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Water efficiency management systems — Requirements with guidance for use

Systèmes de management de l'utilisation efficace de l'eau — Exigences et recommandations d'utilisation

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Foreword

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

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

This document was prepared by Technical Committee ISO/TC 224, *Service activities relating to drinking water supply, wastewater and stormwater systems*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Water is essential to life and forms part of the environment. Global concern for the state of the environment has identified that water resources are subject to significant pressures from water demand and from the impacts of climate change. The pressures on organizations to implement water efficiency programmes can arise from limited water resources and exist particularly in resource exploitation activities such as mining, forestry, oil and gas extraction, and in agriculture. They might also arise from commercial, institutional and industrial activities whether water is supplied by water utilities or comes directly from the environment.

As pressure grows to improve the quality of the environment and increase sustainability, organizations of all types and sizes are increasingly turning their attention to the environmental impacts of their activities, products and services. This might include measuring the water footprint of an activity or striving towards a more efficient use of water within an organization. Achieving sound water efficiency performance requires organizational commitment to a systematic approach and to the achievement of continual improvement in water use through a water efficiency management system.

Water efficiency management, like quality management, environmental management and energy management could be a matter of vital interest in promoting sustainable economic activities, industries and ultimately a sustainable environment. The introduction of water efficiency programs is often, but not always, triggered by a shortage in water supply.

The purpose of this document is to enable organizations to assess and account for their water use, and to identify, plan and implement measures to achieve water savings through the systematic management of water. Successful implementation depends on commitment from all levels and functions within the organization, especially commitment by top management.

This document specifies water efficiency management system requirements and contains guidance for its use. Using this document, an organization can develop and implement a water efficiency policy through the establishment of objectives, targets, action plans, monitoring, benchmarking, and review programs. These should take into account any requirements related to significant water use. A water efficiency management system enables an organization to achieve its relevant policy commitments and take action as needed to improve its water management according to the requirements of this document. This document can apply to some or all of the activities under the control of the organization. Application of this document may be tailored to fit the specific requirements of the organization, including the complexity of its system, the degree of documentation and available resources.

In any organization, water might be used for a variety of purposes, including the following:

a) cleaning;

b) transportation;

c) heating and cooling;

d) manufacturing a product and as part of a product;

e) drinking;

f) sanitation;

g) irrigation;

h) fire suppression;

i) recreational, water sport and aesthetic purposes.

The adoption and proper implementation of a water efficiency management system is intended to result in improved water efficiency and can help to achieve the following outcomes:

1) identifying water as a resource that can be considered as part of organizational and budgetary planning;

2) assisting an organization to better manage water use and optimize water demand;

3) recognizing the impact on others that can occur with changing water use;

4) ensuring a greater level of accountability in water use;

5) providing a process for regular review for possible improvement and adoption of opportunities arising in water efficiency.

Water efficiency management systems — Requirements with guidance for use

1 Scope

This document specifies requirements and contains guidance for its use in establishing, implementing and maintaining a water efficiency management system. It is applicable to organizations of all types and sizes that use water. It is focused on end-use consumers.

This document is applicable to any organization that wishes to:

a) achieve the efficient use of water through the 'reduce, replace or reuse' approach;

b) establish, implement and maintain water efficiency;

c) continually improve water efficiency.

This document specifies requirements and contains guidance for its use regarding organizational water use. It includes monitoring, measurement, documentation, reporting, design and procurement practices for equipment, systems, processes and personnel training that contribute to water efficiency management.

NOTE 1 'Reduce' includes the use of water-efficient fittings and equipment and, for example, putting in place a proper monitoring system for usage and leak detection.

NOTE 2 'Replace' includes substitution of drinking water with reclaimed water, sea water and rainwater wherever feasible.

NOTE 3 'Reuse' includes recycling of, for example, process water or grey water. For utilizing water reuse systems, ISO/TC 282 documents can be referred to as guidelines.

NOTE 4 Guidance in the annexes provides additional practical information to support implementation. Annex A provides guidance on the use of this document and Annex B gives examples of scenarios in water efficiency.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 24513, *Service activities relating to drinking water supply, wastewater and stormwater systems — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 24513 and the following apply.

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

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

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

3.1
audit
systematic, independent and documented *process* (3.24) for obtaining audit evidence and evaluating it objectively to determine the extent to which the audit criteria are fulfilled

Note 1 to entry: An audit can be an internal audit (first party) or an external audit (second party or third party), and it can be a combined audit (combining two or more disciplines).

Note 2 to entry: An internal audit is conducted by the organization itself, or by an external party on its behalf.

Note 3 to entry: "Audit evidence" and "audit criteria" are defined in ISO 19011.

[SOURCE: ISO/IEC Directives Part 1, 2019, Annex L, Appendix 2, 3.17]

3.2
baseline water efficiency indicator
reference level of water used per *business activity indicator* (3.4)

Note 1 to entry: "Used" in the context of this indicator means the net amount of water used (including any water consumed) in the course of the *business activity* (3.3), discounting the amount of water applied that is reclaimed or recycled for further use.

Note 2 to entry: The indicator can be established in the initial *water use review* (3.40) considering a data period suitable to the *organization's* (3.20) *water use* (3.39) (including any water consumed).

3.3
business activity
umbrella term covering all the functions, *processes* (3.24), activities and transactions of an *organization* (3.20) and its employees

Note 1 to entry: Includes public administration as well as commercial business.

[SOURCE: ISO 16175-2:2011, 3.4, modified — "an" deleted; 2nd sentence becomes Note 1 to entry.]

3.4
business activity indicator
measure of *business activity* (3.3) that takes into account core business operations specific to the application site

Note 1 to entry: Depending on the business activity indicator, *water use* (3.39) (including any water consumed) will vary. For example, m^3 of water/kg of product; l/person supplied; m^3 of water/guestroom.

EXAMPLE Quantity of products produced, number of staff and visitors, number of guestrooms.

3.5
competence
ability to apply knowledge and skills to achieve intended results

[SOURCE: ISO/IEC Directives Part 1, 2019, Annex L, Appendix 2, 3.10]

3.6
conformity
fulfilment of a *requirement* (3.26)

Note 1 to entry: In English the word "conformance" is synonymous but deprecated. In French the word "compliance" is synonymous but deprecated.

[SOURCE: ISO/IEC Directives Part 1, 2019, Annex L, Appendix 2, 3.18, modified — Note 1 to entry added.]

3.7
continual improvement
recurring activity to enhance *performance* (3.22)

Note 1 to entry: The process of establishing *objectives* (3.19) and finding opportunities for improvement is a continual process through the use of audit findings and audit conclusions, analysis of data, management reviews or other means, and generally leads to *corrective action* (3.8) or preventive action.

Note 2 to entry: In the case of this document the recurring process is one of enhancing the *water efficiency management system* (3.36) in order to achieve improvements in overall *water efficiency performance* (3.37) consistent with the *organization's* (3.20) *water efficiency policy* (3.35).

[SOURCE: ISO/IEC Directives Part 1, 2019, Annex L, Appendix 2, 3.21, modified — Notes 1 and 2 to entry added.]

3.8
corrective action
action to eliminate the cause of a *nonconformity* (3.18) and to prevent recurrence

Note 1 to entry: There can be more than one cause for a nonconformity.

[SOURCE: ISO/IEC Directives Part 1, 2019, Annex L, Appendix 2, 3.20, modified — Note 1 to entry added.]

3.9
documented information
information required to be controlled and maintained by an *organization* (3.20) and the medium on which it is contained

Note 1 to entry: Documented information can be in any format and media, and from any source.

Note 2 to entry: Documented information can refer to:

— the *management system* (3.15), including related *processes* (3.24);

— information created in order for the organization to operate (documentation);

— evidence of results achieved (records).

[SOURCE: ISO/IEC Directives Part 1, 2019, Annex L, Appendix 2, 3.11]

3.10
effectiveness
extent to which planned activities are realized and planned results achieved

[SOURCE: ISO/IEC Directives Part 1, 2019, Annex L, Appendix 2, 3.6]

3.11
full-time equivalent
ratio of the total number of occupant hours spent in the facility divided by the standard working hours per day

Note 1 to entry: The ratio provides an estimation of actual facility occupancy in terms of hours occupied per day and is used to determine the number of occupants for the facility.

[SOURCE: ISO 24513:2019, 3.1.15]

3.12
grey water
greywater
graywater
wastewater from bathtubs and showers, hand basins, kitchen sinks, clothes washing and laundry tubs but excluding excreta and *trade effluent* (3.30)

Note 1 to entry: It excludes used water from urinals or toilet bowls.

Note 2 to entry: Wastewater from kitchen sinks, food waste grinders or dishwashers can be excluded, subject to local *requirements* (3.26).

[SOURCE: ISO 24513:2019, 3.2.2.2.3]

3.13
interested party
stakeholder
person or *organization* (3.20) that can affect, be affected by, or perceive itself to be affected by a decision or activity

[SOURCE: ISO/IEC Directives Part 1, 2019, Annex L, Appendix 2, 3.2]

3.14
legal requirement or other requirement
compliance obligation
requirement (3.26) that an *organisation* (3.20) has to or chooses to comply with

Note 1 to entry: This could be a legal requirement or another type of requirement.

