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Smart water management —

Part 1: General guidelines and governance

Gestion intelligente de l'eau —

Partie 1: Lignes directrices générales et gouvernance

FDIS stage

Contents

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~~document 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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This document was prepared by Technical Committee ISO/TC 224, *Drinking water, wastewater and stormwater systems and services*.

A list of all parts in the ISO 24591 series can be found on the ISO website.

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

In recent years, governments, enterprises and researchers have shown increasing interest in incorporating digital and smart approaches, including sensor monitoring, real-time data transmitting, data processing, artificial intelligence (AI) and real-time controlling, into water systems. The worldwide demand for water from the growing population, increasing urbanization and maintaining the cost of ageing infrastructure drive the growth of the smart water management market.

With the development of smart water management, water utilities are facing increasing challenges in developing an appropriate digital strategy for water, wastewater, stormwater systems and service. First, data silos and electro-mechanical rotating equipment with various communication protocols block systems integration and interoperability. Second, cybersecurity and user data protection are critical considerations when deploying smart water management. Third, managing data for valuable information is the key element in designing and managing a smart water system. Fourth, adopting digital technologies can bring up human resources concerns related to skills gaps, workforce transition and change management.

The digital maturity of water utilities is different but they all need to have digital architecture and general guidelines to develop value systems and governance to adapt to the changing environment and face these new challenges.

While there are some standards on data exchanging and data sharing relating to smart city and smart community infrastructures, standards on smart management in the water and wastewater domain have still to be developed.

This document provides principles and guidelines for smart water management relating to drinking water, wastewater, stormwater systems and services. It is intended to help water utilities decrease operational expenditure, increase workforce efficiency and increase user engagement and satisfaction. It also helps guide a new generation of water utilities during their uptake of digital strategy and integration into water services adapted to their context, ~~as well as accelerate~~and accelerates collaboration with public agencies and other businesses in the smart cities field.

Smart water management —

Part 1: General guidelines and governance

1 Scope

This document provides principles and guidelines for smart water management relating to drinking water, wastewater, stormwater systems and services.

The following are within the scope of this document:

— ~~—~~principles and guidelines for smart water management system design;

— ~~—~~principles and guidelines for operation and maintenance of smart water management systems;

— ~~—~~principles and guidelines for smart water management system governance.

This document applies to all sizes of public or private water utilities that want to design, develop, implement, operate and/or maintain smart water management systems.

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 24513:2019, *Service activities relating to drinking water supply, wastewater and stormwater systems — Vocabulary*

~~*ISO 24536:2019, Service activities relating to drinking water supply, wastewater and stormwater systems — Stormwater management — Guidelines for stormwater management in urban areas*~~

3 Terms, definitions and abbreviated terms

3.1 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 terminology databases for use in standardization at the following addresses:

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

— ~~—~~IEC Electropedia: available at https://www.electropedia.org/

3.1.1
controller
piece of equipment that combines the function of at least the input elements, the comparing elements and the amplifying and signal processing elements for a process control system

[SOURCE: ISO 1213-1:2020, 11.2.5]

3.1.2
~~Cybersecurity~~cybersecurity by design
~~an~~ approach to developing systems, applications~~,~~ or processes with security measures and hardware architecture embedded from the outset, prioritizing the prevention, detection~~,~~ and mitigation of cyber threats throughout the entire ~~lifecycle~~life cycle of the system

3.1.3
data management
process of keeping track of all data and/or information related to the creation, production, distribution, storage and use of e-media, and associated processes

[SOURCE: ISO 20294:2018, 3.5.4]

3.1.4
data repository
functional unit that stores and retrieves data

EXAMPLE A data repository ~~might~~can support services such as search, indexing, storage, retrieval and security.

[SOURCE: ISO/IEC 20944-1:2013, 3.21.13.15]

3.1.5
governance
system of directing and controlling water utilities, corporate governance systems, responsible bodies, relevant stakeholders, relevant authorities and responsible authorities

Note 1 to entry: This includes all of the processes of governing ~~-~~– whether undertaken by the government of a state, by a market or by a network ~~-~~– over a social system (e.g. family, tribe, formal or informal organization,~~ a~~ territory or across territories) and whether through the laws, norms, power or language of an organized society.

[SOURCE: ISO 24540:2023, 3.2]

3.1.6
~~Integration~~integration by design
~~an~~ approach where systems, hardware, applications~~,~~ or processes are developed and deployed with seamless interoperability and communication between components from the outset, fostering efficient and cohesive connections among elements throughout their entire ~~lifecycle~~life cycle

3.1.7
~~IIOT (~~industrial internet of things~~)~~
IIOT
industrial infrastructure of interconnected entities, people, systems and information resources, together with services which process and react to information from the physical world and the virtual world

Note 1 to entry:~~ industrial~~ Industrial internet of things is used to identify the industrial specializations of the *internet of things* (3.1.8~~.~~).

