Data Collection Manual
for the OECD/Eurostat
Joint Questionnaire on Inland Waters
and
Eurostat Regional Water Questionnaire

Concepts, definitions, current practices, evaluations and recommendations

Version 4.1 (2021)

FOREWORD

The OECD/Eurostat questionnaires on the state of the environment are an attempt to set up worldwide coherent data collections on the main environmental issues. The OECD first established the data collection in 1980 and Eurostat joined the exercise in 1988. The United Nations Statistical Division (UNSD) set up environmental data collections that are on a more reduced scale but entirely compatible with the OECD/Eurostat Joint Questionnaire. The work on statistics for inland waters is covered by the European statistical programme 2021-27 (Regulation (EU) 2021/690) and covers one of the most sensitive environmental topics.

The questionnaires are regularly revised in line with changing needs. The latest major revision sought to improve the internal consistency of the questionnaire, clarify the variables requested, and harmonise terminology with definitions in European Union (EU) water directives and other standards. Increasingly, simplification of reporting and reduction of burden has become an issue: In 2014 and 2016, several tables were either simplified (2, 4, 8) or dropped entirely (1_OF, 1_IF, 6).

Since 2004 Eurostat publishes the *Data Collection Manual for the OECD/Eurostat Joint Questionnaire on Inland Water* to provide guidance, good practices and standards in collecting, estimating and compiling the data required for the Joint Questionnaire on Inland Waters (JQ-IW). It contains a comprehensive description of the terminology and methodology for water statistics, including the various natural and anthropogenic processes in the water cycle, from internal resource generation to water abstractions and discharges. This new version 4.1 (2021) adapts the manual to the current questionnaire structure for tables 3 (reused water) and 8 (secondary treatment of urban and industrial wastewater) and shows an updated version of the freshwater flows scheme.

The objective of this manual is to support those involved in the collection and processing of water-related data for the JQ-IW and regional water questionnaire, and to contribute to harmonising data collection practices and greater international comparability of data.

Eurostat is especially grateful for the efforts and diligence of the teams of experts who drafted the various editions of the manual under Eurostat service contracts.

Jürgen Förster, Eurostat — E2

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ACRONYMS

BAT	Best available technology
BSC	British Shippers' Council
BOD	Biochemical oxygen demand
BOD_5	Five-day biochemical oxygen demand
BOD_7	Seven-day biochemical oxygen demand
BREF	Best available technology reference [documents]
CAMS	Catchment Abstraction Management Strategy
CEN	*Comité Européen de Normalisation* [European Committee for Standardisation]
COD	Chemical oxygen demand
CODIF	*Comité de diffusion*
COFRAC	*Comité français d'accréditation*
DCM	*Data Collection Manual for the OECD/Eurostat Joint Questionnaire on Inland Waters Tables 1-8*
DEM	Digital elevation model
DS	Dry substance
EEA	European Environment Agency
EINECS	European Inventory of Existing Commercial Substances
ELINCS	European List of Notified Chemical Substances
ELV	Emission limit value
EMAS	Eco-Management and Audit Scheme
EPER	European Pollutant Emission Register
E-PRTR	European Pollutant Release and Transfer Register
EQS	Environmental quality standards
ESMS	Euro SDMX Metadata Structure
ET_a	Evapotranspiration (actual)
ET_p	Evapotranspiration (potential)
ETC/WTR	European Topic Centre on Water
Eurostat	European Statistical Office
EU	European Union
FNDAE	*Fonds National pour le Développement des Adductions d'Eau potable*
GIS	Geographical information system
GWAAA	Groundwater available for annual abstraction
HELCOM	Helsinki Commission [Baltic Marine Environment Protection Commission]
IDM	Inductive distance measurement
ILI	Infrastructure leakage index
IPPC	Integrated pollution prevention and control [European Directive]
ISIC	International Standard Industrial Classification
ISO	International Organization for Standardization
ISTAT	Italian national institute of statistics
IWA	International Water Association
JQ-IW	OECD/Eurostat Joint Questionnaire on Inland Waters
JRC	Joint Research Centre [European Commission]
KNMI	*Koninklijk Nederlands Meteorologisch Instituut* [Royal Dutch Meteorological Institute]
LAU	Local Administrative Units
LEI	*Landbouw-Economisch Institut* [Agricultural economic institute]
LTAA	Long-term annual average
MS	Member State [of the European Union]
MWh	MegaWatt hour

NACE	Nomenclature statistique des Activités économiques dans la Communauté Européenne [Statistical classification of economic activities in the European Union]
NSI	National Statistical Institute
NSO	National Statistical Office
NUTS	Nomenclature of Territorial Units for Statistics
OECD	Organisation for Economic Cooperation and Development
ONEMA	*Office national de l'eau et des milieux aquatiques* [National Agency for Water and Aquatic Environments]
OSPAR	Oslo Paris Marine Convention
p.e.	Population Equivalent
PRODCOM	PRODucts of the European COMmunity
PRTR	Pollutant Release and Transfer Register
PWS	Public water supply
Q_{95}	Quantity [regular freshwater resources] available 95 % of the time
RBD	River basin district
RBDSU	River basin district and subunits
RWQ	Eurostat Regional water questionnaire
scm	Standard cubic meter
SDMX	Statistical data and metadata exchange
SEBAL	surface energy balance algorithm for land
SISPEA	*Système d'Information sur les Services Publics d'Eau et d'Assainissement*
SMEs	Small and medium-sized enterprises
SURS	*Statistični urad Republike Slovenije*
SWWA	Swedish Water and Wastewater Association
TIRL	Technical indicator for real losses
TOC	Total organic carbon
TOD	Total oxygen demand
TSS	Total suspended solids
UARL	Unavoidable annual real losses
UN	United Nations
UNECE	United Nations Economic Commission for Europe
UNSD	United Nations Statistical Division
USGS	United States Geological Survey
UWWT	Urban wastewater treatment
UWWTD	Urban Wastewater Treatment Directive (91/271/EEC)
UWWTP	Urban wastewater treatment plant
WFD	Water Framework Directive (2000/60/EC)
WWT	Wastewater treatment
WWTP	Wastewater treatment plant

INTRODUCTION

Dear reader,

The objective of this *Data Collection Manual* (DCM) is to support those involved in the collection and processing of water-related data for the OECD/Eurostat Joint Questionnaire on Inland Waters (JQ-IW) and Eurostat Regional water questionnaire (RWQ) and to contribute to the harmonisation of data collection practices and greater international comparability of data.

This introduction will help you understand the structure of the DCM and find your way around it. Please read it before going too much further...

For ease of use, the structure of the DCM reflects that of the water questionnaires and consists of four parts:

- **Part I** – three chapters on the tables in the JQ-IW and RWQ, with general advice on how to fill them in;
- **Part II** – a chapter on each of the seven JQ-IW tables (each chapter is organised in subchapters according to the same structure) and Chapter 8 on the summary table;
- **Part III** – a chapter on each of the three RWQ tables (each chapter is organised in subchapters according to the same structure); and
- **Part IV** – references and an annex with different examples from different data providers.

Here is a quick overview:

PART I — GENERAL SUPPORT

1. **RECOMMENDATIONS FOR FILLING IN THE WATER QUESTIONNAIRES**
2. **DATA ACCURACY:** advice on general aspects of data accuracies applicable to all water tables (e.g. standards for rounding, number of digits, etc.). The accuracies for standard methods are given under 'good practices' in the respective chapters.
3. **TABLE DESCRIPTION AND INDEX:** this chapter describes the general aim of each table and helps users quickly to find explanations, definitions and good practices for the individual parameters. The index chapter includes a copy of each table, including cross-references to the relevant pages of the DCM, with definitions, decision trees (see explanation below) and good practices.

Chapters with detailed information on each of the seven JQ-IW tables (1-5 and 7-8) and the summary table:

(The structure is the same for each JQ-IW table).

PART II — DETAILED INFORMATION FOR EACH TABLE IN THE JQ-IW

1. **JQ-IW TABLE 1: RENEWABLE FRESHWATER RESOURCES (million m^3)**

1.1. **DEFINITIONS & REMARKS:** This first subchapter provides the definitions of the parameters for the chapter (as also given in the JQ-IW) and additional remarks for a better understanding or further explanation.

1.2. **GENERAL INFORMATION:** This subchapter gives information on the structure of the table in question and on its parameters (definition options, data accuracy, calculation, explanation schemes, etc.), and tips.

1.3. **DECISION TREE:** This helps users find the national institutions or organisations responsible for collecting the relevant data, and the related best practices. The JQ-IW is sent to national statistical institutes (NSIs), which should pass it on to experts or institutions dealing with water-related topics (e.g. environment agencies, hydrological institutes, etc.). The decision trees give an overview of organisations, institutions and experts likely to be involved in data collection and of collections already available within a country (on the basis of reporting obligations) and help the NSI identify relevant contact persons for data collection for the JQ-IW. Cross-referring to the relevant chapters in the DCM, the decision trees give methods for quality-checking the information collected by different institutions and for obtaining missing information.

1.4. **GOOD PRACTICES:** This subchapter explains good practices for data collection and data calculation, and also detailed methods for data quality checks. There is a particular emphasis on practical examples to illustrate the methods. Cross-referencing the index chapter and the decision trees makes it easier to identify the most appropriate methods.

1.5. **SITUATION IN INDIVIDUAL REPORTING COUNTRIES:** This sub-chapter contains examples from reporting countries. These examples describe real situations observed by the countries during the data collection.

Chapters with detailed information on each of the three RWQ tables:

(The structure is the same as for each RWQ table).

PART III — DETAILED INFORMATION FOR EACH RWQ TABLE

1. RWQ TABLE 11: RENEWABLE FRESHWATER RESOURCES (million m^3)

1.1. DEFINITIONS: This first subchapter provides the definitions of the parameters for the chapter.

1.2. GENERAL INFORMATION: This subchapter gives information on the structure of the table in question and on its parameters (definition options, data accuracy, calculation, explanation schemes, etc.), and tips

1.3. DECISION TREE: This helps users find the national institutions or organisations responsible for collecting the relevant data, and the related best practices. Additional information on this sub-chapter is explained above for the JQ-IW part.

1.4. SITUATION IN INDIVIDUAL COUNTRIES THAT REPORT THE RWQ: This sub-chapter contains examples from reporting countries. These examples describe real situations observed by the countries during the data collection.

References and annexes:

PART IV — REFERENCES & ANNEXES

1. **REFERENCES:** the main sources of information are listed here.
2. **ANNEXES:** This section provides additional information and examples for completing the questionnaires.

PART I — GENERAL SUPPORT

1 Recommendations for filling in the Water Questionnaires

What has to be highlighted?

The JQ-IW as well as the RWQ are both sent to NSIs, which often need to seek advice and support from experts or institutions dealing with water-related topics. Such experts (e.g. from ministries, universities, and hydrological institutes) have an in-depth understanding of the data requirements and can provide valuable information on accuracy, comprehensiveness, data sources and collection methods.

It is recommended that the NSI cooperates with external water experts when filling in both water questionnaires (JQ-IW and RWQ).

Ideally, the needed information transfer for the water questionnaires is covered in the national provisions for water data, since there are legal obligations and constraints, financing, environmental issues and public information requirements.

If data on various water parameters are only available for part of the national territory, the **incomplete dataset should be provided** in the questionnaires. In addition, it should be made clear whether the figures given are for only part of the territory, or whether data for the missing part were estimated on the basis of available data, estimation coefficients, etc. These explanations could be given in an accompanying table on data quality (see section 2.4). All information about the recorded or estimated data is a valuable contribution to the water questionnaires.

The DCM includes data examples on **estimation coefficients** for nearly all tables. As (for climatic, geological, economic, social and technical reasons) these differ widely from country to country, they have to be determined individually in each case. Country-specific factors can be derived from data collected via sample surveys and should be updated frequently. Estimation coefficients are therefore included in the DCM only by way of guidance for determining specific locally accurate coefficients and to indicate the orders of magnitude of the coefficients.

Clear advice is given for filling in the questionnaires if data are not available at all (missing) or if the parameter is not relevant in a country (Table 1-1).

Table 1-1: Recommendations on how to fill in the questionnaires

Water-parameter answered with	**Explanation**
0	The parameter is not relevant, of negligibly minor relevance or you know/estimate that the parameter value is zero (e.g. Table 1: for a country that has no border with the sea, total actual outflow into the sea is not relevant, for a country that has no border with another country, actual outflow into the neighbouring territories is not relevant; Table 3: a country has no desalination activity or activity is so minor as to be negligible).
empty cell	No data available at all (missing)
flag Z	Not applicable

2 Data Accuracy

Article 12 (statistical quality) of Regulation (EC) No 223/2009 on European statistics requires that European statistics be developed, produced and disseminated on the basis of uniform standards and harmonised methods. The quality criteria that apply are relevance, accuracy, timeliness, punctuality, accessibility, comparability and coherence.

'Accuracy' refers to the closeness of estimates to the unknown true values.

2.1 Rules for rounding/number of digits

Where imprecise numerical data are reported in tables, there is always a conflict between the indication of computational precision to ensure consistency within the table and rounding to the number of significant digits as justified by the method of determination. In all cases, the range of uncertainty should be indicated in a footnote (see description below).

Correct rounding is recommended for the following reasons:

- Water data are frequently used for international comparison without the range of uncertainty being indicated; and
- Artificial trends and/or fluctuations in time series (where data for consecutive years differ only due to the uncertainty of the estimation method) should be avoided.

Example:

Fresh surface water abstraction for cooling purposes (production of electricity)

On the basis of available coefficients (m^3/MWh), it was possible to calculate 1 826 024 474 m^3 of water abstracted for cooling purposes in 2012. Using approach 1, the figure in the JQ-IW would be 1 826.02 million m^3. The values in previous years were:

2011	2012	2013	2014	2015	2016	2017
1 578.44	1 567.84	1 443.83	1 615.63	1 625.07	1 839.18	1 826.02

As regards the trend, it can be seen that a higher amount of water was used for cooling purposes in 2011 and 2012 than in the years before. However, due to the uncertainty of the numbers (caused by the use of a wide range of coefficients), the difference between the figure for 2010 and that for 2012, for example, is regarded as negligible. If the figures are rounded to the secure digit (approach 2), the table looks like this:

2011	2012	2013	2014	2015	2016	2017
1 600	1 600	1 400	1 600	1 600	1 800	1 800

Recommendation for all water tables: figures should be rounded according to the range of uncertainty (on the basis of the method used) and/or expert judgment. It is important that the figures clearly reflect trends/significant changes.

2.2 Recommendations for producing accurate data

The objective of the questionnaires is to address all possible national and regional circumstances without being over-complex. This has led to some simplifications and may make it difficult to report specific cases. In this event, it is recommended that you find the most similar case addressed in the questionnaire, report the specific case to Eurostat and consult experts to resolve the issue.

Ideally, data collected through the questionnaires are based on measurements and monitoring or surveys and cover 100 % of the parameters requested (i.e. all water abstracted, all discharges, etc.). If this is the case, and the monitoring system or the survey is designed and implemented correctly, data have a high confidence level because they have been obtained through observation of the real situation in the environment, and statistical accuracy/confidence can be derived from the survey method used or uncertainty of measurement method (including use of limit of determination and limit of quantification). However, exhaustive measurement and monitoring of the environment is costly (and sometimes simply not possible). To reduce costs, monitoring systems are often designed to cover only the most significant part for a parameter, and the missing part is estimated, often on the basis of an approximation using models, tools or coefficients to derive the result.

2.3 Accuracy and uncertainty of hydrological information (JQ-IW Table 1 and RWQ Table 11)

The entries in JQ-IW Table 1 and in RWQ Table 11 are spatially and temporally aggregated figures of hydrological variables characterising processes which are in general highly variable in space and time. The data cannot be obtained by statistical surveys, making it difficult to achieve a high degree of certainty, so the parameters are evaluated using estimation methods; these are subject to uncertainty because of:

- (random and/or systematic) measurement errors at the stations;
- error due to a small number of stations (incomplete coverage of spatial variability);
- error due to a large observation interval (incomplete capture of time variability), which is generally not significant for the annual values requested in Table 1 or Table 11; and
- modelling error of integration in space and time.

Of the variables in the water-balance equation for a national territory, precipitation and run-off are usually the only ones with a representative number of observations. Even for these, considerable modelling, based on a thorough understanding of hydrological processes, is necessary to obtain aggregated national figures. The following paragraphs address the most important issues of uncertainty for the main variables. The aim is to enable proper assessment of the reported data rather than water-balance modelling itself.

2.3.1 Areal precipitation

Measurement error at rain gauges is characterised by systematic underestimation, depending on wind speed, precipitation as snow or rain, evaporation, etc. The error may well be in the range of 10-20 %, or up to 50 % where snowfall dominates. In some countries, the meteorological services correct these errors using wind data and the digital elevation model (DEM). The geographical (spatial) representation of the network appears in general to be good, eliminating random errors, but there are not enough stations at high altitudes, resulting in systematic underestimation of areal precipitation (e.g. in the range of 10-15 % for a mountainous watershed in Austria). To limit the modelling error of areal interpolation, the method must be appropriate and should use terrain elevation as an auxiliary variable in mountainous regions (e.g. external drift kriging, co-kriging).

The increased use of automatic stations has improved data accuracy and substantially reduced various categories of error (data collection, transmission, processing, etc.).

2.3.2 Discharge at stream gauges

The measurement error is determined by the rating curves relating discharge and stage measurements. Near the mean discharge, results are reliable, while large relative uncertainties apply for low and high discharges. Uncertain rating curves cause systematic balance errors (both over- and underestimation) for the individual watershed but should behave like random errors for a whole country. In most countries, the important rivers are sufficiently monitored. Problems may occur when distinguishing between basin areas and national territory. There is no particular modelling error if gauges are properly located. The inflows and outflows are then derived by adding up gauge data.

2.3.3 ACTUAL EVAPOTRANSPIRATION (ET_A)

Good point results are collected only at lysimeters ('grass reference evapotranspiration') and can be used to determine empirical relationships for different types of land cover. These data are hardly ever useful for a national water balance, as there are only few stations, while a good coverage with meteorological data is available for indirect estimation (of potential evapotranspiration - ET_p). The modelling error depends heavily on the model: if ET_a is estimated from the water-balance equation, it might have a large relative error due to subtracting large numbers with considerable error, depending on climatic conditions. Process-based water-balance models can achieve good results.

2.3.4 AQUIFER RECHARGE

Measurement error cannot be indicated because there are no direct measurements. The state of a groundwater system is usually monitored by groundwater table observation (under the Water Framework Directive). For larger aquifers, the spatial representation is usually sufficient. Modelling error: estimating recharge requires comprehensive numerical groundwater modelling for each aquifer (coupled surface water/groundwater models), which can produce reliable recharge data.

2.3.5 CONCLUSIONS

The spatially lumped main annual components of the water balance can be estimated reliably with commonly available data and models. Independent, univariate evaluations of water-balance components should be avoided. A simultaneous calibration of all water-balance elements (preferably in process-based models) leads to more consistent results and knowledge of hydrological processes helps to reduce error.

2.4 INDICATING DATA QUALITY

Quality is defined in the ISO 9000 2015 as:

'The adjective quality applies to objects and refers to the degree to which a set of inherent characteristics fulfils a set of requirements. An object is any entity that is either conceivable or perceivable and an inherent characteristic is a feature that exists in an object.'

'Quality management includes all the activities that organisations use to direct, control and coordinate quality. These activities include formulating a quality policy and setting quality objectives. They also include quality planning, quality control, quality assurance and quality improvement.'
(Source: Praxiom)

Based on OECD definition, *'quality is viewed as a multi-faceted concept. The quality characteristics of most importance depend on user perspectives, needs and priorities, which vary across groups of users. Given the work already done in the area of quality by several organisations, notably, Eurostat, IMF and Statistics Canada, the OECD was able to draw on their work and adapt it to the OECD. Thus quality is viewed in terms of seven dimensions, namely:*

- *relevance*
- *accuracy*
- *credibility*
- *timeliness*
- *accessibility*
- *interpretability*
- *coherence.'*

Similar dimensions were defined by Eurostat in 2003 through the following six criteria:

1. *Relevance: an inquiry is relevant if it meets users' needs. The identification of users and their expectations is therefore necessary. In the European context, domains for which statistics are available should reflect the needs and priorities expressed by the users of the European Statistical System (completeness).*
2. *Accuracy: accuracy is defined as the closeness between the estimated value and the (unknown) true value.*

3. *Timeliness and punctuality in disseminating results: most users want up-to-date figures which are published frequently and on time at pre-established dates.*
4. *Accessibility and clarity of the information: statistical data have most value when they are easily accessible by users, are available in the forms users desire and are adequately documented.*
5. *Comparability: statistics for a given characteristic have the greatest usefulness when they enable reliable comparisons of values taken by the characteristic across space and time. The comparability component stresses the comparison of the same statistics between countries in order to evaluate the meaning of aggregated statistics at the European level.*
6. *Coherence: when originating from a single source, statistics are coherent in that elementary concepts can be combined reliably in more complex ways. When originating from different sources, and in particular from statistical surveys of different frequencies, statistics are coherent in so far as they are based on common definitions, classifications and methodological standards.*

Between a request for information and its release, data have to be produced, collected, edited, harmonised and aggregated. The methods used have a great influence on data quality. The correct implementation of this sequence[1] of steps is the main guarantee that real environment conditions are correctly reflected and as close as possible to the 'accurate understanding of environment conditions' (adapted from UNECE, 1996). It is the responsibility of each institution involved in the chain to report in a transparent way the main elements of data quality. However, data quality covers many interrelated aspects, such as relevance, accuracy, coherence or timeliness that may be of varying degrees of importance for specific needs, and any action to address one aspect can affect others (see UNSD, 2012).