[SOURCE: ISO 19600: 2014, 3.16, modified – incorporating additional elements from 3.14 and 3.15 of that document.]

3.15
management system
set of interrelated or interacting elements of an *organization* (3.20) to establish *policies* (3.23) and *objectives* (3.19), and *processes* (3.24) to achieve those objectives

Note 1 to entry: A management system can address a single discipline or several disciplines.

Note 2 to entry: The system elements include the organization's structure, roles and responsibilities, planning and operation.

Note 3 to entry: The scope of a management system may include the whole of the organization, specific and identified functions of the organization, specific and identified sections of the organization, or one or more functions across a group of organizations.

[SOURCE: ISO/IEC Directives Part 1, 2019, Annex L, Appendix 2, 3.4]

3.16
measurement
process (3.24) to determine a value

[SOURCE: ISO/IEC Directives Part 1, 2019, Annex L, Appendix 2, 3.16]

3.17
monitoring
determining the status of a system, a *process* (3.24) or an activity

Note 1 to entry: To determine the status, there can be a need to check, supervise or critically observe.

[SOURCE: ISO/IEC Directives Part 1, 2019, Annex L, Appendix 2, 3.15]

3.18
nonconformity
non-fulfilment of a *requirement* (3.26)

[SOURCE: ISO/IEC Directives Part 1, 2019, Annex L, Appendix 2, 3.19]

3.19
objective
result to be achieved

Note 1 to entry: An objective can be strategic, tactical, or operational.

Note 2 to entry: Objectives can relate to different disciplines (such as financial, health and safety, and environmental goals) and can apply at different levels [such as strategic, organization-wide, project, product and *process* (3.24)].

Note 3 to entry: An objective can be expressed in other ways, e.g. as an intended outcome, a purpose, an operational criterion, as a water efficiency objective or by the use of other words with similar meaning (e.g. aim, goal, or target).

Note 4 to entry: In the context of *water efficiency management systems* (3.36), water efficiency objectives are set by the organization, consistent with the water efficiency policy, to achieve specific results.

[SOURCE: ISO/IEC Directives Part 1, 2019, Annex L, Appendix 2, 3.8]

3.20
organization
person or group of people that has its own functions with responsibilities, authorities and relationships to achieve its *objectives* (3.19)

Note 1 to entry: The concept of organization includes, but is not limited to, sole-trader, company, corporation, firm, enterprise, authority, partnership, charity or institution, or part or combination thereof, whether incorporated or not, public or private.

[SOURCE: ISO/IEC Directives Part 1, 2019, Annex L, Appendix 2, 3.1]

3.21
outsource, verb
make an arrangement where an external *organization* (3.20) performs part of an organization's function or *process* (3.24)

Note 1 to entry: An external organization is outside the scope of the *management system* (3.15), although the outsourced function or process is within the scope.

[SOURCE: ISO/IEC Directives Part 1, 2019, Annex L, Appendix 2, 3.14]

3.22
performance
measurable result

Note 1 to entry: Performance can relate either to quantitative or qualitative findings.

Note 2 to entry: Performance can relate to managing activities, *processes* (3.24), products (including services), systems or *organizations* (3.20).

[SOURCE: ISO/IEC Directives Part 1, 2019, Annex L, Appendix 2, 3.13]

3.23
policy
intentions and direction of an *organization* (3.20), as formally expressed by its *top management* (3.29)

[SOURCE: ISO/IEC Directives Part 1, 2019, Annex L, Appendix 2, 3.7]

3.24
process
set of interrelated or interacting activities which transforms inputs into outputs

[SOURCE: ISO/IEC Directives Part 1, 2019, Annex L, Appendix 2, 3.12]

3.25
reclaimed water
reused water
recycled water
non-drinking water
wastewater that has been treated to meet specific water quality *requirements* (3.26) for intended beneficial use

Note 1 to entry: Examples of treatment technologies include microfiltration, reverse osmosis and/or ultraviolet disinfection.

[SOURCE: ISO 24513:2019, 3.2.2.3]

3.26
requirement
need or expectation that is stated, generally implied or obligatory

Note 1 to entry: "Generally implied" means that it is custom or common practice for the organization and interested parties that the need or expectation under consideration is implied.

Note 2 to entry: A specified requirement is one that is stated, e.g. in documented information.

[SOURCE: ISO/IEC Directives Part 1, 2019, Annex L, Appendix 2, 3.3]

3.27
risk
effect of uncertainty

Note 1 to entry: An effect is a deviation from the expected — positive or negative.

Note 2 to entry: Uncertainty is the state, even partial, of deficiency of information related to, understanding or knowledge of, an event, its consequence, or likelihood.

Note 3 to entry: Risk is often characterized by reference to potential "events" (as defined in ISO Guide 73) and "consequences" (as defined in ISO Guide 73), or a combination of these.

Note 4 to entry: Risk is often expressed in terms of a combination of the consequences of an event (including changes in circumstances) and the associated "likelihood" (as defined in ISO Guide 73) of occurrence.

[SOURCE: ISO/IEC Directives Part 1, 2019, Annex L, Appendix 2, 3.9]

3.28
significant water use
activity accounting for a substantial portion of total *water used* (3.39) [including any *water consumed* (3.31)] and/or offering considerable potential for *water efficiency performance* (3.37) improvement

Note 1 to entry: Water use can include both "new" drinking water and *reclaimed water* (3.25) components.

[SOURCE: ISO 24513:2019, 3.4.2.1]

3.29
top management
person or group of people who directs and controls an *organization* (3.20) at the highest level

Note 1 to entry: Top management has the power to delegate authority and provide resources within the organization.

Note 2 to entry: If the scope of the *management system* (3.15) covers only part of an organization, then top management refers to those who direct and control that part of the organization.

[SOURCE: ISO/IEC Directives Part 1, 2019, Annex L, Appendix 2, 3.5]

3.30
trade effluent
liquid, including particles of matter and other substances in suspension in the liquid, which is the outflow from any trade, business or manufacture or of any works of engineering or building construction

Note 1 to entry: Trade effluent is also referred to as trade waste.

[SOURCE: ISO 24513:2019, 3.2.2.2.5]

3.31
water consumption
portion of *water use* (3.39) that is neither returned to the original water source after being withdrawn nor available for reclamation

Note 1 to entry: Consumption occurs, for example, when water is lost to the atmosphere through evaporation or incorporated into a product or plant (such as a corn stalk) and is no longer available for reclamation.

3.32
water efficiency
accomplishment of a function, task, *process* (3.24), service or result, with the minimum amount of water practicable

3.33
water efficiency indicator
amount of water used per unit of *business activity indicator* (3.4)

Note 1 to entry: "Used" in the context of this indicator means the net amount of water used (including any water consumed) in the course of the *business activity* (3.3), discounting the amount of water applied that is reclaimed or recycled for further use.

3.34
water efficiency management plan
document specifying the means of identifying the potential scope, measures, actions and priorities for achieving efficiencies in the organization's current *water use* (3.39) (including any water consumed)

3.35
water efficiency policy
intentions and direction of an *organization* (3.20) related to its *water efficiency performance* (3.37) as formally expressed by *top management* (3.29)

Note 1 to entry: The water efficiency policy (3.35) provides a framework for action and for the setting of water efficiency *performance* (3.37) *objectives* (3.19) and targets.

[SOURCE: ISO 14001:2015, 3.1.3, modified — term changed from "environmental policy", "environmental performance" replaced by "water efficiency performance" and Note 1 to entry added.]

3.36
water efficiency management system
part of the *management system* (3.15) used to manage *water efficiency* (3.32) aspects, fulfil *requirements* (3.26) and address *risks* (3.27) and opportunities

[SOURCE: ISO 14001:2015, 3.1.2, modified — to address water efficiency.]

3.37
water efficiency performance
measurable result related to *water efficiency* (3.32) or *water use* (3.39) (including any water consumed)

Note 1 to entry: In the context of *water efficiency management systems* (3.36), results can be measured against the organization's *water efficiency policy* (3.35), *objectives* (3.19), targets and other water efficiency performance requirements.

Note 2 to entry: Water efficiency performance is one of the components of the performance of the water efficiency management system.

3.38
water meter
instrument intended to measure continuously, store, and display the volume of water passing through the measurement transducer at metering conditions

Note 1 to entry: A transducer is a device for converting energy from one domain into another, calibrated to minimize the errors in the conversion process. It could be a sensor or an actuator.

[SOURCE: ISO 16399:2014, 3.1, modified — Note 1 to entry replaced.]

3.39
water use
amount of water used

Note 1 to entry: The amount of water used can be described and quantified by one or more *business activity indicators* (3.4), for example m^3 of water/kg of product; l/person supplied; m^3 of water/guestroom.

Note 2 to entry: "Used" in this context means the gross amount required in the course of the *business activity* (3.3), including the amounts of both new drinking water and *reclaimed water* (3.25).

Note 3 to entry: In this document, the portion of water use that is neither returned to a water source after being withdrawn nor available for reclamation is called *water consumption* (3.31). Consumption occurs, for example, when water is lost to the atmosphere through evaporation or incorporated into a product or plant (such as a corn stalk) and is no longer available for reclamation.

