2.44) does not meet the availability conditions specified in the **service agreement** (2.45)

NOTE Restrictions can be planned or unplanned.

**2.44**
**service**
result of a **process** (2.31)

NOTE 1 Adapted from the definition of "product" in ISO 9000:2005.

NOTE 2 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 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** (2.50) and, in the second place, a **stakeholder** (2.47). Service is generally intangible. Provision of a service can involve for example the following:

— activity performed on a tangible product supplied by the user, e.g. **wastewater** (2.51),

— activity performed on an intangible product coming from the user, e.g. processing new **connection** (2.9) requests,

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

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

NOTE 4 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**" (2.53); hence in this International Standard, in order to avoid confusion, only the definition in 2.44 applies.

**2.45**
**service agreement**
establishment of an accord between the **registered user** (2.50) and the **water utility** (2.53) on the conditions of **service** (2.44) provisions

EXAMPLE A contract.

NOTE It may be implicit or explicit.

**2.46**
**service area**
local geographic area where an organization has the legal or contractual responsibility to provide a **service** (2.44)

NOTE The service area can be established by political boundaries (e.g. citywide utility), by legislative action (e.g. formation of a utility district), or by interjurisdictional agreements [e.g. intercity agreements to provide **wastewater** (2.51) services].

**2.47**
**stakeholder**
person or group or organization having an interest in the **performance** (2.24) or success of an organization

EXAMPLES **Users** (2.50) and building owners, **relevant authorities** (2.36), **responsible bodies** (2.42), **operators** (2.23), employees of the operator, external product suppliers and providers of other **services** (2.44), contractors, **communities** (2.7), customers and environmental associations, financial institutions, scientific and technical organizations, laboratories.

NOTE 1 Adapted from the definition of "interested party" in ISO 9000:2005.

NOTE 2 For the application of this International Standard, **environment** (2.15) is considered as a specific stakeholder (see 2.15, Note 2).

**2.48**
**sustainable development**
development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs

**2.49**
**tariff**
structured publicly available elements permitting calculation of the **price** (2.29) paid for a product or **service** (2.44)

EXAMPLE Flat (uniform) tariff for a cubic metre of **drinking water** (2.11), blocks with progressive or decreasing **prices** (2.29), prices of **connections** (2.9) depending on the pipe diameter.

**2.50**
**user**
person, group or organization that benefits from **drinking water** (2.11) delivery and related **services** (2.44), or from **wastewater** (2.51) service activities

NOTE 1 Users are a category of **stakeholder** (2.47).

NOTE 2 Users can belong to various economic sectors: domestic users, commerce, industry, tertiary activities, agriculture.

NOTE 3 The term “consumer” can also be used, but in most countries the term “user” is more frequent when referring to public services. It is not appropriate for wastewater services.

**2.51**
**wastewater**
water arising from any combination of domestic, industrial or commercial activities, surface runoff and any accidental sewer inflow/infiltration water and which can include collected storm water, discharged to the **environment** (2.15) or sewer

NOTE 1 The definition of wastewater in this International Standard also includes sanitary waste in undiluted form.

NOTE 2 Wastewater can flow in separate or combined sewer systems.

**2.52**
**wastewater system**
tangible **assets** (2.4) necessary for collecting, treating and disposing or reusing **wastewater** (2.51), as well as wastewater **residues** (2.41)

**2.53**
**water utility**
whole set of organization, **processes** (2.31), activities, means and resources necessary for abstracting, treating, distributing or supplying **drinking water** (2.11) or for collecting, treating and disposing of **wastewater** (2.51) and for providing the associated **services** (2.44)

NOTE 1 Some key features for a water utility are:

— its mission, to provide drinking water services or wastewater services, or both:

— its physical area of responsibility and the population within this area,

— its **responsible body** (2.42),

— the general organization with the function of **operator** (2.23) being carried out by the responsible body, or by legally distinct operator(s),

— the type of physical systems used to provide the services, with various degrees of centralization.

NOTE 2 Drinking water utility addresses a utility dealing only with drinking water; wastewater utility addresses a utility dealing only with wastewater.

NOTE 3 When it is not necessary or it is difficult to make a distinction between responsible body and operator, the term “water utility” covers both.

NOTE 4 In common English, “water service” can be used as a synonym for “water utility” (see 2.44, Note 4), but this International Standard does not recommend using the term in this way.

# 3 Components of wastewater systems

## 3.1 General

A wastewater system generally comprises

— collection and transport of wastewater and residues removed from wastewater,

— treatment of wastewater and residues removed from wastewater, and

— disposal/reuse of residues.

See B.1.

## 3.2 Types of wastewater systems

The systems can be centralized, decentralized for a small system (subsystem) or on-site.

Schematic presentations showing the wastewater systems and the relations between the various components are shown in B.2 and B.3.

Depending on the extent of the development of the wastewater services in a particular country or area, only one or a few of the above mentioned components of the system may be used (e.g. only collection, disposal). See B.3.

## 3.3 Centralized/decentralized systems

### 3.3.1 Collection and transport

The wastewater collection and transport system consists of networks with connections to the various wastewater sources. Such networks are furnished with the necessary equipment (e.g. gates, weirs, pumps) to achieve the collection and transport function. In some cases, centralized systems will receive wastewater (treated or untreated) or separated residues from neighbouring centralized systems for further processing.

Components of the centralized system for collection and transport of wastewater may include:

— drains;

— sanitary/storm/combined sewers and auxiliaries including:

  — gravity sewers;

  — pressure/vacuum sewers;

  — interceptors/trunk sewers;

  — storage and retention basins;

— pumping and storage facilities;

— overflow structures;

— bulk liquid carriers;

— monitoring/sampling/measuring/remote control facilities.

### 3.3.2 Treatment

Treatment of sanitary or municipal wastewater and the separated wastewater residues can include several stages, depending on the nature and quality of the wastewater source and the disposal environment (i.e. the nature and size of the receiving body of water for liquids that are not reused) and disposal method for residues that are not reused. Treatment stages can include mechanical treatment for removal of larger debris such as rags and grit, as well as settling and removal of suspended solids, biological treatment for removal of the dissolved organic contaminants, removal of nutrients such as nitrogen and phosphorus and disinfection of final effluents to remove/inactivate pathogens such as bacteria and viruses. In general, treated wastewater effluent is disposed of by direct discharge to a receiving body of water, infiltrated to land, or reused.

Wastewater treatment may include for centralized/decentralized systems:

— treatment inlet holding tanks,

— septage receiving facilities,

— treatment facility inlet structures,

— monitoring/sampling/measuring/remote control facilities,

— preliminary/primary/secondary/advanced treatment and reuse/disposal facilities,

— discharge facilities/outfall structures,

— odour control facilities,

— energy recovery facilities,

— combined sewer overflow (CSO) treatment facilities, and

— storm water treatment facilities.

## 3.4 On-site-systems

### 3.4.1 Collection and transport

On-site systems may or may not include a wastewater collection network within the site. On-site systems may also be connected to central systems by direct physical means or by transport vehicles.

On-site equipment for the collection of sanitary waste or wastewater may include:

a) pit latrine, and

b) tank.

Transportation of sanitary waste, wastewater or wastewater residues from on-site systems includes:

— manually emptied storage tank,

— vacuum emptied storage tank, and

— small bore (diameter) system,

and is usually done by carrier.

#### 3.4.2 Treatment

On-site treatment systems components can include:

— grease traps,

— septic tanks,

— anaerobic reactors,

— wetland/lagoons/pond systems,

— soakaways,

— reed beds,

— evaporation beds, and

— composting toilet.

### 3.5 Disposal/reuse of residues

Residues, after their processing using such methods as dewatering to reduce their volume, may be incinerated or sent by surface transport vehicles to a landfill site for permanent storage/burial.

Residues are increasingly finding reuse markets. Wastewater residues may be reused for soil enhancement or fertilizer purposes (whether or not mixed with other organic residuals) or may be used as an energy source through incineration with heat recovery.

Residue processing and disposal system may include:

— residues handling/conditioning facilities such as:

  — stabilisation tanks (e.g. aerobic or anaerobic digesters with possible biogas recovery);

  — conditioning facilities (for physical and/or chemical conditioning of residues);

  — dewatering/drying facilities;

  — composting facilities;

— residue reuse/disposal facilities including:

  — thermal destruction (e.g. incineration, gasification, with possible heat recovery);

  — disposal buried *in situ*;

  — dumping/landfill sites;

  — beneficial application sites (e.g. agricultural, silvicultural land application sites).

# 4 Objectives for the wastewater utility

## 4.1 General

**4.1.1** The responsible body, in conjunction with its operator(s), if relevant, should establish for the wastewater utility:

— the objectives,

— all related requirements (mandatory or self-established), and

— a service assessment policy, taking into account relevant service assessment criteria and measurements, such as performance indicators.

**4.1.2** All these elements should take into account:

— legal requirements,

— land and urban planning and human settlement policies established by the relevant authorities,

— expectations of the users and other stakeholders,

— the physical and management components of the wastewater utility,

— the financial resources available, and

— the affordability of service for the user.

**4.1.3** Figure 2 gives an example of possible relationships among stakeholders for establishing objectives, and also shows the relationships between objectives, service assessment criteria and performance indicators.

**4.1.4** The management of a wastewater utility should include:

— formulation of objectives and service assessment criteria, and

— evaluation of the performance by assessment.

**4.1.5** The responsible body should take into account the criterion of affordability for customers when setting the objectives for the management of a wastewater utility, in accordance with the guidance given in ISO 24510.

**4.1.6** Objectives are generally defined for a certain geographic area, and they should be expressed in the form of service assessment criteria.

The objectives specified in 4.2 to 4.7 are considered to be the principal objectives for wastewater utilities. Service assessment criteria related to these objectives are discussed in 7.4. Possible actions that a wastewater utility can undertake to achieve these objectives are shown in Annex C.