Various institutions, such as national reference laboratories but also international bodies (e.g. CEN, ISO and the European Environment Agency (EEA)), are developing tests to assess whether data are fit for their intended purpose. These can range from simple mathematical calculations to the use of additional data on related conditions, such as the type of water meter, weather, soil, etc.

For a standardised compilation of information on data coverage, there is an accompanying table for each JQ-IW and RWQ tables to indicate data quality/accuracy (see Table 2-1 and 2-3 for examples for JQ-IW Tables 4 and 5). The relevant years (represented by different columns) are given and data suppliers have to select the parameters (from a drop-down menu). This enables users of the JQ-IW and RWQ to select those elements for which the data quality can be determined. At the same time, pre-setting JQ-IW elements makes it easier to fill in the table.

Example:

JQ-IW Table 4 – Public water supply, of which used by private households (see Table 2-1)

'Public water supply, of which used by: private households' (JQ-IW Table 4) is composed 65 % of measured data ('M') and 35 % of calculated data ('C'). Total data coverage for the national territory ('T') is 100 %. This is represented by the formula M65+C35=T100.

Measured data are obtained mainly from water meters. For methods for which data accuracy can be determined, the value should be given in brackets.

Hence, the formula can be expressed as follows: M65(5 %)+C35=T100.

[1] This sequence of steps should be taken from the Generic Statistical Business Process Model – under the 'process' portion

Table 2-1: Example JQ-IW Table 4 - Data coverage and methods used

Table 4 — Water use by supply category and by sector	2000	2001	2002	2003	Comments
Public water supply, of which used by: private households	M65(5 %)+C35 = T100	M65(5 %) +C35 = T100	M65(5 %) +C35 = T100	M65(5 %) +C35 = T100	About 65 % of data collected by water association (from water meters), rest calculated on the basis of water-use coefficients (e.g. 130 l/person/day) and census data.

About 65 % of total value based on measurement (5 % standard deviation).

About 35 % of total value based on calculations (standard deviation not known).

Value indicated in JQ IW covers 100 % of territory.

Example: JQ-IW Table 3 – Losses during transport (see Table 2-2)

'Losses during transport – Total' (JQ-IW Table 3) was determined for more than 90 % of the national territory according to the method described in Lambert et al., 2000. This situation is described by the abbreviation 'Lambert90' and the explanation of the abbreviation 'Lambert' in the caption. It was not possible to calculate data for the whole national territory, so only the value derived according to the Lambert method is provided. Total T is therefore indicated as 90.

Table 2-2: Example JQ-IW Table 3 - Data coverage and methods used

Table 3 – Water made available for use	2000	2001	2002	2003	Comments
Losses during transport - Total			Lambert90=T90	Lambert90=T90	

Example: JQ-IW Table 5 – Percentage of resident population connected to urban wastewater treatment, of which secondary treatment (see Table 2-3)

The figure for 'resident population: urban wastewater treatment, of which secondary treatment' (JQ-IW Table 5) covers only 90 % of the population. Information about population connected is available for agglomerations ≥ 2 000 p.e. in line with reporting obligations under the Urban Wastewater Treatment Directive (UWWTD). For agglomerations < 2 000 p.e., data are neither estimated nor calculated.

Table 2-3: Example JQ-IW Table 5 - Data coverage and methods used

Table 5: Population connected to wastewater treatment plants (%)	2000	2001	2002	2003	Comments
Per cent of resident population connected to: urban wastewater treatment, of which: secondary treatment	-	-	UWWTD90 =T90	UWWTD90 =T90	

2.4.1 Abbreviations for data quality

Questionnaires water data providers can provide information on data quality very clearly using abbreviations, and at the same time indicate coverage and data accuracies.

Water data providers have to complete a list of abbreviations used, as the sources of information and the methods used might vary significantly. The caption should be given for all tables.

List of abbreviations used *(in italics: to be filled in individually by the data suppliers)*

Abbreviation	Explanation
T	Total
E	*Estimated**
M	*Measured**
C	*Calculated**
Lambert	*Method used according to Lambert* et al. *(2000).* Losses from Water Supply Systems: Standard Terminology and Recommended Performance Measures. — *IWA blue pages, London, p. 13*
UWWTD	*Reporting obligations under the Urban Wastewater Treatment Directive*
...	

* methods of obtaining data refer to EPER guidance (EC DG Environment, 2000)

2.5 General information for data collection

2.5.1 Standard flags used in water statistics

Flags are added to data to define a specific characteristic and provide supplementary information about statistical values; they are represented by a code (usually a letter) stored in a separate column and shown next to the actual value. **Special values** are codes (usually a special character) which replace the statistical value. The following flags can be used in the JQ-IW and RWQ webforms:

B = break in time series

C = confidential

D = definition differs, see metadata

The d-flag should be used sparingly and only where deemed absolutely necessary. The relevant explanations must be provided in the annex[2] *.*

E = estimated

P = provisional

Z = not applicable

[2] For inclusion by Eurostat in the ESMS (reference metadata) if appropriate

An additional flag can be used in the reference/dissemination database for data estimated by Eurostat:

s = Eurostat estimate

Flags 'C', 'D', 'E', 'P' should be attached to a value. The 'B' flag can be attached to value or to empty cell (= not available). All these flags can be combined with flag 'D' in case additional information need to be provided.

Flag 'Z' is meaningful only when combined with an empty cell.

2.5.2 Reference period

Calendar versus hydrological year

In general, the JQ-IW and the RWQ refer to the calendar year. However, for water balance purposes, a 'hydrological year' is commonly preferred, which helps to overcome problems of estimating storage in snow cover or in the soil zone. In many European countries, the hydrological year starts on 1 October, when soil and groundwater are often low and snow cover has not yet started to accumulate. Please indicate in the questionnaires whether the reported quantities refer to the hydrological year instead of the calendar (default).

Long-term annual averages (LTAAs)

For all items, long-term annual averages (LTAAs) (12) are also requested. These should be based on annual values averaged over at least 30 consecutive years. It is recommended that the methods and basic data for the LTAA values be consistent with those for the annual values.

2.5.3 Economic sector

Data for JQ-IW Tables 4 and 8 are collected by economic activity according to industries (division 00-99) and households. The common statistical classification of economic activities in the European Community as established by Regulation (EC) No1893/2006 of the European Parliament and of the Council (NACE Rev.2) is used. All references made to the NACE in this document concern NACE Rev.2.

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3 INDEX

The aim of this chapter is to provide easy-to-find explanations, definitions and good practices for specific parameters in the questionnaires. Information on a table can be accessed through the hyperlink associated with a given parameter.

3.1 JQ-IW TABLE 1: RENEWABLE FRESHWATER RESOURCES

Table 1 is designed to provide an overview of freshwater resources on the national territory and the flows of which they are composed (internal flow and actual external inflow). By definition, the concept of renewable resources excludes non-renewable resources available from the potential use of water reserves (essentially groundwater).

Table 1: RENEWABLE FRESHWATER RESOURCES (million m^3)			
Parameters (definition number)	**Definition** DCM page	**Decision tree** DCM page	**Good practices** DCM page
Precipitation (1)	30	35	-
Actual evapotranspiration (2)	30	35	36
Internal flow (3)	30	35	-
Actual external inflow (4)	31	35	37
Total actual outflow (5)	31	35	37
into the sea (6)	31	35	-
into neighbouring territories (7)	31	35	-
Total renewable freshwater resources (8)	31	35	-
Recharge into the aquifer (9)	31	35	37
Groundwater available for annual abstraction (10)	32	35	38
Freshwater resources 95 % of years (LTAA only) (11, 12)	32	35	38

3.2 JQ-IW TABLE 2: ANNUAL FRESHWATER ABSTRACTION BY SOURCE AND BY SECTOR

Table 2 seeks to establish the volumes of water abstracted from freshwater resources (surface and groundwater) for different sectors of water use. The aim is to identify the principal sources, establish the proportion of the available freshwater and other resources abstracted, and quantify the distribution of water between use sectors.

The table provides key components for water-use balance (‘Fresh surface and groundwater - Total gross abstraction’, ‘Fresh surface and groundwater - Water returned without use’, ‘Fresh surface and groundwater - Net abstraction’).

Table 2: ANNUAL FRESHWATER ABSTRACTION BY SOURCE AND BY SECTOR (million m^3)

Parameters (definition number)	Definition DCM page	Decision tree DCM page	Good practices DCM page
Fresh surface water (13) Total gross abstraction (15) (NACE 01-99)	39	42	-
Public water supply (16)	39	42	43
Agriculture, forestry, fishing (NACE 01-03)	-	42	46
Irrigation (17)	40	42	-
Aquaculture (18)	40	42	-
Mining and quarrying (NACE 05-09)	-	42	-
Manufacturing industry (NACE 10-33)	-	42	50
Cooling in manufacturing industry (19)	40	42	-
Cooling in electricity production (19) (NACE 35.11-35.13)	40	42	54
Construction (NACE 41-43)	-	42	-
Services (NACE 45-99)	-	42	55
Private households	-	42	56
Fresh groundwater (14) Total gross abstraction (15) (NACE 01-99)	39	42	-
Public water supply (16)	39	42	43
Agriculture, forestry, fishing (NACE 01-03)	-	42	46
Irrigation (17)	40	42	-
Aquaculture (18)	40	42	-
Mining and quarrying (NACE 05-09)	-	42	-
Manufacturing industry (NACE 10-33)	-	42	50
Cooling in manufacturing industry (19)	40	42	-
Cooling in electricity production (19) (NACE 35.11-35.13)	40	42	54
Construction (NACE 41-43)	-	42	-
Services (NACE 45-99)	-	42	55
Private households	-	42	56
Water returned without use (20)	40	42	56
Total net freshwater abstraction (21)	40	42	-

3.3 JQ-IW TABLE 3: WATER MADE AVAILABLE FOR USE

Table 3 seeks to establish the volumes of water made available for use, in principle from non-freshwater sources (seawater and transitional water, such as brackish water), desalinated water and reused water.

The table provides components for the water use balance.

Table 3: WATER MADE AVAILABLE FOR USE (million m³)			
Parameters (definition number)	**Definition** DCM page	**Decision tree** DCM page	**Good practices** DCM page
Non-freshwater sources (22) (Marine and brackish water) Total gross abstraction (15) (NACE 01-99)	60, 59	62	-
Agriculture, forestry, fishing (NACE 01-03)	-	62	-
Irrigation (17)	60	62	-
Aquaculture (18)	60	62	-
Manufacturing industry (NACE 10-33)	-	62	-
Cooling in manufacturing industry (19)	60	62	-
Cooling in electricity production (19) (NACE 35.11-35.13)	60	62	-
Services (NACE 45-99)	-	62	-
Desalinated water (23) - Total	60	62	-
Public water supply (16)	59	62	63
Reused water (24) - Total	60	62	-
Irrigation in agriculture, forestry (NACE 01-02)	-	62	-
From at least secondary treatment	-	62	-
Irrigation in agriculture, forestry (NACE 01-02)	-	62	-
Manufacturing industry (NACE 10-33)	-	62	-
Imports of water (25) - Total	60	62	-
Exports of water (30) - Total	61	62	-
Non-renewable groundwater (14) - Total	59	62	-
Total water made available for use (26)	60	62	-
Losses during transport (27) - Total	61	62	63
Evaporation losses	-	62	-
Leakage	-	62	-
Memorandum items for water abstraction	-	62	-
Abstraction from artificial reservoirs	-	62	-
Abstraction for hydroelectricity generation	-	62	-

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3.4 JQ-IW Table 4: Water use (26) by supply category and by sector

Table 4 seeks to distinguish water used within economic sectors by supply category, with a separate breakdown for manufacturing industries.

The table provides one component for the water use balance ('Total water available for final use within territory').

Table 4: WATER USE BY SUPPLY CATEGORY AND BY SECTOR (million m^3)			
Parameters (definition number)	**Definition** DCM page	**Decision tree** DCM page	**Good practices** DCM page
Public water supply (16) - Total (NACE 01-99)	66	70	71
Agriculture, forestry, fishing (NACE 01-33)	-	70	-
All industrial activities (NACE 05-43)	-	70	-
Mining and quarrying (NACE 05-09)	-	70	-
Manufacturing industry (NACE 10-33)	-	70	72
Cooling in manufacturing industry (19)	66	70	-
Food processing industry (NACE 10-11)	-	70	-
Basic metals (NACE 24)	-	70	-
Motor vehicles and transport equipment (NACE 29-30)	-	70	-
Textiles (NACE 13-15)	-	70	-
Paper and paper products (NACE 17)	-	70	-
Chemicals, refined petroleum, etc. (NACE 19-21)	-	70	-
Other manufacturing industry n.e.c.	-	70	-
Production and distribution of electricity (NACE 35.11-35.13)	-	70	-
Cooling in electricity production (19) (NACE 35.11-35.13)	66	70	-
Construction (NACE 41-43)	-	70	-
Services (NACE 45-99)	-	70	-
Private households	-	70	-
Self and other supply (28, 29) - Total (NACE 01-99)	66	70	-
Agriculture, forestry, fishing (NACE 01-03)	-	70	-
All industrial activities (NACE 05-43)	-	70	-
Mining and quarrying (NACE 05-09)	-	70	-
Manufacturing industry (NACE 10-33)	-	70	72
Cooling in manufacturing industry (19)	66	70	-
Food processing industry (NACE 10-11)	-	70	-
Basic metals (NACE 24)	-	70	-
Motor vehicles and transport equipment (NACE 29-30)	-	70	-
Textiles (NACE 13-15)	-	70	-
Paper and paper products (NACE 17)	-	70	-

Table 4: WATER USE BY SUPPLY CATEGORY AND BY SECTOR (million m³)			
Parameters (definition number)	Definition DCM page	Decision tree DCM page	Good practices DCM page
Chemicals, refined petroleum, etc. (NACE 19-21)	-	70	-
Other manufacturing industry n.e.c.	-	70	-
Production and distribution of electricity (NACE 35.11-35.13)	-	70	-
Cooling in electricity production (19) (NACE 35.11-35.13)	66	70	-
Construction (NACE 41-43)	-	70	-
Services (NACE 45-99)	-	70	-
Private households	-	70	-
Memorandum item	-	70	-
Population connected to public water supply (%)	-	70	71

3.5 JQ-IW Table 5: Population connected to wastewater (33) treatment (34) plants

Table 5 aims to describe the connection rates of the resident population to sewer networks and associated types of treatment plant. It provides service parameters and indirectly gives information on quantitative aspects and apportionment of the main flows originating from the population within a territory and on the treatment of pollution from inhabitants.

Table 5: POPULATION CONNECTED TO WASTEWATER TREATMENT PLANTS (%)			
Parameters (definition number)	Definition DCM page	Decision tree DCM page	Good practices DCM page
Percentage of resident population	-	-	-
Connected to urban wastewater collecting system (45)	76	78	-
Connected to a wastewater treatment plant (WWTP) (34, 36, 44) - Total	74	78	83
Primary treatment (40)	74	78	-
Secondary treatment (41)	75	78	-
Tertiary treatment (42)	75	78	-
Unspecified treatment	-	78	-
Not connected to a WWTP (without treatment)	-	78	-
Connected to independent wastewater treatment (46)	76	78	86
With at least secondary treatment (41)	75	78	-
Total connected to wastewater treatment	-	78	-
Memorandum items	-	78	-
National resident population whose wastewater is transported from independent storage tanks to wastewater treatment plants by means of trucks (%) (43)	75	78	-

Population living in agglomerations of less than 2000 p.e. (in thousands) (54)	76	78	-

3.6 JQ-IW TABLE 7: SEWAGE SLUDGE (50) PRODUCTION AND DISPOSAL (IN DRY SUBSTANCE (DS))

Table 7 is for data on quantities of sludge generated from the treatment of wastewater from urban WWTPs and other WWTPs and of sludge going to the various disposal pathways.

Table 7: SEWAGE SLUDGE PRODUCTION AND DISPOSAL (IN DRY SUBSTANCE (DS)) (thousands of tonnes)			
Parameters (definition number)	**Definition** DCM page	**Decision tree** DCM page	**Good practices** DCM page
SLUDGE FROM URBAN WASTEWATER TREATMENT (36)	88	90	-
Total sludge production	-	90	98
Total sludge disposal	-	90	101
Agricultural use	-	90	-
Compost and other applications	-	90	-
Landfill	-	90	-
Incineration	-	90	-
Others, please specify	-	90	-
SLUDGE FROM OTHER WASTEWATER TREATMENT (44)	88	90	-
Total sludge production	-	90	98
Total sludge disposal	-	90	101
Agricultural use	-	90	-
Compost and other applications	-	90	-
Landfill	-	90	-
Incineration	-	90	-
Others (please specify)	-	90	-

3.7 JQ-IW Table 8: Generation and discharge of wastewater

Table 8 has two main parts. The first aims to compile an exhaustive inventory of the quantities of pollution from all anthropogenic sources for eight main parameters. The second is focused on the main groups of point sources, i.e. urban wastewater (whether or not treated), industrial wastewater (whether or not treated) and agricultural wastewater (including forestry and fishery) direct discharges. This part records the quantities for the same six parameters and their discharges into the receiving water.

The table provides components for water-use balance.

Table 8: GENERATION AND DISCHARGE OF WASTEWATER			
Parameters (definition number)	**Definition** DCM page	**Decision tree** DCM page	**Good practices** DCM page
Volume	-	-	-
GENERATION OF WASTEWATER (33) POINT SOURCES – Total (NACE 01-99)	103	110	-
Agriculture, forestry, fishing (NACE 01-03)	-	110	114
Industry – total (NACE 05-43)	-	110	115
Mining and quarrying (NACE 05-09)	-	110	-
Manufacturing industry (NACE 10-33)	-	110	-
Food processing industry (NACE 10-11)	-	110	-
Basic metals (NACE 24)	-	110	-
Motor vehicles and transport equipment (NACE 29-30)	-	110	-
Textiles (NACE 13-15)	-	110	-
Paper and paper products (NACE 17)	-	110	-
Chemical products and refined petroleum (NACE 19-21)	-	110	-
Production and distribution of electricity (excluding cooling water) (NACE 35.11-35.13)	-	110	-
Construction (NACE 41-43)	-	110	-
Domestic sector - total (38)	103	110	-
Services (NACE 45-99)	-	110	116
Private households	-	110	117
ALL SOURCES	-	110	-
TREATMENT AND DISCHARGE OF WASTEWATER	-	110	-
1. Urban wastewater - Total generated (37)	103	110	119
Treated in WWTPs (36, 44) - Total inflow (34)	103, 104	110	-
At least secondary treatment (40, 41)	104	110	
Discharged to Inland waters - Total (52)	105	110	-
Discharged after treatment in WWTPs	-	110	-
Discharged after independent treatment (46)	104	110	-
Discharged without treatment	-	110	-

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Table 8: GENERATION AND DISCHARGE OF WASTEWATER			
Parameters (definition number)	**Definition** DCM page	**Decision tree** DCM page	**Good practices** DCM page
2. Industrial wastewater (not part of Urban WW) - Total generated (39)	103	110	119
Treated in 'other' WWTPs (34) - Total inflow (44)	103, 104	110	-
At least secondary treatment (40, 41)	104	110	
Discharged to Inland waters - Total (51,52)	105	110	-
Discharged after treatment in 'other' WWTPs	-	110	-
Discharged without treatment	-	110	-
Total discharges of WWTPs (urban **(36)** and other **(44)**) – after treatment	103, 104	110	-
3. Agricultural wastewater (incl. forestry + fisheries) - direct discharges	-	110	-
Total discharges to Inland waters (52)	105	110	-
Total discharges to the sea (52)	105	110	-
BOD (47)	**105**	**110**	**-**
GENERATION OF WASTEWATER (33) POINT SOURCES – Total (NACE 01-99)	103	110	-
Agriculture, forestry, fishing (NACE 01-03)	-	110	114
Industry – total (NACE 05-43)	-	110	115
Mining and quarrying (NACE 05-09)	-	110	-
Manufacturing industry (NACE 10-33)	-	110	-
Food processing industry (NACE 10-11)	-	110	-
Basic metals (NACE 24)	-	110	-
Motor vehicles and transport equipment (NACE 29-30)	-	110	-
Textiles (NACE 13-15)	-	110	-
Paper and paper products (NACE 17)	-	110	-
Chemical products and refined petroleum (NACE 19-21)	-	110	-
Production and distribution of electricity (excluding cooling water) (NACE 35.11-35.13)	-	110	-
Construction (NACE 41-43)	-	110	-
Domestic sector - total (38)	103	110	-
Services (NACE 45-99)	-	110	115
Private households	-	110	117
NON-POINT SOURCES	-	110	118
ALL SOURCES	-	110	-
TREATMENT AND DISCHARGE OF WASTEWATER	-	110	-
1. Urban wastewater - Total generated (37)	103	110	119
Treated in WWTPs (36, 44) - Total inflow (34)	103, 104	110	-
Discharged to Inland waters - Total (52)	105	110	-
Discharged after treatment in WWTPs	-	110	-
Discharged after independent treatment (46)	104	110	-

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Table 8: GENERATION AND DISCHARGE OF WASTEWATER			
Parameters (definition number)	**Definition** DCM page	**Decision tree** DCM page	**Good practices** DCM page
Discharged without treatment	-	110	-
2. Industrial wastewater (not part of Urban WW) - Total generated (39)	103	110	119
Treated in 'other' WWTPs (34) - Total inflow (44)	103, 104	110	-
Discharged to Inland waters - Total (51,52)	105	110	-
Discharged after treatment in 'other' WWTPs	-	110	-
Discharged without treatment	-	110	-
Total discharges of WWTPs (urban **(36)** and other **(44)**) – after treatment	103, 104	110	-
3. Agricultural wastewater (incl. forestry + fisheries) - direct discharges	-	110	-
Direct discharges from non-point sources	-	110	-
Total discharges to Inland waters (52)	105	110	-
Total discharges to the sea (52)	105	110	-
The same breakdown as for 'BOD' has been applied to the following parameters:	-	110	-
COD (53)	105	110	-
Suspended solids	-	110	-
N-tot	-	110	-
P-tot	-	110	-

3.8 JQ-IW SUMMARY TABLE: WATER USE BALANCE

This table is included to summarise the information in the JQ-IW. It contains only three parameters that are not available from the other tables: losses during use, cooling water discharged to inland waters and cooling water discharged to marine waters.