[SOURCE: ISO 24513:2019, 3.4.2]

3.40
water use review
determination of the *organization's* (3.20) *water efficiency performance* (3.37) based on data and other information, leading to identification of opportunities for improvement

[SOURCE: ISO 24513:2019, 3.4.3]

4 Context of the organization

4.1 Understanding the organization and its context

The organization shall determine external and internal issues that are relevant to its purpose and that affect its ability to achieve the intended outcome(s) of its water efficiency management system.

NOTE See A.2 for more information.

4.2 Understanding the needs and expectations of interested parties

The organization shall determine:

a) the interested parties that are relevant to the water efficiency management system;

b) the relevant requirements of these interested parties.

NOTE See A.3 for more information.

4.3 Determining the scope of the water efficiency management system

The organization shall determine the boundaries and applicability of the water efficiency management system to establish its scope.

When determining this scope, the organization shall consider:

a) the external and internal issues referred to in 4.1;

b) the requirements referred to in 4.2 b).

The scope shall be available as documented information.

4.4 Water efficiency management system

The organization shall establish, implement, maintain and continually improve a water efficiency management system, including the processes needed and their interactions, in accordance with the requirements of this document.

5 Leadership

5.1 Leadership and commitment

Top management shall demonstrate leadership and commitment with respect to the water efficiency management system by:

a) identifying the scope and boundaries to be addressed by the water efficiency management system;

b) ensuring that the water efficiency policy and water efficiency objectives are established and are compatible with the strategic direction of the organization;

c) ensuring that the responsibilities and authorities for relevant roles are assigned and communicated within the organization as documented information;

d) ensuring the integration of the water efficiency management system requirements into the organization's business processes;

e) ensuring that the resources needed for the water efficiency management system are available;

f) communicating the importance of effective water efficiency management and of conforming to the water efficiency management system requirements;

g) ensuring that the water efficiency management system achieves its intended outcome(s);

h) directing and supporting persons to contribute to the effectiveness of the water efficiency management system;

i) promoting continual improvement;

j) supporting other relevant management roles to demonstrate their leadership as it applies to their areas of responsibility;

k) conducting management reviews.

NOTE 1 Reference to "business" in this document can be interpreted broadly to mean those activities that are core to the purpose of the organization's existence.

NOTE 2 Resources include but are not limited to human resources, specialized skills, technology and financial resources.

NOTE 3 See A.4 for more information.

5.2 Policy

Top management shall establish a water efficiency policy that:

a) is appropriate to the purposes of the organization;

b) takes a holistic approach with respect to water efficiency objectives alongside its overall objectives;

c) reflects the nature and scale of the organization's water use;

d) provides a framework for setting and reviewing water efficiency objectives and water efficiency targets;

e) includes a commitment to satisfy applicable requirements;

f) supports the use of water-efficient products, services and designs to achieve water efficiency performance improvement;

g) includes a commitment to continual improvement of the water efficiency management system;

h) is implemented, periodically reviewed and, if required, updated.

The water efficiency policy shall:

1) be available as documented information;

2) be communicated within the organization;

3) be available to interested parties, as appropriate.

NOTE See A.5 for more information.

5.3 Organizational roles, responsibilities and authorities

Top management shall ensure that the responsibilities and authorities for relevant roles are assigned and communicated within the organization.

Top management shall assign the responsibility and authority for:

a) ensuring that the water efficiency management system conforms to the requirements of this document;

b) reporting on the performance of the water efficiency management system to top management and ensuring that the water efficiency management system is established, funded, implemented, maintained and continually improved;

c) identifying a person(s), authorized by an appropriate level of management, to work with the respective management representatives in support of water efficiency activities;

d) defining and communicating responsibilities and authorities in order to facilitate effective water efficiency management.

NOTE See A.6 for more information.

6 Planning

6.1 Actions to address risks and opportunities

When planning for the water efficiency management system, the organization shall consider the issues referred to in 4.1 and the requirements referred to in 4.2 b), and determine the risks and opportunities that need to be addressed to:

a) give assurance that the water efficiency management system can achieve its intended outcome(s);

b) prevent, or reduce, undesired effects;

c) achieve continual improvement;

d) forecast related short-, mid- and long-term economic and investment impacts;

e) allocate necessary human and financial resources.

The organization shall plan:

1) actions to address these risks and opportunities;

2) how to:

   — integrate and implement the actions into its water efficiency management system processes;

   — evaluate the effectiveness of these actions;

   — establish mid- and long-term projections, and allocate human and financial resources accordingly;

   — foster financial, technical or administrative innovation to control risks.

The organization shall maintain documented information on:

i. risks and opportunities;

ii. the process(es) and actions needed to determine and address its risks and opportunities to the extent necessary to have confidence that they are carried out as planned.

6.2 Water efficiency objectives and planning to achieve them

6.2.1 General

The organization shall establish water efficiency objectives at relevant functions and levels.

The water efficiency objectives shall:

a) be consistent with the water efficiency policy;

b) be measurable (if practicable);

c) take into account applicable requirements;

d) be monitored;

e) be communicated;

f) be updated as appropriate (for example following internal or external benchmarking).

The organization shall retain documented information on the water efficiency objectives.

When planning how to achieve its water efficiency objectives, the organization shall determine:

1) what will be done;

2) what resources will be required;

3) who will be responsible;

4) when it will be completed;

5) how the results will be evaluated.

6.2.2 Planning

The organization shall implement and document its water efficiency planning process(es).

A water efficiency management plan is a document detailing the following:

a) identification of locations/areas of an organization's current water use;

b) identification of water recycling potential in the organization's processes and measurement of quantity and quality of water before and after for those processes that have been identified as having water recycling/recovery potential;

c) identification of water-saving measures that can be readily applied, with links to the respective management systems and processes;

d) an action plan to implement the identified measures, including identified savings, programme priority and implementation timelines.

The organization in its planning process(es) shall identify opportunities that continually improve water efficiency performance. Water efficiency planning shall involve a review of the organization's activities that can affect water efficiency performance.

NOTE 1 A conceptual diagram illustrating water efficiency management planning is shown in A.7.1, Figure A.2.

NOTE 2 See A.7.1 for more information.

6.2.3 Legal requirements or other requirements

The organization shall ensure that legal requirements or other requirements are considered in establishing, implementing and maintaining the water efficiency management system and are reviewed at defined intervals.

NOTE See A.7.2 for more information.

6.2.4 Conduct water use review

The organization shall develop, conduct and maintain a water use review to:

a) identify the activities and functions that use water;

b) record the water used for each identified activity and function;

c) determine processes and services that affect the used water quality, with the aim of segregating the used water streams with the objective of water recycling;

d) determine activities and functions with the potential for greater water efficiency.

The methodology and criteria used to develop the water use review shall be maintained as documented information.

To develop the water use review, the organization shall:

1) analyse water use based on measurement and other data as follows:

   — identify current water sources;

   — identify current water-using activities and functions;

   — evaluate past and present water use;

   — estimate future water use.

2) identify, based on the water use analysis, the activities and functions of significant water use, including:

   — the facilities, equipment, systems, processes and personnel working for or on behalf of the organization that significantly affect water use;

— other relevant variables affecting water use;

— the current performance of facilities, equipment and systems and processes related to identified significant water use.

3) prioritize and record opportunities for improving water efficiency performance.

The water use review shall be updated at defined intervals, as well as in response to major changes in facilities, equipment, systems or processes.

In order to develop an accurate water balance chart, it is desirable to measure the amount of water use [see Annex C for a guide on the development of a water balance chart and Formula (C.1)].

NOTE See A.7.3 for more information.

6.2.5 Identify business activity indicator(s)

The organization shall identify specific business activity indicator(s) appropriate for monitoring and measuring water efficiency performance. The methodology for determining and updating the business activity indicator(s) shall be retained as documented information, regularly reviewed and periodically updated as appropriate. Annex D gives examples of business activity indicator(s).

NOTE See A.7.4 for more information.

6.2.6 Determine water efficiency indicator(s)

The methodology for determining and updating the water efficiency indicator(s) shall be maintained as documented information and regularly reviewed. Water efficiency indicator(s) shall be reviewed and compared with the baseline water efficiency indicator(s) as appropriate and periodically updated as appropriate.

NOTE See A.7.5 for more information.

6.2.7 Identify baseline water efficiency indicator(s)

The organization shall identify baseline water efficiency indicator(s) appropriate for monitoring and measuring its water efficiency programme achievements. Changes in water efficiency performance shall be measured against the baseline water efficiency indicator(s).

Adjustments to the baseline(s) shall be made in the case of one or more of the following:

a) the specific business activity indicator(s) no longer reflect organizational water use;

b) there have been changes to the process, operational patterns or water systems;

c) variation from predetermined and documented methods.

The organization shall retain documented information on its baseline water efficiency indicator(s).

NOTE See A.7.6 for more information.

6.3 Targets and action plans

The organization shall establish, within or supplemental to the objectives, water efficiency targets at relevant functions, levels, processes or facilities within the organization.

Time frames shall be established for achievement of the targets.

When establishing and reviewing objectives and targets on water use and efficiency, the organization shall take into account:

a) legal requirements or other requirements related to its water use, water efficiency, wastewater discharge and pollution control;

b) opportunities to improve water efficiency performance, as identified in the water use review;

c) financial, operational and business conditions, technological options on process water use, general and hygienic considerations.