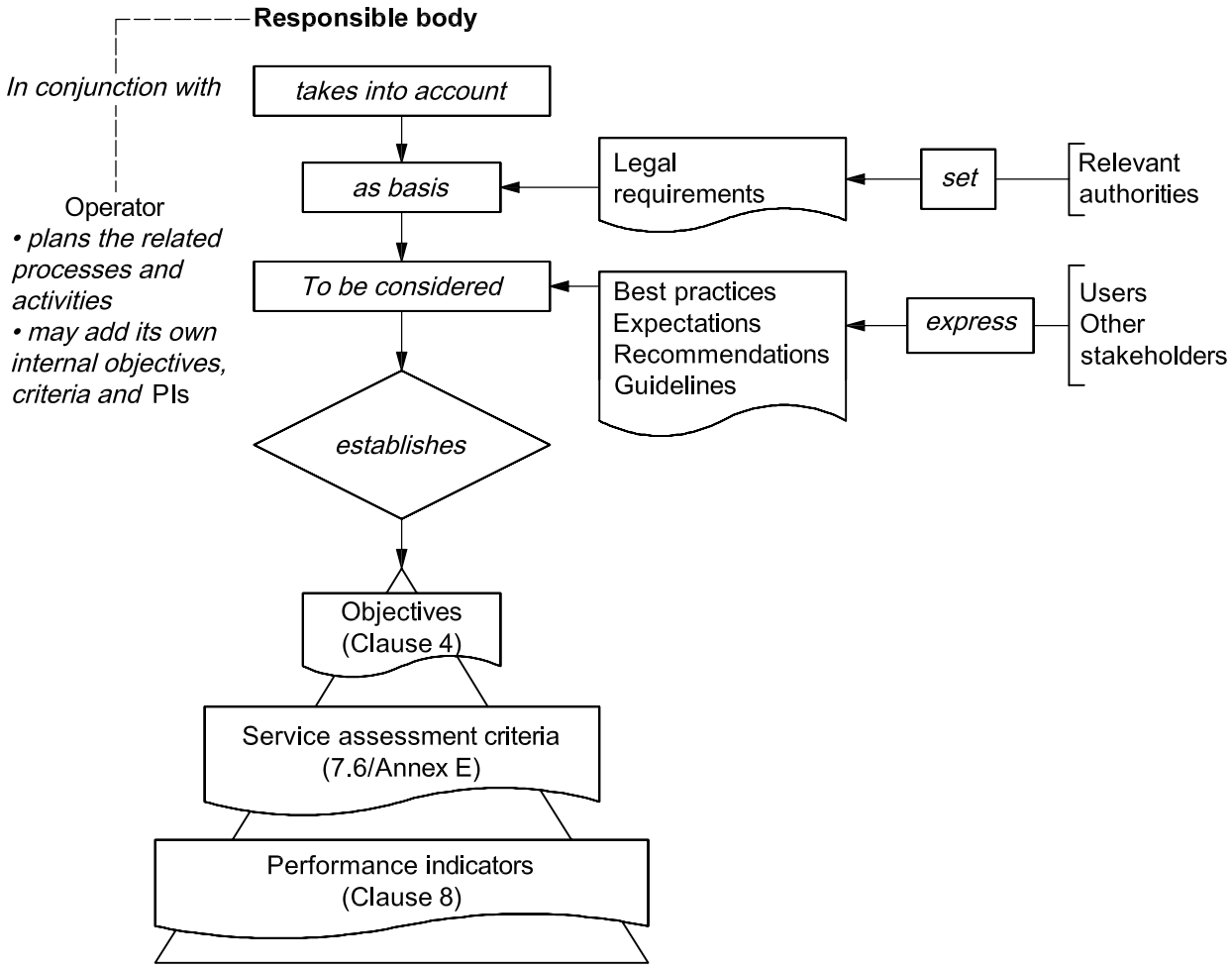


**Figure 2 — Example of relevant relationships among stakeholders for establishing objectives, service assessment criteria and performance indicators**

## 4.2 Protection of public health

A main objective of a wastewater utility should be to ensure the safe collection/transport, treatment and disposal/reuse of wastewater and residues for the protection of human health and safety, while controlling the related emissions.

Special precautions should be taken if the wastewater effluents or residues are reused. Such precautions may include additional treatment and minimizing risk to public health.

## 4.3 Meeting users' needs and expectations

An objective of a wastewater utility should be to ensure service activities meet users' needs and expectations.

For guidelines for the assessment and for the improvement of the service to users and the objectives and guidelines to meet users' needs and expectations, see ISO 24510.

## 4.4 Provision of services under normal and emergency situations

An objective of a wastewater utility should be to ensure that under normal conditions, the wastewater services (collection, transport, treatment and disposal/reuse) are available on a continuous basis.

Wastewater services may be interrupted by planned or emergency events. Where an emergency condition applies, emergency plans and response actions should be initiated.

## 4.5 Sustainability of the wastewater utility

A wastewater utility should ensure that the assets are maintained and provide capacity to meet current and future needs.

When a wastewater utility makes decisions which have cost impacts, it should ensure that appropriate revenues (e.g. through corresponding service rates/tariffs/fees) will cover the related expenditures over time.

Wastewater utilities represent major social investments. It is usually expected they provide service over many decades. Ensuring the sustainability of a wastewater utility over time is therefore a key objective of its management.

Environmental, economic and social changes will occur over the assets' lifetime, affecting water source availability as well as the needs for wastewater collection, treatment and disposal/reuse. Appropriate resources (e.g. financial) should be dedicated to meeting these needs, taking into account current social constraints without shifting the burden to future generations.

The wastewater utility should react to changes in the natural, economic and social environment, and strive for continuous improvement, in protecting the environment and public health, taking into consideration the most current research and appropriate technology.

## 4.6 Promotion of sustainable development of the community

**4.6.1** Wastewater utilities should address sustainable development, i.e. the ability for the community to grow and prosper within the environmental, infrastructural and economic resources available to it, without limiting the use of those resources by future generations. This includes contributing to and implementing sustainable development by:

— promoting efficient use of resources through recycling and reuse, and

— instituting pollution prevention techniques by eliminating or separating pollutants at their sources.

**4.6.2** In considering strategic priorities for the management of wastewater, attention should also be given to the overall management of water resources.

Distinction can be made between quantitative and qualitative aspects of water management.

**4.6.3** Quantitative aspects of water management for the promotion of sustainable development comprise the following (in the order of priority given):

a) efficient use of water;

b) retention and reuse;

c) discharge.

**4.6.4** Qualitative aspects of water management for the promotion of sustainable development comprise the following (in the order of priority given):

a) pollution prevention;

b) separation of polluted flows from non-polluted flows;

c) removal and disposal/reuse of residues.

## 4.7 Protection of the environment

### 4.7.1 Protection of the natural environment

Another objective of a wastewater utility should be to ensure the reliable collection/transport, treatment and disposal/reuse of wastewater and residues for the protection of the natural environment, including:

— preservation/conservation of natural resources,

— control of overflows, and

— preservation of flora and fauna.

### 4.7.2 Protection of the built/public environment

A further objective of a wastewater utility should be the safe collection/transport, treatment and disposal/reuse of wastewater for the protection of the built/public environment, in order to ensure:

— value to users and user safety,

— asset value and maintainability,

— functionality and value for the future,

— prevention of pollution,

— control/minimization of flooding, and

— protection of amenity value (e.g. value for recreational uses).

# 5 Management components of a wastewater utility

## 5.1 General

It is recommended that the wastewater utility establish an integrated management approach that encompasses all the management components for providing the wastewater services, consisting of:

— activities and processes,

— resources,

— assets,

— customer relations,

— information,

— environment, and

— risks.

Possible actions related to the management components addressed in 5.2 to 5.8 are given in Annex D.

## 5.2 Activities and process management

There are many individual activities and processes (operations) within a wastewater utility. These are undertaken at all levels within the hierarchy of the organization. Activities and process management include:

— policy-making,

— procedure development,

— strategy formulation,

— regulatory compliance,

— internal and external coordination, and

— operations/control/re-engineering of processes.

## 5.3 Resources management

Wastewater utilities usually have the following resources that should be managed:

— personnel (human resources),

— material and equipment (non-fixed assets, e.g. spare parts, vehicles, chemicals) (see also 5.4),

— financial resources (revenue and expenditures), and

— natural resources (e.g. land).

## 5.4 Asset management

Wastewater utilities have tangible and intangible assets. Tangible assets should be managed on a sustainable life-cycle basis.

Management of the assets includes:

— maintaining an up-to-date system inventory,

— monitoring and documenting data,

— assessing system condition,

— planning, maintaining or rehabilitating the system,

— optimizing depreciation and reinvestment, and

— identifying and managing risks.

All of these actions aim to ensure the serviceability of the assets.

## 5.5 Customer relations management

A wastewater utility exists to provide service to its users. Customer relations management is critical to the success of the utility. Examples include:

— identifying user needs and expectations,

— striving to meet user needs and expectations,

— registering and handling of complaints,

— accounting and billing, and

— communicating, educating and disseminating information.

For further guidance, see ISO 24510.

### 5.6 Information management

In all wastewater services, information management is becoming increasingly important and a feature of regulatory control programmes. Information management consists of:

— data management

— acquisition,

— evaluation,

— registration,

— updating of data, and

— data dissemination.

Increasingly, information needs to be communicated transparently within the utility as well as to relevant authorities, users and other stakeholders.

### 5.7 Environmental management

The planned development of the wastewater system should be based on a long-term strategy for environmental protection. It should involve improving the wastewater system step by step, taking into account the population and urbanization development, safeguarding public health and mitigation of flooding hazards.

### 5.8 Risk management

Risk management comprises proactive approaches taken to ensure the continuity of the service in emergency situations, e.g. technological and other accidents, natural disasters (earthquake, extreme weather events, etc.). Further proactive measures include the prevention or response to criminal acts of vandalism or terrorism.

## 6 Guidelines for the management of wastewater utilities

### 6.1 General

The task of the wastewater utility is to collect, transport, treat, dispose and/or reuse or facilitate the reuse of wastewater and its residues, addressing all the components of the management of the wastewater utility as stated in Clause 5 in order to fulfil the objectives as stated in Clause 4.

The organization's management structure should be designed to ensure the correct, effective and efficient planning, implementation, monitoring and checking of all tasks, processes and activities. It should encompass the full range of provided services or functions.

Process management of and within wastewater utilities should be carried out using the methodology of “plan-do-check-act”, as outlined below:

— **plan**: establish the objectives and processes necessary to deliver results in accordance with customer requirements, the organization policies and legal requirements;

— **do**: implement the processes;

— **check**: monitor and measure processes and product against policies, objectives and requirements for the product and report the results;

— **act**: take actions to continually improve process performance.

Centralized and on-site wastewater services should be improved and monitored to aid the protection of water resources and of the receiving environment from pollution, and to ensure maximum recovery and reuse of wastewater and residues.

## 6.2 Organization

### 6.2.1 General

The wastewater utility should establish and document a management system comprising its hierarchy and organizational structure, responsibilities and workflow.

Periodic reviews of the management system should be carried out to ensure proper application and continual improvement.

Managers and supervisors should periodically check all legal and other requirements for compliance. If they detect non-compliance, they should initiate immediate remedial action. Should they detect non-conformity or deviation in either the organizational responsibility, the workflow and/or the documented regulations, appropriate corrective action should be undertaken.

Management capability appropriate to the organization is required.

Adequate financial capability and funding should be provided to meet both the day-to-day operational and sustainable long-term (sustainable) capital requirements.

Consideration should be given to developing and making the best use of staff expertise.

At all levels, there should be sufficient staff with the necessary specialized education and training. An environment of continuous education and training should also be established.

### 6.2.2 Organizational structure and responsibilities

The wastewater utility should define all tasks, competencies and the responsibilities relating to the activities. The management structure and organization should be clearly defined to establish responsibilities to ensure that all activities are completed correctly.