Summary table: WATER-USE BALANCE			
Parameters	**Definition** DCM page	**Decision tree** DCM page	**Good practices** DCM page
Losses during use, total	-	-	-
Total cooling water discharged	-	-	-
Cooling water discharged to inland waters	-	-	-
Cooling water discharged to marine waters	-	-	-

3.9 RWQ TABLE 11: RENEWABLE FRESHWATER RESOURCES

Table 11 is designed to provide an overview of freshwater resources available on the spatial unit – River Basin Districts and of their different flows (internal flow and actual external inflow). By definition, the concept of renewable resources excludes non-renewable resources available from the potential use of water reserves (essentially groundwater). The data definitions and methodology follow those of the JQ-IW Table 1.

Table 11: RENEWABLE FRESHWATER RESOURCES (mio m³)			
Parameters (definition number)	**Definition** DCM page	**Decision tree** DCM page	**Good practices** DCM page
Precipitation (1)	126	35, 128	-
Actual evapotranspiration (2)	126	35, 128	36
Internal flow (3)	126	35, 128	-
Actual external inflow (4)	127	35, 128	37
Total actual outflow (5)	127	35, 128	37
Total renewable freshwater resources (8)	127	35, 128	-

3.10 RWQ TABLE 12: TOTAL GROSS WATER ABSTRACTION AND WATER LOSSES BY SOURCES

Table 12 provides an overview of the volume of water abstraction and water available for use on the spatial unit River Basin District. The aim is to identify the principal sources, establish the proportion of the available freshwater and other resources abstracted, and quantify the distribution of water and the main purposes of use. The data definitions and methodology follow those of the JQ-IW Tables 2 and 3.

Table 12: TOTAL GROSS WATER ABSTRACTION AND WATER LOSSES BY SOURCE (mio m³)			
Parameters (definition number)	**Definition** DCM page	**Decision tree** DCM page	**Good practices** DCM page
Fresh surface water (13) – total gross abstraction **(15)**	132	42, 135	-
Public water supply (16)	132	42, 135	43
Irrigation (17)	133	42, 135	-
Cooling in electricity production (19)	133	42, 135	54
Fresh groundwater (14) – total gross abstraction **(15)**	132	42, 135	-
Public water supply (16)	132	42, 135	43
Irrigation (17)	133	42, 135	-
Non fresh water sources (22) – total gross abstraction **(15)**	133, 132	62, 135	-
Desalinated water – total **(23)**	133	62, 135	-
Reused water – total **(24)**	133	62, 135	-
Water transferred from other regions (imports) (55)	133	62, 135	-
Water transferred to other regions (exports) (55)	133	62, 135	-
Losses during transport – total (27)	133	62, 135	63

3.11 RWQ Table 13: Water use (from all sources: public supply, self supply, other supply)

Table 13 provides an overview of the volume of water used on the spatial unit River Basin District for the main sectors of economic activity. The data definitions and methodology follow those of the JQ-IW Table 4.

Table 13: WATER USE (FROM ALL SOURCES: PUBLIC SUPPLY, SELF SUPPLY, OTHER SUPPLY (Def. 16, 28, 29)) (mio m^3)			
Parameters (definition number)	**Definition** DCM page	**Decision tree** DCM page	**Good practices** DCM page
Total water use (26) (NACE 01-99)	137	42, 139	-
Agriculture, forestry fishing (NACE 01-03)(A)	137	42, 139	-
All industrial activities (NACE 05-43)(B-F)	137	42, 139	71
Services (NACE 45-99)(G-U)	137	42, 139	-
Private households	137	42, 139	-

PART II — DETAILED INFORMATION FOR EACH TABLE IN THE JQ-IW

1 JQ-IW TABLE 1: RENEWABLE FRESHWATER RESOURCES

1.1 DEFINITIONS AND REMARKS

Name	Precipitation
Number	1
Definition	Total volume of atmospheric wet precipitation (rain, snow, hail...). Precipitation is usually measured by meteorological or hydrological institutes
Remarks	Please provide the water equivalent, as is usually recorded by rain gauges.

Name	Actual evapotranspiration
Number	2
Definition	Total volume of evaporation from the ground, wetlands and natural water bodies and transpiration of plants. According the definition of this concept in Hydrology, the evapotranspiration generated by all human interventions is excluded, except unirrigated agriculture and forestry. The 'actual evapotranspiration' is calculated using different types of mathematical models, ranging from very simple algorithms (Budyko, Turn Pyke, etc.) to schemes that represent the hydrological cycle in detail. Please do not report potential evapotranspiration which is 'the maximum quantity of water capable of being evaporated in a given climate from a continuous stretch of vegetation covering the whole ground and well supplied with water'. AVERAGE LONG-TERM ACTUAL EVAPOTRANSPIRATION: The average of actual evapotranspiration over a long period, normally 30 consecutive years or more.
Remarks	'Actual evapotranspiration' can be calculated using various mathematical models, ranging from very simple algorithms (e.g. Turc, Penman, Budyko or Turc-Pyke) and methods that make corrections related to vegetal cover and season, to models that represent the hydrological cycle in detail.

Name	Internal flow
Number	3
Definition	Total volume of river runoff and groundwater generated, in natural conditions, exclusively by precipitation into a territory. The internal flow is equal to precipitation less actual evapotranspiration and can be calculated or measured. If the river runoff and groundwater generation are measured separately, transfers between surface and groundwater should be netted out to avoid double counting.
Remarks	Should include both surface and underground flows.

PART II - TABLE 1

Name	Actual external inflow
Number	4
Definition	Total volume of actual flow of rivers and groundwater, coming from neighbouring territories. AVERAGE LONG-TERM ACTUAL EXTERNAL INFLOW INTO A TERRITORY: The average of the actual external inflow of rivers and groundwater into a TERRITORY, averaged over a period of at least 30 consecutive years.
Remarks	See Part II 1.4.3

Name	Total actual outflow
Number	5
Definition	Actual outflow of rivers and groundwater into the sea plus actual outflow into neighbouring territories.
Remarks	See Part II 1.4.3

Name	Actual outflow into the sea
Number	6
Definition	The total volume of actual outflow of rivers and groundwater into the sea.
Remarks	

Name	Actual outflow into neighbouring territories
Number	7
Definition	The total volume of actual outflow of rivers and groundwater into neighbouring territories. AVERAGE LONG-TERM ACTUAL OUTFLOW: The total volume of the actual outflow of rivers and groundwater from a territory, annual data averaged over a period of at least 30 consecutive years.
Remarks	

Name	Total renewable freshwater resources
Number	8
Definition	Internal flow plus actual external inflow.
Remarks	

Name	Recharge
Number	9
Definition	Total volume of water added from outside to the zone of saturation of an aquifer. The recharge can be natural (through the natural water cycle) or artificial (through injection of rain water or reclaimed water). For the purpose of this questionnaire, only the natural recharge is considered.
Remarks	See Part II 1.4.4 Please note that the definition above should be used for ‘Recharge into the aquifer’

Name	Groundwater available for annual abstraction
Number	10
Definition	Recharge less the long term annual average rate of flow required to achieve ecological quality objectives for associated surface water. It takes account of the ecological restrictions imposed to groundwater exploitability, nevertheless other restrictions based on economic and technical criteria could also be taken into account in terms of accessibility, productivity and maximum production cost deemed acceptable by developers. The theoretical maximum of groundwater available is the recharge.
Remarks	See Part II 1.4.5

Name	Freshwater resources 95 % of the time
Number	11
Definition	Portion of the total freshwater resource that can be depended on for annual water development during 19 out of 20 consecutive years, or at least 95 per cent of the years included in longer consecutive periods. This item yields information about the average annual long-term availability of freshwater for use in human activities.
Remarks	See Part II 1.4.6

Name	Long-term annual average (LTAA)
Number	12
Definition	The minimum period of calculation for the LTAA is 30 consecutive recent years. For the purpose of this questionnaire, the recommended period of calculation for the LTAA is 1981-2010.
Remarks	

1.2 General information

JQ-IW Table 1 shows the **annual** water balance of the national territory. The underlying water-balance equation is:

$$P + Q_i - ET_a - Q_o - R - C = 0$$

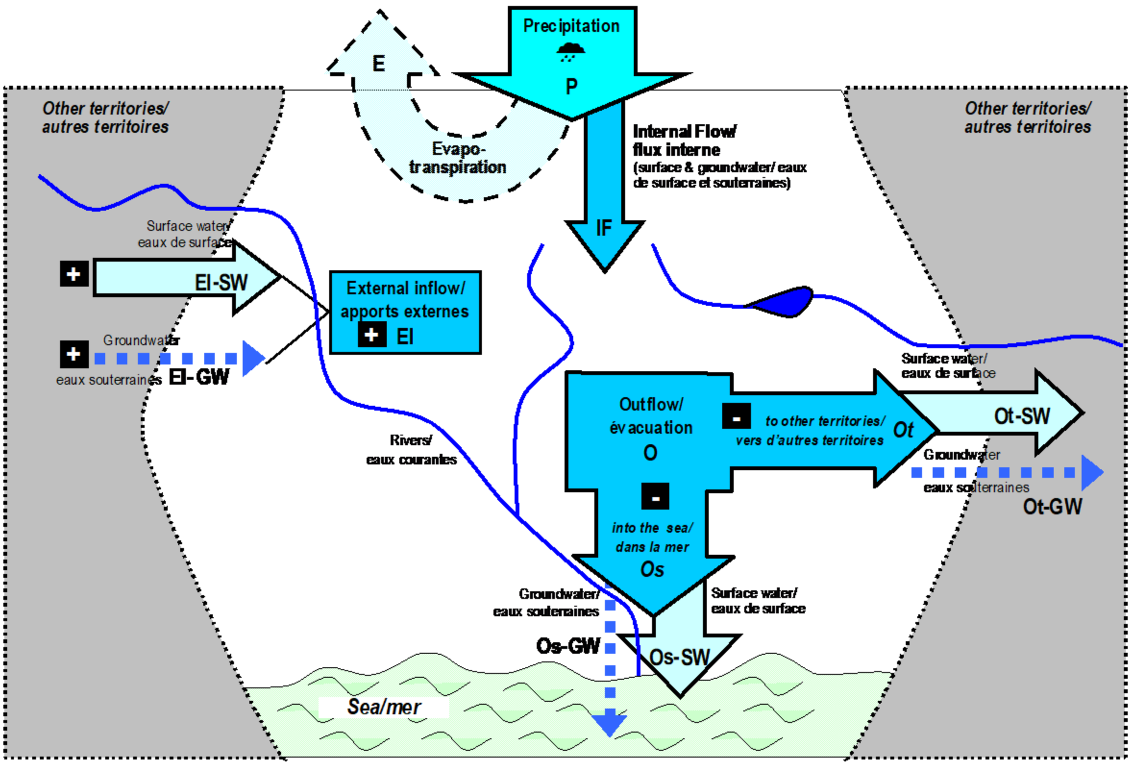
where

P areal precipitation (item 1)
Q_i external inflow (item 4)
ET_a actual evapotranspiration (item 2)
Q_o total outflow from the territory ($Q_o = Q_{o,s} + Q_{o,n}$) (items 5 (6,7))
R net recharge into the aquifers (item 9)
C consumptive water use
$P\text{-}ET_a$ internal flow (IF) (often also referred to as internally generated depth of run-off) (item 3)

A schematic illustration is given in Figure 1-1.

Figure 1-1: Schematic illustration of the water cycle as captured by the JQ-IW

Simplified hydrological cycle



Legend

▪▪▪▪▪▪▪▪▪▪▪▪ Boundary

P Precipitation

E Actual evapotranspiration

IF Internal flow

INFLOW		**OUTFLOW**	
From other territories		**Into other territories or the sea**	
+ EI	Actual external inflow	**- O**	Total actual outflow
+ EI-SW	Surface water external inflow	of which:	
+EI-GW	Groundwater external inflow	**- Ot**	Actual outflow to other territories
		- O-SW	Surface water
		- O-GW	Groundwater
		- Os	Actual outflow to the sea
		- O-SW	Surface water
		- O-GW	Groundwater

Note:

In an average year, with no changes in water stocks (and prior to exports/imports and water consumption):

P = E+IF

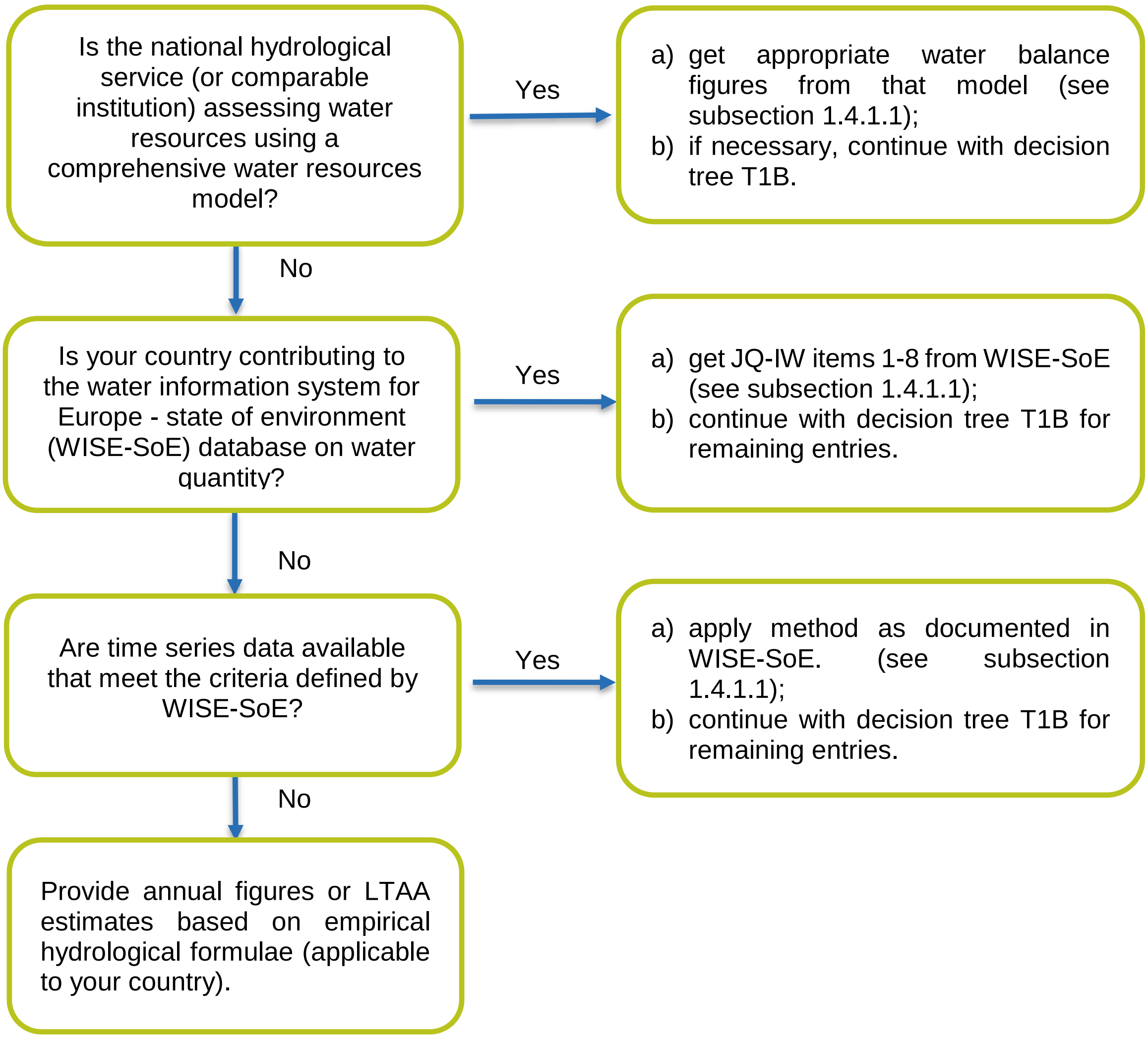
IF +EI = Os+Ot

The parameters are spatially and temporally grouped figures of hydrological variables, characterising processes which are in general highly variable in space and time. Spatial variability is captured through monitoring at a sufficiently large number of stations, while the fluctuations in time are tracked by recording time series. Deriving the aggregated quantities for the annual national water balance therefore essentially involves drawing together spatio-temporal processes from incomplete, discrete data. This is - for all parameters - a **non-trivial task, which requires thorough hydrological knowledge and expertise**. Therefore, the entries in JQ-IW Table 1 should be compiled by skilled hydrologists, generally at the **national hydrological or meteorological service institution**.

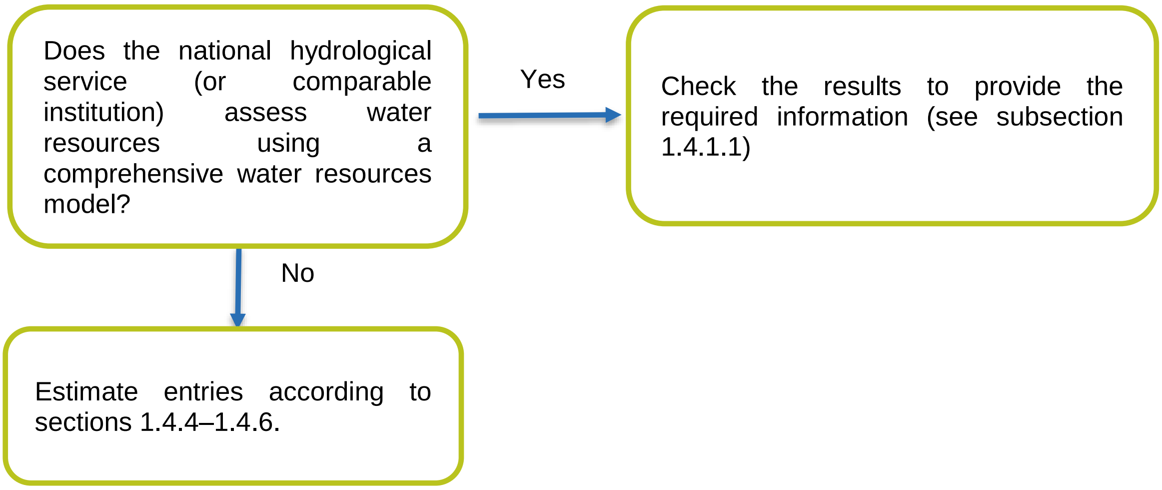
Additionally, JQ-IW Table 1 asks for some variables which are not determined purely by hydrology, but are related to basic concepts of water management. According to the JQ-IW definitions, total freshwater resources (8) are understood to be the maximum amount of renewable freshwater in a territory. This definition assumes that only ET_a is an uncontrollable ‘loss’.