The organization shall establish, implement and maintain action plans to achieve its targets on water use and water efficiency. The action plan shall include:

1) the designation of responsibility;

2) the means and time frame by which individual targets are to be achieved;

3) the method by which an improvement in water efficiency performance shall be verified;

4) the method of verifying the results.

The action plans shall be maintained as documented information and updated at defined intervals.

NOTE See A.7.7 for more information.

7 Support

7.1 Resources

The organization shall determine and provide the resources needed for the establishment, implementation, maintenance and continual improvement of the water efficiency management system.

NOTE See A.8.1 for more information.

7.2 Competence

The organization shall:

a) determine the necessary competence of person(s) doing work under its control that affects its water efficiency performance;

b) ensure that these persons are competent on the basis of appropriate education, training or experience;

c) where applicable, take actions to acquire the necessary competence, and evaluate the effectiveness of the actions taken;

d) retain appropriate documented information as evidence of competence.

NOTE 1 Applicable actions can include, for example, the provision of training to, the mentoring of, or the re-assignment of currently employed persons; or the hiring or contracting of competent persons.

NOTE 2 See A.8.2 for more information.

7.3 Awareness

Persons doing work under the organization's control shall be aware of:

a) the water efficiency policy;

b) their roles, responsibilities and authorities in achieving the objectives of the water efficiency management system;

c) their contribution to the effectiveness of the water efficiency management system, including the benefits of improved water efficiency performance;

d) the impact, actual or potential, of their activities with respect to water use, and how their activities and behaviour contribute to the achievement of water efficiency management objectives and targets;

e) the implications of not conforming with the water efficiency management system requirements.

7.4 Communication

The organization shall determine the internal and external communications relevant to the water efficiency management system, including:

a) on what it will communicate;

b) when to communicate;

c) with whom to communicate;

d) how to communicate.

The organization shall establish and implement a process by which any person working for, or on behalf of, the organization can make comments or suggest improvements to the water efficiency management system.

NOTE See A.8.3 for more information.

7.5 Documented information

7.5.1 General

The organization's water efficiency management system shall include:

a) documented information required by this document;

b) documented information determined by the organization as being necessary for the effectiveness of the water efficiency management system.

NOTE The extent of documented information for a water efficiency management system can differ from one organization to another due to:

— the size of organization and type of activities, processes, products and services;

— the complexity of processes and their interactions;

— the competence of persons.

NOTE See A.9 for more information.

7.5.2 Creating and updating

When creating and updating documented information the organization shall ensure appropriate

a) identification and description (e.g. a title, date, author or reference number);

b) format (e.g. language, software version, graphics) and media (e.g. paper, electronic);

c) review and approval for suitability and adequacy.

7.5.3 Control of documented information

Documented information required by the water efficiency management system and by this document shall be controlled to ensure:

a) it is available and suitable for use, where and when it is needed;

b) it is adequately protected (e.g. from loss of confidentiality, improper use, loss of integrity).

For the control of documented information, the organization shall address the following activities, as applicable:

1) distribution, access, retrieval and use;

2) storage and preservation, including preservation of legibility;

3) control of changes (e.g. version control);

4) retention and disposal.

Documented information of external origin determined by the organization to be necessary for the planning and operation of the water efficiency management system shall be identified, as appropriate, and controlled.

NOTE Access can imply a decision regarding the permission to view the documented information only, or the permission and authority to view and change the documented information.

8 Operation

8.1 Operational planning and control

The organization shall plan, implement and control the processes needed to meet requirements, and to implement the actions determined in 6.1, by:

a) establishing criteria for the processes;

b) implementing control of the processes in accordance with the criteria;

c) keeping documented information to the extent necessary to have confidence that the processes have been carried out as planned.

The organization shall control planned changes and review the consequences of unintended changes, taking action to mitigate any adverse effects, as necessary.

The organization shall ensure that outsourced processes are controlled.

Establishing criteria for processes includes setting minimum levels for the effective management of significant water use.

Processes to be controlled include:

1) operation and maintenance activities which are related to the organization's significant water use, discharges or pollution potential according to established operational criteria;

2) activities needed to meet requirements of the organization's water efficiency policy, water efficiency objectives, targets and action plan.

To ensure processes are controlled, the organization shall undertake appropriate communication of the operational controls to personnel working for, or on behalf of, the organization.

NOTE See A.10 for more information.

8.2 Design

When designing new, modified and renovated facilities, equipment, systems or processes that have a significant impact on its water efficiency performance, the organization shall consider, among other possibilities or options, the water efficiency performance improvement opportunities and operational control of the resulting design changes.

The results of water efficiency performance evaluation shall be incorporated where appropriate into the specification, design and procurement activities of the relevant project(s).

The considerations, results of the design activity, verification and any necessary action, as applicable, shall be documented.

8.3 Procurement of water services, products and equipment

When procuring water services, products and equipment that have, or may have, a significant impact on water use, the organization shall inform suppliers that procurement is partly evaluated on the basis of water efficiency performance.

The organization shall establish and implement the criteria for assessing water use and water efficiency over the planned or expected operating lifetime when procuring water services, products and equipment which are expected to have a significant impact on the organization's water efficiency performance.

The organization shall define and document water efficiency purchasing specifications, as applicable, for efficient water use.

NOTE See A.11 for more information.

8.4 Maintenance and inspection

The organization shall ensure that facilities, equipment, systems and processes that consume water are maintained and inspected on a regular basis to ensure water efficiency performance is consistently managed while taking operation requirements into consideration.

9 Performance evaluation

9.1 Monitoring, measurement, analysis and evaluation

The organization shall determine:

a) what needs to be monitored and measured;

b) the methods for monitoring, measurement, analysis and evaluation, as applicable to ensure valid results;

c) when the monitoring and measuring shall be performed;

d) when the results of the monitoring and measurement shall be analysed and evaluated;

As a minimum, the water use shall be metered.

In addition, the following shall be undertaken:

1) monitor and measure as a minimum:

   — the breakdown of types of water supplied or used in the facility, including by source;

   — the breakdown of significant water use and other outputs of the water use review;

— the relevant variables related to significant water use;

— the business activity indicators;

— the water efficiency indicators;

— the effectiveness of the action plans in achieving objectives and targets;

— evaluations of actual versus expected water use.

2) apply the appropriate methods for monitoring, measurement, analysis and evaluation, as applicable, to ensure valid results;

3) identify and investigate any significant deviations in water efficiency performance;

4) evaluate compliance with legal requirements or other requirements in regard to water use, water efficiency, wastewater discharge and pollution control.

The organization should define, periodically review and update/revise its measurement needs.

The organization shall retain appropriate documented information as evidence of the results.

The organization shall evaluate the water efficiency performance and the effectiveness of the water efficiency management system. When evaluating its water efficiency performance, the organization shall review its water use and update its action plan in the water efficiency management plan if necessary and possible.

NOTE See A.12 for more information.

9.2 Internal audit

9.2.1 General

The organization shall conduct internal audits at planned intervals to provide information on whether the water efficiency management system:

a) conforms to:

— the organization's own requirements for its water efficiency management system;

— the requirements of this document;

b) is effectively implemented and maintained.

9.2.2 Internal audit programme

The organization shall:

a) plan, establish, implement and maintain an audit programme(s), including the frequency, methods, responsibilities, planning requirements and reporting, which shall take into consideration the importance of the processes concerned and the results of previous audits;

b) define the audit criteria and scope for each audit;

c) select auditors and conduct audits to ensure objectivity and impartiality of the audit process;

d) ensure that the results of the audits are reported to relevant management;

e) retain documented information as evidence of the implementation of the audit programme and the audit results.

NOTE See A.13 for more information.

9.3 Management review

Top management shall review the organization's water efficiency management system, at planned intervals, to ensure its continuing suitability, adequacy and effectiveness.

The management review shall include consideration of:

a) the status of actions from previous management reviews;

b) changes in external and internal issues that are relevant to the water efficiency management system;

c) information on the water efficiency management system performance, including trends in the:

   — nonconformities and corrective actions;

   — monitoring and measurement results;

   — audit results;

d) opportunities for continual improvement.

The outputs of the management review shall include decisions related to continual improvement opportunities and any need for changes to the water efficiency management system.

Decisions to be made and recorded shall relate to:

1) assessing water efficiency management of the organization;

2) assessing water efficiency policy;

3) the organization's business activity indicator(s);

4) objectives, targets or other elements of the water efficiency management system, consistent with the organization's commitment to continual improvement;

5) the allocation of resources.

The organization shall retain documented information as evidence of the results of management reviews.

NOTE See A.14 for more information.

10 Improvement

10.1 Nonconformity and corrective action

When a nonconformity occurs, the organization shall:

a) react to the nonconformity and, as applicable:

   — take action to control and correct it;

   — deal with the consequences;

b) evaluate the need for action to eliminate the cause(s) of nonconformities, in order that it does not recur or occur elsewhere, by:

   — reviewing the nonconformity;

   — determining the cause of the nonconformity;

   — determining if similar nonconformities exist, or could potentially occur;

c) implement any action needed;

d) review the effectiveness of any corrective action taken;

e) make changes to the water efficiency management system, if necessary.

Corrective actions shall be appropriate to the effects of the nonconformities encountered.

The organization shall retain documented information as evidence of:

1) the nature of the nonconformities and any subsequent actions taken;

2) the results of any corrective action.