### 6.2.3 Organization of work flow

The wastewater utility should define the sequence of all essential operations required for the proper performance of its tasks, processes and activities on the basis of its hierarchical organization (see Clause 5), ensuring that both internal cooperation and the interfaces resulting from the integration of third-party organizations are organized in a coordinated manner. More detailed working instructions (such as standard operating procedures and operation and maintenance manuals) should be prepared whenever required, in order to ensure the proper and expert handling of individual activities, adhering to applicable national or generally accepted requirements or practices.

There should be a clear definition of the type, scope and level of detail of the organization of workflow, including the qualification level and in-service proficiency of the employees in charge of handling all tasks and activities.

#### 6.2.4 Operational documents and records

All tasks and activities as set out in Clause 5 should be properly documented and maintained as evidence of its compliance.

Managers and supervisors should check these records at regular intervals.

All supervision and checking activities should be documented.

If not stated otherwise in national legal provisions, license permits and official directions or the nationally generally accepted requirements or practices, every document should be kept on record for a defined period.

Examples of documents and records include:

— plans and documentation of the system;

— operating instructions, diaries, records, and work rules;

— financial records;

— employee records including training, occupational health and safety related records;

— test records, proof of maintenance;

— records of wastewater analysis, effluents and residues quality and quantity;

— contractual and legal affairs.

### 6.3 Planning and construction

The planning, development and construction of the wastewater system should be based on a long-term strategy for safeguarding the residents' health and safety, as well as protection of the natural and built environment. It should be done by improving the wastewater system step by step, taking into account

— local climatic conditions,

— the population and urbanization development,

— the evolution of the stakeholders' needs and expectations, and

— changes in the mandatory and legal requirements.

### 6.4 Operations and maintenance

#### 6.4.1 General

Operations and maintenance of the wastewater system can include:

a) service connection (control of quality of installation of the connection, control of the impact of industrial connections),

b) collection and transport (inspection and assessment of conditions of sewers and drains, rehabilitation of sewers and drains, inspection of the on-site system at each emptying or residue removal operation, inspection and maintenance of haulage tankers, etc.), and

c) treatment, reuse (if possible) or discharge/disposal of the treated wastewater and the separated wastewater residues.

The wastewater operator should develop a plan for an operations and maintenance strategy, covering both proactive and reactive activities. Proactive maintenance includes maintenance performed at planned, condition orientated or scheduled intervals to prevent, minimize, or delay failures or shutdowns that result in unplanned maintenance activities, or to ensure continued, efficient asset operation and to prolong asset life. Corrective or reactive maintenance includes maintenance performed following a failure or shutdown, and involves activities necessary to repair or restore assets or systems of assets to a satisfactory condition or level of performance.

The activities and responsibilities of the wastewater operator should cover the aspects listed below:

— operations,

— operational efficiency controls,

— maintenance (servicing, inspection, rehabilitation, repair),

— monitoring of wastewater and residue quality and quantity,

— commissioning (stopping, re-starting, decommissioning), possibly in conjunction with the responsible body,

— troubleshooting (during and outside normal hours of work),

— documentation, and

— emergency response.

The management of all processes with the wastewater utilities should be undertaken in a manner that optimizes the use of equipment and resources involved.

### 6.4.2 Technical activities

#### 6.4.2.1 Wastewater transport system

Wastewater can be transported by different means (pipelines, road tankers, etc.). The system should be operated in accordance with its specifications. The proper operation of the wastewater transport system may require in particular:

— controlling the transported wastewater quality, quantity, flow velocity,

— adjusting gates and/or overflow weirs to the volume of wastewater transported, and

— driving, filling and emptying a fleet of tank cars.

#### 6.4.2.2 Wastewater treatment facilities

The management of treatment and other processes by the wastewater utilities should be undertaken in a manner that optimizes the use of equipment and resources involved.

Each unit of the wastewater treatment facilities should be operated in accordance with its specifications. The proper operation of the treatment facilities may require in particular:

— adjusting the treatment processes and the type and volume of chemicals used to the characteristics of the wastewater or residues treated,

— ensuring the regular supply of treatment products (e.g. chemicals), their correct storage and maintenance of receiving and dosing equipment,

— controlling the disposal/reuse of waste and of residues, and

— controlling the efficiency of the processes and establishing and monitoring critical control points.

#### 6.4.2.3 Emergency provisions

The continuity of provision of the wastewater service to users for protection of public health and environment should be a priority for the wastewater utility. The wastewater utility should therefore be prepared to take the necessary steps to deal with emergency situations.

Emergency situations can include technological failures (e.g. pipe failures) and natural disasters (e.g. earthquakes and severe weather events), criminal acts (e.g. vandalism, and terrorism). Emergency plans covering all these situations should be developed. When service is interrupted, the service should be restored as soon as possible. Special attention should be given to the needs of critical users or critical service areas.

For emergency situations, in order to minimize the negative impacts on the wastewater service, the wastewater utility should formulate an emergency response plan based on an assessment of risks.

It is recommended that the emergency plans be tested and that simulation exercises be conducted in order to train the operating personnel in managing emergency situations. Experience of previous emergencies and simulation exercises should be documented.

On the basis of the risks previously analysed and classified, preventive actions should be assessed, economically evaluated and appropriate response initiated.

### 6.4.3 Support activities

#### 6.4.3.1 Purchasing equipment, materials and products

Written procedures should be established for both the procurement and stockpiling of all materials, equipment and products.

Clear and precise specifications should be produced and conformity assessed.

Appropriate equipment should be available to employees to carry out the tasks and activities.

The type of material used for wastewater system components (e.g. pipes, tanks, valves and gates) should be chosen based on the quality of wastewater allowed to be discharged to the system, especially as it applies to commercial and industrial discharges and takes into account the physical demands placed on the system components during installation and operation.

These requirements should be included in both the procurement specifications and the installation and operating instructions for all such materials and components.

#### 6.4.3.2 Contractual and legal affairs

All rights, permits and contracts (e.g. supply contracts, customer contracts) should be managed properly. Specific attention should be paid to material requirements, discharge consents/discharge permits, rights to lay sewers, easements for treatment and disposal facilities.

#### 6.4.3.3 Accounting/billing

The accounting system should take into account all costs and may include environmental and resource costs. If users are charged for the provision of wastewater, fees may reflect the full or partial costs of the wastewater utility, in accordance with applicable social policies. The calculation of the fee should be transparent.

#### 6.4.3.4 Human resources

The wastewater utility should ensure that all employees are educated, trained and qualified for the tasks to be carried out.

#### 6.4.3.5 Protection of labour

The wastewater utility should provide a safe environment, appropriate equipment (e.g. personal safety equipment) and work procedures. The personnel concerned should receive instruction and training on working safely, with routine follow-up training as appropriate. Attention should be paid to the occupational health for all personnel with respect to specific risks in operating wastewater systems.

#### 6.4.3.6 Outsourcing

When outsourcing work to a contractor, the responsibility for the overall service should remain with the wastewater utility. Consequently, the utility should specify that the contractor for the outsourced work

— has all the necessary personnel and material resources to do the work,

— is capable of ensuring the proper monitoring and checking of its own activities,

— has staff of suitable skills, reliability and efficiency, as well as having the technical and expert knowledge required to perform the tasks in question, and

— reports reliably and regularly on its activities and the conditions of its contract.

#### 6.4.3.7 Protection of the environment

Planning the development of the wastewater system should be based on a long-term strategy for environmental protection, by improving the wastewater system step-by-step, taking into account:

— the population and urbanization development,

— the possibilities for wastewater management and the reuse of treated effluents and residues, and

— the safeguarding of public health and the protection of water sources.

The environmental impacts addressed cover more than just water-related issues, and may be permanent or temporary.

Environmental management is an essential part of operating a wastewater utility and for planning its future development.

Examples of environmental management, in addition to the items mentioned above under planning, include minimizing impacts of construction and repair activities (e.g. noise, community disruption).

#### 6.4.3.8 Public awareness and communications

The wastewater utility should develop and implement:

— activities to raise public awareness regarding the importance and costs of operations of the wastewater collection and treatment services, as well as disposal/reuse of treated wastewater and residues;

— programmes to communicate with the public regarding levels of service, customer needs, protection of water resources and economic/social/environmental sustainability of wastewater services.

# 7 Assessment of water services

## 7.1 General

Assessment as a process should be managed to achieve a clear and precise purpose and refer to the objectives outlined in Clause 4. The following should be established as part of a comprehensive policy (see 7.2):

— the goal and scope of the assessment (see 7.3);

— the parties involved in the assessment (see 7.4);

— the methodology of assessment (see 7.5);

— the necessary service assessment criteria (see 7.6);

— the resources necessary to conduct the assessment (see 7.7);

— the production of output and recommendations for the use of the output (7.8).

How and by whom the assessment information is to be used, should also be identified.

If not precisely specified, the assessment can cause confusion or conflicts among the parties involved.

There is a great variety of types of assessment, depending on the characteristics listed above.

EXAMPLE Environmental performance assessment, conformity assessment relating to best practice, risk assessment, audits.

The output of this process (i.e. assessment as a result) should facilitate the further decision-making process for the stakeholder requesting the assessment.

## 7.2 Assessment policy

The responsible body should establish a comprehensive policy for the assessment of service.

A sound assessment policy is a key component of the continuous improvement of the service. It should give a general framework for the assessment. It facilitates the determination of the actual situation and how strategic planning and decision making influences performance.

The assessment policy should address the overall efficiency and effectiveness of the strategic planning and decision-making activities. It should be designed to encompass all of the various management systems and procedures, and include self-assessment in the management component.

It should assist in the measurement of achievements of the various functions and activities performed for providing the services, closing the cycle and linking

— the set of objectives stipulated in Clause 4,

— the guidelines for satisfying users' needs and expectations in Clause 5, and

— the selected assessment criteria in Clause 6.

Assessment should be designed and implemented as a tool for promoting the development of collective learning and feedback to decision making.

## 7.3 Goal and scope of the assessment

The general goal of assessment is to check if the water service objectives concerning the users have been met. Objectives for the service to users are defined in Clause 4.

The goal and scope for a specific assessment should be clearly defined.

This International Standard does not deal with the assessment of the management of the utility.

Service assessments should be focused on service performance, on the satisfaction of users and on meeting the objectives for the service, but not on the means used or the detailed organization implemented for meeting the objectives.

Part of the assessment of water services deals with the assessment of service to users. For service to users, assessment should focus on the interface between the utility and the user (e.g. measuring user satisfaction). Assessment of service to users should involve effectively the users in the process. More guidance is given in ISO 24510 for identifying users' expectations and their criteria for assessing the quality of the service.

With regard to assessment of water services (in addition to the assessment of service to users), the general recommendation is to focus on the service performance. Nevertheless, some activities do not fit well with direct measurement of their performance. In such cases, indirect assessment of the performance can be accomplished through the evaluation of some management systems (e.g. risk management, security management, asset management).

## 7.4 Parties involved in the assessment

The responsible parties and all other parties (e.g. the assessment team) involved in the assessment should be clearly defined. Their responsibilities, their role in the process and the framework of operation for each party should be specified.