1.3 DECISION TREE

Tree T1A: Water balance components (items 1-8 in JQ-IW)



Tree T1B: Recharge into the aquifer (9), groundwater available for annual abstraction (10), freshwater resources 95 % time (11)



1.4 GOOD PRACTICES

1.4.1 GENERAL PRACTICES

1.4.1.1 METHODS OF DATA CALCULATION/ESTIMATION

Country-wide numerical water balance models

In recent years, several countries have established country-wide numerical water balance models to assess the spatial and temporal characteristics of their water resources. If such a model is operational in your country, try to get the aggregated water balance results from there, including the annual values and the long-term annual averages (LTAAs).

Depending on the modelling approach used, some of the remaining items should also be available, including recharge into the aquifer (9), groundwater available for annual abstraction (10) and freshwater resource 95 % of the time (11).

Data accuracy: These models can be expected to give the most accurate and consistent water-balance results. If such a model is carefully calibrated and validated, and consistently applied in consecutive years, the increments of individual water balance components can be trusted to be accurate within a few percentage points.

Method of the water information system for Europe — state of environment (WISE-SoE) Waterbase - water quantity

Waterbase is the generic name for the EEA databases on the status and quality of Europe's rivers, lakes, groundwater bodies and transitional, coastal and marine waters. Waterbase also provides data on the quantity of Europe's water resources. It contains timely, reliable and policy-relevant data collected from EEA member countries through the WISE-SoE data collection exercise (formerly known as Eionet-Water and Eurowaternet), which takes validated monitoring data from national databases. It adds information on the physical characteristics of the water bodies monitored and on pressures that potentially affect water quality. The added value of Waterbase is that data collected through WISE-SoE are from statistically stratified monitoring stations and groundwater bodies, and are comparable at European level. Waterbase data are used primarily to produce the EEA's indicator-based factsheets.

The specifications for the water quantity data requested under WISE-SoE are described in the water quantity data manual. These data can be used directly to determine JQ-IW precipitation (1), internal flow (3), actual external inflow (4) and outflow (5). Appropriate identification of outflow gauges also allows a distinction to be made between outflow into the sea (6) and into neighbouring countries (7). Using the water-balance equation, recommendations are also made on estimating actual evapotranspiration (2). However, the estimate of actual evapotranspiration might be subject to considerable relative uncertainty and you should check it carefully for plausibility, using empirical or semi-empirical relationships applicable to the climatic region of your country.

1.4.2 GOOD PRACTICES FOR 'ACTUAL EVAPOTRANSPIRATION'

1.4.2.1 METHODS OF DATA CALCULATION/ESTIMATION

The most general and widely used equation, and that recommended by the Food and Agriculture Organisation, is Penman-Monteith, a weighted average of the rates of evaporation due to net radiation and turbulent mass transfer, taking into account the crop coefficient.

In addition to this method, you may use energy balance methodology. The surface energy balance algorithm for land (SEBAL) solves the energy balance on the surface of the earth using satellite images. This allows for both actual and potential evapotranspiration to be calculated on a pixel-by-pixel basis.

Example: The Netherlands

In the Netherlands, 'actual evapotranspiration' is calculated by applying energy balance models. The 'ET-Look' model determines the energy available per pixel each day and calculates how this is distributed across the physical processes. This allows evaporation (soil evaporation) and transpiration (crop transpiration) to be calculated separately (WaterWatch, 2011). The input parameters in the 'ET-Look' model include observable meteorological conditions, such as cloud cover, air temperature, wind speed and relative humidity. These are measured at a number of specified points in the relevant area. Using the 'MeteoLook algorithm', these point measurements can be converted to a coverage area map with a high level of detail, as each pixel has a specific value.

(Graveland, C & K.Baas (2012) - Eurostat water statistics grant: improvement of the national water balance; water stocks; feasibility of water balances per river basin 2012.)

1.4.3 Good practices for 'actual external inflow' and 'total actual outflow'

1.4.3.1 Methods of data calculation/estimation

The task appears to be methodologically simple, since stream gauges are commonly located at country borders, at least on significant rivers.

If stream gauges are not at the country border, flows should be allocated in proportion to the relevant catchment areas on both sides of the border.

If a stream coincides with a part of the country border, the countries involved must agree on the allocation.

If a particular stream enters and leaves a country more than once (e.g. the River Thaya/Dyje between the Czech Republic and Austria), inflow and outflow should be counted only once.

1.4.4 Good practices for 'recharge into the aquifer'

1.4.4.1 Methods of data calculation/estimation

Net recharge into the aquifer

If a network of groundwater stations exists where the groundwater table is recorded, the change of groundwater during the reporting period (one year) can be estimated **for each aquifer** as a weighted mean of the differences in groundwater table, thus:

$$R = \sum_{i=1}^{n} w_i \Delta h_i S_i$$

where R (m^3) is the net recharge into the aquifer, n is the number of stations in the aquifer, w_i (m^2) is the area represented by station i, Δh_i (m) is the change of the groundwater table during the year, and S_i is the storage coefficient of the aquifer in the neighbourhood of station i.

The area represented by a station can be delineated according to hydrogeological considerations, or simply by Thiessen tessellation. The storage coefficient S_i can be estimated from pumping tests, from soil samples taken during drilling or taken from literature, on the basis of a hydrogeological classification of the aquifer media.

Annual recharge into an aquifer

Recharge into an aquifer occurs due to (vertical) percolation of rainwater through the soil, by lateral inflow of near-surface subsurface flow or by exfiltration of rivers. The relative importance of these processes depends on the hydrogeological characteristics of the aquifer, and on the patterns of precipitation, climate and vegetation. Furthermore, these conditions can change with time. No simple, single method to estimate the overall recharge during a year can be recommended.

The different methods for estimating recharge can be classified into three categories: surface water techniques (channel water budget, seepage meters, base flow discharge, tracers, watershed modelling), unsaturated zone techniques (water budget, lysimeters, zero flux plane, Darcy's law, tracers, numerical modelling) and groundwater techniques (Darcy's law, water table fluctuations, tracers, numerical modelling). The choice of the appropriate technique depends on the availability of data, the climatic region and the hydrogeological conditions of the individual aquifers.

The requested entry for the JQ-IW is the **sum of the annual recharge of each aquifer**.

1.4.5 Good practices for 'groundwater available for annual abstraction' (GWAAA)

1.4.5.1 Methods of data calculation/estimation

GWAAA differs from other variables, as the term 'available' is interpreted as including only groundwater which is also economically and technically abstractable. GWAAA has to be estimated individually for every aquifer (a 'groundwater body' according to the WFD). GWAAA is the annual recharge minus ecological discharge minus quantities unavailable as a result of economic and technical constraints.

The estimation of ecological discharge, i.e. the flow needed to maintain environmental integrity, is not just a hydrological problem, but is related to the ecological requirements of a particular river reach and to water management decisions. The estimate should take account of the fact that the magnitude of the flow, and its timing, duration and frequency, can negatively affect aquatic life and disrupt ecological integrity.

Common approaches link ecological discharge to a certain quantile of the statistical distribution of the natural discharges. A widely used rule is that water use should not reduce the flow to less than Q_{95}, i.e. the flow exceeded 95 % of the time or 347 days per year. The 'Montana' method specifies that 10 % of the average flow is the lower limit for sustaining aquatic life and 30 % of the average flow provides a satisfactory water body environment.

For EU Member States, it is recommended that ecological discharge be assessed as the minimum flow required to meet the criteria for good ecological status according to the Water Framework Directive (WFD). For increased consistency between reporting obligations, it is also recommended that you use the same monitoring networks and evaluation procedures as for reporting under the WFD. The competent authorities in the river basin districts should be able to provide this information.

Precise assessments for all aquifers in a country are unlikely to be available, especially if there is no water shortage.

Similarly to the procedure for assessing ecological discharge, it is recommended that Member States estimate GWAAA as the amount of water that can be abstracted from the groundwater body without violating the good quantitative status of the groundwater body, according to the WFD.

1.4.6 Good practices for 'freshwater resources 95 % of the time'

1.4.6.1 Methods of data calculation/estimation

This variable is the total renewable freshwater resource (8), including surface flow and groundwater available for abstraction, which can be depended on **for human activities** in **95 % of the years** measured (e.g. exceeded in 19 of 20 consecutive years). According to the definition in the JQ-IW, flow requirements for ecological discharge and other constraints have to be subtracted from the total freshwater resource. Within the context of the WFD[3], ecological flows are considered 'an hydrological regime consistent with the achievement of the environmental objectives of the WFD in natural surface water bodies as mentioned in Article 4(1)' (non-deterioration, achievement of good ecological status, meeting specific requirements of protected areas where relevant).

As a first step, the estimation requires an assessment of the annual values of the freshwater resources available, and the second step should be a statistical analysis of these to get an estimate of the 5 % quantile. This estimate should be based on data from at least 20 consecutive years.

Note: This parameter refers to a time series of annual values and is not to be confused with the Q95 parameter, which refers to daily values.

[3] For more information, see Ecological flows in the implementation of the Water Framework Directive

2 JQ-IW TABLE 2: ANNUAL FRESHWATER ABSTRACTION BY SOURCE AND BY SECTOR

2.1 DEFINITIONS AND REMARKS

Name	Fresh surface water
Number	13
Definition	Water which flows over, or rests on the surface of a land mass, natural watercourses such as rivers, streams, brooks, lakes, etc., as well as artificial watercourses such as irrigation, industrial and navigation canals, drainage systems and artificial reservoirs. For purposes of this questionnaire, bank filtration (induced infiltration of river water through bankside gravel strata (by pumping from wells sunk into the gravel strata to create a hydraulic gradient) with the intention of improving the water quality) is included under fresh surface water. Sea-water, and transitional waters, such as brackish swamps, lagoons and estuarine areas are not considered fresh surface water and so are included under NON FRESHWATER SOURCES.
Remarks	

Name	Fresh groundwater
Number	14
Definition	Fresh water which is being held in, and can usually be recovered from, or via, an underground formation. All permanent and temporary deposits of water, both artificially charged and naturally, in the subsoil, of sufficient quality for at least seasonal use. This category includes phreatic water-bearing strata, as well as deep strata under pressure or not, contained in porous or fracture soils. For purposes of this questionnaire, ground water includes springs, both concentrated and diffused, which may be subaqueous. Resources of fresh groundwater are called RENEWABLE if they receive significant natural recharge over a human lifespan. In contrast, NON-RENEWABLE groundwater resources (also referred to as FOSSIL GROUNDWATER) are those that do not receive natural recharge over a human lifespan (although they may receive artificial recharge).
Remarks	

Name	Gross water abstraction (= water withdrawal)
Number	15
Definition	Water removed from any source, either permanently or temporarily. Mine water and drainage water are included. Water abstractions from groundwater resources in any given time period are defined as the difference between the total amount of water withdrawn from aquifers and the total amount charged artificially or injected into aquifers. Water abstractions from precipitation (e.g. rain water collected for use) should be included under abstractions from surface water. The amounts of water artificially charged or injected are attributed to abstractions from that water resource from which they were originally withdrawn. Water used for hydroelectricity generation is an in-situ use and should be excluded.
Remarks	

Name	Public water supply
Number	16
Definition	Water supplied by economic units engaged in collection, purification and distribution of water (including desalination of sea water to produce water as the principal product of interest, and excluding treatment of wastewater solely in order to prevent pollution). It corresponds to division 36 (NACE/ISIC) independent of the sector involved, but excluding systems operation for agricultural irrigation such as irrigation canals, which should be reported under 'other supply', cf. definition 29. Deliveries of water from one public supply undertaking to another are excluded.
Remarks	This includes water for domestic use and water used at offices. It also includes small factories, use by local authorities (e.g. for cleaning streets and watering parks), and the watering of private gardens.

Name	Irrigation water
Number	17
Definition	Water which is applied to soils in order to increase their moisture content and to provide for normal plant growth. For purposes of the questionnaire, data reported under this item fit in NACE/ISIC division 01.
Remarks	

Name	Aquaculture use
Number	18
Definition	Addition of freshwater to assist in fish hatcheries for stocking and on-land fish farming etc. - Water used for pond based freshwater fish farming systems is an in-situ use and should be excluded. Examples for this are embankment ponds, watershed ponds, water required for feed, cage aquaculture in irrigation canals.
Remarks	

Name	Cooling water
Number	19
Definition	Water which is used to absorb and remove heat. In this questionnaire cooling water is broken down into cooling water used in the generation of electricity in power stations, and cooling water used in other industrial processes.
Remarks	Typically, cooling water is not significantly polluted by the cooling process. For the purposes of the JQ-IW, heat is not regarded as pollution.

Name	Water returned without use
Number	20
Definition	Water abstracted from any freshwater source and discharged into freshwaters without use, or before use. Occurs primarily during mining, construction activities or in connection with spring overflows. Discharges to the sea as well as discharges after use are excluded.
Remarks	In countries which draw significant amounts of their water supply from spring sources, spring overflows can also be counted as returned water if they occur at storage tanks after the water has been abstracted and transported through pipes.

Name	Net Water Abstraction (= net water withdrawal)
Number	21
Definition	Water gross abstraction minus returned water (20)
Remarks	

2.2 General information

The subchapter on good practices for JQ-IW Table 2 includes six sections on the abstractor parameters (public water supply, agriculture, manufacturing industry, production of electricity, services and private households) and one on the 'returned water' parameter. The reason for making this distinction is that, in general, the abstractors in JQ-IW Tables 2 and 3 are the same for all water sources (i.e. for fresh surface water, fresh groundwater, non-freshwater sources, desalinated water and reused water). The same decision tree therefore applies to all the main abstractors.

On the basis of certain assumptions, a number of parameters in JQ-IW Tables 2 and 4 can be taken to be practically identical. Assuming that water losses in self-supply are often negligible, the group of parameters listed under 'total surface and groundwater abstraction' in Table 2 (with the exception of 'public water supply' (16)) will closely match those listed under 'self-supply' in Table 4. Good practices for calculating data are therefore the same for the two groups of parameters. If data for these parameters are available in Table 2, it should also be possible to provide data for the corresponding parameters in Table 4. The results should be similar for these two groups of parameters.

There are major differences between the data on **public water supply (PWS)** recorded in Tables 2 and 4. This is due to losses occurring during transport and during the processing of water in waterworks (see subsection 2.4.1.3).

Please take particular care to **prevent double counting of water abstraction**. This may occur as a result of water being transferred between water suppliers within a national territory (e.g. supplier 1 abstracts groundwater and sells it to supplier 2). In this context, please note that the 'imports of water' parameter refers only to water purchased in bulk from abroad (i.e. from outside the national territory); it does not refer to water transferred between water suppliers within the national territory.

If data on water abstraction or use are missing for one group of abstractors or users, please focus on the largest (and/or most significant) abstractors or users within a country or region, and encourage them to provide data. In the industrial sector in particular, a very small number of plants often accounts for a large proportion of the total volume of water abstraction or use.

The JQ-IW identifies two categories of **cooling water**: 'total manufacturing industry' (NACE 10-33) and 'production and distribution of electricity' (NACE 35.11-35.13). Large industrial sites, or those that need large volumes of water (e.g. nuclear power plants), often have a local water treatment system to produce the water needed for their processes, in particular for cooling. For the purposes of this manual, it is therefore assumed that, in general, water for cooling purposes comes from self-supply, and not from the public water supply. In some countries, however, most of the small cooling systems use PWS, as the quantities needed are not particularly great (water is recycled) and the quality of water makes the management of the system simpler. Higher quality water means that smaller quantities of products such as anti-fur-up and bacteriostatic agents are used, and there is therefore no need to monitor water quality or to have an abstraction permit, for example. In countries where PWS is used for small cooling systems, this information could therefore be obtained through questionnaires.

If data on water abstraction are collected through **benchmarking projects**, consideration should be given to using these for completing the JQ-IW. Benchmarking projects rely on consistent data collection, as required for comparing businesses or plants, and the data are therefore of high quality.

<u>Total gross abstraction</u>

Total gross abstraction (NACE 01-99) should include all NACE activities, *including* activities not covered by the detailed breakdown requested for table 2. This concerns e.g. activities such as NACE 35.2 'Manufacture of gas; distribution of gaseous fuels through mains' and NACE 35.1 'Steam and air conditioning supply'. Please note that these two NACE activities should *not* be included in NACE 41-43, for which only 'Construction' activities should be included.

<u>Households and services:</u>

'Services' are clearly identified by NACE 45-99 (e.g. offices, hotels, schools, universities and services), and involve situations where water is mainly used for similar purposes as it is used in households (e.g. sanitary purposes, washing, cleaning and cooking).

'Private households' refers to water use in the households sector, typically use of water for sanitary purposes and for other domestic activities (e.g. cooking, cleaning, watering gardens, private swimming pools, etc.).

<u>Data accuracy for items in JQ-IW Tables 2 and 4</u>

The best method for generating accurate figures with a high confidence level is to use direct or indirect measurement methods to derive figures for water abstraction and/or water use. Provided that the meter calibration and reading techniques are reliable, direct measurement (e.g. by water meter) will provide the highest quality results. If water metering is performed using magnetic inductive flow metering, data accuracy of between 6 % and 10 % can be expected (Krekel *et al.*, 1998).

Indirect measurement methods (such as extrapolating instantaneous pipe flow measurements to longer time periods, or combining data on the pump capacity and the duration of pumping) will also produce good data quality.

2.3 Decision tree

1. Does the NSI collect information on water abstraction by source? Please check with the teams responsible for environment, agriculture and industry.

- Yes, major parts → see box A below
- No → question 2

2. Are there reporting commitments under the WFD, in particular Articles 5 and 7, or under national standards?

- Yes, major parts → Contact the administrative body responsible for data collection and treatment (e.g. the environment agency or the relevant government ministry). → see box A below
- No → question 3

3. Do national or regional water associations, the chamber of commerce or national farmers´ unions collect data on water abstraction by source?

- Yes, major parts → see box A below
- No → question 4

4. Do regional authorities and/or regional governments collect data on water abstraction?

- Yes, major parts → see box A below
- No → question 5

5. Do operators of, e.g. water works and irrigation systems, collect data about their water abstraction based on direct measurement (e.g. using flow meters) and consistent water balancing?

- Yes, major parts → see box A below
- No → question 6

Box A:

a) Methods for checking the quality of the information collected by the NSI (for PWS, see subsection 2.4.1.3; for agriculture, see subsection 2.4.2.3; for industry, see subsection 2.4.3.3; for households, see subsection 2.4.6.3; for services, see subsection 2.4.5.3);

b) Methods for calculating the missing data (for PWS, see subsection 2.4.1.2; for agriculture, see subsection 2.4.2.2; for industry, see subsection 2.4.3.2; for households, see subsection 2.4.6.3; for services, see subsection 2.4.5.2);

c) For the missing data, please proceed to the next question.

6. In the short term, estimate the water abstraction in your country (e.g. using coefficients for water use, including water losses).

→ For PWS, see the methods given in subsection 2.4.1.2; for agriculture, see subsection 2.4.2.2; for the manufacturing industry, see subsection 2.4.3.2; for private households, see subsection 2.4.6.2; and for services, see subsection 2.4.5.2.

- No → question 7

7. In the long term, tailor-made questionnaires should be developed and/or statistical programs launched.

→ For PWS, see subsection 2.4.1.1; for agriculture, see subsection 2.4.2.1; for industry, see subsection 2.4.3.3; for services, see subsection 2.4.5.1.

2.4 GOOD PRACTICES

2.4.1 GOOD PRACTICES FOR REPORTING ON THE VARIABLE 'PUBLIC WATER SUPPLY'

2.4.1.1 METHODS FOR DATA COLLECTION

Questionnaires to be completed by public water supply companies

Questionnaires could be sent out to PWS companies (e.g. this approach is used in the Netherlands). The main questions requesting specific data should cover the following areas:

- abstraction of water by source, making a clear distinction between fresh surface water, fresh groundwater and non-freshwater, and clearly identifying transfer from other water suppliers so as to avoid double counting; and
- returned water, before or without use, e.g. overflows of spring waters into storage tanks.

Questionnaires should always be designed to avoid double counting due to transfers of water between water suppliers.

Water metering

This method is described in detail in subsection 4.4.4.1.

Indirect measurement

Where water abstraction is not measured directly, indirect measurements can be used, e.g.:

- pump capacity multiplied by duration of pumping; or
- energy consumption of pumps, multiplied by a specific factor (m^3/MWh).