NOTE See A.15 for more information.

10.2 Continual improvement

The organization shall continually improve the suitability, adequacy and effectiveness of the water efficiency management system.

This will be achieved if the organization takes into account the outputs of the evaluation and the management review to determine the needs or opportunities for improvement.

Annex A
(informative)

Guidance on the use of this document

A.1 General

Each of the following subclauses includes a reference to the corresponding clause in the main body of the text in this document.

The implementation of a water efficiency management system specified by this document is intended to result in improved water efficiency. Therefore, this document is based on the premise that the organization will periodically review and evaluate its water efficiency management system in order to identify opportunities for improvement and their implementation. The organization is given flexibility in how it implements the water efficiency management system; for example, the rate, extent and timescale of the continual improvement process are determined by the organization. The Plan – Do – Check – Act (PDCA) continual improvement framework to deliver results that will improve water efficiency in accordance with the organization's water efficiency policy is illustrated in Figure A.1.

The concept of scope and boundaries gives an organization the flexibility to define what is included within the water efficiency management system.

The key concepts of water efficiency include water use and the water efficiency indicator. Thus, the organization can choose from a wide range of water efficiency efforts. For example, the organization could include recycling systems or improve the operation of its systems, processes or equipment.

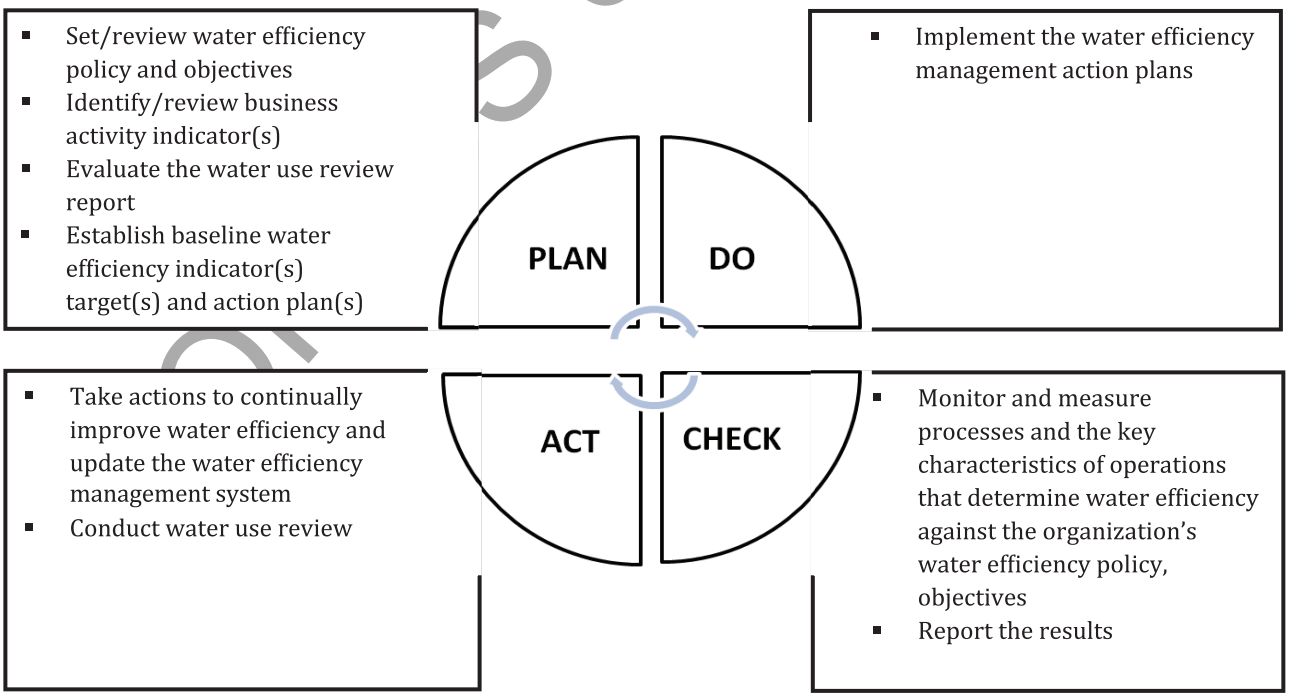


Figure A.1 — The PDCA cycle adapted to water efficiency management

A.2 Understanding of the organization and its context

To understand an organization and its context, the organization's main business and its water-related issues and the cost and impacts created by these issues should be analysed.

A.3 Identification and engagement of interested parties

To identify the group of interested parties, it is important to consider who is affected or involved in the water efficiency activity. This can include relevant authorities, suppliers, contractors and customers.

The interested parties should be informed of the water efficiency policy, water efficiency management system or other information.

The organization should engage interested parties in water efficiency in any function in which their involvement could be relevant, taking into account that:

a) some interested parties may have legal or ethical entitlement to consultation;

b) the precise form of interested parties' identification and engagement can depend on the size and complexity of the organization and its context at a particular time.

The organization should identify parties:

1) that have a particular stake or can claim interest;

2) whose decisions could have a significant impact;

3) that have crucial information or necessary expertise;

4) that are entrusted with or can contribute to awareness-raising or communication.

Effective involvement does not imply involving all interested parties in all phases of the engagement process.

A.4 Leadership and commitment

Top management, or its representative, when communicating within the organization, should emphasize the importance of water efficiency management through employee involvement activities such as empowerment, motivation, recognition, training, rewards and participation.

Organizations conducting long-term planning can include water efficiency management considerations such as water source and water efficiency improvements in the planning activities.

The following activities should be undertaken to demonstrate consistency in implementing the requirements:

a) ensuring that water use and efficiency objectives and targets are established in the water efficiency policy;

b) defining appropriate measures for the organization to establish its water efficiency;

c) identifying business activity indicator(s) to establish its water efficiency indicator(s);

d) attributing responsibility for implementation, supervision and monitoring;

e) drawing up action and business plans;

f) establishing an implementation schedule.

A.5 Policy

The water efficiency policy is the driver for implementing and improving an organization's water efficiency management system and water efficiency within its scope and boundaries. The policy can be a brief statement that members of the organization can readily understand and apply to their work activities. The water efficiency policy dissemination may be used as a driver to manage organizational behaviour.

A.6 Organizational roles, responsibilities and authorities

The management representative may be a current or contracted individual. The responsibilities of the management representative may represent all or part of the job function. Skills and competencies may be determined with respect to an organization's size, culture and complexity, or to legal or other requirements.

The aim of the team driving water efficiency is delivery of water efficiency improvements. The size of the team is determined by the complexity of the organization.

For small organizations, it may be one person, such as the management representative. For larger organizations, a cross-functional team can provide an effective mechanism to engage different parts of the organization in the planning and implementation of the water efficiency management system.

A.7 Water efficiency management planning

A.7.1 General

Figure A.2 shows the basic concepts of water efficiency planning and provides a conceptual diagram intended to improve understanding of the water efficiency planning process. This diagram is not intended to represent the details of a specific organization. The information in the water efficiency planning diagram is not exhaustive and there may be other details specific to the organization or to particular circumstances.