3.1.8
~~IoT (~~internet of things ~~)~~
IoT
infrastructure of interconnected entities, people, systems and information resources, together with services which process and react to information from the physical world and the virtual world

[SOURCE: ISO/IEC 20924:2021, 3.2.~~1~~4]

3.1.9
~~**performance indicator**~~
~~parameter, or a value derived from parameters, which provides information about performance~~

~~Note 1 to entry: Performance indicators are typically expressed as ratios between variables. These ratios may be commensurate (e.g. %) or non-commensurate (e.g. $/m³).~~

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

~~[SOURCE: ISO 24513:2019, 3.9.6]~~

~~**3.1.10**~~
sensor
detector or transducer normally used for measuring quantities and qualities or detecting occurrences

Note 1 to entry: Analogue transducers are sometimes called sensors.

[SOURCE: ISO 1213-1:2020, 11.2.1, modified — Definition revised.]

3.1.~~11~~10
smart city
city that increases the pace at which it provides social, economic and environmental sustainability outcomes and responds to challenges such as climate change, rapid population growth and political and economic instability by fundamentally improving how it engages society, applies collaborative leadership methods, works across disciplines and city systems, and uses data information and modern technologies to deliver better services and quality of life to those in the city (residents, businesses, visitors), now and for the foreseeable future, without unfair disadvantage of others or degradation of the natural environment

Note 1 to entry: A smart city also faces the challenge of respecting planetary boundaries and taking into account the limitations these boundaries impose.

Note 2 to entry: There are numerous definitions of a smart city; however, the definition that is used within TC 268 is the official one agreed to by the ISO/IEC Technical Management Board.

[SOURCE: ISO 37122:2019, 3.4]

3.1.~~12~~11
smart water management
the activity of planning, developing, distributing and managing the use of water resources using an array of information, operations and IoT technologies which are designed to enhance the quality, quantity, efficiency and transparency of the drinking water, wastewater, stormwater and associated services, and make more reasonable and sustainable usage of water resources

Note 1 to entry: Smart water management can be configured selectively or integrally for drinking water, wastewater and stormwater, depending on the situation in each country.

Note 2 to entry: It integrates information and communication technology to monitor water resources, diagnose problems, improve efficiency and coordinate management, transforming the management mode of water business from experience management to data and experience management to help overcome the challenges and provide every citizen with a sustainable water supply.

3.1.~~13~~12
supervisory control and data acquisition
SCADA
system operating with coded signals over communication channels in order to provide control of equipment and to acquire information about the status of the equipment for display or recording functions

[SOURCE: IWA 33-1:2019, 11.6.1.29]

3.2 Abbreviated terms

ADSL	asymmetric digital subscriber line
AI	artificial intelligence
CAPEX	capital expenditure
CMMS	computerized maintenance management system
DCS	distributed control system
DMZ	demilitarized zone
EPON	ethernet passive optical network
FTTB	fibre to the building
FTTC	fibre to the curb
FTTH	fibre to the home
FTTO	fibre to the office
GIS	geographic information system
HDSL	high-speed digital subscriber line
HSE	health, safety, environment
ICT	information and communication technology
~~IIOT~~	~~industrial internet of things~~
~~IoT~~	~~internet of things~~
IT	information technology
LAN	local area network
MSTP	multi-service transport platform
NFC	near field communication
OPEX	operating expenditure
OT	operational technology
PI	performance indicator
PLC	programmable logic controller
PON	passive optical network
PPP	public-private partnership
RTU	remote terminal unit
VDSL	very-high-bit-rate digital subscriber loop
VPN	virtual private network

WLAN wireless local area network

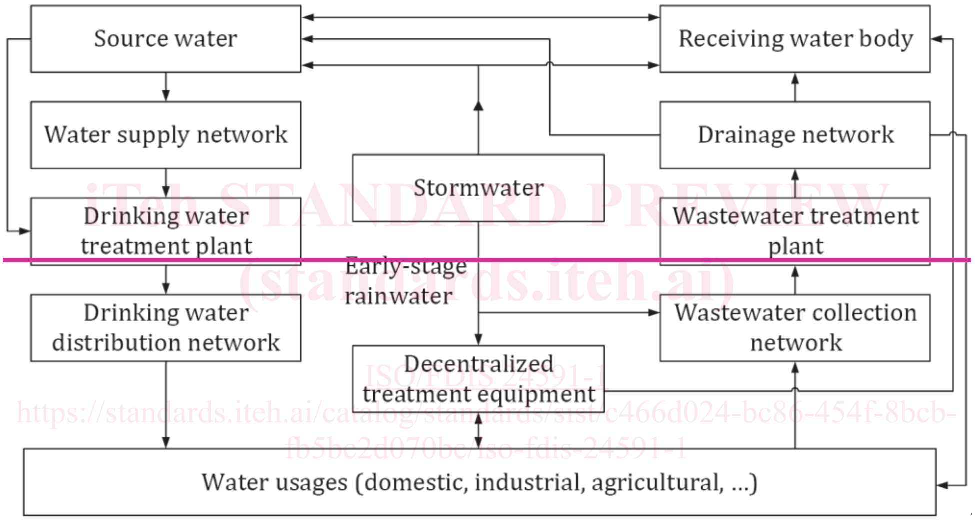
WPAN wireless personal area network

WWAN wireless wide area network

4 General

4.1 Scope for smart water management

Smart water management covers the entire water cycle, linking the source water, drinking water treatment, water supply networks, distribution networks, the users, wastewater collection networks, wastewater treatment plants and the receiving water body. It may also include the collection, decentralized treatment and utilization of stormwater, as well as the reuse of the treated wastewater. Digital technologies and smart solutions can be integrated at every main point to enhance the reliability, safety and efficiency of water management. Figure 1Figure 1 gives an illustration of the scope for smart water management.



