



BSI Standards Publication

Drinking water, wastewater and stormwater systems and services — Adaptation of water services to climate change impacts

Part 4: Wastewater services

National foreword

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**International
Standard**

ISO 24566-4

**Drinking water, wastewater and
stormwater systems and services —
Adaptation of water services to
climate change impacts —**

**Part 4:
Wastewater services**

*Services et systèmes d'alimentation en eau potable,
d'assainissement et de gestion des eaux pluviales — Adaptation
des services de l'eau aux impacts du changement climatique —*

Partie 4: Services d'assainissement

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Contents

Page

Foreword	v
Introduction	vi
1 Scope	1
2 Normative references	1
3 Terms, definitions and abbreviations	1
4 Objectives	3
5 Impacts of climate change on wastewater systems and responses	3
5.1 General	3
5.2 Impacts	3
5.3 Responses	4
6 Methodology	5
6.1 General	5
6.2 Key functions	5
7 Assessment of current situation, vulnerabilities and opportunities	6
7.1 General	6
7.2 Description and characterisation of the current wastewater system	6
7.2.1 Typical assets of a system	6
7.2.2 Governance	6
7.2.3 Strategies	7
7.2.4 Risk management	7
7.2.5 Operation and asset management	7
7.2.6 Metrics and targets	8
7.3 Identification and assessment of current climate-related hazards to wastewater services	9
7.3.1 Current climatic and hydrological conditions	9
7.3.2 Current climate-related hazards	10
7.4 Identification and assessment of current system risks and vulnerabilities	13
7.4.1 General	13
7.4.2 Governance	13
7.4.3 Strategies	13
7.4.4 Risk management	14
7.4.5 Operation and asset management	14
7.4.6 Metrics and targets	16
7.5 Assessment of current system opportunities	16
8 Assessment of future situation, vulnerabilities and opportunities	17
8.1 Identification and assessment of the future climate change hazards	17
8.2 Identification and assessment of future vulnerabilities to the wastewater system	18
8.2.1 Governance	18
8.2.2 Strategies	19
8.2.3 Risk management	19
8.2.4 Operation and asset management	19
8.2.5 Metrics and targets	19
8.3 Assessment of future opportunities	20
9 Financial assessments	20
9.1 General	20
9.2 Financing adaptation	21
9.3 Cost-benefit analysis	21
10 Development of adaptation strategy	22
10.1 General	22
10.2 Adaptation strategies	22
10.2.1 General	22

10.2.2	Governance.....	22
10.2.3	Strategies.....	23
10.2.4	Risk management.....	23
10.2.5	Operation and asset management.....	24
10.2.6	Metrics and targets.....	24
10.3	Assessment of revised system.....	24
10.4	Assessment protocols.....	25
10.5	Implementation.....	25
11	Proposed templates.....	25
11.1	Template for response options and actions.....	25
11.2	Template for response categorisations.....	27
12	Monitor, review and update.....	27
Annex A	(informative) Examples of wastewater management responses.....	29
Bibliography		39

Foreword

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

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, *Drinking water, wastewater and stormwater systems and services*.

A list of all parts in the ISO 24566 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

The occurrence of climate change is recognized globally. Accordingly, mitigation and adaptation programmes have been introduced in many nations, and internationally through a number of agreements.

Locally, operators of water services have had to assess the impacts and options for responding to the effects of climate change, some of which are slow and long-term, while others are acute, arising from extreme weather events and changes.

Drinking water, wastewater and stormwater systems and services — Adaptation of water services to climate change impacts —

Part 4: Wastewater services

1 Scope

This document provides guidance and requirements for identifying and assessing impacts of climate change on wastewater systems and on developing strategies for the adaptation to these impacts. The assessment of the impacts is based on the assessment principles described in ISO 24566-1.

This document also provides examples of some of the impacts of climate change on wastewater systems and of the responses that have been implemented by municipal water services or by the relevant jurisdiction (e.g. municipality or region served by the service). The examples of responses illustrate adaptation strategies that have been applied.

NOTE Both combined and non-combined wastewater systems are included in this document regarding the activities of collection, transport, storage and treatment of wastewater.

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, definitions and abbreviations

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

adaptation to climate change

process of adjustment to actual or expected climate and its effects

Note 1 to entry: In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities.

Note 2 to entry: In some natural systems, human intervention can facilitate adjustment to expected climate and its effects.

[SOURCE: ISO 14030-3:2022, 3.1.4.10, modified — The admitted terms “climate change adaptation” and “adaptation” have been removed.]

3.2

climate risk

potential of negative climate change impacts that reflects the interaction among vulnerability, climate change exposure and hazard

[SOURCE: ISO 14050:2020, 3.8.12, modified — The preferred term “climate change risk” has been removed.]