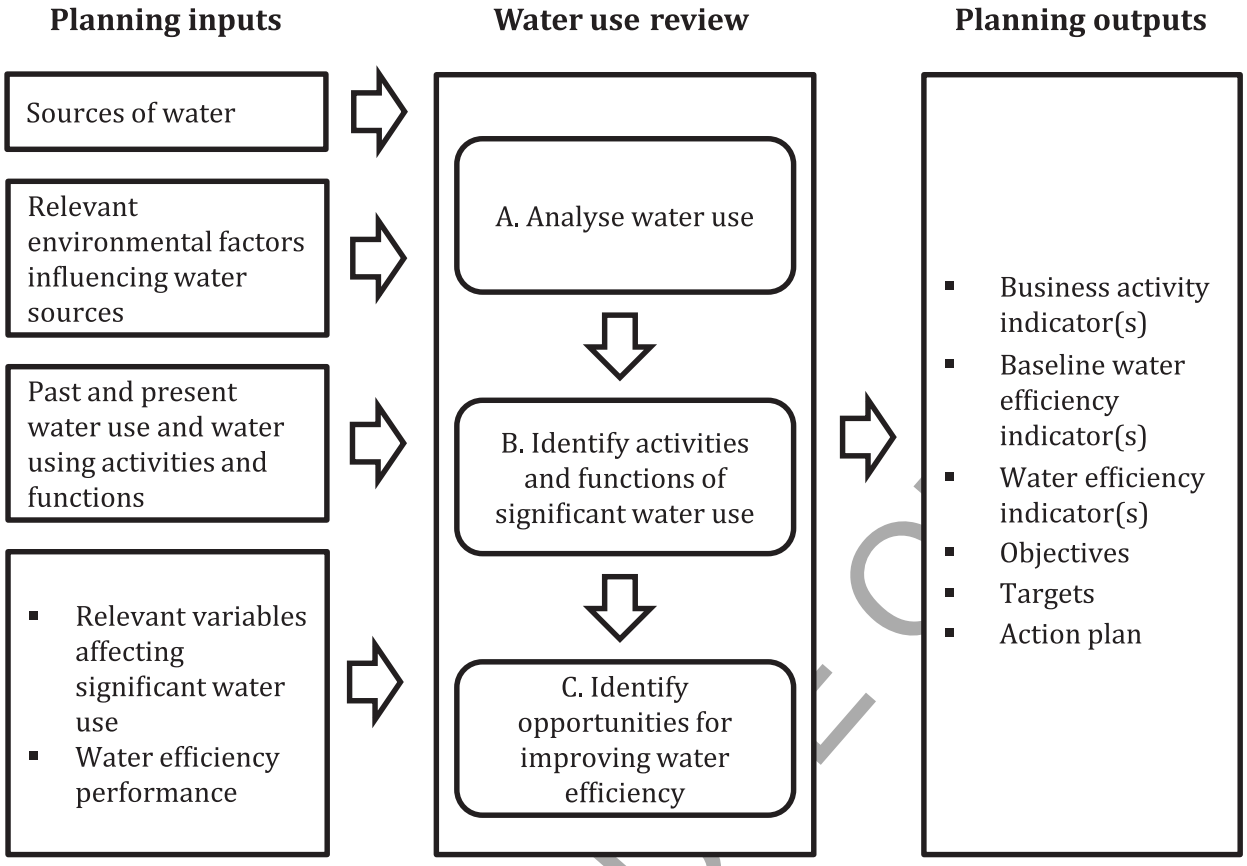


Figure A.2 — Water efficiency management planning process conceptual diagram

A.7.2 Legal requirements or other requirements

Applicable legal requirements or other requirements could be, for example, those international, national, regional and local requirements that apply to the scope of the water efficiency management system related to water use, water efficiency, wastewater discharge and pollution control.

Examples for requirements may include national, regional or local water supply regulations, sewerage and drainage regulations, and sewerage and drainage (trade effluent) regulations or agreements with customers, codes of practice, voluntary programmes, industry sector guidelines and others.

A.7.3 Water use review

The process of identification and evaluation of water use should lead the organization to define activities and functions of significant water use and identify opportunities for improving water efficiency.

Examples of personnel working on behalf of the organization include service contractors, full and part-time personnel and temporary staff.

Potential sources of water can include sources not previously, or not currently, used by the organization. Alternative water sources may include but not be limited to reclaimed water, grey water, rain water and sea water.

Updating the water use review means updating the information related to the analysis of significant activities and functions of water use and water efficiency improvement opportunities.

The review comprises an analysis of water efficiency of an organization in respect of each function or activity using water, including both process water and water consumed by the process. It is typically

based on appropriate measurement and observation of actual water efficiency. Water use review is planned and conducted as part of the identification and prioritization of opportunities to improve water efficiency.

Review outputs typically include information on current water use and water efficiency, accompanied by a series of ranked recommendations for improvement in terms of water efficiency.

Water use review could take into consideration the recovery of resources such as chemicals contaminating used processed water. This could present one or more opportunities (e.g. water reuse; discharge compliance improvement; alternative discharge routes.)

A.7.4 Business activity indicator(s)

Business activity indicator(s) is a measure of business activities that takes into account core business operations specific to the site such as quantum of product, floor area (e.g. gross floor area, lettable area, and construction floor area), number of employees or hotel rooms. Variations in the business activity indicator(s) will influence water use (including any water consumed) and will also determine the specific water efficiency indicator(s) such as water use per unit of product, water use per unit floor area, water use per guest room or water use per person.

A.7.5 Water efficiency indicator(s)

Water efficiency indicator(s) may be a simple parameter, a simple ratio or a complex model. Examples of water efficiency indicator(s) may include water use per unit of product, water use per unit floor area, and multi-variable models. The organization may choose water efficiency indicator(s) that indicate the water efficiency of their operation and may update the water efficiency indicator(s) when changes occur in business activities or baseline, affecting the relevance of the water efficiency indicator(s) to the organization, as applicable. In the computation of the water efficiency indicator(s), all types of water should be included.

A suitable data period should account for legal requirements or other requirements or variables that affect the organization's water use. Variables may include weather, business activity cycles and other conditions.

A.7.6 Baseline water efficiency indicator(s)

The baseline water efficiency indicator(s) is maintained constant, and recorded as a means for the organization to determine the documented information's maintenance period. The adjustments to the baseline(s) are also considered maintenance and the requirements are defined in this document.

A.7.7 Targets and action plans

In addition to action plans focused on achieving specific improvements in water efficiency, an organization may have action plans that focus on achieving improvements in overall water efficiency management or improvements in the processes of the water efficiency management system itself.

Action plans for these types of improvements should state how the organization will verify the results achieved by the action plan. For example, an organization may have an action plan designed to improve its water recycling rate [see Formulae (C.3) and (C.5)]. The extent to which the action plan achieves the improved recycling rate should be verified using the method determined by the organization and documented in the action plan.

A.8 Support

A.8.1 Resources

Resources should be provided to successfully implement the water efficiency management system. The organization should assess the requirements in the planning stage and document the provision of necessary resources.

A.8.2 Competence

The organization should define current and required competence, training and awareness requirements based on its organizational needs.

A.8.3 Communication

The organization should implement a procedure for communicating internally and externally, in whole or in part, its water efficiency policy, water efficiency management system and water efficiency performance or other information, based on its own needs and the needs of interested parties. Interested parties may include, for example, customers, contractors, suppliers and relevant authorities.

A.9 Documented information

The only procedures that have to be documented are the ones that are specified as documented procedures.

The organization may develop any additional documented information that it deems necessary to effectively demonstrate water efficiency and support the water efficiency management system.

It is recommended that procedures be established and documented for distribution, storage, access control, control of changes and disposition of any document.

The organization should establish, implement and maintain information, in paper, electronic or any other medium, to describe the core elements of the water efficiency management system and their interaction.

The water efficiency management system's documented information should include:

a) the scope and boundaries of the water efficiency management system;

b) the water efficiency policy;

c) water use and water efficiency objectives, targets and action plans;

d) water efficiency management plan, i.e. water use and action plans;

e) internal audit, management review and corrective actions' results;

f) other documented information as required by this document and details of legal requirements or other requirements as determined by the organization to be necessary.

A.10 Operation planning and control

An organization should identify and evaluate any of its functions and activities associated with significant water use, wastewater discharge or pollution and ensure that those functions are conducted in a way that will control or reduce the adverse impacts associated with them. This will enable the organization to fulfil the requirements of its water efficiency policy and meet its objectives and targets. This should include all parts of its processes, operations and maintenance activities.

It is recommended that organizations consider water efficiency performance when planning for contingencies, emergency situations or potential crises.

A.11 Procurement of water services, products, equipment and water

Water efficiency improvements can be achieved through the procurement and use of more efficient services, products and equipment. It is also an opportunity to work with the supply chain and influence its water efficiency.

Elements of purchasing specification should reflect water efficiency matters and could include water quality, availability, cost structure, environmental impact and alternative sources.

A.12 Monitoring, measurement, analysis and evaluation

An early step to improving water efficiency is to install separate water meters in dedicated areas to quantify key water-using activities and functions and to monitor water use on a regular basis.

Measurement may range from only water meters up to complete monitoring and measurement systems connected to a software application capable of consolidating data and delivering automatic analysis. It is up to the organization to determine the means and methods of measurement.

The organization should ensure that the equipment used in monitoring and measuring key characteristics provide data which are accurate and repeatable. Documented information regarding establishing measurement accuracy and repeatability should be maintained where applicable.

The organization should investigate and rectify significant deviations in water efficiency performance, including reviewing its water use and updating its action plan in the water efficiency management plan if necessary and possible.

For water meters, the organization should ensure that verification/validation tests are carried out periodically (e.g. once every 5 years) or per frequency recommended by the meter manufacturer or supplier, whichever is more stringent, to ensure the accuracy of water meters (e.g. within ± 3 %). Full documented information of the measurements should be maintained.

Measurement accuracy and the level of uncertainty should be taken into account when interpreting and reporting water use data and water efficiency indicator(s).

Monitoring of water use can be carried out:

a) manually through manual recording of the meter readings; or

b) remotely through linking the data obtained from the flowmeters or water meters with automated meter reading (AMR) capability to a computerized control system utilized for the data collection and monitoring.

The computerised control system should include but not be limited to the following:

1) trending of the data collected [the trending data can be exported in comma-separated values (csv) format or other equivalent open file formats];

2) ease of use of interfaces for monitoring, analysis and evaluation;

3) provision of suitable alarms (i.e. to identify abnormal water use) and to provide accurate alerts (i.e. to indicate system health, battery failure, tampering or communication failure);

4) water balancing between water supply data and water-using activities and functions;

5) other requirements essential to the improvement of water efficiency within the premises.

Data collection should be performed periodically (e.g. hourly, daily, weekly). This frequency should be determined by the organization to be suitable for measuring and understanding the impact of the relevant variables on water efficiency performance.

Water is used widely in most business activities. Table A.1 indicates areas within business activities where water use can be significant, and in which monitoring can be beneficial in order to achieve water efficiencies.