When the responsible body and the operator(s) are not the same legal body, assessment procedures, if not fixed by legal requirements from the relevant authorities, should be agreed to in advance to provide coherent assessment results from all involved parties, in accordance with respective rights and responsibilities. Concerning service to users, the responsible body and its operator(s) should take a consistent position relevant to the assessment procedures concerning service to users.

## 7.5 Methodology of assessment

Due to the diversity of legal, institutional and managerial systems governing water services, this International Standard does not present detailed service assessment procedures. However, this International Standard should be used to configure assessment procedures appropriate to local conditions.

The selection of the assessment tools should fit the assessment goals and scope. Performance indicator systems are one of these tools (see Clause 8).

NOTE In some cases, specifications for assessments can be required by relevant authorities or by financial investors.

Assessment methodology and procedures should be:

— developed with a capacity for repeated measurement to determine trends;

— periodically reviewed to check their efficiency and effectiveness, paying attention notably to avoidance of duplication;

— flexible to adjust to changes in goals, framework, assessment criteria and indicators as new insights are gained.

Some types of assessment procedures may be already standardized. In such cases, it is recommended that the relevant standards be used.

EXAMPLE Review [ISO 9000:2005, 3.8.7]; environmental performance evaluation [ISO 14031:1999, 2.9].

If, at a geographically relevant level (country, region and city), specifications are established for the water services, then these specifications should also include provisions concerning assessment processes (e.g. user satisfaction).

## 7.6 Service assessment criteria

The necessary service assessment criteria should be selected in accordance with the objectives and requirements of interest as determined by stakeholders taking into account local conditions.

Service assessment criteria are the link between objectives and performance indicators. The example below shows, for one of the objectives proposed in Clause 4, possible service assessment criteria. More examples are given in Annex E.

It should be noticed that a service assessment criteria can be related to more than one objective.

EXAMPLE

**Objective:** Protection of public health

**Possible service assessment criteria:**

— safe and complete collection of wastewater discharged

— adequate hydraulic capacity for safe transport

— sufficient collection system robustness and integrity

— adequate and safe wastewater treatment

— safe disposal/reuse of treated wastewater and the separated wastewater residues

## 7.7 Resources to conduct the assessment

The responsible party for the assessment should ensure that the necessary resources, including human, financial, organizational and required information technology, are available. The team with the responsibility for carrying out the assessment should be clearly defined. This team should be empowered to specify and steer the assessment process within the given framework (e.g. goals, scope, resources, parties involved, methodology, outputs).

### 7.8 The production of output and recommendations for the use of the output

The output of assessment should be a report about the assessment process and its results. It should include additional guidelines for the use of these outputs. The output should make transparent the distinction between the defined targets and the actual service.

## 8 Performance indicators

### 8.1 General

Performance indicators are used to measure the efficiency and effectiveness of a utility in achieving its objectives (particularly those identified in Clause 4).

Performance indicator systems should be considered as a key assessment tool among the various existing assessment tools (see Clause 7).

Performance indicators should be used within the context of a comprehensive service assessment system. This system should include, amongst other tools, a coherent set of indicators and the related components that allow for a clear definition of these performance indicators and assist in their interpretation.

### 8.2 Performance indicators systems

#### 8.2.1 Key components of a performance indicator system

A performance indicator system comprises a set of the following key components:

— performance indicators,

— context information, and

— variables.

In addition, specific targets for each indicator should be established and routinely monitored, tracked and adjusted as needed.

#### 8.2.2 Performance indicators

Individual performance indicators should be unique and collectively appropriate for representing the relevant aspects of the service in a true and unbiased way.

Each performance indicator should:

— be clearly defined, with a concise and unequivocal interpretation;

— be assessed from variables that are easily and reliably measured at a reasonable cost;

— contribute to the expression of the level of actual performance achieved in a certain area;

— be related to a specified geographical area (and, in the case of comparison analysis, it should be for the same geographical area);

— be related to a specific time period (e.g. annual, quarterly);

— allow for a clear comparison with targeted objectives and simplify an otherwise complex analysis;

— be verifiable;

— be simple and easy to understand;

— be objective and avoid any personal or subjective appraisal.

Performance indicators are typically expressed as ratios between variables. These ratios may be commensurate (e.g. %) or non-commensurate (e.g. $\$/m^3$). In the case of non-commensurate ratios, the denominator should represent one dimension of the system (e.g. number of service connections; total water main length; annual costs). This allows for comparisons through time, or between systems.

Variables that may vary substantially in time (e.g. annual extraction/discharge volumes), particularly if not under the control of the utility, should be avoided as denominators in the indicator ratios. An exception can be made when the numerator varies in the same proportion as the denominator.

A clear processing rule should be defined for calculating each indicator. The rule should specify all the variables required and their algebraic combination. The variables may be data generated and managed within the utility (utility data) or externally (external data). In either case, the quality of the data should be assessed (see 8.3) and verified. The interpretation of the performance indicators should not be carried out without taking into account the context, particularly if it is based on comparisons with other cases. Therefore, complementary to the performance indicators, the context information should consider also the characteristics of the system and the region in which the services are provided.

Additional information on performance indicators and grading systems for performance indicators are provided in Annexes E and F.

### 8.2.3 Variables

Each variable should:

a) fit the definition of the performance indicator or context information it is used for;

b) refer to the same geographical area and the same period of time or reference date as the performance indicator or context information it will be used for;

c) be as reliable and accurate as the decisions made based on it require.

Some of the variables are external data and mainly informative, and their availability, accuracy, reference dates and limits of the corresponding geographical area is generally out of the control of the utility. In this case, variables should also:

— whenever possible be collected from official sources, which include information on the accuracy and reliability of the variable(s);

— be essential for the performance indicator assessment or interpretation.

### 8.2.4 Context information

Context information defines inherent characteristics of a system that are relevant for the interpretation of the performance indicators. There are two possible types of context information:

— information describing pure context and external factors that are not under the control of the utility (e.g. demographics, topography, climate), and

— characteristics that can only be influenced by management decisions in the long term (e.g. age of the infrastructures).

## 8.3 Quality of the information

The quality of the data should reflect the importance of the assessment being conducted.

A scheme providing information on data quality is needed so that users of the performance indicators and context information are aware of the reliability of the information available. The value of the performance indicators can be questionable without this scheme.

The confidence grade of a performance indicator can be assessed in terms of its accuracy and reliability. The accuracy accounts for measurement errors in the acquisition of input data. The reliability accounts for uncertainties in evaluating the reliability of the source of the data.

An example of a confidence-grading scheme is presented in Annex F.

## 8.4 Example of a performance indicator

Performance indicators are relevant to service assessment criteria to which they link. The example below shows, for one of the objectives proposed in Clause 4, possible performance indicators relevant to one of the service assessment criteria shown in 7.6. More examples are given in Annex E.

EXAMPLE

**Objective:** protection of public health

The main objective of a wastewater utility should be to ensure safe collection, treatment, disposal/reuse of wastewater for the protection of human health and safety.

**Possible service assessment criteria:** safe discharge of wastewater

**Possible performance indicator:** discharge from WWTPs (Wastewater Treatment Plants) into the receiving bodies complying with discharge consents

**Performance indicator:** WWTPs compliance with discharge consents (%)

**Definition:** percentage of the population equivalent (if applicable) that is served by wastewater treatment plants that comply with the applicable discharge consents

**Processing rule:** [population equivalent that is served by wastewater treatment plants complying with applicable standards (number)] × 100 / [population equivalent served by wastewater treatment plants managed by the utility (number)]

**Comment:** Each responsible body should establish legislated requirements for safe discharge consents from WWTP into the environment and use acceptable methods of measurement. Discharge consents refer to the effluent quality standards that apply. The compliance is assessed regarding the loads or concentrations and their potential environmental impacts. This indicator should normally be assessed for one-year period. It may also be assessed for periods shorter than one year, but special care is required in result interpretation when used for internal or external comparisons.

**IWA code:** wEn1

# Annex A
(informative)

# Tables of corresponding terms in English, French and Spanish

This annex contains three tables of correspondence between equivalent terms in English, French and Spanish. Table A.1 lists the English terms defined in Clause 2 in alphabetical order together with the corresponding French and Spanish terms. Table A.2 lists the French terms in alphabetical order together with the corresponding English and Spanish terms. Table A.3 lists the Spanish terms in alphabetical order together with the corresponding English and French terms.

**Table A.1 — Table of corresponding terms, English alphabetical order**

| Numerical term | English | French | Spanish |
|---|---|---|---|
| 2.1 | accuracy | exactitude | exactitud |
| 2.2 | affordability | accessibilité économique | asequibilidad |
| 2.3 | assessment | évaluation | evaluación |
| 2.4 | asset | bien | activo |
| 2.5 | asset management | gestion du patrimoine | gestión de infraestructura |
| 2.6 | availability | disponibilité | disponibilidad |
| 2.7 | community | communauté | comunidad |
| 2.8 | confidence grade | niveau de confiance | nivel de confianza |
| 2.9 | connection | branchement | conexión |
| 2.10 | coverage | couverture | cobertura |
| 2.11 | drinking water | eau potable | agua potable |
| 2.12 | drinking water system | système d'alimentation en eau potable | sistema de agua potable |
| 2.13 | effectiveness | efficacité | eficacia |
| 2.14 | efficiency | efficience | eficiencia |
| 2.15 | environment | environnement | medio ambiente |
| 2.16 | indicator | indicateur | indicador |
| 2.17 | infrastructure | infrastructures | infraestructura |
| 2.18 | interruption | interruption | interrupción |
| 2.19 | maintenance | maintenance | mantenimiento |
| 2.20 | management | management | gestión |
| 2.21 | management system | système de management | sistema de gestión |
| 2.22 | on-site system | système autonome | sistema local |
| 2.23 | operator | opérateur | operador |
| 2.24 | performance | performance | desempeño |
| 2.25 | point-of-collection | point de collecte | punto de recolección |
| 2.26 | point-of-delivery | point de livraison | punto de suministro |

**Table A.1** (*continued*)

| Numerical term | English | French | Spanish |
|---|---|---|---|
| 2.27 | point-of-discharge | point de rejet | punto de descarga |
| 2.28 | point-of-use | point de consommation | punto de uso |
| 2.29 | price | prix | precio |
| 2.30 | procedure | procédure | procedimiento |
| 2.31 | process | processus | proceso |
| 2.32 | quality | qualité | calidad |
| 2.33 | rate of return | taux de retour | tasa de retorno |
| 2.34 | registered user | abonné | cliente registrado |
| 2.35 | rehabilitation | réhabilitation | rehabilitación |
| 2.36 | relevant authority | pouvoirs publics | autoridad competente |
| 2.38 | reliability<br>⟨asset or process⟩ | fiabilité<br>⟨bien ou processus⟩ | confiabilidad<br>⟨activo o proceso⟩ |
| 2.37 | reliability<br>⟨information⟩ | fiabilité<br>⟨informations⟩ | credibilidad<br>⟨información⟩ |
| 2.39 | repair | réparation | reparación |
| 2.40 | requirement | exigence | requisito |
| 2.41 | residues | résidus | residuos |
| 2.42 | responsible body | organisme responsable | organismo responsable |
| 2.43 | restriction | restriction | restricción |
| 2.44 | service | service | servicio |
| 2.45 | service agreement | contrat d'abonnement | acuerdo de servicio |
| 2.46 | service area | zone de compétence | área de servicio |
| 2.47 | stakeholder | partie intéressée | parte interesada |
| 2.48 | sustainable development | développement durable | desarrollo sostenible |
| 2.49 | tariff | tarif | tarifa |
| 2.50 | user | usager | usuario |
| 2.51 | wastewater | eaux usées | agua residual |
| 2.52 | wastewater system | système d'assainissement | sistema de agua residual |
| 2.53 | water utility | service public de l'eau | entidad prestadora de serviciosde agua |