3.3

data

recorded information

[SOURCE: ISO 22005:2007, 3.11]

3.4

governance

system of directing and controlling

[SOURCE: ISO/IEC 38500:2015¹⁾, 2.8]

3.5

hydrogen sulphide

H_2S

colourless, toxic gas with an odour similar to rotten eggs

[SOURCE: ISO 14532:2014, 2.5.2.3.7]

3.6

methane

CH_4

gas originating from both natural and anthropogenic sources of relevance to the climate that contributes directly to the atmospheric greenhouse effect

Note 1 to entry: Adapted from ISO 25140.

3.7

metric

verifiable measure that captures performance in terms of how something is being done relative to a standard, allows and encourages comparison, supports business strategy

[SOURCE: ISO/TS 18864:2017, 3.20]

3.8

strategy

organization's approach to achieving its objectives

[SOURCE: ISO 30400:2016¹⁾, 3.5]

3.9

wastewater

water arising from any combination of domestic, institutional, commercial, or industrial activities, surface runoff and any accidental sewer inflow/infiltration water and which can include collected stormwater, discharged to the environment or sewer

Note 1 to entry: Wastewater in this document also includes sanitary waste in undiluted form.

Note 2 to entry: Wastewater can flow in separate or combined sewer systems.

Note 3 to entry: In some countries, stormwater is not considered to be part of wastewater.

[SOURCE: ISO/TS 24520:2017, 3.40, modified — Note 3 to entry added.]

1) Withdrawn.

3.10

wastewater system

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

Note 1 to entry: For the purposes of this document, the wastewater system may be a combined or a non-combined system. Combined systems include the collection, transport, and treatment of stormwater.

Note 2 to entry: In some countries, stormwater is not considered to be part of wastewater.

[SOURCE: ISO 24516-3:2017, 3.27, modified — Notes 1 and 2 to entry added.]

4 Objectives

The objectives for this document are to:

- demonstrate how the assessment principles set out in ISO 24566-1 can be applied to the management of wastewater services;
- assist water services to identify, assess, and adapt to expected climate change impacts on wastewater services.

5 Impacts of climate change on wastewater systems and responses

5.1 General

The impacts of climate change on wastewater systems should be established and responses considered.

5.2 Impacts

The impacts of climate change are dependent on the:

- nature and effects of climate change;
- condition of the wastewater system and its assets;
- design parameters of the system and its components;
- nature of the system's service area;
- nature of the wastewater system's catchment;
- operation of the system.

The impacts on wastewater systems include:

- infrastructural capacity problems, including:
 - increased or decreased flows due to changes in water use and wastewater generation;
 - increased levels in receiving waters restricting free gravity discharge;
 - overwhelmed wastewater storage, treatment facilities, receiving water bodies, and land applications;
 - treatment capacity problems from changing water qualities and quantities;
- underused wastewater system, i.e. network, storage, and treatment facilities, due to lower wastewater volumes;

- deterioration due to increased H₂S levels in network;
- infrastructural structural problems, including:
 - subsoil subsidence, changes in subsoil conditions and pipe network damages caused by drought or freeze/thaw cycles;
 - damage or loss of assets due to more intense storms, hurricanes, typhoons;
 - changes in wastewater volumes and flows (decreases and increases);
 - changes in incoming wastewater qualities impacting on treatment processes;
 - treatment capacity problems from changing source water qualities;
 - pluvial flooding from the surrounding areas impacting treatment plants and other above ground assets;
 - damage or risk of damage caused by costal erosion, riverbank erosion or destabilisation of supporting subsoils in the event of landslips;
 - increased health and nuisance problems for staff (e.g. insects and insect-borne disease and other vectors, and odours including those from high H₂S levels due to increased temperatures of effluent);
- operational problems, including:
 - increases in sewer blockages;
 - increased accumulation of settled or attached deposits;
 - increases in odour complaints;
 - increased infiltration flows;
 - increased fouling of asset access equipment (e.g. ladders) and screening equipment;
 - increased need for temporary or standby power generation.

The impacts on the service area of the wastewater system can include:

- risk to lives and public health;
- extensive property damage through flooding;
- damage or loss of infrastructure assets;
- long-term impacts on the development of the service area, including:
 - deterioration of assets;
 - less economic and social development potential;
 - depopulation, social disturbances or diseases caused by climate change.

5.3 Responses

Responses are adaptive responses, and apply to:

- infrastructure;
- operation and maintenance;
- management;
- governance;

- societal behaviour and issues.

Adaptive responses can also have a consequential mitigative character in regard to climate change, i.e. reduce the production of greenhouse gases (GHG). Adaptive responses tend to anticipate longer-term climate change conditions such as continuing higher frequencies of events or longer durations of events beyond the capability to adjust through operational changes.