Table A.1 — Areas in which water use can be monitored

Industry sector	Water use areas
1. Industries	(a) Process (b) Cooling tower (c) Boiler (d) Scrubber (e) Cooking area or kitchen (f) Toilet
2. Hotels	(a) Guestroom (b) Cooling tower (c) Food and beverage outlet (d) Production kitchen (e) Laundry (f) Cold water inlet to hot water supply or boiler (g) Swimming pool
3. Tertiary institutions, prisons, or military or defence installations	(a) Cooling tower (b) Toilets at each block (c) Washing area (d) Swimming pool
4. Hospitals	(a) Cooling tower (b) Toilets, wards and operating theatres for each block (c) Kitchen (d) Cold water inlet to hot water supply or boiler
5. Workers' dormitories	(a) Toilets for each block (b) Cooking area (c) Laundry (d) Washing area
6. Construction sites and concrete batching plants	(a) Construction activity (b) Recharge well (c) Concrete production (d) Toilet (e) Vehicle washing area

Table A.1 *(continued)*

Industry sector	Water use areas
7. Sports and recreational facilities and tourist attractions	(a) Cooling tower (b) Exhibit or enclosure (c) Washing area (d) Toilet (e) Food and beverage outlet (f) Irrigation (g) Swimming pool
8. Offices or retail buildings, or any other building not mentioned in items 1 to 7	(a) Cooling tower (b) Toilet

To maintain and continually improve water efficiency, benchmarking can be used as a tool. It is the process of collecting, analysing and relating water efficiency data of comparable activities with the purpose of evaluating and comparing water efficiency performance between or within entities. Different types of benchmarking exist, from internal benchmarking, in order to establish "industry/sector best practice" through to establishing a water efficiency indicator for an installation/facility or for a specific product/service in the same field or sector.

The benchmark process can be applied to any or all of these elements. Provided relevant and accurate data are available, benchmarking is a valuable input to an objective water use review (see 6.2.3), and consequent setting of water use and water efficiency objectives and targets (see 6.3).

A.13 Internal audit of a water efficiency management system

Internal audits of a water efficiency management system can be performed by personnel from within the organization (first party audit), or by external persons (second party audit) selected by the organization, working on its behalf. In either case, the persons conducting the audit should be competent and in a position to act impartially and objectively. In smaller organizations, auditor independence can be demonstrated by an auditor being free from responsibility for the activity being audited.

If an organization wishes to combine audits of its water efficiency management system with other internal audits such as energy audits, the intent and scope of each should be clearly defined.

The water use review (A.7.3) is not the same conceptually as an internal audit of a water efficiency management system or an internal audit of the performance of a water efficiency management system.

A.14 Management review

The management review should cover the scope of the water efficiency management system, although not all elements of the water efficiency management system need to be reviewed simultaneously. The review process can occur over a period of time. The review should make recommendations for improvement and check performance against targets and objectives.

A.15 Nonconformity and corrective action

Nonconformities occur because of non-fulfilment of requirements and should be evaluated in terms of their significance for each issue and its potential impact. The organization should identify the source(s) of each issue and should eliminate the causes of nonconformities.

There are many ways to determine the causes of nonconformity. The organization should ensure that the people involved in investigating and resolving nonconformities are competent, experienced and

knowledgeable. Effective implementation of corrective actions ought to ensure that nonconformities do not reoccur.

Annex B
(informative)

Examples of water efficiency scenarios

This annex gives examples of scenarios each having the possibility to improve water efficiency.

B.1 Case 1 — Optimization of manufacturing processes

A manufacturing facility uses approximately 50 000 m^3/month of water to produce 25 000 units of product A. The facility has calculated its baseline water efficiency indicator to be 2 m^3/unit/day. By optimising manufacturing processes, it achieves the following:

a) The facility reduces the water use to 40 000 m^3/month, resulting in 20 % water savings.

b) The facility produces 40 000 units of the product per month, while the water use remains the same at 50 000 m^3/month. Thus, the facility uses the same volume of water in an improved manner to produce more goods or services. The water efficiency indicator has reduced 37,5 % from 2 m^3/unit/day to 1,25 m^3/unit/day.

B.2 Case 2 — Reduction in pollutant load via segregation

A manufacturing facility uses approximately 50 000 m^3/month of water and discharges almost the same volume of trade effluent with an average chemical oxygen demand (COD) of 1 000 mg/l. Through better segregation of waste stream, 10 000 m^3/month of less polluted water with COD of 500 mg/l can be reclaimed, thus reducing the monthly water use.

B.3 Case 3 — Recycling of process water

A manufacturing facility uses approximately 50 000 m^3/month of water to produce 25 000 units of a product X. With modifications to the production line and through recycling of water from production line X, the facility is able to produce 5 000 units of a new product Y while maintaining the same water use of 50 000 m^3/month. Thus, the facility uses the same volume of water in an improved manner to produce additional or different types of goods.

B.4 Case 4 — Recycling of non-process water

a) Cooling tower blowdown

A facility uses approximately 40 000 m^3/month of water for its cooling tower, of which 5 % goes to cooling tower blowdown. With ultrafiltration and reverse osmosis (RO) treatment system in place, 70 % of the water used by cooling tower blowdown can be recovered, resulting in water savings of approximately 1 400 m^3/month.

b) Wastewater discharge from local scrubbers

A manufacturing facility uses approximately 50 000 m^3/month of water for production. By adopting filtration and reverse osmosis membrane technology with an appropriate dosing/ion exchange system, the facility is able to achieve approximately 60 % to 70 % recovery of the water used from the local scrubber to be recycled for use in the local scrubber and cooling tower.

B.5 Case 5 — Use of alternative water

A manufacturing facility uses approximately 50 000 m^3/month of drinking water for various purposes. By using 10 000 m^3 of alternative water (e.g. sea water, air handling unit condensate, rainwater) for its cooling purposes, the facility reduces the intake of drinking water to 40 000 m^3/month.

B.6 Case 6 — Use of water-efficient fittings, apparatus, appliances and products

The facility uses approximately 100 m^3/month for its staff usage (e.g. toilet flushing, pantry, basin taps). By installing water-efficient fittings, the facility saves approximately 15 m^3/month.

B.7 Case 7 — Optimization of cooling tower operations

Cooling towers can consume large volumes of water due to high evaporation and drift losses. By adopting water-efficient design at the cooling towers and water-efficient practices during building operations, it is possible to reduce the use of the makeup water. The following design criteria can be considered:

a) minimization of drift through the installation of high-efficiency drift eliminators and an enclosure of the area above the cooling tower pond to reduce the effects of windage that cause the drift to escape through the sides;

b) reduction in the blowdown rates and/or chemical by-products via the installation of side stream water filters to remove the suspended solids;

c) maximization of total chiller plant efficiency by the installation of variable drive-speed fans which can match fan speed to actual cooling load;

d) monitoring of water use by the installation of water meters on make-up and blowdown lines;

e) achieving high cycles of concentration while meeting water quality requirements;

f) adoption of energy-efficiency measures to reduce cooling load, such as setting/increasing the temperature of air-conditioning systems or switching off air-conditioning systems when not in use.

In addition, alternative sources of make-up water could be considered, including:

1) reclaimed or recycled water;

2) condensate water;

3) reverse osmosis reject;

4) final rinse water or treated wastewater from the production process.

For cooling tower operations that use surface water sources/sea water for single pass cooling processes, care should be taken to ensure the returned water does not create thermal plumes in the receiving surface water that would adversely affect the aquatic populations inhabiting the surface water.

B.8 Case 8 — Climate-controlled smart irrigation installations

a) In a field trial, 40 climate-based “smart” controllers were installed in the homes of high water users (the top 23 % of all residential water users) in the Westpark Village community of Irvine, California. Results showed that the climate-based “smart” controllers reduced outdoor water use by an average of 16 %, and have the potential to reduce it by as much as 24 %.

b) Studies in Boulder, Colorado, comparing water use at both residential and business sites before and after installation of a climate-based “smart” controller found an average saving of 130 m^3 of water per site, per year (based on an average landscape size of 800 m^2).

Annex C
(informative)

Guidance on the development of a water balance chart

After carrying out a water use review, an organization should be able to develop its own water balance chart. A water balance chart compares the total water supplied to the site to the actual water use at the equipment and process level. It will allow an organization to identify activities and functions of significant water use and problem areas, including leaks and uncontrolled losses. In order to develop an accurate water balance chart, it is desirable to measure the amount of water use.

Water input to be included in a water balance chart consists of types and quantities of:

a) water supplied by a water utility to the site;

b) other water sources (e.g. sea water, demineralised water, ground water, reclaimed water, rain water).

Water output to be included in a water balance chart consists of types and quantities of:

1) water that is lost through evaporation and drift from the facility, for example cooling towers;

2) water that is contained in the facility's products, for example beverage;

3) water use for irrigation;

4) used water discharged from the facility into the sewer system, which includes foul wastewater and effluent from any on-site wastewater treatment facility;

5) water lost through leaking assets, including piping systems and ancillary infrastructure, or water used for general property and facility cleaning processes.

Besides information on these streams, the water balance chart should also indicate:

i) recycling streams from source to destination and the recycling rate if recycling is carried out;

ii) locations of water meters.