**Table A.2 — Table of corresponding terms, French alphabetical order**

| Numerical term | French | English | Spanish |
|---|---|---|---|
| 2.34 | abonné | registered user | cliente registrado |
| 2.2 | accessibilité économique | affordability | asequibilidad |
| 2.4 | bien | asset | activo |
| 2.9 | branchement | connection | conexión |
| 2.7 | communauté | community | comunidad |
| 2.45 | contrat d'abonnement | service agreement | acuerdo de servicio |
| 2.10 | couverture | coverage | cobertura |
| 2.48 | développement durable | sustainable development | desarrollo sostenible |
| 2.6 | disponibilité | availability | disponibilidad |
| 2.11 | eau potable | drinking water | agua potable |
| 2.51 | eaux usées | wastewater | agua residual |
| 2.13 | efficacité | effectiveness | eficacia |
| 2.14 | efficience | efficiency | eficiencia |
| 2.15 | environnement | environment | medio ambiente |
| 2.3 | évaluation | assessment | evaluación |
| 2.1 | exactitude | accuracy | exactitud |
| 2.40 | exigence | requirement | requisito |
| 2.38 | fiabilité<br>⟨bien ou processus⟩ | reliability<br>⟨asset or process⟩ | confiabilidad<br>⟨activo o proceso⟩ |
| 2.37 | fiabilité<br>⟨informations⟩ | reliability<br>⟨information⟩ | credibilidad<br>⟨información⟩ |
| 2.5 | gestion du patrimoine | asset management | gestión de infraestructura |
| 2.16 | indicateur | indicator | indicador |
| 2.17 | infrastructures | infrastructure | infraestructura |
| 2.18 | interruption | interruption | interrupción |
| 2.19 | maintenance | maintenance | mantenimiento |
| 2.20 | management | management | gestión |
| 2.8 | niveau de confiance | confidence grade | nivel de confianza |
| 2.23 | opérateur | operator | operador |
| 2.42 | organisme responsable | responsible body | organismo responsable |
| 2.47 | partie intéressée | stakeholder | parte interesada |
| 2.24 | performance | performance | desempeño |
| 2.25 | point de collecte | point-of-collection | punto de recolección |
| 2.28 | point de consommation | point-of-use | punto de uso |
| 2.26 | point de livraison | point-of-delivery | punto de suministro |
| 2.27 | point de rejet | point-of-discharge | punto de descarga |
| 2.36 | pouvoirs publics | relevant authority | autoridad competente |
| 2.29 | prix | price | precio |

**Table A.2** (*continued*)

| Numerical term | French | English | Spanish |
|---|---|---|---|
| 2.30 | procédure | procedure | procedimiento |
| 2.31 | processus | process | proceso |
| 2.32 | qualité | quality | calidad |
| 2.35 | réhabilitation | rehabilitation | rehabilitación |
| 2.39 | réparation | repair | reparación |
| 2.41 | résidus | residues | residuos |
| 2.43 | restriction | restriction | restricción |
| 2.44 | service | service | servicio |
| 2.53 | service public de l'eau | water utility | entidad prestadora de serviciosde agua |
| 2.22 | système autonome | on-site system | sistema local |
| 2.12 | système d'alimentation en eau potable | drinking water system | sistema de agua potable |
| 2.52 | système d'assainissement | wastewater system | sistema de agua residual |
| 2.21 | système de management | management system | sistema de gestión |
| 2.49 | tarif | tariff | tarifa |
| 2.33 | taux de retour | rate of return | tasa de retorno |
| 2.50 | usager | user | usuario |
| 2.46 | zone de compétence | service area | área de servicio |

**Table A.3 — Table of corresponding terms, Spanish alphabetical order**

| Numerical term | Spanish | English | French |
|---|---|---|---|
| 2.4 | activo | asset | bien |
| 2.45 | acuerdo de servicio | service agreement | contrat d'abonnement |
| 2.11 | agua potable | drinking water | eau potable |
| 2.51 | agua residual | wastewater | eaux usées |
| 2.46 | área de servicio | service area | zone de compétence |
| 2.2 | asequibilidad | affordability | accessibilité économique |
| 2.36 | autoridad competente | relevant authority | pouvoirs publics |
| 2.32 | calidad | quality | qualité |
| 2.34 | cliente registrado | registered user | abonné |
| 2.10 | cobertura | coverage | couverture |
| 2.7 | comunidad | community | communauté |
| 2.9 | conexión | connection | branchement |
| 2.38 | confiabilidad<br>⟨activo o proceso⟩ | reliability<br>⟨asset or process⟩ | fiabilité<br>⟨bien ou processus⟩ |
| 2.37 | credibilidad<br>⟨información⟩ | reliability<br>⟨information⟩ | fiabilité<br>⟨informations⟩ |
| 2.48 | desarrollo sostenible | sustainable development | développement durable |
| 2.24 | desempeño | performance | performance |
| 2.6 | disponibilidad | availability | disponibilité |
| 2.13 | eficacia | effectiveness | efficacité |
| 2.14 | eficiencia | efficiency | efficience |
| 2.53 | entidad prestadora de serviciosde agua | water utility | service public de l'eau |
| 2.3 | evaluación | assessment | évaluation |
| 2.1 | exactitud | accuracy | exactitude |
| 2.20 | gestión | management | management |
| 2.5 | gestión de infraestructura | asset management | gestion du patrimoine |
| 2.16 | indicador | indicator | indicateur |
| 2.17 | infraestructura | infrastructure | infrastructures |
| 2.18 | interrupción | interruption | interruption |
| 2.19 | mantenimiento | maintenance | maintenance |
| 2.15 | medio ambiente | environment | environnement |
| 2.8 | nivel de confianza | confidence grade | niveau de confiance |
| 2.23 | operador | operator | opérateur |
| 2.42 | organismo responsable | responsible body | organisme responsable |
| 2.47 | parte interesada | stakeholder | partie intéressée |
| 2.29 | precio | price | prix |
| 2.30 | procedimiento | procedure | procédure |

**Table A.3** (*continued*)

| Numerical term | Spanish | English | French |
|---|---|---|---|
| 2.31 | proceso | process | processus |
| 2.27 | punto de descarga | point-of-discharge | point de rejet |
| 2.25 | punto de recolección | point-of-collection | point de collecte |
| 2.26 | punto de suministro | point-of-delivery | point de livraison |
| 2.28 | punto de uso | point-of-use | point de consommation |
| 2.35 | rehabilitación | rehabilitation | réhabilitation |
| 2.39 | reparación | repair | réparation |
| 2.40 | requisito | requirement | exigence |
| 2.41 | residuos | residues | résidus |
| 2.43 | restricción | restriction | restriction |
| 2.44 | servicio | service | service |
| 2.12 | sistema de agua potable | drinking water system | système d'alimentation en eau potable |
| 2.52 | sistema de agua residual | wastewater system | système d'assainissement |
| 2.21 | sistema de gestión | management system | système de management |
| 2.22 | sistema local | on-site system | système autonome |
| 2.49 | tarifa | tariff | tarif |
| 2.33 | tasa de retorno | rate of return | taux de retour |
| 2.50 | usuario | user | usager |

# Annex B
(informative)

# Schematics of wastewater systems

## B.1 Components of wastewater systems

A wastewater system is generally comprised of four components:

— a wastewater source,

— a means for collecting or transporting the wastewater from the source or sources (whether by physical connection or not),

— a treatment facility or facilities, and

— a discharge, disposal or reuse component for treated effluents and the separated residues.

In some simple systems (e.g. pit latrines), the treatment component is not present or, if present, can include only a screening component, depending on the quantity and quality of the wastewater and the disposal method.

In more complex wastewater systems, there can be multiple sources of widely varying wastewater quality, multiple pumping stations and storage/equalization tanks in the collection and transport system, or a combination of pumped and trucked wastewaters, multiple stages to the treatment facility and processes, pumping and re-treatment facilities in the disposal/reuse component, including treated wastewater reservoirs, processed residues or compost storage areas, post treatment transportation elements to deliver treated wastewater or wastewater residues to the point-of-use.

## B.2 Schematic of wastewater systems

Figure B.1[1)] provides a schematic of wastewater systems.

NOTE Depending on the extent of the development of the wastewater services in a particular country or area, there may be only one or more of the components shown in the system (e.g. only collection, disposal). See B.3.

## B.3 Types of wastewater systems

Figure B.2[2)] shows different types of wastewater systems.

NOTE The following terms are commonly used when referring to on-site wastewater systems: improved traditional latrine, ventilated improved pit latrine, double-vault compost latrine, bored hole latrine, pour-flush latrine, septic tank, vacuum tanker.