2.4.1.2 METHODS FOR DATA CALCULATION AND ESTIMATION

Use of estimation coefficients

Coefficients for water use can be found in the literature (see Table 2-1 and 2-2, for example) and can be used to help estimate water use in the domestic sector. Nonetheless, as these coefficients are closely related to the social structure, climate, economic situation and technical infrastructure, for example, countries are strongly recommended to derive country- or region-specific coefficients, and to update these frequently (e.g. every five to ten years). Stratified sample surveys or data from water associations or university studies may serve as an appropriate basis for setting the estimation coefficients.

Example: Germany

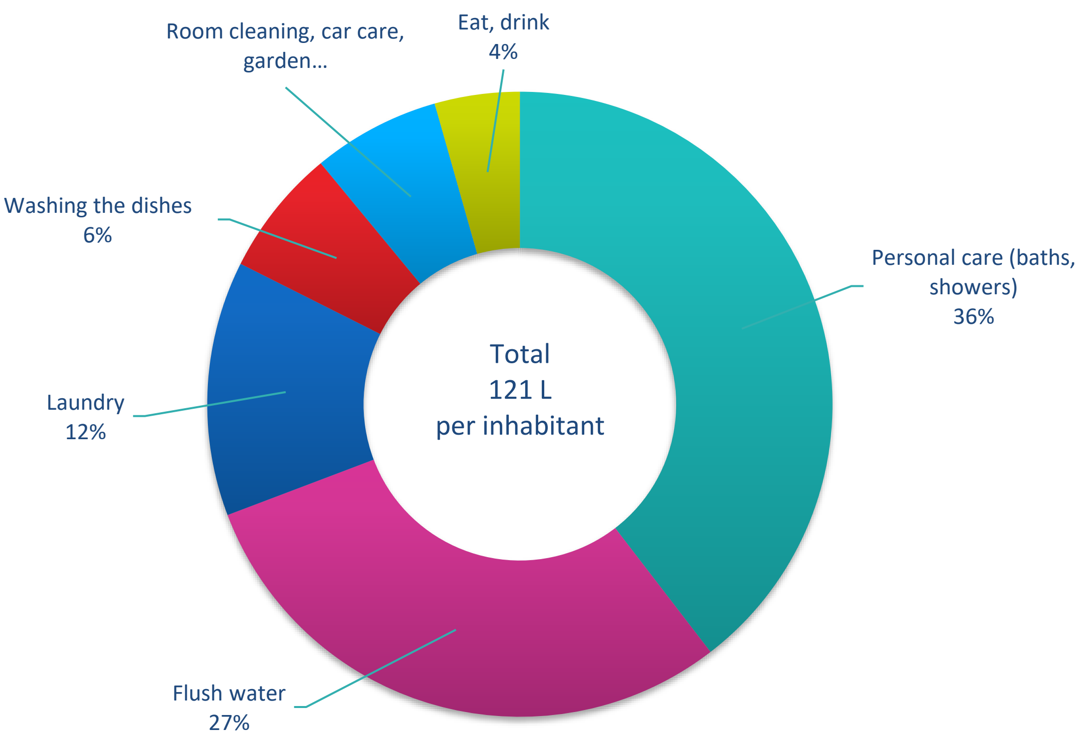
The following coefficients are examples of water-use coefficients in Germany, and should be used with care by other countries. The JQ-IW shows the average daily consumption of water in households to range from around 112 litres/person to 213 litres/person.

Mutschmann et al. (2002) gives water-use coefficients for a standard German household (Table 2-1). Mutschmann et al. (2002) and Hosang et al. (1998) give water-use coefficients for other activities in the domestic sector (Table 2-2).

Table 2-1: Water-use coefficients for a standard German household (Mutschmann et al., 2002)

Activity	Water use (litres/person/day)
Drinking and cooking	3
Washing the dishes	8
Personal hygiene (excluding bathing)	8
Showering and bathing	39
Washing clothes	16
Flushing the toilet	40
Watering the garden and washing the car	8
Cleaning the house	8
Total	**130**

Figure 2-1: Water use for a typical household, 2013
(Average, based on the water supply to households and small businesses)



Source: *Umweltbundesamt* (German environmental protection agency), *Statistisches Bundesamt* (German NSO), *Wassernutzung privater Haushalte, 2013*

Table 2-2: Water-use coefficients for other activities in the domestic sector (Mutschmann et al.**, 2002; Hosang** et al.**, 1998)**

User	Unit	Water use/unit (litres)
School	per student/day	10-15
School with showers	per student/day	20-40
School with showers and swimming pool	per student/day	30-50
University: faculty of humanities	per student/day	150
University: faculty of chemistry	per student/day	1000
University: faculty of physics	per student/day	500
University: faculty of biology and/or water management	per student/day	400
Students' dormitory	per student/day	150
Hospital	per patient/employee and day	350-600
Nursing home	per patient/employee and day	180
Indoor swimming pool	per user	200
Office building (without canteen)	per employee/day	40-50
Office building (air-conditioned and with canteen)	per employee/day	140
Campsite	per stand/day	≥ 200
Luxury hotel (employee to guest ratio ≥ 1)	per guest/employee and day	600
Hotel (employee to guest ratio = 0.5)	per guest/employee and day	375
Basic hotel (employee to guest ratio = 0.25)	per guest/employee and day	150

Example: The Netherlands

(Water use for services is currently estimated on the basis of water-use coefficients derived from Eurostat's Water Grant Study 2008).

Statistics Netherlands estimates the amount of drinking water used by the 'other activities' sector. The use of drinking water in the agriculture sector, in manufacturing industries and in households is known, as is the total use of drinking water. The use of water in the 'other activities' sector is calculated as the total use minus use by the agriculture sector, the manufacturing industry and households. Use of drinking water is attributed to the different NACE categories in proportion to the number of employees involved, as derived from labour statistics/labour accounts, satellite to the national accounts. Water-use coefficients per employee per NACE three-digit level are calculated. The resulting coefficients are then multiplied by the total number of people employed in each industry (NACE) to give per industry and the total volume of tap water used.

Extrapolation of data from metered abstractors (or users) to non-metered abstractors (or users) or extrapolation from the results of a survey of a subset of abstractors, representative of one sector

Extrapolation methods can be used providing suitable precautions are taken to match the nature of the sampled or surveyed group with those who were not sampled or surveyed. The more similar the sampled and the non-sampled group, the smaller the sample population can be and the more accurate will be the result. The overall result will be more reliable if a larger percentage of the largest users is included.

Data accuracy: Please note that estimates calculated in this way are likely to be the least accurate and reliable, as the response rate may be low and any follow-up requests add to the expense of the operation.

2.4.1.3 Methods for checking the quality of the data

Quality checks at institutional level

An initial quality check involves comparing the total volume of surface and groundwater abstracted for PWS (JQ-IW Table 2) with the total PWS (JQ-IW Table 4). The difference is made up of losses + process water use in the waterworks (e.g. 20 % of the water abstraction). The figure derived should be checked by experts (e.g. from water associations) or checked against the literature (e.g. Lambert *et al.*, 2002).

Example:

JQ-IW Table 2: Total surface and groundwater abstraction (10^6 m^3)	623.25
JQ-IW Table 4: Total public water supply (10^6 m^3)	549.34
Calculation step 1: Difference (= losses + process water used in waterworks)	73.91
Calculation step 2: Relative difference	12 %*

*This value should be checked by experts or against the literature

A further simple but effective quality check is to calculate average water use per inhabitant/day on the basis of the volume of water supplied to households and the population connected to the PWS.

Example: Bulgaria, 2016

JQ-IW Table 4: National resident population (1000s)	7127.8
JQ-IW Table 4: Population connected to public water supply (%)	99.3
JQ-IW Table 4: Public water supply: households (10^6 m^3)	257.5
Calculation step 1: Absolute number of people connected in thousands (national resident population * % of population connected / 100)	7080.0
Calculation step 2: Average water consumption per inhabitant (litres/day) ([public water supply in households] * 1 000 000 / ([result from step 1] * 365)	100.0

It is advisable to carry out other quality checks using water balance calculations, e.g. the water-balance structure of the International Water Association (IWA) (Lambert *et al.*, 2002).

Quality checks at operator level

Practical methods for checking quality can be found in the literature, e.g.:

- standard terminology and recommended performance measures to be used when checking for losses from water supply systems (Lambert et al., 2000); and
- performance indicators for water supply services (Alegre et *al.*, 2000, *Manual of best practice*).

2.4.2 Good practices for reporting on the variable 'agricultural use'

2.4.2.1 Methods for data collection

Questionnaires to be completed by large farms and operators of irrigation systems

Agricultural statistics, which are regulated by the European Council, the European Parliament and national legislation, are an important source of information. Specific data on water use are not usually collected in agricultural statistics, but data on irrigated or irrigable area and livestock are collected via farm structure surveys. In the 2010 Farm Structure Survey, information was also requested on sources of water supply (e.g. rivers, the public water supply and farms' own springs). Farms and other businesses concerned are obliged to provide information. The questions in the Farm Structure Survey are standardised across Europe, but further questions may be included at national level, e.g. on the actual abstraction of fresh surface and groundwater for irrigation, livestock and other agricultural purposes.

A structured sample survey could be carried out according to the following steps:

1. identifying regions used intensively for agriculture and irrigation (e.g. with the help of experts from agricultural associations, universities, national ministries and national environment agencies);
2. preparing a questionnaire – can be web based or paper (see suggested contents below);
3. sending the questionnaire out to the largest farms or operators of large irrigation systems in the areas selected in step 1;
4. providing support to recipients of the questionnaires (e.g. via telephone); this will lead to a better response rate and better data;
5. collecting and evaluating the questionnaire results (deriving water-use factors for estimating water abstraction and use by farms not included in the sample). If the development of irrigation factors is one of the purposes of the survey, the type of irrigation system and the type of crop are important dimensions.

The main questions requesting specific data should cover the following areas:

- the type and location (i.e., on-farm/off farm) of water source (public water supply, self-supply from fresh surface water, self-supply from fresh groundwater, desalinated water, reused water/wastewater, or reservoir for collecting water and avoiding flooding);
- the actual area that was irrigated (the type of crop according to agricultural statistics, irrigated hectares, irrigation in m^3/year);
- the type of irrigation system: (a) Fully controlled methods: surface, sprinkler, drip, spray or micro-sprinkler, bubbler; (b) Partially controlled methods: equipped wetland and inland valley bottoms, equipped flood recession cultivation, spate irrigation; (the area irrigated in hectares and the volume of water distributed in m^3/year);
- the volume of water used for other purposes (e.g. livestock or washing). There may be interest in knowing the water source for the livestock (borehole, dam or lake, well, river or spring, rainwater harvested, or other). If the amount of water is not known or cannot be reported, estimates can be made using animal specific coefficients and the number of each type of livestock.

The FAO (2018) '[Handbook on the Agricultural Integrated Survey (AGRIS)]' is a helpful sourcebook for survey development for irrigation and livestock. The Handbook provides modular survey instruments that can be used as examples for asking questions about farming practices. The AGRIS Production Methods and Environment (PME) module is applicable in this case.

2.4.2.2 METHODS FOR DATA CALCULATION AND ESTIMATION

Water-use coefficients

Data on the abstraction and use of water by the agricultural sector (including for irrigation purposes) is collected regularly in some countries (e.g. via a structured sample survey as described above — see subsection 2.4.2.1). Other countries provide specific irrigation coefficients, derived on the basis of research projects or studies.

As the characteristics of irrigation water use in the agricultural sector are very dependent on climate, topography, geological situation, irrigation technique and the type of crops grown, each country should determine its own water-use coefficients. National organisations which are likely to hold relevant data (e.g. on the agrarian structure, areas under irrigation, types of crop grown, geological situation and precipitation) include:

- National Statistical Institutes (NSIs);
- agricultural institutes;
- universities.

The literature listed below gives details of water-use coefficients and the methods used to determine them for various countries. We would again emphasise that specific coefficients for water abstraction and use differ from country to country and must be determined by each country individually. Country-specific factors can be derived from data collected in sample surveys and should be updated frequently. The estimation coefficients in the following documents are provided merely to give guidance on the methods for determining specific water-use coefficients and the order of magnitude of such coefficients.

- England and Wales:

Optimum use of water for industry and agriculture dependent on direct abstraction: best practice manual, Mathieson *et al.* (1998)

Optimum use of water for industry and agriculture: technical report, Mathieson *et al.* (1998)

Optimum use of water for industry and agriculture: Best Practice Manual, Mathieson *et al.* (2000)

- Austria:

Beregnungswasserbedarf im Marchfeld, Supersberg *et al.* (1990) (only available in German)

- USA:

National handbook of recommended methods for water data acquisition, United States Geological Survey (1999)

Combining water-use coefficients and measured data

In many countries, operators of large irrigation systems collect data about their annual water abstraction, broken down by source. Where irrigated areas cannot be covered by ‘real’ data, water-use coefficients, derived using the process described in subsection 2.4.2.2, should be used.

Experience in Austria has shown that using the permitted maximum water abstraction (as laid down in the individual water permits) tends to overestimate the volumes actually used. ‘Real’ data should therefore be used where available. In Austria, the following method was chosen for estimating annual water abstraction for agricultural irrigation, as a way of combining ‘real’ data, i.e. figures actually collected, and values which had been calculated (ESTAT, 2000).

Example: Austria, 1995

The total volume in each region, computed using the specific irrigation volume (Supersberg et al., 1990), was divided by the total irrigated area in that region. The volume specific to each region was multiplied by the area for which ‘real’ data could be collected, and this was subtracted from the total volume for the region. The irrigation volumes actually collected were then added up for the various reference years.

Data for Upper Austria are given in the table below as an example, in order to better illustrate the calculation process. The figures are for 1995 and cover 70 irrigation systems:

a)	total irrigated area according to Statistics Austria (ha)	938
b)	annual volume calculated using specific irrigation volume (m³)	1 938 700
c) = b) / a)	irrigation volume specific to the region (m³/ha)	2 066.8
d)	total irrigation volumes of the systems covered (m³)	293 349
e)	total irrigated area of the systems covered (ha)	364.23
f) = c) * e)	2 066.8 * 364.23	752 807
g) = b) — f)	1 938 700 – 752 807	1 185 893
h) = d) + g)	293 3491 + 185 893	1 479 242

Thus, an irrigation volume of around 1.5 million m3 was estimated for Upper Austria for 1995.

Combining statistical data and calculated data

To estimate average irrigation volumes, Austria chose the following method. The basis for the estimate is the average irrigated area, which is collected for the farm structure survey every 10 years as a full scope survey and, between censuses, is collected every two or three years through sample surveys. These average irrigated areas are then multiplied by the specific irrigation volume/ha, which has been calculated by means of a model approach.

The model includes the Invekos (*Integriertes Verwaltungs- und Kontrollsystem – integrated administration and control system*) data on the annual cultivated area for each crop, the gradient and the available soil moisture. The crop-specific irrigation worthiness was also categorised. Long-term averages of precipitation and evapotranspiration are included in the model, to represent climatic conditions. Information on the aquifer type and on possible climate change supplements the data included in the model. The model's output does not take annual weather conditions into account.

Invekos is the system through which Austria implements the EU-wide integrated administration and control system, which Member States should operate to ensure that transactions financed by the European Agricultural Guarantee Fund are carried out and executed correctly, and to prevent and/or address any irregularities.

Combining statistical data and measured data

Austria uses a simple method for estimating annual irrigation volumes. This combines the data from the farm structure survey with irrigation volume measurements and annual data on climatic conditions. Based on the information from the agricultural census, the annual irrigation volume is extrapolated by a factor that depends on measurements of the annual irrigation volume which varies according to the climatic data.

Combining statistical data and water-use coefficients

The calculation of the amount of water needed for livestock breeding was based on the number of livestock per livestock type in the farm structure survey of 2010, multiplied by livestock-specific water-use rates. To distinguish between groundwater and surface water as the source, the same ratio was applied as that used for drinking water use. This calculation was performed for each groundwater body.

The total annual freshwater abstraction for agriculture by source comprises the abstractions for irrigation and for livestock breeding.

2.4.2.3 METHODS DEVELOPED FOR DATA QUALITY CHECKS

Quality check at institutional and operator level

Specific water use for agriculture (irrigation, livestock) can be seen as a relevant parameter for checking data quality. If the territory in a country includes strongly differing topographic, climatic and geological regions or regions of varying agricultural intensity, the quality check should be performed individually for each region. To check data on irrigation, you should divide the total volume used for irrigation for one region (the relevant data is collected by operators of irrigation system) by the total irrigated area (the relevant information will come from operators of irrigation systems or agricultural statistics, see subsection 2.4.2.1). The result of this calculation provides the water use for irrigation in m³/ha, which can be converted to irrigation in mm:

Example:

a)	Water volume used for irrigation (m³)	2 600
b1)	Total irrigated area (e.g. potatoes) (ha)	2
b2)	Total irrigated area (e.g. potatoes) (m²)	20 000
a/b2 * 1 000	Water volume used for irrigation (mm)	130

The resulting specific water-use factor should be checked by national experts (e.g. from agricultural institutes, Ministry of Agriculture, etc.).

2.4.3 Good practices for 'manufacturing industry'

2.4.3.1 Methods for data collection

As a general rule, a small number of economic activities account for a large share of the total water volume abstracted / used. We therefore recommend that you focus your data collection on these industries or on largest industrial water abstractors and users. Usually, the most intensive industries include:

- Manufacture of basic metals (NACE 24)
- Manufacture of chemicals and chemical products (NACE 20-21)
- Manufacture of pulp, paper and paper products (NACE 17)
- Manufacture of food products and beverages (NACE 10-11)
- Manufacture of other non-metal mineral products (NACE 23)
- Manufacture of textiles (NACE 13-15)
- Manufacture of fabricated metal products (NACE 25)
- Manufacture of coke, refined petroleum products and nuclear fuel (NACE 19)
- Manufacture of electronic components and boards (NACE 26.1)
- Other mining and quarrying (NACE 08-09)

With regard to water used for cooling purposes in manufacturing industry, the following sectors usually play a significant role:

- Manufacture of basic metals (NACE 24)
- Manufacture of chemicals and chemical products (NACE 20-21)
- Manufacture of food products and beverages (NACE 10-11)
- Manufacture of other non-metal mineral products (NACE 23)
- Manufacture of fabricated metal products (NACE 25)
- Manufacture of coke, refined petroleum products and nuclear fuel (NACE 19)

In these industries, data on cooling water as a proportion of total water abstracted or used must be collected for those plants where the highest amount of water for cooling purposes is abstracted. These will usually be a small number of plants which can be identified with, for example, help from experts from the chamber of commerce. Generally applicable recommendations cannot be made, as the data will depend on a number of factors, e.g. technologies, economic situation in a certain year and type of product.

The water-use coefficients for different industry sectors (Table 2-3) include process water and cooling water.

<u>Circulation of questionnaires to companies in the manufacturing industry</u>

This method involves circulating a questionnaire to companies in the manufacturing industry, as is the practice in Bulgaria and until 2001 in the Netherlands. Key questions relating to data acquisition should cover the following areas:

- abstraction of water by source (clear distinction between fresh surface water and fresh groundwater; non-freshwater resources, desalinated water and reused water) in m^3.

Example: The Netherlands

Data are collected via electronic environmental annual reports for approximately 500 companies in the manufacturing industry, energy production and environmental services sector. This data cover the abstraction of surface water and groundwater, the use of public supply water, emissions to air and water, and the disposal of waste. Statistics Netherlands grosses up the individual water data to provide totals per NACE category.

Source: Water abstraction and use at river basin level — Eurostat grant project.

2.4.3.2 METHODS FOR DATA CALCULATION/ESTIMATION

Methods of estimation include using business registers and production statistics, together with water-use coefficients for industrial sectors. NSIs should have business registers and production statistics (according to the PRODCOM classification), in line with EU legislation. The volume of water used is generally related to the type of industry. Typically, the largest proportion of surface water is required by power stations (see section 2.4.4).

Estimates based on water-use coefficients

The following coefficients (Table 2-3) are given as examples of water-use coefficients and should be used carefully by other countries. Water-use coefficients for industry are provided in:

- *Optimum use of water for industry and agriculture dependent on direct abstraction: best practice manual,* Mathieson *et al.* (1998)
- *Optimum use of water for industry and agriculture: technical report,* Mathieson *et al.* (1998)
- *Optimum use of water for industry and agriculture: best practice manual,* Mathieson *et al.* (2000)
- *National handbook of recommended methods for water data acquisition,* United States Geological Survey (1999)
- *Reports and guidelines prepared by UK Envirowise*

Country-specific factors can be derived from data collected through sample surveys and should be updated frequently. The coefficients relate water consumption to another characteristic for which data is available, in particular the type of use, and could be correlated with industries sectors or production units within a country. The water-use coefficients for various industries (see Table 2-3) include process water and cooling water.