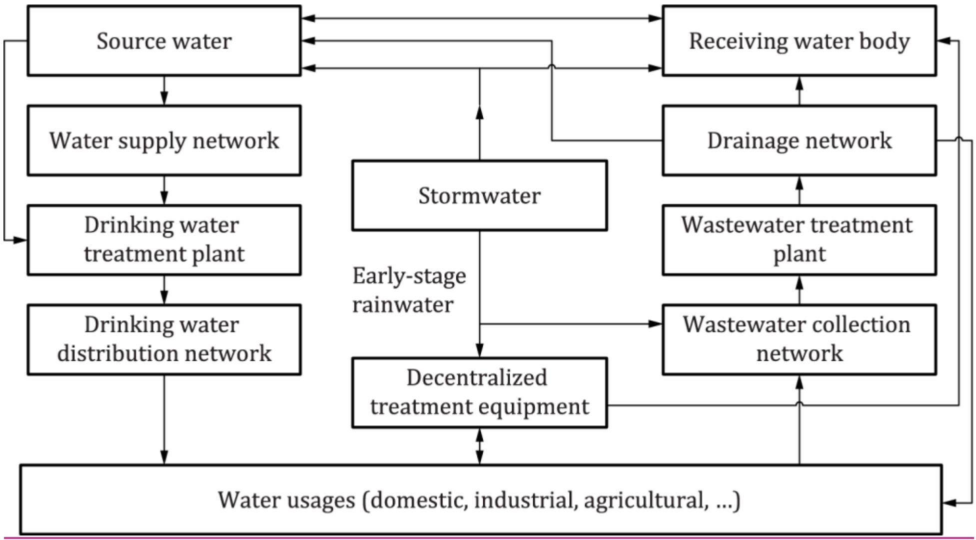


Figure 1 — Illustration of the scope for smart water management

4.2 Challenges and constraints

4.2.1 Stakeholders

The stakeholders typically comprise three categories:

— ~~—~~governments or public agencies (international, national, regional or metropolitan areas and cities) acting with legal or legislative authority;

— ~~—~~water utilities (e.g. international, regional or multinational and national), including drinking water, wastewater or stormwater utilities and their staff;

— ~~—~~users.

Involvement, interaction and coordination between all three of these stakeholder groups is key for qualifying local needs and thus ~~contribute~~contributing to a successful design and implementation of a smart water management system.

4.2.2 Considerations and challenges

With the increase of the digitalization of smart water services management, water utilities are facing increasing challenges to developing an appropriate digital strategy, implementing appropriate and flexible smart drinking water, wastewater or stormwater treatment and management systems, developing data analytics and decision-making and ensuring sufficient cybersecurity protection.

The digital maturity of each water utility is unique; however, the maturity assessment is based on a common set of principles and guidelines which are adapted to their context to develop value and ensure appropriate governance. This is the most efficient way to mitigate environmental, technical and financial risks in a context of ~~rapid~~rapidly developing technology, changing user expectations and an increasing need for collaboration with other businesses within a smart city.

For more than 10 years, smart water platforms and smart water management systems have been deployed in various countries and contexts.

Intelligent warning systems, water loss detection, operation optimization, emergency management and performance assessment are examples of use cases where water authorities and water utilities have deployed smart water management systems.

The deployment of these systems requires the integration of several key digital functions, including sensing, monitoring and control, integration by design, data and information management, modelling and optimization, and cybersecurity requirements. Interoperability is key for implementing, expanding or updating any integrated smart water information management system. Such an integrated system needs to address functionality considerations through effective design.

In the context of drinking water, wastewater and stormwater services' contracting and operational requirements particularly, the impact of smart water management is primarily relevant to governance, data ownership, standards and cybersecurity policies.

There is an increasing need for stakeholder (e.g. user, relevant authority, responsible body, operator, community, environmental association, financial institution) transparency through this sharing of data. The data are typically internal sources, for example PIs, online sensors with external data (e.g. weather forecast, open data), with a growing requirement for these data to be readily shareable in a secure manner with entities outside the water utility.

4.2.3 Constraints

Constraints on smart water management ~~includes~~include water resources, water rights, proposed ~~mode~~modes of service, ~~funder~~funders and installation. Different types of constraints and the main concerns are listed in Table 1~~Table 1~~.

Table 1 — Types of ~~constraints~~constraint and main concerns