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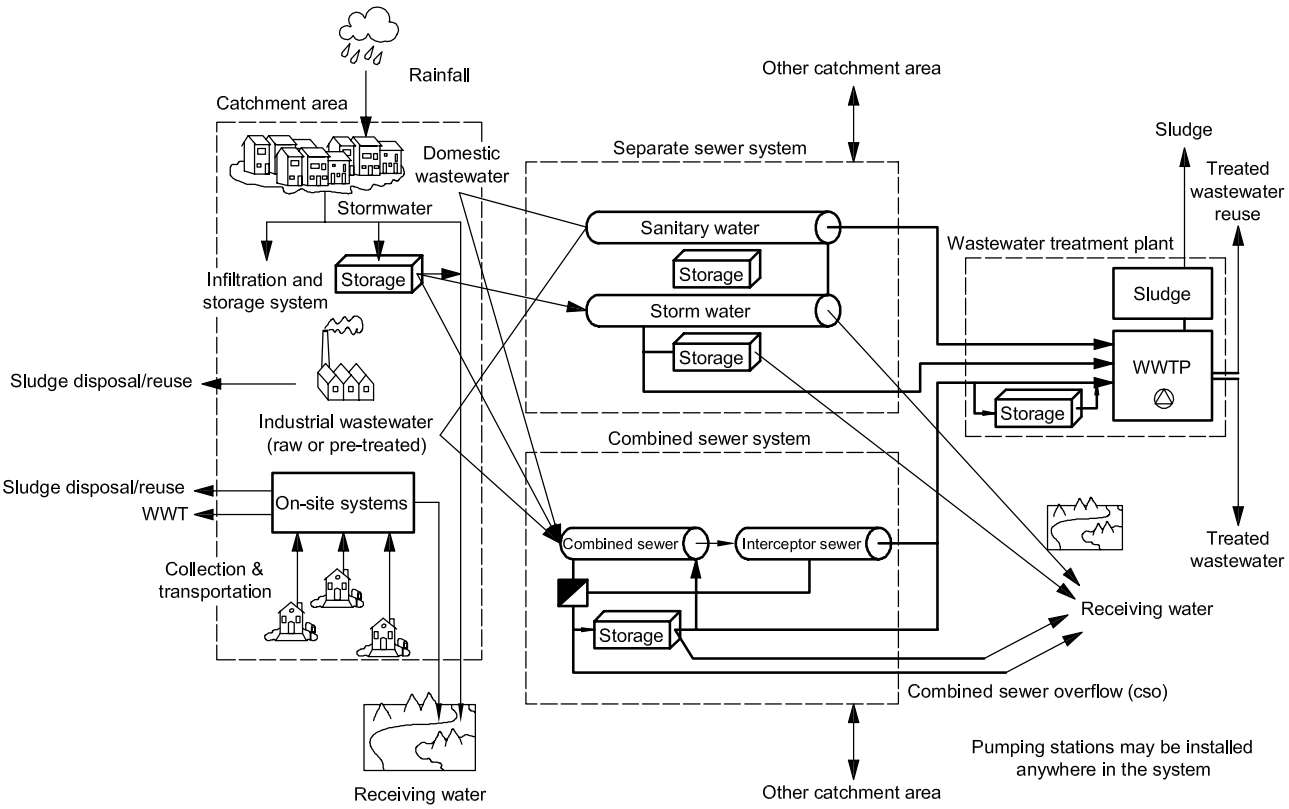
1) Reprinted from *Performance Indicators for Wastewater Services, Manual of best practice Series*, ISBN: 1900222906, with permission from the copyright holders, IWA Publishing[10].

2) Based on a scheme from Hydroconseil, France, 2002.




NOTE In this International Standard, the term “sludge” is replaced by the term “residue”.

**Figure B.1 — Schematic of wastewater systems**

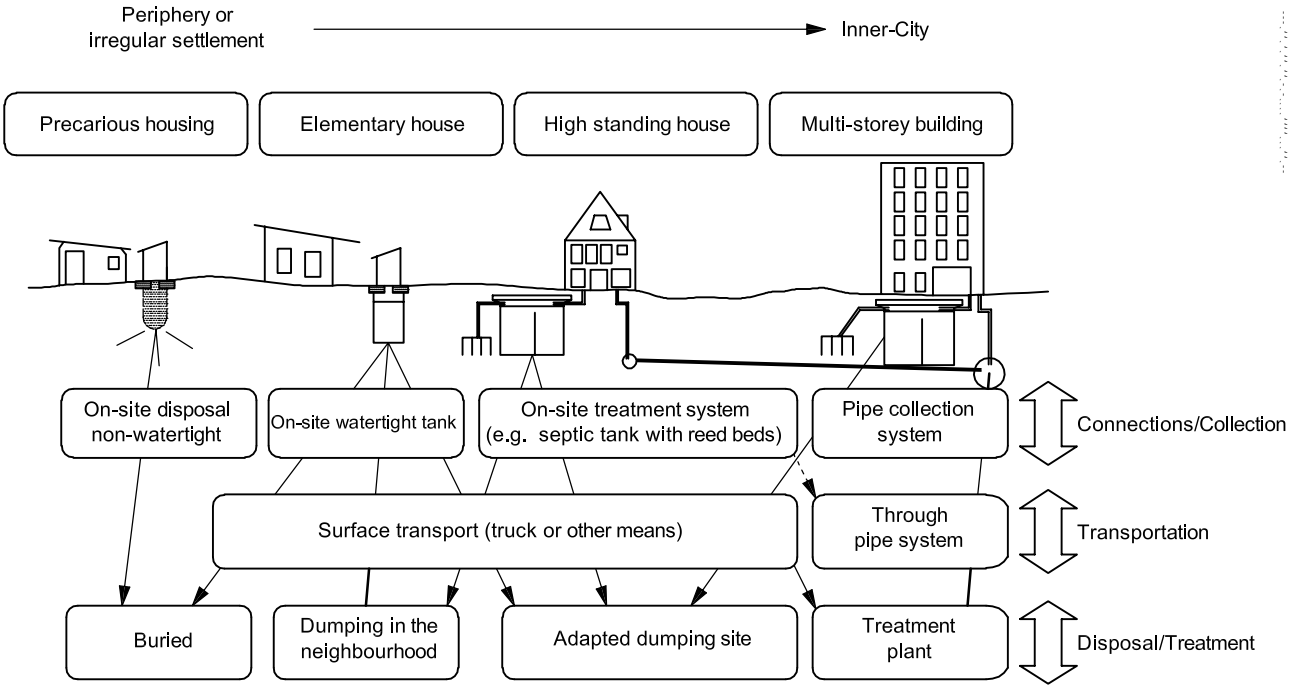



**Figure B.2 — Types of wastewater systems**

# Annex C
(informative)

# Possible actions to achieve the objectives of the wastewater utility

In order to achieve the objectives described in Clause 4, a series of related possible actions can be developed, which may serve to achieve more than one objective, as illustrated in Table C.1.

**Table C.1 — Wastewater utility objectives and examples of possible actions**

| Wastewater utility objective | Examples of possible actions |
|---|---|
| Protection of public health<br>(see 4.2) | — maintain and secure health and safety of personnel<br>— provide training for personnel to improve their abilities<br>— identify and meet user needs<br>— respond to user complaints swiftly and appropriately<br>— provide users with communication opportunities to express their opinions<br>— give consideration to people in neighbouring communities to gain their support<br>— provide understandable and transparent information to users<br>— act as a responsible stakeholder in watershed/river basin institutions<br>— promote Integrated Water Resource Management in water projects<br>— control and limit pollution in the flows of water returned to the environment or reused<br>— protect water quality in public water bodies<br>— educate users on environmental management concerns, and also not to discharge certain substances<br>— do not adversely affect wastewater systems or the environment (e.g. establish sewer by-laws)<br>— comply with local rules and regulations and consider user requirements<br>— minimize the impacts of combined sewer overflows (CSO)<br>— address diffuse pollutants in stormwater systems<br>— utilize good practices for disposal/reuse of the wastewater collection and treatment residues<br>— maintain stable water quality of final effluent, even during fluctuation of water quality and quantity in influent<br>— improve service quality by developing and introducing new technologies<br>— maintain backup systems to avoid overflow of untreated wastewater into the environment and to maintain quality of final effluent in cases of power supply interruptions or break-downs of wastewater system elements (e.g. pumps, treatment process equipment) |

**Table C.1** (*continued*)

| Wastewater utility objective | Examples of possible actions |
|---|---|
| Meeting users' needs and expectations<br>(see 4.3) | — see ISO 24510 |
| Provision of services under normal and emergency situations<br>(see 4.4) | — monitor sewer clogging<br>— identify and address problem spots of the network (where blockages reoccur)<br>— keep an appropriate stock of spare parts (e. g. sewer pipes, pumps)<br>— limit impact of disasters and accidents:<br>  — provide information to related organizations<br>  — establish systems to cope with leakage and inflow of toxic, hazardous or explosive substances<br>  — prepare for earthquake and other natural disasters<br>  — operate and maintain rainwater drainage systems for flood control<br>  — develop a plan to secure public health in cases of possible system damage from natural disasters, e.g. earthquakes |
| Sustainability of the wastewater utility<br>(see 4.5) | — develop applicable revenue sources to ensure cost recovery and long-term sustainability of the wastewater infrastructure and services<br>— ensure long-term functionality of systems while considering cost-effectiveness<br>— assign qualified personnel in compliance with laws/by-laws/regulations<br>— develop a clear and fair service charge structure that accounts for local economic considerations and revitalization efforts, considering affordability of service to users<br>— maintain an up-to-date asset inventory and forecast new asset needs<br>— maintain sound finances in accordance with long-term management projections<br>— analyze management conditions using appropriate methods while considering regional characteristic<br>— continue cost reduction efforts<br>— identify and meet user needs<br>— respond to users' complaints swiftly and appropriately<br>— provide users with communication opportunities to express their opinions<br>— apply measures against ageing of system components to maintain sound systems |

**Table C.1** (*continued*)

| Wastewater utility objective | Examples of possible actions |
|---|---|
| | — act as a responsible stakeholder in basin institutions<br>— maintain and secure health and safety of personnel<br>— provide training for personnel to improve their abilities<br>— provide users with communication opportunities to express their opinions<br>— give consideration to people in neighbouring communities to gain their support<br>— improve service quality by developing and introducing new technologies<br>— participate as volunteers in local events |
| Promotion of sustainable development of the community<br>(see 4.6) | — contribute to sustainable Integrated Water Resources Management policies<br>— act as a responsible stakeholder in basin institutions<br>— promote Integrated Water Resources Management in water projects<br>— promote reuse of treated wastewater<br>— optimize energy efficiency and minimize consumption of energy in wastewater systems<br>— optimize the use of renewable energy in wastewater systems<br>— ensure users comply with requirements to connect to wastewater systems, including limitations on:<br>  — quantity and quality of wastewater discharged<br>  — related generation of gases, noise, vibration and odours<br>  — ability to dispose and reuse wastewater residues<br>— maximize utilization of wastewater residues:<br>  — use as energy source<br>  — recycle as fertilizer for greenery and agricultural land<br>  — recycle as construction materials<br>— utilize good practices for disposal/reuse of wastewater residues |
| Protection of the natural environment<br>(see 4.7.1) | — promote Integrated Water Resources Management in water projects<br>— control and limit pollution in the flows of water returned to the environment or reused<br>— protect water quality in water bodies |

**Table C.1** (*continued*)

| Wastewater utility objective | Examples of possible actions |
|---|---|
| | — promote reuse of treated wastewater<br>— operate wastewater systems with considerations for the global environment<br>— educate users on environmental management concerns, including impact of hazardous substances<br>— establish and enforce sewer by-laws to protect wastewater systems and the environment<br>— minimize the impacts of combined sewer overflows (CSO)<br>— address diffuse pollutants in stormwater systems<br>— maintain stable final effluent quality irrespective of fluctuations in quality and quantity of influents<br>— limit impact of disasters and accidents:<br>  — provide information to related organizations<br>  — establish systems to cope with leakage and inflow of toxic, hazardous or explosive substances<br>  — prepare for earthquakes and other natural disasters<br>  — operate and maintain stormwater systems for flood control<br>  — develop a plan to secure public health under emergency conditions by ensuring/restoring continuity of service<br>— monitor the wastewater system processes<br>— provide monitoring systems to prevent inflow of hazardous substances into the wastewater system |
| Protection of the built/public environment<br>(see 4.7.2) | — ensure users comply with requirements to connect to wastewater systems, including limitations on:<br>  — quantity and quality of wastewater discharged<br>  — related generation of gases, noise, vibration and odours<br>  — ability to dispose and reuse wastewater residues<br>— utilize good practices for disposal/reuse of the wastewater residues<br>— conduct systematic operations and preventive as well as reactive maintenance for stable service and activities:<br>  — apply measures to prolong the life of system components to maintain sound systems<br>  — prevent any subsidence due to pipe collapse<br>— maintain stable water quality of final effluent against fluctuation of |