Table 2-3: Water-use coefficients for various industries

Industry / line of production	Product area	Unit	Water use/unit	Reference
food industry	cereals	1 t cereals	1.5 – 8 m³	Hosang *et al.*, 1998
	canned fruits or vegetables	1 t cans	4 – 14 m³	Hosang *et al.*, 1998
	candies	1 t product	6 – 26 m³	Hosang *et al.*, 1998
	sugar	1 t beets	10 – 30 m³	Hosang *et al.*, 1998
	meat and fish products, slaughterhouse	1 cow or 1 horse or 2.5 pigs	0.3 – 0.4 m³	Hosang *et al.*, 1998
	creamery (fresh milk)	1 000 l milk	4 – 6 m³	Hosang *et al.*, 1998
	creamery	1 L milk	1 - 1.5 l	Mutschmann *et al.*, 2002
	cheese dairy or butter production	1 000 l milk	10 m³	Hosang et al.*et al.*, 1998
	margarine	1 t margarine	20 m³	Hosang *et al.*, 1998
	brewery	1 000 l beer	5 – 20 m³	Mutschmann *et al.*, 2002; Hosang *et al.*, 1998
	wine and liqueur distillery	1 000 l corn	4 – 6 m³	Hosang *et al.*, 1998
leather and textile industry	shoes	1 pair of shoes	5 l	Hosang *et al.*, 1998
	leather, tannery	1 t of skins	40 – 60 m³	Hosang *et al.*, 1998
	wool laundry	1 t wool	20 – 70 m³	Hosang *et al.*, 1998
	bleachery	1 t product	50 – 100 m³	Hosang *et al.*, 1998
	dyeing factory	1 t product	20 – 50 m³	Hosang *et al.*, 1998
	synthetic fibre	1 kg product	200 l	Mutschmann *et al.*, 2002
cleaning industry, timber and paper industry	machine laundry	1 t laundry	5 m³	Hosang *et al.*, 1998
	laundry	1 t dry laundry	40 l	Mutschmann *et al.*, 2002
	spun rayon	1 t spun rayon	400 – 1300 m³	Hosang *et al.*, 1998
	sulfite pulp	1 t pulp	200 – 400 m³	Mutschmann *et al.*, 2002; Hosang *et al.*, 1998
	paper mill with pulp production	1 t paper	125 – 1000 m³	Hosang *et al.*, 1998
	newsprint	1 kg newsprint	15 l	Mutschmann *et al.*, 2002
	printing plant and paper conversion	1 employee	120 l/day	Hosang *et al.*, 1998
chemical industry	paint and coating compounds	1 employee	110 l/day	Hosang *et al.*, 1998
	glass	1 t glass	3 – 28 m³	Hosang *et al.*, 1998
	soaps and cleaning agents	1 t soap	25 m³	Hosang *et al.*, 1998
	bases, acids, salts (raw material)	1 t chlorine	50 m³	Hosang *et al.*, 1998
	rubber	1 t finished product	100 – 150 m³	Hosang *et al.*, 1998
	synthetic rubber	1 t buna	500 m³	Hosang *et al.*, 1998

Industry / line of production	Product area	Unit	Water use/unit	Reference
processed goods	precision mechanics, optical or electrical industry	1 employee	20 – 40 l/day	Hosang *et al.*, 1998
	fine ceramics	1 employee	40 l/day	Hosang *et al.*, 1998
	engine building	1 employee	40 l/day	Hosang *et al.*, 1998
	steel construction	1 employee	40 – 200 l/day	Hosang *et al.*, 1998
	iron-, steel-, plate- and metal- processing	1 employee	60 l/day	Hosang *et al.*, 1998
	timber-processing industry	1 scm(1) plywood	4 m^3	Hosang *et al.*, 1998
	timber-processing industry	1 scm(1) lumber	0.7 m^3	Hosang *et al.*, 1998
	roofing cardboard	1 000 m^2	1 – 2 m^3	Hosang *et al.*, 1998
mining, smelter- and steelworks	cast iron	1 t cast	3 – 8 m^3	Hosang *et al.*, 1998
	cold rolling mill	1 t product	8 – 50 m^3	Hosang *et al.*, 1998
	forge-, hammer- and press-device	1 t product	80 m^3	Hosang *et al.*, 1998
	ore mining	1 m^3 washed ore	16 m^3	Hosang *et al.*, 1998
	potash mining	1 t carnallite	1 m^3	Hosang *et al.*, 1998
	metal semi-finished part	1 t product	10 m^3	Hosang *et al.*, 1998
	coal mining	1 t coal	2 – 10 m^3	Hosang *et al.*, 1998
	steel	1 t crude steel	50 – 220 m^3	Hosang *et al.*, 1998
	mineral oil	1 kg	0.3 l	Mutschmann *et al.*, 2002

(1) scm: standard cubic meter

Remark: a significant amount of information is needed to produce these estimates.

2.4.3.3 Methods developed for data quality checks

Quality check at institutional level

The simplest quality check is a ranking of water abstraction or use by NACE category. In industrialised countries, the total water abstraction or use in the categories listed above (section 2.4.3) is expected to account for more than 90 % of total industrial abstraction or use.

Another quality check is to calculate specific water use per type and unit of product (e.g. m^3/t product) (see below).

Quality check at institutional and operator level

Specific water use per type and unit of product (e.g. m^3/t product) is considered a suitable indicator for checking data quality. When checking quality, the amount of water used per sector must be combined with data on the corresponding products from production statistics. The resulting specific water-use factor should be checked by experts (e.g. from the chamber of commerce) or against the water-use coefficients listed in subsection 2.4.3.2.

Example: Brewery, 2003

a)	*Freshwater use (hl)*	*1 259 610*
b)	*Beer produced (hl)*	*262 897*
a) / b)	*Specific water use (m^3 water/m^3 beer)*	*4.79*

2.4.4 Good practices for 'Production and distribution of electricity (cooling water)'

Water is used when generating electricity with steam-driven turbine generators. Steam is produced when water is heated (e.g. using coal, natural gas or nuclear energy). There are two main types of cooling systems used in thermoelectric plants, once-through cooling systems and recirculation cooling systems. Once-through cooling systems circulate water through heat exchangers and then return the water to the source. Recirculation cooling systems circulate water through heat exchangers, then cool the water using ponds or towers, and then the water is recirculated. Once-through systems have higher water use than recirculation systems. Freshwater or saline water can be used depending on the type of plant.

It should be noted that there are also combined heat and power plants (CHP) and district heating plants that also require the use of cooling water. Water use in these facilities should also be included in the category for cooling water.

Methods for data calculation/estimation

As a general rule, the largest proportion of surface water used in industry is required by power stations. Each country needs to determine specific estimation factors for the cooling water volume per MWh electricity that is thermally produced. Information to help determine this will be available from the operators of large power plants/energy supply companies or EMAS reports. These factors must be applied in energy statistics (MWh electricity produced in caloric power plants).

As seen in Austria (see Table 2-4), specific water use can be highly variable. Therefore we recommend collecting as much information as possible for individual plants (e.g. directly from electricity companies and/or EMAS reports).

Example: Austria

In order to obtain volumes of cooling water used for the production of electricity, energy supply companies were asked to provide values for each thermal power station. Several energy suppliers replied that actual water use is rarely measured and can only be estimated.

Measured in terms of total water use calculated, some 40 % of the water used for cooling in thermal power plants could be calculated using data from the energy supply companies. The remaining figures were calculated using the thermal production of electricity in national supply areas (according to operating statistics from the Federal Ministry of Economics and Labour) and from the specific cooling water volumes reported by the companies for the relevant years.

Examples for specific cooling water volumes per MWh thermally produced in Austria are given in Table 2-4.

Table 2-4: Specific cooling water volumes per MWh thermally produced (Austria)

Power plant	2000			2001			2002		
	MWh	Water abstraction (m^3)	Specific water use (m^3/MWh)	MWh	Water abstraction (m^3)	Specific water use (m^3/MWh)	MWh	Water abstraction (m^3)	Specific water use (m^3/MWh)
A	727 143	83 773 000	115	609 759	68 333 000	112	672 043	76 124 000	113
B				376 201	3 153 600	8	343 414	4 824 000	14
C				850 900	59 990 000	71			
D				2 626 000	408 445 200	156			

Example: Hungary

The water resources' fee statistics from the General Directorate of Water Management provide data on cooling water used to produce electricity. The water resources fee has been used as a basis for effectively determining the abstracted water quantity according to the Act on Water Management (LVII. 1995).

Source: Statistics on water resources, water use and wastewater treatment — Eurostat grant project.

2.4.5 Good practices for 'services'

2.4.5.1 Methods for data collection

According to the JQ-IW definition, 'services' refers to water abstraction or use for categories not specified elsewhere, e.g. transport, services, education (NACE 46-99). NSIs should be able to provide data on the relevance of these categories for each country (statistics on services, on education, etc.). It is assumed that double counting is usually excluded when applying water-use coefficients for other activities and for households at the same time (e.g. water use/inhabitant/day = 130 l + water use/teacher/day = 10-15 l).

Where it is difficult to separate the services sector from private households as only aggregated figures are available from public water supply entities, try allocating water use by applying water-use coefficients. If this is not feasible, report the aggregated figure and include a footnote.

As the use of water meters becomes more common, the public water supply companies may be able to supply the amount of water to different types of customers. This may provide some assistance when there is only one customer in a building. In the case of only one meter for the water to an office building, then assigning the water use to the different occupants of the building becomes the challenge. If there is no methodology found for splitting the water use among the building tenants, then the water use is assigned to the owner of the building by default.

In most countries, a permit system is in place to regulate water abstraction by commercial users (see also the requirements in the WFD). Good practice, illustrated by the relevant organisation in England and Wales, involves using models to estimate demand from various sectors of water use (Mathieson *et al.* 1998, Mathieson *et al.* 2000). It is good practice to check that the models make the best use of all information available to estimate any missing values. This includes making projections based on earlier values and using of results/trends noted by other reporting units.

2.4.5.2 Methods for data calculation/estimation

Coefficients can be found in the literature (e.g. Table 2-2, see subsection 2.4.1.2) to help estimate water use by services. However, as water-use coefficients are closely related to social structure, climate, economic situation, technical infrastructure, etc., we strongly recommend deriving country-specific coefficients and updating these frequently (e.g. every five to 10 years). Stratified sample surveys or data from water associations or university studies might serve as a basis for these country-specific coefficients.

2.4.5.3 Methods developed for data quality checks

<u>Quality check at institutional level</u>

The simplest quality check is a ranking of water abstraction or use by NACE category. The results of this ranking will be country-specific, depending on the economic/social situation in a country. For example, if tourism is a major economic sector, there will be significant water abstraction/use for the hospitality industry (hotels and restaurants, NACE 55). The results of the ranking should be checked by experts (e.g. staff from the Ministry of Trade and Commerce or the chamber of commerce).

Another quality check can be done by calculating the specific water use per NACE category (e.g. m^3/hotels) (see below).

<u>Quality check at institutional and operator level</u>

Specific water use per NACE category (e.g. m^3/hotels) is considered a suitable indicator for checking data quality. When checking quality, the amount of water used per sector must be combined with data on the corresponding number of facilities available from relevant statistics (e.g. statistics on services, on education, etc.) to calculate specific water-use factors. These factors should be checked by experts (e.g. staff from the Ministry of Trade and Commerce or the chamber of commerce) or checked against the water-use coefficients listed in Table 2-2 (see subsection 2.4.1.2).

2.4.6 Good practices for 'private households'

2.4.6.1 Methods for data collection

Water use in the household sector may vary depending on the type of supply. Before applying water-use coefficients, you should check whether households served by the public water supply have different levels of water consumption than households with self-supply (e.g. from a well). Water abstraction/use coefficients and data extrapolated from metered/sampled abstractors/users to non-metered abstractors/users should be treated with care.

2.4.6.2 Methods for data calculation/estimation

Water abstraction/water use by households with self-supply is usually estimated, due to a lack of metered data.

Coefficients can be found in the literature (e.g. Table 2-2, see subsection 2.4.1.2) to estimate water use for other activities. However, as water-use coefficients are closely related to social structure, climate, economic situation, technical infrastructure, etc., we strongly recommend deriving country-specific coefficients and updating them frequently (e.g. every five to 10 years). Coefficients from Table 2-1 and Table **2-2** should be handled with great care, as households served by the public water supply might have different water consumption from those with self-supply.

2.4.6.3 Methods developed for data quality checks

A simple quality check is to calculate average water consumption per inhabitant/day on the basis of water supplied/abstracted/used. If households are supplied from the public water supply, the quality check described in subsection 2.4.1.3 is recommended. If water is supplied by self-supply, information from permit (licensing) systems or direct metering can be compared with water-use coefficients, specific to each country (e.g. see Table 2-1, subsection 2.4.1.2 for Germany).

Another quality check for households supplied by self-supply involves expert judgment. The 'self-supplied domestic population' is defined as the difference between the total population (based on the information in the most recent census) and the population served by public suppliers.

2.4.7 Good practices for 'returned water'

2.4.7.1 Methods for data collection

Circulation of questionnaires

This method involves circulating a questionnaire to companies, users in the mining industry and other industries and users with self-supply (NACE 05-09).

Example: Poland

The Central Statistical Office of Poland carries out four statistical surveys on water and wastewater issues, including gathering data for the 'returned water' parameter via statistical survey OS-3 (water management, wastewaters and loads of pollution in industrial enterprises). The industrial enterprises which meet the environmental hazard quantity criterion for the purposes of the OS-3 survey are those that take from their own sources 5 000 m³ or more -underground water or 20 000 m³ or more -surface water, or discharge 20 000 m³ or more wastewater. Data on returned water presented in the JQ-IW include part of the data on water pumped from mines and building sites returned to the environment unused.

Example: Bulgaria

Data on the volume of 'returned water' are obtained by survey on Water Use. The survey covers larger consumers (the threshold for coverage is that they use over 36 000 m^3 of water annually). The enterprises below this criterion submit data on a voluntary basis. 'Returned water' is a separate water-balance parameter in the statistical questionnaire, usually reported by users in the mining and quarrying industry (NACE 05-09) but also those carrying out other economic activities.

2.5 Situation in Individual Reporting Countries

The Netherlands

There is currently a 'national groundwater register' (LGR) which contains data on fresh groundwater abstraction. It combines and tries to harmonise data from 12 custom-made provincial registers, but does not have complete coverage of the Netherlands. A further issue is that the register does not accurately take into account 'other water/industrial water' (i.e. water which is not 'real drinking water' supplied by the public water network, but water used by industries and provided through separate water networks). Data for this type of water are collected from annual environmental reports in the form of data on tap water. However, the register overestimates the quantity of real drinking water, as a number of companies provide a total sum in the annual environment reports that includes 'real' drinking water, as supplied by the public water network, and other water/industrial water, provided through separate water networks, operated by specialised industrial water companies, utility companies or other industrial companies with their own water purification facilities. As a result, precise figures still need to be obtained on the supply of drinking quality water, as opposed to total tap water.

Data sources for water statistics:

- the Association of all 10 Dutch water companies (Vewin);
- Wageningen Economic Research (WER), formerly the agricultural economic institute (LEI) — data collected using a panel survey;
- annual environment reports for some NACE groups;
- for all other economic activities: Baas & Graveland (2011).

The annual environment report includes a 'water-use module' in the form of tables in which data have to be provided on emissions to air, emissions to water, and waste produced, and a module in which water use and the discharged volumes and other outflow must be filled in. This table is designed as a kind of water balance. One of the items in the water module is the use of tap water. This normally covers the use of drinking water, but other tap water (not of drinking water quality) is often included. The format for annual environment reports has been set out in a legal act.[4]

England and Wales

Net abstraction is estimated using a geographical information system (GIS) for water resources information. This includes catchment abstraction management strategy (CAMS) systems. Net abstraction is calculated by multiplying the recorded abstraction by a loss factor (four different factors are used). Only abstractions greater than 20 m^3 per day are covered. Few data on actual volumes discharged are available. In Scotland, four water quantity abstraction classes are used. Only two classes are licensed and thus required to report abstracted water volumes (>50 m^3 per day requires a normal abstraction licence and > 2000 m^3 per day requires a special licence). All discharges above 10 m^3 per day or 15 population equivalents (p.e.) are licensed and required to report data.

Per capita use is derived by dividing total use across the population supplied by the sample of water supply companies.

[4] For more information, see 'Improving water statistics and water accounts'.

Bulgaria

The NSI conducts several statistical surveys to calculate data on water abstraction. These include a census on water suppliers (public water companies and irrigation systems), and a survey on Water Use by industries (by NACE). The survey covers the larger enterprises using over 36 000 m^3 water annually, and also those below this criterion - on a voluntary basis. Electronic questionnaires contain indicators of the type of water sources by river basin and geographical location. Usually, the volume of water is reported on the base of measured data. Data available by NACE category are aggregated according to the principal economic activity of the abstractor. Water abstraction by physical persons is not covered by the survey.

3 JQ-IW TABLE 3: WATER MADE AVAILABLE FOR USE

3.1 DEFINITIONS AND REMARKS

Name	Fresh groundwater
Number	14
Definition	Fresh water which is being held in, and can usually be recovered from, or via, an underground formation. All permanent and temporary deposits of water, both artificially charged and naturally, in the subsoil, of sufficient quality for at least seasonal use. This category includes phreatic water-bearing strata, as well as deep strata under pressure or not, contained in porous or fracture soils. For purposes of this questionnaire, ground water includes springs, both concentrated and diffused, which may be subaqueous. Resources of fresh groundwater are called RENEWABLE if they receive significant natural recharge over a human lifespan. In contrast, NON-RENEWABLE groundwater resources (also referred to as FOSSIL GROUNDWATER) are those that do not receive natural recharge over a human lifespan (although they may receive artificial recharge).
Remarks	

Name	Gross water abstraction (= water withdrawal)
Number	15
Definition	Water removed from any source, either permanently or temporarily. Mine water and drainage water are included. Water abstractions from groundwater resources in any given time period are defined as the difference between the total amount of water withdrawn from aquifers and the total amount charged artificially or injected into aquifers. Water abstractions from precipitation (e.g. rain water collected for use) should be included under abstractions from surface water. The amounts of water artificially charged or injected are attributed to abstractions from that water resource from which they were originally withdrawn. Water used for hydroelectricity generation is an in-situ use and should be excluded.
Remarks	

Name	Public water supply
Number	16
Definition	Water supplied by economic units engaged in collection, purification and distribution of water (including desalination of sea water to produce water as the principal product of interest, and excluding treatment of wastewater solely in order to prevent pollution). It corresponds to division 36 (NACE/ISIC) independent of the sector involved, but excluding systems operation for agricultural irrigation such as irrigation canals, which should be reported under 'other supply', cf. definition 29. Deliveries of water from one public supply undertaking to another are excluded.
Remarks	This includes water for domestic use and water used at offices. It also includes small factories, use by local authorities (e.g. for cleaning streets and watering parks), and the watering of private gardens.

Name	Irrigation water
Number	17
Definition	Water which is applied to soils in order to increase their moisture content and to provide for normal plant growth. For purposes of the questionnaire, data reported under this item fit in NACE/ISIC division 01.
Remarks	

Name	Aquaculture use
Number	18
Definition	Addition of freshwater to assist in fish hatcheries for stocking and on-land fish farming etc. - Water used for pond based freshwater fish farming systems is an in-situ use and should be excluded. Examples for this are embankment ponds, watershed ponds, water required for feed, cage aquaculture in irrigation canals.
Remarks	

Name	Cooling water
Number	19
Definition	Water which is used to absorb and remove heat. In this questionnaire cooling water is broken down into cooling water used in the generation of electricity in power stations, and cooling water used in other industrial processes.
Remarks	Typically, cooling water is not significantly polluted by the cooling process. For the JQ-IW on Inland Waters heat is not regarded as pollution.

Name	Non-freshwater sources
Number	22
Definition	Includes sea water and transitional water, such as brackish swamps, lagoons and estuarine areas. Such water resources may be of great importance locally, although in a national context, they are usually of lesser importance as compared to surface and groundwater resources.
Remarks	

Name	Desalinated water
Number	23
Definition	Total volume of water obtained from desalination processes.
Remarks	Includes both sea water and brackish water

Name	Reused water
Number	24
Definition	Treated or untreated wastewater that is directly delivered to a user as reclaimed wastewater. Excluded is wastewater discharged into a watercourse and used again downstream. Recycling within industrial sites is excluded.
Remarks	

Name	Imports
Number	25
Definition	Traded bulk water from another territory (bottled water is not included).
Remarks	The term ‘another territory’ typically means another country, i.e. outside the (national) territory of the country for which the data are collected/reported.