The water balance equation can be represented by Formula (C.1):

$$W_{in} = W_{out} \quad \text{(C.1)}$$

where

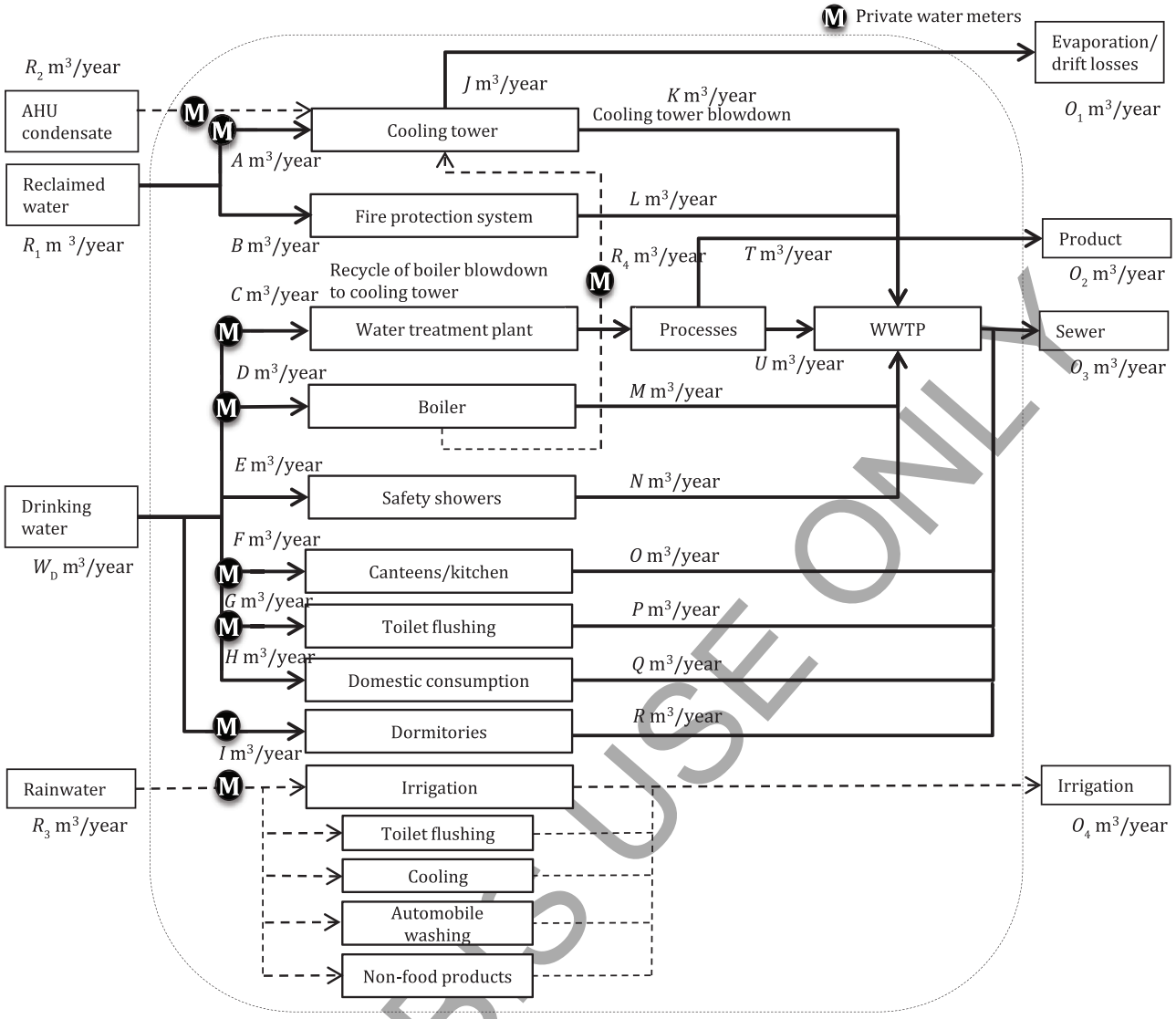
W_{in} is total water input;

W_{out} is total water output.

Should total water input exceed total water output, the difference could be due to leaks and uncontrolled losses.

Figure C.1 provides an example of a water balance chart.

Figure C.2 illustrates how the recycling rate can be computed.



Key

AHU air handling unit

WWTP wastewater treatment plant

Figure C.1 — Example of a water balance chart

The water balance can be computed using Formula (C.2).

$$W_{in} = W_{out} \tag{C.2}$$

$$W_D + R_1 + R_2 + R_3 = O_1 + O_2 + O_3 + O_4$$

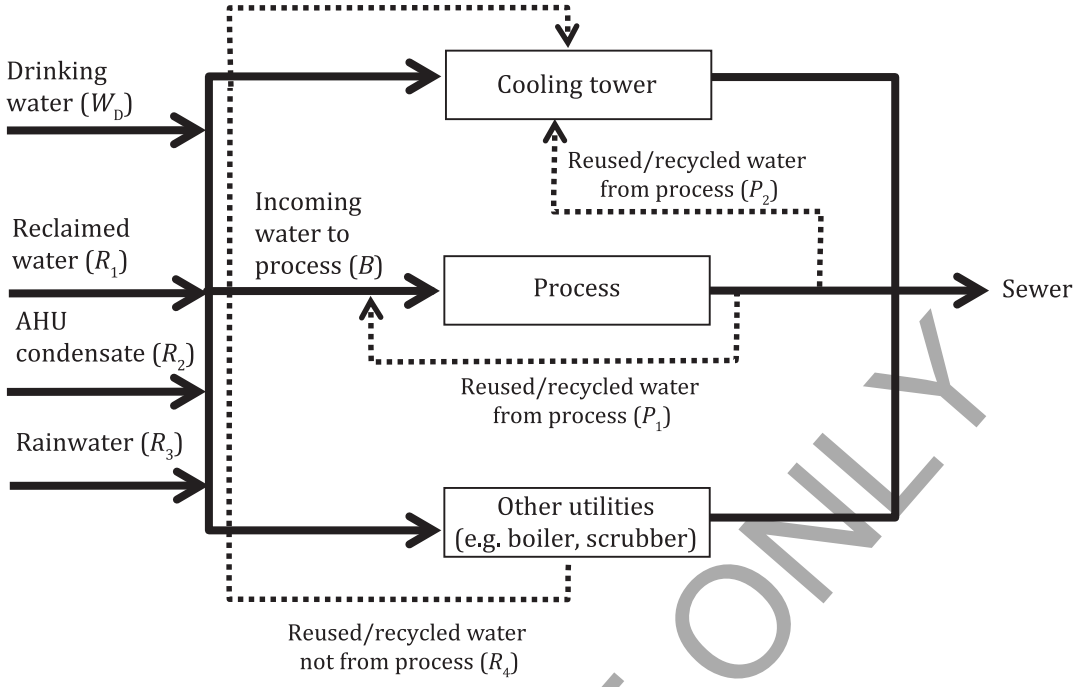


Figure C.2 — Illustration for the computation of recycling rate

The plant/premises recycling rate (%) calculated by Formula (C.3) looks at all reused/reclaimed streams within the premises.

$$\frac{R_p + R_{np}}{R_p + R_{np} + W_D} \times 100\,\% \tag{C.3}$$

where

R_p is total reused/recycled water from the process;

R_{np} is total reused/recycled water not from the process;

An example of the plant/premise recycling rate, based on Figure C.2, is illustrated in Formula (C.4).

$$\frac{P_1 + P_2 + R_1 + R_2 + R_3}{P_1 + P_2 + R_1 + R_2 + R_3 + R_4 + W_D} \times 100\,\% \tag{C.4}$$

The process recycling rate (%) shown in Formula (C.5) only looks at reused/reclaimed streams within the process.

$$\frac{R_p}{W_p + R_{pp}} \times 100\,\% \tag{C.5}$$

where

R_p is total reused/recycled water from the process;

W_p is incoming water to process;

R_{pp} is reused/ recycled water from process back to process.

An example of the process recycling rate, based on Figure C.2, is illustrated in Formula (C.6).

$$\frac{P_1 + P_2}{B + P_1} \times 100\,\% \tag{C.6}$$

Annex D
(informative)

Examples of business activity indicators

Table D.1 — Examples of business activity indicators for industry sectors

Industry sector	Business activity indicator(s)
Wafer fabrication	Number of units produced
Semiconductor	Number of units produced
Electronics	Number of units produced
Chemical and pharmaceutical	Volume or mass of products
Food processing	Volume or mass of products
Other manufacturing	Volume, mass or number of units produced as relevant to the manufacturing activity
Mining	Mass of ore produced
Pulp and paper	Mass or number of rolls produced
Wood	Amount of products produced
Power generation	Energy produced
Agriculture	Volume or mass of raw food products
Livestock	Number of head of processed meat
Incineration plant	Mass of waste processed
Petrochemical/refinery	Mass/volume of chemicals produced and/or mass/volume of throughput
Laundries	Mass of washloads
Tree nurseries	Number of seedlings
Data centres	IT equipment energy load
Shipyards	Number of ships/oil rigs serviced, repaired or built
Commercial/office buildings	Number of staff and visitors (calculate the full-time equivalent for visitors)
Retail	Number of staff and visitors (calculate the full-time equivalent for visitors)
Institutions/schools	Number of staff/students and visitors (calculate the full-time equivalent for visitors)
Hospitals	Number of staff and occasional occupants (calculate the full-time equivalent for occasional occupants, e.g. inpatients/outpatients/visitors)
Hotels	Number of occupied guestrooms
Prisons	Number of staff and inmates and visitors (calculate the full-time equivalent for visitors)

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