**Table C.1** (*continued*)

| Wastewater utility objective | Examples of possible actions |
|---|---|
| | water quality and quantity in influent<br>— limit impact of disasters and accidents:<br>— provide information to related organizations<br>— establish systems to cope with leakage and inflow of toxic, hazardous or explosive substances<br>— prepare for earthquakes and other natural disasters<br>— operate and maintain stormwater systems for flood control<br>— develop a plan to secure public health under emergency conditions by ensuring/restoring continuity of service<br>— guide the management of commercial and industrial discharge into the sewer system in accordance with laws/by-laws/regulations, through information and education campaigns<br>— provide monitoring system to prevent inflow of hazardous substances into wastewater systems<br>— maintain backup systems to avoid overflow of untreated wastewater into the environment and to maintain quality of final effluent in cases of power supply interruptions or break-downs of wastewater system elements (e.g. pumps, treatment process equipment)<br>— minimize infiltration and exfiltration in wastewater systems |
| NOTE Certain actions can be applicable to more than one objective. | |

# Annex D
(informative)

# Possible actions related to the management of the wastewater utility

The possible actions illustrated in Table C.1 are developed from the possible actions shown in Table D.1, related to the management components of the wastewater utility.

**Table D.1 — Management components and examples of possible actions**

| Management components of the wastewater system | Examples of possible actions |
|---|---|
| Activities and process management | — establish corporate objectives<br>— establish corporate strategies<br>— develop and implement strategic, tactical and operation plans<br>— identify regulatory requirements, and assure compliance<br>— assure coordination between processes<br>— establish operational procedures |
| Resources management – personnel (human resources) | — secure and maintain health and safety of personnel<br>— employ appropriate personnel for the jobs considering their technical competences and skills<br>— ensure that personnel comply with laws/by-laws/regulations<br>— provide training for personnel to improve their abilities<br>— assign qualified personnel in compliance with laws/by-laws/regulations<br>— instruct personnel to act in good faith in relation to customers |
| Resources management – financial (costs and benefits) | — develop a clear and fair service charge structure that accounts for local economic considerations and revitalization efforts considering affordability to users<br>— develop applicable revenue sources to ensure cost recovery and long-term sustainability of wastewater infrastructure and services<br>— ensure long-term functionality of systems while considering cost-effectiveness<br>— maintain sound finances in accordance with the long-term management projections<br>— analyze management conditions using appropriate methods while considering regional characteristic<br>— implement cost-effectiveness measures |

**Table D.1** (*continued*)

| Management components of the wastewater system | Examples of possible actions |
|---|---|
| Assets management | — maintain an up-to-date asset inventory (technical and financial)<br>— define performance targets for the main types of assets<br>— define asset condition assessment protocols<br>— record failure and repair events<br>— record asset investment and maintenance costs<br>— forecast new asset needs and corresponding costs |
| Customer relations management | — identify and meet customer needs<br>— respond to users' complaints swiftly and appropriately<br>— provide users with communication opportunities to express their opinions<br>— give consideration to people in neighbouring communities to gain their support<br>— organize events promoting the wastewater facilities<br>— participate as volunteers in local events<br>— provide understandable and transparent information for users |
| Information management | — identify data needs and data flows related to management and to service assessment<br>— define data collection protocols<br>— establish data updating protocols<br>— ensure information integration |
| Environmental management | — contribute to sustainable Integrated Water Resources Management policies<br>— act as a responsible stakeholder in watershed/river basin institutions<br>— promote Integrated Water Resources Management in wastewater projects<br>— control and limit pollution in the flows of water returning to the environment<br>— protect water quality in receiving water bodies<br>— protect and conserve water sources for drinking<br>— promote reuse of treated wastewater and residues<br>— operate wastewater systems with consideration for the global environment<br>— educate users on environmental management concerns, and also not to discharge substances adversely affecting wastewater systems or the environment |

**Table D.1** (*continued*)

| Management components of the wastewater system | Examples of possible actions |
|---|---|
| | — promote energy efficiency and minimize consumption of energy in wastewater systems<br>— optimize the use of renewable energy in wastewater systems<br>— comply with local rules and regulations and consider user requirements<br>— ensure customers comply with requirements for connection to wastewater systems<br>— minimize the impacts of combined sewer overflows (CSO)<br>— address diffuse pollutants in stormwater systems<br>— maximize utilization of wastewater residues:<br>  — use as energy source<br>  — recycle as fertilizer for greenery and agricultural lands<br>  — recycle as construction materials<br>— utilize good practices for disposal/reuse of the wastewater collection and treatment residues |
| Risk management | — conduct risk analyses<br>— develop standard operating procedures<br>— provide and implement scheduled preventive maintenance programmes<br>— maintain inventories of materials and critical equipment,<br>— develop and exercise contingency and emergency plans |

# Annex E
(informative)

# Examples of service assessment criteria related to the wastewater utility objectives, performance indicators related to assessment criteria, and service assessment criteria related to components of a wastewater system

## E.1 Examples of service assessment criteria related to the wastewater utility objectives

The wastewater objectives from Clause 4 are stated below, followed by examples of possible service assessment criteria. The examples of objectives and possible service assessment criteria are summarized in Table E.1.

**a) Protection of public health**

The main objective of a wastewater utility is to ensure the safe collection, treatment and disposal/reuse of wastewater for the protection of human health and safety (see 4.2).

Possible assessment criteria:

— appropriate coverage of services to users;

— health and safety of personnel;

— system integrity;

— safe discharge of wastewater.

**b) Meeting users' needs and expectations**

An objective of a wastewater utility should be to ensure service activities meet users' needs and expectations (see 4.3).

Possible assessment criteria: see ISO 24510 for guidance.

**c) Provision of services under normal and emergency situations**

An objective of a wastewater utility should be to ensure that, under normal conditions, the wastewater service (collection, treatment and disposal/reuse) is available without interruption. When interruptions have occurred, the objective should be to restore service as quickly as possible (see 4.4).

Possible assessment criteria:

— continuity of wastewater treatment plant operation;

— minimization of sewer blockages;

— development of an emergency plan;

— appropriate stock of spare parts (e.g. sewer pipes, pumps).

**d) Sustainability of the wastewater utility**

An objective for a wastewater utility should be to ensure that the services are maintained and developed, as appropriate, in order to meet current and future needs, taking into account economic and social constraints (see 4.5).

Possible assessment criteria:

- network performance (e.g. sewer collapse or blockages);
- assets' condition (e.g. age, reliability);
- operating costs;
- staffing levels and competencies;
- financial performance:
  - billing;
  - collection;
  - debt;
- affordability.

**e) Promotion of sustainable development of the community**

An objective of a wastewater utility is to promote sustainable development namely by promoting efficient use of water and energy, retention and reuse, separation of polluted from non-polluted flows (see 4.6).

Possible assessment criteria:

- reuse of treated wastewater;
- sustainable use of energy (savings and reuse);
- cost recovery and long-term sustainability of services;
- clear and fair charge structures;
- understandable and transparent information to the users/customers.

**f) Protection of the environment.**

**1) Protection of the natural environment**

An objective of a wastewater utility is to ensure the safe collection, treatment and disposal of wastewater for the protection of the natural environment (see 4.7.1).

Possible assessment criteria:

- prevention and control of overflows;
- monitoring of environmental emissions;
- sustainable use of energy;
- preservation of ecosystems (flora and fauna).

**2) Protection of the built/public environment**

An objective of a wastewater utility is to ensure the safe collection, treatment and disposal of wastewater for the protection of the built/public environment (see 4.7.2).

Possible assessment criteria:

— effects of flooding;

— prevention and control of pollution;

— maintenance of assets;

— amenity value (e.g. value for recreation).

**Table E.1 — Examples of objectives and possible service assessment criteria**

| Assessment criteria | Objective | | | |
|---|---|---|---|---|
| | Protection of public health | Sustainability of the wastewater utility | Protection of the natural environment | Protection of the built/public environment |
| Appropriate coverage of services to users | ✓ | ✓ | | |
| Health and safety of personnel | ✓ | | | |
| Pro-active Operation and Maintenance Plan (taking into account hydraulic capacity, condition and structural integrity, pollution prevention and control, safety of personnel and third party interests) | ✓ | | ✓ | ✓ |
| Effects of flooding | | | ✓ | ✓ |
| Prevention and control of overflows | | | ✓ | ✓ |
| Monitoring of environmental emissions (e.g. quantity and quality of effluent discharges; quantity and quality of residues; quantity and quality of other emissions such as odours, noise, vibrations etc.) | ✓ | | ✓ | ✓ |
| Sustainable use of energy (savings and reuse) | | ✓ | ✓ | |
| Sound water cycle (by reuse of treated wastewater) | | ✓ | | |
| Utilization of residues | | ✓ | | |
| Understandable and transparent information to the users/customers/stakeholders | | ✓ | | |
| Response to users/customers' complaints and opinions | | ✓ | | |
| Engagement of people from the communities in wastewater projects to gain their support | | ✓ | | |
| Cost recovery and long-term sustainability of services | | ✓ | | ✓ |
| Clear and fair charge structures | | ✓ | | ✓ |
| Social aspects (including stakeholder participation and affordability) | | ✓ | | |
| Environmental aspects (including preventive measures based on the implementation of protection plans) | | ✓ | | |

## E.2 Examples of performance indicators related to assessment criteria

### E.2.1 General

The wastewater service can be assessed and the management of the systems can be improved in accordance with the objectives defined in Clause 4.

The fulfilment of these objectives can be measured in accordance with appropriate service assessment criteria by means of related performance indicators. However, performance indicators are often not the only method of measurement.

Examples of objectives, possible service assessment criteria and related performance indicators (PI) (taken from *IWA Performance Indicators for Wastewater Services*[10]) are given below. It is noted that performance indicators and guidelines are sensitive to local conditions, and therefore those presented in this annex serve only as examples.

### E.2.2 Objective: protection of public health

**Possible service assessment criteria**: appropriate coverage of service to users

An example of a possible PI related to this assessment criteria is:

**Performance indicator:** resident population not served (%)

**Definition:** percentage of the resident population whose wastewater is neither collected nor treated

**Processing rule:** (percentage of the resident population whose wastewater is neither collected nor treated/ resident population) × 100, at the reference date

**Comment:** Each jurisdiction should establish legislated requirements or guidelines for safe drinking water and use acceptable methods of measurement. This performance indicator can also apply to individual parameters including microbiological, chemical, radioactivity, and aesthetic requirements or guidelines. This indicator should be assessed on an annual basis. It may also be assessed for periods shorter than one year, but special care is required in result interpretation when used for internal or external comparisons.