Name	Water use
Number	26
Definition	In contrast to water supply (i.e. is delivery of water to final users including abstraction for own final use), water use refers to water that is actually used by end users for a specific purpose within a territory, such as for domestic use, irrigation or industrial processing. Excludes returned water (20)

Remarks	

Name	Water losses
Number	27
Definition	Volume of water lost during transport (through leakage or evaporation) between a point of abstraction and a point of use, between a water supplier/distributor and a point of use or between points of use and reuse. Water lost through evaporation during use is excluded and should be reported under consumptive water use (31)
Remarks	Process water used by waterworks (NACE 36) must not be reported as water losses, but has to be reported under industrial activities (NACE 05 – 43).

Name	Exports
Number	30
Definition	Traded bulk water to another territory (bottled water is not included).
Remarks	The term ‘another territory’ typically means another country, i.e. outside the (national) territory of the country for which the data are collected/reported.

3.2 General information

JQ-IW Table 3 refers to water made available for use from non-freshwater sources (marine and brackish water), desalinated water, reused water and losses during transport.

In general, the abstractors in Table 3 for non-freshwater sources are the same as those in Table 2 for fresh surface water and fresh groundwater. The decision tree and the good practices are therefore applicable to all main abstractors.

In addition, this subchapter sets out good practices for ‘losses during transport’ and ‘at operator’s level’ (these apply mainly to public water supply companies, but they can also be applied to other large water abstractors, such as irrigation systems, mining industry, producers of energy, manufacturing industry, etc., according to the NACE category).

3.3 DECISION TREE

Index
a) when major parts of information are available
b) when only minor parts of information are available

1. Does the NSI collect information on water abstraction by source? Please check with NSI units responsible for environment, agriculture and industry!

→ Yes, major parts:

a) methods for quality-checking the information collected by NSI (for PWS see subsection 2.4.1.3, for agriculture see subsection 2.4.2.3, for industry see subsection 2.4.3.3, for households see subsection 2.4.6, for services see subsection 2.4.5.3);
b) methods for calculating the missing information (for PWS see subsection 2.4.1.2, for agriculture see subsection 2.4.2.2, for industry see subsection 2.4.3.2, for households see subsection 2.4.6, for services see subsection 2.4.5.2);
c) for the missing information, please proceed to **2**.

↓ No

2. Do reporting commitments in line with the WFD, especially Articles 5 & 7) or to national standards exist in your country?

→ Yes, major parts:

Contact the administrative body responsible for data collection and treatment (e.g. environment agency, ministry).
a) methods for quality-checking the information collected (for PWS see subsection 2.4.1.3, for agriculture see subsection 2.4.2.3, for industry see subsection 2.4.3.3, for households see subsection 2.4.6, for services see subsection 2.4.5.3);
b) methods for calculating the missing information (for PWS see subsection 2.4.1.2, for agriculture see subsection 2.4.2.2, for industry see subsection 2.4.3.2, for households see subsection 2.4.6, for services see subsection 2.4.5.2);
c) for the missing information, please proceed to **3**.

↓ No

3. Do national or regional water associations, the chamber of commerce or national farmers´ unions collect data on water abstraction by source?

→ Yes, major parts:

a) methods for quality-checking the information collected (for PWS see subsection 2.4.1.3, for agriculture see subsection 2.4.2.3, for industry see subsection 2.4.3.3, for households see subsection 2.4.6, for services see subsection 2.4.5.3);
b) methods for calculating the missing information (for PWS see subsection 2.4.1.2, for agriculture see subsection 2.4.2.2, for industry see subsection 2.4.3.2, for households see subsection 2.4.6, for services see subsection 2.4.5.2);
c) for the missing information, please proceed to **4**.

↓ No

4. Do provincial governments/authorities c ollect data on water abstraction?

→ Yes, major parts:

a) methods for quality-checking the information collected (for PWS see subsection 2.4.1.3, for agriculture see subsection 2.4.2.3, for industry see subsection 2.4.3.3, for households see subsection 2.4.6, for services see subsection 2.4.5.3);
b) methods for calculating the missing information (for PWS see subsection 2.4.1.2, for agriculture see subsection 2.4.2.2, for industry see subsection 2.4.3.2, for households see subsection 2.4.6, for services see subsection 2.4.5.2);
c) for the missing information, please proceed to **5**.

↓ No

5. Do operators of water works, irrigation systems, etc. collect data about their water abstraction on the basis of direct measurement (e.g. flow meters, etc.) and consistent water balancing?

→ Yes, major parts:

a) methods for quality-checking the information collected (for PWS see subsection 2.4.1.3, for agriculture see subsection 2.4.2.3, for industry see subsection 2.4.3.3, for households see subsection 2.4.6, for services see subsection 2.4.5.3);
b) methods for calculating the missing information (for PWS see subsection 2.4.1.2, for agriculture see subsection 2.4.2.2, for industry see subsection 2.4.3.2, for households see subsection 2.4.6, for services see subsection 2.4.5.2);
c) for the missing information, please proceed to **6**.

↓ No

6. As a short-term solution, use estimation methods to determine the water abstraction in your country (e.g. coefficients for water use, also considering water losses). Methods for PWS are given in subsection 2.4.1.2, for agriculture in subsection 2.4.2.2, or manufacturing industry in subsection 2.4.3.2, for private households in subsection 2.4.6.2 and for services in subsection 2.4.5.2.

→

7. As a long-term solution, develop tailor-made questionnaires/adopt statistical programmes (for PWS see subsection 2.4.1.1, for agriculture see subsection 2.4.2.1, for industry see subsection 2.4.3.3, for services see subsection 2.4.5.1).

3.4 Good practices

3.4.1 Good practices for 'Public Water Supply'

3.4.1.1 Methods for data collection

Circulation of questionnaires to public water supply companies

The method is described in detail in subsection 2.4.1.1.

3.4.2 Good practices for 'losses during transport'

3.4.2.1 Methods for data collection

Leakage data are often based on the volume of water input to a transmission/distribution system minus authorised consumption. Authorised consumption is the volume of metered and/or unmetered water used by registered customers, the water supplier and others who are implicitly or explicitly authorised to do so by the water supplier, for domestic, commercial and industrial purposes (Lambert *et al.*, 2000).

Methods of direct and indirect measurement

Lambert *et al.* (2000) provide standard terminology and recommended performance measures on losses from water supply systems. They distinguish clearly between real losses (= physical water losses from the pressurised system, up to the point of customer metering) and apparent losses (= unauthorised consumption (theft or illegal use) and all types of inaccuracy associated with production metering) and explain how these differ from unbilled authorised consumption (Table 3-1). These explanations are of major importance, as the parameters are a considerable source of error (e.g. own water consumption by waterworks or street cleaning are regarded as water losses).

Table 3-1: Components of water balance for a transmission system or a distribution system (Lambert et al., 2000; A. Lambert and Dr W. Hirner, 2000, McKenzie et al., 2005, R. McKenzie and C. Seago, 2005)

System input volume QN	authorised consumption QA	billed authorised consumption QAI	billed metered consumption (including water exported)	revenue water QIR
			billed unmetered consumption	
		unbilled authorised consumption QAN(1)	unbilled metered consumption	non-revenue water QNR
			unbilled unmetered consumption	
	water losses QV	apparent losses QVS	metering inaccuracies	
			unauthorised consumption	
		real losses QVR(2)	leakage in transmission and/or distribution mains	
			leakage and overflows from utility's storage tanks	
			leakage in service connections up to the point of metering	

(1) All quantities Q in m^3/year

(2) Losses to be reported in the JQ-IW

Good practice in management of water losses consists of a combination of continuous water balance calculations together with night-flow measurements on a continuous or 'as required' basis. The water balance (see Table 3-1), usually taken over a 12-month period, should include:

- a thorough accounting of all water entering and leaving a utility system, including inspection of system records;
- an ongoing meter testing and calibration programme; and
- due allowance for the time lags between production meter reading and customer meter reading.

Methods of assessing real losses, other than from water balances, include:

- analysing night flows based on district meter data;
- recording numbers and types of leaks and bursts and their average flow rates and duration; and
- modelling calculations which allow for background leakage and pressure.

Circulation of questionnaires

- involves the circulation of a questionnaire to companies as conducted by the Netherlands and Cyprus.

Example: The Netherlands

All (10) Dutch public water supply companies are members of the Association of Dutch Water Companies (Vewin), which sends out a questionnaire each year in which the complete water balance per water company is inventoried, from abstraction per source to final production. Statistics Netherlands does not have exact information on the methods used, but most of the basic data are a result of measuring the flows (flow meters) at different stages of the drinking water production and distribution process.

The Netherlands reports data on leakage. Data disseminated for this parameter reflects the total production losses of the public water supply companies.

Direct measurement

Example: Finland

The loss in PWS is calculated using the data on the amount of water pumped into the distribution network and on the amount of water that is charged to the customers. The average loss (mostly due to leakages) varies between 10 % and 30 %. Data disseminated for this parameter reflects the total amount of water loss including usage without charge (process water, other usage).

3.4.2.2 METHODS FOR DATA CALCULATION/ESTIMATION

In the United Kingdom, leakage estimates are included in water company returns. The International Water Association provides definitions and guidelines for estimating different components of leakage within a distribution system (e.g. Lambert *et al.*, 1999). An example of how to estimate losses from a distribution system is given below.

Example: Estimating annual real losses in a distribution system (Lambert et al., 1999)

Distribution system with 1 500 km mains and 60 000 service connections with customer meters located on average 6 m from the edge of the road. System pressurised 90 % of the time at an average head of 30 m. Annual real losses from water balance are 4 000 * 103 m3/y.

Calculate technical indicator for real losses (TIRL), unavoidable annual real losses (UARL) and infrastructure leakage index (ILI):

TIRL (l/service connection/d): 4 000 * 10^3 * 10^3/(60 000 * 0.9 * 365)	202
UARL components (requires a look-up table):	
Mains (m^3/y): 18 l/km/d/m * 1 500 km * (0.9 * 365) days * 30 m/106	266 * 10^3
Connections to edge of street (conn)(m^3/y): 0.8 l/conn/d/m * 60 000 * (0.9 * 365) days * 30 m/106	473 * 10^3
Edge of street to customer meter (m^3/y): 25 l/km/d * (60 000 * 6/1 000) * (0.9 * 365) days * 30 m/106	85 * 10^3
UARL total (m^3/y) = 266+473+85	826 * 10^3
l/service connection/d = 826 * 10^3* 10^3/(60 000 * 0.9 * 365)	42
ILI = TIRL/UARL = 202/42	4.8

3.5 SITUATION IN INDIVIDUAL REPORTING COUNTRIES

Austria

Until 1994, the NSI collected annual figures for the abstraction of ground and surface water by industry. These were easily evaluated at regional level. However, since no data are available for the years after 1994, the following approach was chosen:

- as regards the largest industrial users of water in 1994, it emerged that a very small number of plants accounted for a large proportion of the total volume. For example, over 50 % of the total volume extracted by industry was used by only three plants. The 10 largest industrial users consumed over 68 % of the total volume;
- letters were sent to the 50 largest consumers asking them for data for 1995-98;
- of total water use in 1994, 73.18 % was covered;
- where it was not possible to cover particular plants (26.82 % of total water extraction in 1994), it was assumed that use stayed the same. This was then added to the volumes reported by the firms for the individual reference years.

Cyprus

Since 2001, the Statistical Service of Cyprus has conducted an annual sample survey among enterprises in the Mining, Manufacturing, Electricity and Water supply industries (NACE sections B-E) aimed at collecting data on industrial units' spending on environmental protection. The survey includes a question on the volume of water consumed by businesses, broken down by source of water supply (public, individual boreholes, seawater for cooling purposes, recycled or reused water, etc.).

4 JQ-IW TABLE 4: WATER USE (26) BY SUPPLY CATEGORY AND BY SECTOR

4.1 DEFINITIONS AND REMARKS

Name	Public water supply
Number	16
Definition	Water supplied by economic units engaged in collection, purification and distribution of water (including desalination of sea water to produce water as the principal product of interest, and excluding treatment of wastewater solely in order to prevent pollution). It corresponds to division 36 (NACE/ISIC) independent of the sector involved, but excluding systems operation for agricultural irrigation such as irrigation canals, which should be reported under 'other supply', cf. definition 29. Deliveries of water from one public supply undertaking to another are excluded.
Remarks	This includes water for domestic use and water used at offices. It also includes small factories, use by local authorities (e.g. for cleaning streets and watering parks), and the watering of private gardens.

Name	Cooling water
Number	19
Definition	Water which is used to absorb and remove heat. In this questionnaire cooling water is broken down into cooling water used in the generation of electricity in power stations, and cooling water used in other industrial processes.
Remarks	Typically, cooling water is not significantly polluted by the cooling process. For the purposes of the JQ-IW, heat is not regarded as pollution.

Name	Water use
Number	26
Definition	In contrast to water supply (i.e. is delivery of water to final users including abstraction for own final use), water use refers to water that is actually used by end users for a specific purpose within a territory, such as for domestic use, irrigation or industrial processing. Excludes returned water (20)
Remarks	

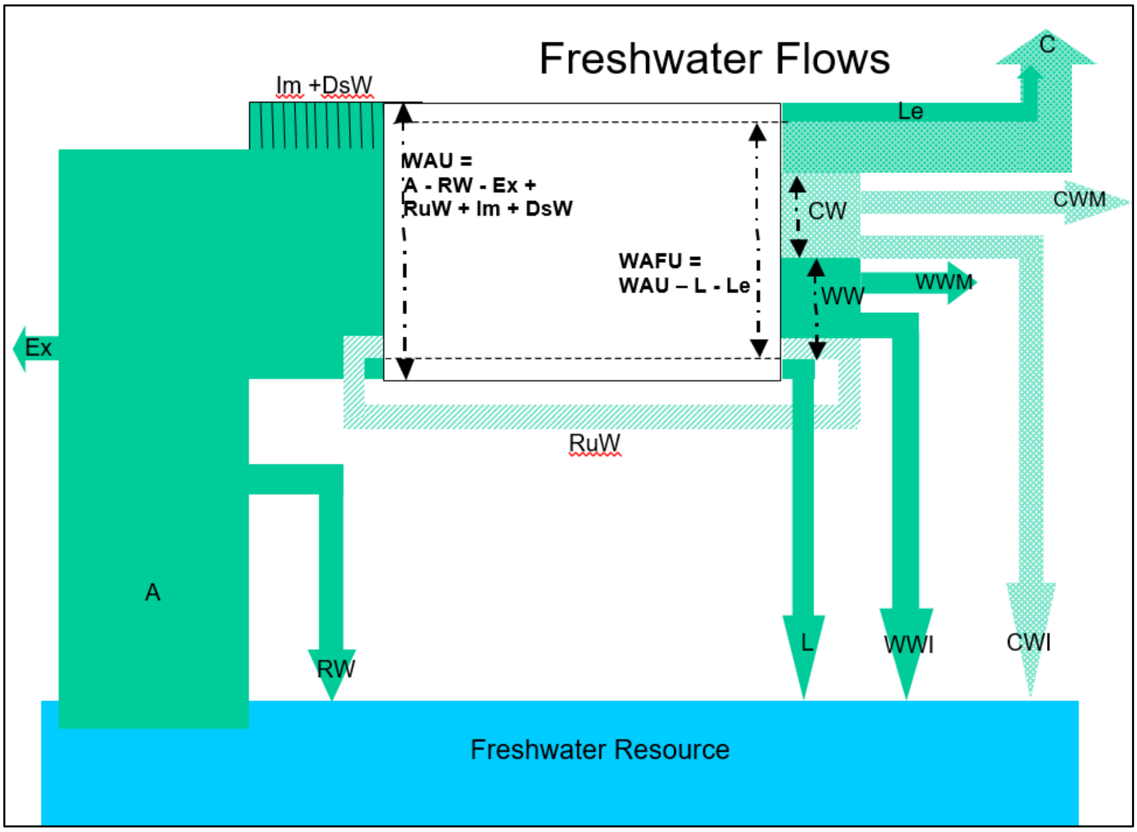
Name	Self-supply
Number	28
Definition	Abstraction of water by the user for own final use.
Remarks	

Name	Other supply
Number	29
Definition	The part of water supply to agriculture which was not included under 'Public water supply' or 'self-supply' (that means all system operation for agricultural irrigation which are not individual irrigation systems). This might also include some water from self-supply distributed to other users. Double-counting has to be avoided.
Remarks	

4.2 GENERAL INFORMATION

In contrast to JQ-IW Tables 2 and 3, which relate to water abstraction from various sources, Table 4 covers water use by supply category. The differences and similarities between the tables are shown in the following water flow diagram (Figure 4-1). Detailed explanations can be found in section 4.2.1.

Figure 4-1: Water flow diagram



CODE	
A	Abstraction
C	Consumptive water use
CW	Cooling water
CWI	Cooling water discharges to inland waters
CWM	Cooling water discharges to marine waters
DsW	Desalinated water
Ex	Exports
Im	Imports
L	Losses by leakage
Le	Losses by evaporation
RuW	Reused water
Rw	Returned water
S	Supply
WAU	Water available for use within the territory
WAFU	Water available for final use within the territory
WW	Wastewater generated
WWI	Wastewater discharged to inland waters
WWM	Wastewater discharged to marine waters

Table 4 is concerned with water from the public water supply which is used in manufacturing, and in the generation and distribution of electricity (NACE). It is worth noting that, in both sectors, water from the public water supply is generally used for sanitation, rather than for cooling or processing purposes.

As good practice guidance for data collection is essentially the same for Tables 2 and 4, the decision tree in Table 4 refers to the good practice guidance provided in Chapter 2 (Table 2). Good practice guidance for the evaluation of losses during transport is provided in section 3.4.2.

4.2.1 Methodological differences between Tables 2 and 4

Accounting for water is a complicated task involving several sectors and fields of expertise that do not always use the same terminology. Methods, definitions and concepts vary. A word may have different meanings in different fields. As a result, errors and confusion abound in the literature. The aim of the concepts and definitions used in water statistics is to ensure clarity and the consistent application of terminology to the entire water system.

As explained above, Tables 2, 3 and 4 are interlinked, and clarifying the terminology used in each will help to explain the differences between them, in particular the differences between Tables 2 and 4. Detailed definitions of the key terms ‘abstraction’ (Table 2), ‘availability’ and ‘use’ (Table 3) and ‘use’ (Table 4) are therefore provided below.

Definition of water abstraction (or withdrawal) (Table 2):

- Total water abstraction (or withdrawal) designates, first, water abstracted from the natural environment by water supply companies for subsequent distribution to economic agents and, secondly, water abstracted directly by economic agents (agriculture and industry in particular) to meet domestic, agricultural and industrial needs. Water that passes through distribution companies or related public services is typically referred to as the ‘public water supply’.
- Water abstraction by water supply companies refers to water abstracted, treated and subsequently used in private households and by businesses and public bodies, plus water losses during transport. This type of abstracted water may also include water distributed to industrial companies.
- Industrial abstraction refers to water abstracted by industrial companies not connected to the public supply network that take water directly from aquifers and rivers. Water abstracted for use in the energy industry is used especially in cooling processes at power stations.
- Water abstracted by agriculture refers to water abstracted directly by the agricultural sector (from groundwater, lakes and rivers), e.g. for irrigation and aquaculture.

Volume of freshwater made available for use (Table 3)

- The total volume of freshwater made available for use within a country is calculated by adding together all abstracted freshwater, desalinated water, reused water (typically treated wastewater) and the difference between water imports and exports.

Water use (Table 4)

- Water use is the volume of water used by the end user (households, industry, agriculture, etc.). The volume of water used is lower than the volume of water abstracted, since losses may occur between the place of abstraction and the place of use (leakage, evaporation, etc.).

Water consumption

- ‘Consumption’ in the domain of water statistics refers to water abstracted but no longer usable owing to evapotranspiration or because it has been incorporated into products or crops, consumed by people or livestock, discharged directly into the sea or removed in some other way from the freshwater supply.

Water use vs. Water consumption

- Water consumption should not be confused with water use. Definitions could be found under section 4.1.
- In the System of Environmental-Economic Accounts manual for water (SEEA-Water) water use and consumption are defined in § 3.44 and 3.47 as follows:

  3.44. The concept of water consumption gives an indication of the amount of water that is lost by the economy during use, in the sense that the water has entered the economy but has not returned to either water resources or the sea. This happens during use because part of the water is incorporated into products, evaporated, transpired by plants or simply consumed by households or livestock, etc. The concept of water consumption that is used in SEEA-Water is consistent with the hydrological concept. It differs, however, from the concept of consumption that is used in the national accounts, which instead refers to water use.

  3.47. Water consumption computed for each industry gives an indication of the industry's water use efficiency. Since water supply does not equal water use by industry, water consumption is computed as the difference between the use and supply by industry.

- Water use and water consumption can be explained in less technical language as follows:

  'Water use describes the total amount of water withdrawn from its source to be used… For example, a manufacturing plant might require 40,000 litres of freshwater a day for cooling, running, or cleaning its equipment. Even if the plant returns 95 percent of that water to the watershed, the plant needs all 40,000 litres to operate'.