Adaptive responses can require changes of a continuing nature to:

- wastewater system design;
- infrastructure;
- treatment processes;
- operations and asset management.

Adaptive responses within the structure and management of the organization itself can include:

- risk management including risks due to climate change impacts;
- adapting monitoring and early warning systems to determine climate change impacts;
- adopting a catchment management approach including forming partnerships with other organizations;
- crisis management programs adapted to climate change impacts;
- increasing preparedness and the range of possible actions of urban actors (e.g. communities, public and private enterprises);
- establishing permanent data backup systems outside the risk zones;
- improve data sharing with other affected organisations.

Adaptive response strategies and their development are covered in [Clause 10](#).

6 Methodology

6.1 General

It is recommended that users of this document follow a five-step approach:

- a) understand and assess the current situation, vulnerabilities and opportunities;
- b) assess future situations and vulnerabilities including awareness and communication;
- c) develop adaptative strategies including a target-setting process;
- d) conduct a financial risk assessment;
- e) monitor, review and update.

Individual steps may be repeated as necessary in the methodological process.

6.2 Key functions

Within each step the following key functions should be considered:

- governance;
- strategies;
- risk management;

- operation and asset management;
- metrics and targets.

7 Assessment of current situation, vulnerabilities and opportunities

7.1 General

Users of this document should assess and document the current situation, risks and vulnerabilities, and the opportunities relevant to the wastewater system they manage. The outline in [Clause 7](#) is recommended.

7.2 Description and characterisation of the current wastewater system

7.2.1 Typical assets of a system

The infrastructure assets of a wastewater system typically comprise:

- the pipe networks (collection and mains);
- treatment plants;
- wastewater holding tanks, reservoirs, retention facilities;
- ancillary facilities (e.g. pumping stations, flow control valves, screens and grills, and treatment facilities against H₂S);
- manholes, chambers and access points.

Guidance on the identification, assessment and management of assets and operation is given in ISO 24516-3 and ISO 24516-4.

7.2.2 Governance

In order to make plans for adapting wastewater management to the impacts of climate change, current governance arrangements should be assessed. The assessment should cover the entire service area and, if possible, the entire catchment area, and it should include:

- describing how wastewater is governed currently, including:
 - the organisations responsible for each part of the wastewater system;
 - which organisations are in the catchment area and how they contribute to wastewater management;
- determining what level of development phase best characterises the wastewater system (this can help to determine the most appropriate management or adaptation response to climate change impacts);
- identifying other relevant organisations in the service area or catchment area that can be affected by climate change impacts to the wastewater systems; for example, such organisations can be responsible for or contribute to managing:
 - surface water run-off (e.g. pluvial and fluvial flooding, run-off from roads, sewer backups);
 - wastewater (e.g. non-separated and separated systems, treatment plants);
 - receiving waters;
 - groundwater;
 - irrigation and drainage.

Such organisations can include:

- regulatory authorities;
- governmental entities;
- public organisations or agencies;
- public or private owners or operators
- the community at large.

7.2.3 Strategies

The current management strategies for the wastewater system and their interdependencies (e.g. from or with all relevant organisations) should be identified, documented and reviewed in order to assess their suitability for:

- managing the impacts of climate change;
- identifying gaps in the analysis;
- considering wastewater as a resource (water reclamation or reuse, phosphate recovery, nitrate recovery, ammonia recovery).

The user should review operational strategies and procedures, as well as operation and asset management plans, asset condition and other asset-related information in order to characterise the wastewater system from an operations and asset management perspective.

The user should consider the elaboration of a wastewater master plan taking into account the effects of climate change, if such a plan does not exist.

Guidance on the identification, assessment and management of assets and operation is given in ISO 24516-3 and ISO 24516-4.

Key factors included in operations and asset management include vulnerability to flooding and pollution events, power losses and societal impacts including mental health and post-traumatic stress disorder (PTSD) effects.

Reviews should be performed for each of the critical components involved in the functioning of the system.

7.2.4 Risk management

The current procedures for the identification, assessment and management of climate-related wastewater risks and how they are currently integrated into the overall risk management policies and practices of the system should be described and documented. In particular, the existing procedures and means dedicated to crisis management, and whether they are formalized in emergency action plans or not, should be clearly identified.

Guidance on risk identification and evaluation is given in ISO 24516-3 and ISO 24516-4.

7.2.5 Operation and asset management

The current operation and asset management practices established and followed in the management of the stormwater system should be identified, described and documented.

Guidance on identification, assessment and evaluation of assets and operations is given in ISO 24511 and ISO 24516-3.