**IWA code:** wQS4

NOTE Examples of other possible performance indicators related to protection of public health are:

— number of non-compliant quality/quantity tests for effluent discharge;

— wastewater quality tests carried out in compliance with requirements;

— residue quality tests carried out in compliance with requirements.

### E.2.3 Objective: meet users' needs and expectations

ISO 24510 provides examples of performance indicators relating to the ability of the utility to meet the needs and expectations of its users.

### E.2.4 Objective: provision of services under normal and emergency situations

**Possible service assessment criteria**: sewer blockages

An example of a possible PI related to this assessment criteria is:

**Performance indicator:** sewer blockages (No./100 km sewer/year)

**Definition:** average number of blockages occurring per 100 km of sewers during the assessment period

**Processing rule:** [number of blockages in sewers occurring during the assessment period × 365/ assessment period (in days) × total sewer length at the reference date (in km)] × 100

**IWA code:** wOp34

NOTE Examples of other possible performance indicators related to provision of continuous services under normal and emergency situations are:

— number of properties affected by sewer malfunction overflows;

— number of wastewater treatment plant failing permit limit.

### E.2.5 Objective: sustainability of the wastewater utility

**Possible service assessment criteria**: financial performance

An example of a possible PI related to this assessment criteria is:

**Performance indicator:** total cost coverage ratio

**Definition:** rate of total costs that are covered by revenues

**Processing rule:** (total revenues/total costs), during the assessment period

**IWA code:** wFi30

NOTE Examples of other possible performance indicators related to the sustainability of the wastewater utility are:

— average network replacement rate;

— unit operational cost;

— total number of staff per connection;

— fixed assets (gross/net);

— average revenue per connection;

— ratio of industrial to residential tariff;

— connection charge;

— monthly wastewater bill per household (may be calculated for a given fixed water consumption volume – if the wastewater tariff depends on this volume);

— bill collection period;

— bill collection rate;

— operating cost coverage;

— debt service ratio.

### E.2.6 Objective: promotion of sustainable development of the community

**Possible service assessment criteria**: reuse of treated wastewater

An example of a possible PI related to this assessment criteria is:

**Performance indicator:** wastewater reuse (%)

**Definition:** percentage of treated wastewater that is reused

**Processing rule:** (volume of reused treated wastewater/volume of wastewater treated by the utility) × 100, during the assessment period

**Comment:** This indicator may be assessed for periods shorter than one year, but special consideration is required when used for comparisons, either internal or external to the utility.

**IWA code:** wEn2

NOTE Examples of other possible performance indicators related to promotion of sustainable development (of the community) are:

— residue utilization;

— energy consumption for wastewater treatment (e.g. per service population equivalent);

— energy recovery from wastewater systems;

— wastewater treatment capacity utilization (current loading rate versus design capacity).

### E.2.7 Objective: protection of the environment

#### E.2.7.1 Objective: protection of the natural environment

**Possible service assessment criteria**: overflow prevention and control

An example of a possible PI related to this assessment criteria is:

**Performance indicator:** intermittent discharge frequency (number/overflow device/year)

**Definition:** average number of discharges per overflow device during the assessment period

**Processing rule:** (number of overflow discharges that occurred during the assessment period × 365)/ [assessment period (in days) × number of overflow devices at the reference date]

NOTE "× 365/assessment period" is a unit conversion expression and is not intended to be considered as extrapolation.

**Comment:** This PI may be assessed for periods shorter than one year, but it is recommended that it be used only where data for the variables have been collected for at least a year. Where it has been used for shorter time periods, special consideration is required when used for comparisons, either internal or external to the utility.

**IWA code:** wEn3

NOTE Examples of other possible performance indicators related to protection of the natural environment are:

— environmental impact of sewer overflows (e.g. volume or contaminant loading);

— system effectiveness (e.g. nº overflows per length of sewer);

— percentage of volume collected versus volume delivered to treatment;

— proportion of collected wastewater that receives at least primary treatment;

— proportion of collected wastewater that receives at least secondary treatment.

#### E.2.7.2 Objective: protection of the built / public environment

**Possible service assessment criteria**: flooding mitigation

An example of a possible PI related to this assessment criteria is

**Performance indicator:** flooding of properties from sewers (number/1 000 properties/year)

**Definition:** ratio of connected properties that are affected by flooding during the assessment period

**Processing rule:** (number of properties affected by flooding from sewers during the assessment period × 365 × 1 000)/(assessment period × number of connected properties at the reference date)

Only flooding from sewers that are the responsibility of the wastewater undertaking should be included. Flooding may affect properties that are not connected to the sewers. These should be included.

NOTE "× 365/assessment period" is a unit conversion expression and is not intended to be considered as extrapolation.

**Comment:** This PI may be assessed for periods shorter than one year, but it is recommended that it be used only where data for the variables have been collected for at least a year. Where it has been used for shorter time periods, special consideration is required when used for comparisons, either internal or external to the utility.

**IWA code:** This Performance Indicator is adapted from IWA code wQS13.

NOTE Examples of other possible performance indicators related to protection of the built/public environment are:

— number of surcharges per sewer length;

— number of flooding events per unit of time;

— weight of sediment removed per sewer length;

— percentage of sewer network inspected per unit of time;

— water infiltrated into sewer as percentage of wastewater flow;

— percentage of sewer network cleaned per unit of time;

— number of pumping stations failures, per year and per length of sewer;

— weight of residue removed from grit and grease separators and screens;

— volume of sediments removed from on-site systems (e.g. septic tanks);

- frequency of equipment inspection;
- percentage of personnel trained to appropriate skill level (e.g. in confined space entry).

## E.3 Examples of assessment criteria related to components of a wastewater system

### E.3.1 General

The main activities of a wastewater utility are as follows:

- collection and transport of wastewater,
- treatment of wastewater, and
- disposal/reuse of effluents and residues.

E.3.2 to E.3.4 provide some examples of wastewater assessment criteria related to the above activities.

### E.3.2 Examples of wastewater service assessment criteria related to collection and transport

The following are examples of wastewater service assessment criteria related to collection and transport:

- coverage (population served within the area);
- hydraulic capacity:
  - sedimentation;
  - flooding;
  - overflow;
- physical condition:
  - tightness (e.g. infiltration, ex-filtration);
  - corrosion;
  - structural integrity;
- operation and management of the system:
  - safety of personnel;
  - system inspection (including wrong connection);
  - inflow control (including source, quantity and quality);
  - disposal of residues (from system cleaning operations);
  - reuse of residues;
  - staffing levels;
  - nuisances control (e.g. odour, flies, rodent control);

- preventive maintenance;
- rehabilitation (repair/renovation/replacement);
- asset protection;
- meeting future requirements (e.g. expansion, legal requirements);
- response time (e.g. time between request and collection of septage);

— monitoring:

- discharge permit/sewer by-laws (control of discharges to the sewer system and to the environment);
- flow quantity and quality;
- cost.

### E.3.3 Examples of wastewater service assessment criteria related to treatment

The following are examples of wastewater service assessment criteria related to treatment:

— coverage (population served by wastewater treatment plants within the area);

— quantity of incoming wastewater;

— quality/concentration of contaminants/pollutants in incoming wastewater;

— treatment capacity:

- hydraulic capacity;
- pollutant removal capacity;
- residues treatment capacity;

— physical condition:

- structural integrity;
- equipment condition;
- equipment redundancy;

— operation and management:

- treatment effectiveness and efficiency;
- environmental impact, including impact on neighbourhood residents;
- use of resources (e.g. power, fuel, chemicals);
- biogas use;
- staffing levels;
- preventive maintenance;

- rehabilitation (repair/renovation/replacement);
- assets protection;
- meeting future requirements (e.g. expansion, legal requirements);

— monitoring:

- process monitoring (i.e. flow and performance of individual treatment processes);
- discharge permit/sewer by-laws;
- inspection of equipment.

### E.3.4 Examples of wastewater service assessment criteria related to disposal/reuse of effluent/residues

The following are examples of wastewater service assessment criteria related to disposal/reuse of effluent/residues.

Effluents and residues from treatment facilities (discharge permit):

— quantity and quality of effluent disposed of or reused;

— quantity and quality of effluent discharge into a particular receiving water or site;

— quantity and quality of wastewater residues disposed of or reused;

— other environmental impacts of disposal/reuse of effluent and residues (e.g. odours, dust, noise).

# Annex F
(informative)

# Example of confidence-grading scheme for performance indicators systems

The quality of input data should be assessed in terms of the reliability of the source and of the accuracy of data. The reliability of the source accounts for uncertainties in how reliable the source of the data may be, i.e. the extent to which data source yields consistent, stable and uniform results over repeated observations or measurements under the same conditions each time. The accuracy accounts for measurement errors in the acquisition of input data.

NOTE 1 No measurement device is completely accurate, and some of the data for use in assessing the performance indicators may have been obtained by less accurate methods.

NOTE 2 Old records can be reliable in terms of depicting the current situation of assets.

Practice shows that, in general, data providers do not have detailed information on reliability and accuracy, but are able to provide informed estimates, if broad bands are adopted. An example of possible data accuracy bands is given in Table F.1.

**Table F.1 — Example of data accuracy bands**

| Accuracy band<br>% | Associated uncertainty |
|---|---|
| 0 to 5 | Better than or equal to ± 5 % |
| 5 to 20 | Worse than ± 5 %, but better than or equal to ± 20 % |
| 20 to 50 | Worse than ± 20 %, but better than or equal to ± 50% |
| > 50 | Worse than ± 50% |

An example of possible bands for the reliability of the source is given in Table F.2.

**Table F.2 — Example of data source reliability bands**

| Reliability band | Definition |
|---|---|
| ★★★ | Highly reliable data source: data based on sound records, procedures, investigations or analyses that are properly documented and recognized as the best available assessment methods. |
| ★★ | Fairly reliable data source: worse than ★★★, but better than ★. |
| ★ | Unreliable data source: data based on extrapolation from limited reliable samples or on informed guesses. |

For instance, a variable measured with an estimated uncertainty of ± 12 % and from a highly reliable source will have a confidence grade of [5 % to 20 %/***].

Data source reliability and data accuracy should be assessed for every input variable.

Clearly, a [0 % to 5 %/***] confidence grade can be achieved for some input variables, although it may not be generally attainable for every variable. Utilities should aim for a grade of at least [5 % to 20 %/**].

Confidence grades can only be estimated directly for the variables. Based on these, uncertainty assessment of the resulting PI should be assessed as well, either quantitatively or, at least, qualitatively. Quantitative assessment should be based on the uncertainty propagation theory, in accordance with the *Guide to the expression of uncertainty in measurement (GUM)*[8].

Confidence grades should be assessed for every water service and for every indicator. To make it possible for comparisons to be carried out between services, confidence grades should be chosen appropriately and applied consistently.

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**ICS 13.060.30; 93.030**

Price based on 59 pages