  'Water consumption is the portion of water use that is not returned to the original water source after being withdrawn. Consumption occurs when water is lost into the atmosphere through evaporation or incorporated into a product or plant… and is no longer available for reuse'.

The differences between Tables 2 and 4 can be further clarified as follows:

- Table 2 (breakdown of water volume by origin of the water):
  - provides details of freshwater abstracted by the various sectors of activity: the public water supply, plus the sectors with a typically high aggregated level (industry, agriculture, service industries, mines and quarries, electricity generation, and private households);
  - provides information on water origin (surface or underground water).
- Table 4 (breakdown of volume by use):
  - provides details of the amount of water used, by sector (industry, agriculture, service industries, mines and quarries, electricity generation, and private households) and by method of distribution;
  - two types of use are possible:
    a. distribution by public distribution bodies (public water supply — top part of Table 4);
    b. own use (self-supply — middle part of Table 4);
  - provides details of sub-sectors of the 'industry' sector.

Table 3 covers water from other origins (salt or brackish water), non-conventional water production, water discharged before use, and imports and exports of water. It provides the total amount of water made available for use (total water made available for use = groundwater + surface water + non-fresh water – returned water – reused water + imports – exports + non-renewable groundwater). The amount of water made available for use does not necessarily correspond to the amount used, since there will be some water loss before final use.

4.3 Decision tree

1. Does the NSI collect information on water abstraction by source? Please check with the teams responsible for environment, agriculture and industry.

   Yes, major parts → see box A below.

   No ↓

2. Are there reporting commitments under the WFD, in particular Articles 5 and 7, or under national standards?

   Yes, major parts → Contact the administrative body responsible for data collection and treatment (e.g. the environment agency or the relevant government ministry). → see box A below.

   No ↓

3. Do national or regional water associations, the chamber of commerce or national farmers´ unions collect data on water abstraction by source?

   Yes, major parts → see box A below.

   No ↓

4. Do regional authorities and/or regional governments collect data on water abstraction?

   Yes, major parts → see box A below.

   No ↓

5 Do operators of, e.g. water works and irrigation systems, collect data about their water abstraction based on direct measurement (e.g. using flow meters) and consistent water balancing?

   Yes, major parts → see box A below.

   No ↓

6. In the short term, estimate the water abstraction in your country (e.g. using coefficients for water use, including water losses).

   → For PWS, see the methods given in subsection 2.4.1.2; for agriculture, see subsection 2.4.2.2; for the manufacturing industry, see subsection 2.4.3.2; for private households, see subsection 2.4.6.2; and for services, see subsection 2.4.5.2.

   No ↓

7. In the long term, tailor-made questionnaires should be developed and/or statistical programs launched.

   → For PWS, see subsection 2.4.1.1; for agriculture, see subsection 2.4.2.1; for industry, see subsection 2.4.3.3; for services, see subsection 2.4.5.1.

Box A:

a) Methods for checking the quality of the information collected by the NSI (for PWS, see subsection 2.4.1.3; for agriculture, see subsection 2.4.2.3; for industry, see subsection 2.4.3.3; for households, see subsection 2.4.6.3; for services, see subsection 2.4.5.3);

b) Methods for calculating the missing data (for PWS, see subsection 2.4.1.2; for agriculture, see subsection 2.4.2.2; for industry, see subsection 2.4.3.2; for households, see subsection 2.4.6.3; for services, see subsection 2.4.5.2);

c) for the missing data, please proceed to the next question .

4.4 GOOD PRACTICE

4.4.1 GENERAL PROCEDURE

4.4.1.1 DATA COLLECTION METHODS

Institutional framework

Providing data on water requires cooperation between the relevant institutions to ensure information flows continuously between administrative bodies, and to improve the quality and compatibility of the data produced.

Example: Romania

The cooperation framework is underpinned by the Cooperation Protocol, which sets out the joint actions of the National Institute of Statistics, the Ministry of Environment and Climate Change, and the National Administration for Romanian Waters in relation to the production of regular statistics on water abstraction and distribution, the collection, treatment and discharge of wastewater, and the reporting of data at national and international level.

The data entered in the JQ-IW and RWQ result from this cooperation and are provided by administrative sources: the National Institute of Hydrology and Water Management, the National Administration of Meteorology, and National Administration for Romanian Waters. In addition, the wastewater survey conducted together with the NIS produced very useful data for the completion of JQ-IW Tables 5 to 8.

4.4.2 GOOD PRACTICE FOR 'WATER USE FROM THE PUBLIC WATER SUPPLY' AND 'POPULATION CONNECTED TO THE PUBLIC WATER SUPPLY'

4.4.2.1 DATA COLLECTION METHODS

Circulation of questionnaires to public water supply companies

This method involves circulating a questionnaire to the PWS companies. Questions relating to data acquisition should cover the following key areas:

Delivery of tap water, clearly distinguishing the following categories:

- agriculture, forestry, fishing (NACE 01-03)
- mining and quarrying (NACE 05-09)
- total manufacturing industries (NACE 10-33)
- generation and distribution of electricity (NACE 35.11-35.13)
- services (NACE 45-99)
- private households

If it is not possible for water supply companies to distinguish between water supplied to private households and water supplied to SMEs, which usually belong to the 'services' category, the aggregated figure should be reported under 'private households' with an explanatory footnote.

In any case, the questionnaire should be designed to prevent double counting resulting from the transfer of water between water suppliers.

4.4.3 Good practice for 'manufacturing'

4.4.3.1 Data collection methods

Circulation of questionnaires to manufacturers

The method is described in detail in subsection 2.4.3.1.

4.4.4 Good practice at operator level (operators of waterworks, irrigation systems, etc.)

4.4.4.1 Data collection methods

Water metering

In many European countries, water metering is the dominant method in the domestic, commercial and industrial sectors, but it is not so widely used in the agricultural sector. It provides good results, as long as meter calibration and reading techniques are sound.

It is important to remember that, owing to the large numbers of customer meters, measurement periods do not usually correspond to the calendar year. In larger cities, meter readings are generally carried out throughout the year, and thus have to be aggregated by period accruals to annual values (which can lead to inaccurate values, especially if there is high annual variability in water use).

When aggregating total water use among a subset of suppliers, it is important to take account of water deliveries between suppliers, so that these amounts are not double-counted or overlooked.

Data accuracy: For different types of water meter, measurement accuracies have to be determined individually. In general, the load of water meters (flow rate/hour) is divided into a lower measurement range (Q_{min}–Q) and into an upper measurement range (Q–$Q_{max.}$). In the lower range, the calibration error of flow meters has to be < 5 %; in the upper measurement range, it has to be ≤ 2 %. Measurement accuracy in the period between calibrations of water meters is allowed to be twice the calibration error.

Extrapolation of pipe-flow measurements

Instantaneous pipe-flow measurements are extrapolated to longer time periods.

4.4.4.2 Data calculation/estimation methods

Licensing system

Licensing (permit) systems have also been widely introduced for self-supply for water resource management purposes. Good practice, typified by the approach in England and Wales, involves the use of models to estimate demand from various use sectors (Mathieson *et al.*, 1998; Mathieson *et al.*, 2000). It is good practice to check that the models make use of all available information to estimate missing values. This includes projecting from previous values and making use of results/trends identified by other reporting units.

Extrapolation of data from metered abstractors to non-metered abstractors

Extrapolation of data from a sample of metered abstractors to non-metered abstractors of the same type is recommended, with suitable precautions being taken to match the sampled group with a non-sampled group of the same type.

The greater the similarities between the sampled group and the non-sampled group, the smaller the sample population needs to be and thus the more accurate the findings. The overall result will be better if a larger percentage of the major users is included.

Extrapolation of surveyed abstractors to non-surveyed abstractors

The findings of a survey of a representative subset of abstractors (carried out by questionnaire or interview) should be extrapolated, provided that suitable precautions are taken to match the type of the surveyed group with the non-surveyed group type. Where possible, the surveys used as a basis for calculating abstraction estimates should be timed to coincide with the biennial frequency of the JQ-IW.

Data accuracy: Such estimates are likely to be the least accurate and reliable, as the response rate may be low and any follow-up requests add to the cost of the operation.

4.5 SITUATION IN INDIVIDUAL REPORTING COUNTRIES

Romania

Method for collecting 'water use from public water supply' data

The data are collected via the annual statistical survey on water distribution carried out by the NIS. The questionnaires are sent to economic units belonging to NACE 36, and to units owning an abstraction permit for a flow rate of over 100 l/sec.

The units complete the questionnaire with the number of persons connected to water supply and the amount of water distributed to the population, the service sector, industry and agriculture. Data are aggregated at county, regional and national level.

United Kingdom

Information comes directly from water companies on their delivery of tap water to customers in various commercial and industrial categories and sectors. The sum of the measured metered consumption and estimated unmetered consumption is the total.

Sweden

Statistics Sweden uses a range of different sources to determine the water use by supply category and sector. Data collected from municipalities by the Swedish Water and Wastewater Association (SWWA) is the main source of information on production and use of public water. Estimates and imputations are used only where it is not possible to obtain data:

- households: for public water supply used by households, data from the SWWA is the main source. Volumes delivered to households are measured by the municipalities. For households with self-supply, volumes must be estimated using per inhabitant/day water use derived from the SWWA data. Population in households with self-supply is assumed to use the same amount of water per capita as population in households connected to the public network. The per capita/day coefficient is approximately 160 litres;
- industry: data is collected via Statistics Sweden's survey on water use in the manufacturing industry (every five years). Use of public water in industry is identified in the questionnaire;
- other use (use of public water by schools, hospitals, public administrations, etc.): This is derived from the SWWA data. To close data gaps, the average usage per resident in the responding municipalities is applied to non-responding municipalities;
- waterworks use: This is derived from the SWWA data. To close data gaps, the waterworks usage as average share of total water production (use of waterworks/total volume produced) is calculated for responding municipalities and applied to non-responding municipalities; and
- losses from pipes and other leakages: This is derived from the SWWA as the difference between the total volume of water produced and the total volume of water delivered by the municipality. For non-responding municipalities, the average share from the responding municipalities are used as estimations.

Bulgaria

Method for calculating water use:

The figures are obtained by combining data collected via statistical surveys, conducted by the NSI. Public water supply companies and irrigation systems operators provide data on water delivered to consumers (households, industry, services, irrigation). Data on water used under 'self-supply' and 'other supply' are collected via the *Survey on Water Use* (covering larger enterprises using over 36 000 m^3 annually, and also these below this criterion - on a voluntary basis). An estimation method based on the economic activities of the water consumers is applied for calculating water use by supply category and by sector.

5 JQ-IW TABLE 5: POPULATION CONNECTED TO WASTEWATER (33) TREATMENT (34) PLANTS

5.1 DEFINITIONS AND REMARKS

Name	Wastewater
Number	33
Definition	Water which is of no further immediate value to the purpose for which it was used or in the pursuit of which it was produced because of its quality, quantity or time of occurrence. However, wastewater from one user can be a potential supply to a user elsewhere. Cooling water is not considered to be wastewater for purposes of this questionnaire.
Remarks	

Name	Wastewater treatment
Number	34
Definition	Process to render wastewater fit to meet applicable environmental standards or other quality norms for recycling or reuse. Three broad types of treatment are distinguished in the questionnaire: primary, secondary and tertiary. For purposes of calculating the total amount of treated wastewater, and in order to avoid double counting, volumes and loads reported should be shown only under the 'highest' type of treatment to which it was subjected.
Remarks	

Name	Resident population
Number	35
Definition	The average over a year of the number of persons belonging to the permanent population living in a territory.
Remarks	

Name	Urban wastewater treatment
Number	36
Definition	Urban wastewater treatment is all treatment of urban wastewater (37) in urban wastewater treatment plants (UWWTP's). UWWTP's are usually operated by public authorities or by private companies working by order of public authorities. For the purpose of this questionnaire, it includes the treatment of wastewater transported periodically by trucks from independent storage tanks to urban wastewater treatment plants. (Term used in the legislation of the European Union).
Remarks	Please provide data on the percentage of the population whose wastewater is treated at either a public sewage treatment plant or another WWTP. Industrial wastewater should be excluded from the data. Do NOT specify here the load treated by the WWTPs in person equivalents relative to the national population. The definition includes the population equipped with cesspools (underground watertight tanks without outflow used for collecting domestic wastewater (EN 1085, September 1997) where the wastewater from these is delivered to the UWWTP.

Name	Primary treatment
Number	40
Definition	Treatment of wastewater by a physical and/or chemical process involving settlement of suspended solids, or other process in which the BOD5 of the incoming wastewater is reduced by at least 20% before discharge and the total suspended solids of the incoming wastewater are reduced by at least 50%.
Remarks	Stage of treatment involving the removal of suspended solids from raw wastewater or from wastewater having undergone preliminary treatment (EN 1085, September 1997),

	where preliminary treatment is defined as: the stage of treatment involving the removal of gross solids, sand, grit or floating matter from wastewater (EN 1085, September. 1997).

Name	Secondary treatment
Number	41
Definition	Treatment of wastewater by a process generally involving biological treatment with a secondary settlement or other process, resulting in a BOD removal of at least 70% and a COD removal of at least 75%.
Remarks	Stage of treatment by biological processes such as activated sludge, biological filtration or other processes giving equivalent results. (EN 1085, September 1997).

Name	Tertiary treatment
Number	42
Definition	Treatment (additional to secondary treatment) of nitrogen and/or phosphorous and/or any other pollutant affecting the quality or a specific use of water: microbiological pollution, colour etc. For the purpose of this questionnaire, the following minimum treatment efficiencies define a tertiary treatment: organic pollution removal of at least 95% for BOD and 85% for COD, and at least one of the following: – nitrogen removal of at least 70% (48) – phosphorus removal of at least 80% (49) – microbiological removal achieving a faecal coliform density less than 1000 in 100 ml.
Remarks	Tertiary or advanced treatment: additional treatment processes which result in purification beyond that achieved through primary and secondary treatment. Note: reference should be made to the precise treatment, e.g. nitrogen removal, phosphorus removal, polishing lagoons, disinfection or filtration, as, in some cases, the tertiary treatment can also be integrated into the secondary treatment. (EN 1085, September 1997). As it is possible to combine the improved treatment for various parameters (e.g. N, N+P, P) in the same facility or in separate facilities, particular care should be taken to avoid double counting.

Name	Independent wastewater collecting system
Number	43
Definition	Individual private systems and operations in place to evacuate and collect domestic and other wastewater in cases where a collective/public/urban collecting system (cf. def. 45) is not available or not justified because it would either produce no environmental benefit or involve excessive cost. This includes in particular the transport of wastewater from storage tanks to treatment plants by means of trucks.
Remarks	

Name	Other wastewater treatment
Number	44
Definition	Treatment of wastewater in any non-public treatment plant, e.g. industrial wastewater treatment plants or treatment facilities of hotels, army camps etc. that do not fall under Independent Treatment. Excluded from 'other wastewater treatment' is the treatment in septic tanks.
Remarks	In addition to treatment in industrial WWTPs, this definition includes wastewater treatment by hotels, army camps, hospitals, etc. which have their own treatment plants (because these are not run by or on behalf of public authorities). (For Table 5, wastewater from hotels, army camps, hospitals, etc. is not usually relevant, as the table relates to the national resident population). See definition 46 of this table for the definition of a septic tank. 'Other wastewater treatment' should also exclude all other small independent treatments that should be included in the field covered by definition 46. Be careful not to confuse this treatment category, defined on the basis of ownership or management, with the category 'other wastewater treatment', defined under EN 1085, September 1997, on the basis of the process used.

Name	Wastewater collecting system (public sewerage, sewage network)
Number	45
Definition	Means a system of conduits which collects and conducts urban wastewater (37). Collecting systems are often operated by public authorities or semi-public associations. (Term used in the legislation of the European Union).
Remarks	Three main types of systems can be distinguished and defined; for each, only the part of the system conducting the wastewater produced by the public is considered. Combined system: sewer system designed to carry wastewater and surface water in the same pipeline(s) [3.6 of EN 7-521: 1996] (EN 1085, September 1997). Separate system: sewer system, normally consisting of two pipelines, one carrying wastewater and the other surface water [3.37 of EN 7-521: 1996] (EN 1085, September 1997). Partially separate system: sewer system, normally consisting of two pipelines, where one pipeline carries wastewater together with a specific volume of surface water and the other carries the rest of the surface water [3.38 of EN 7-521: 1996] (EN 1085, September 1997).

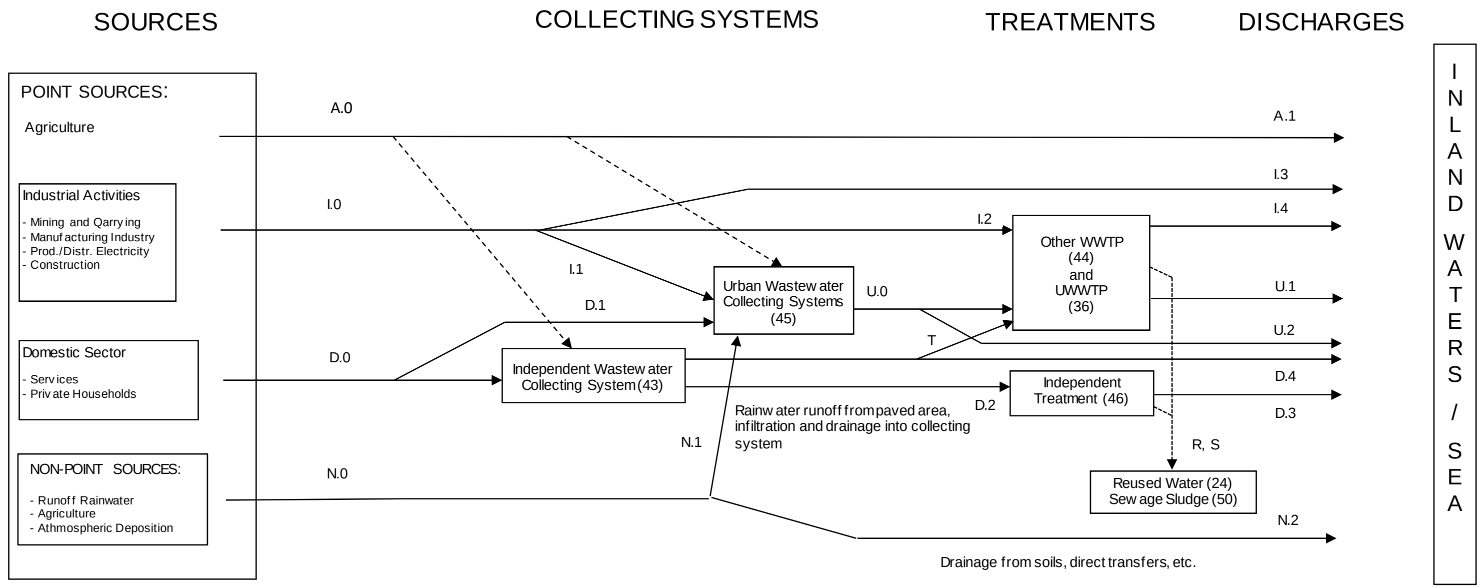
Name	Independent treatment
Number	46
Definition	Facilities for preliminary treatment, treatment, infiltration or discharge of domestic wastewater from dwellings generally between 1 and 50 population equivalents (54), not connected to an urban wastewater collecting system. Examples of such systems are septic tanks. Excluded are systems with storage tanks from which the wastewater is transported periodically by trucks to an urban wastewater treatment plant. These systems are considered to be connected to the urban wastewater system. For examples of types of independent treatment, see the 'Note 5a' in the guidelines.
Remarks	This includes septic tanks, other types of independent treatment (such as those listed in the questionnaire) and dry sanitation. Septic tank: closed sedimentation tank in which settled sludge is in direct contact with the wastewater flowing through the tank and the organic solids are partially decomposed by anaerobic bacterial action (EN 1085, September 1997); not to be confused with a cesspool. Cesspool: underground watertight tank with no outflow, used for collecting domestic wastewater (EN 1085, September 1997). For the purpose of the JQ-IW, cesspools are classified as independent collecting systems, but the population in question is otherwise considered as being connected to an urban treatment system.

Name	Population equivalent
Number	54
Definition	The organic biodegradable load having a five-day biochemical oxygen demand (BOD_5) of 60g oxygen per day
Remarks	

5.2 General information

The following diagram illustrates JQ-IW Tables 5 to 8; the part dedicated to each table is indicated (see legend). The small number of exceptions that might not be covered by this diagram should be included in the part of the diagram that is most similar (i.e. for any of the following: industrial wastewater first treated in an industrial WWTP and then connected to an urban collecting system; industrial wastewater connected directly to an UWWTP and not discharged via a public collecting system; or domestic wastewater connected first to an independent and then to an urban system, this would be the route via the urban collecting system).

Figure 5-1: Wastewater loading diagram

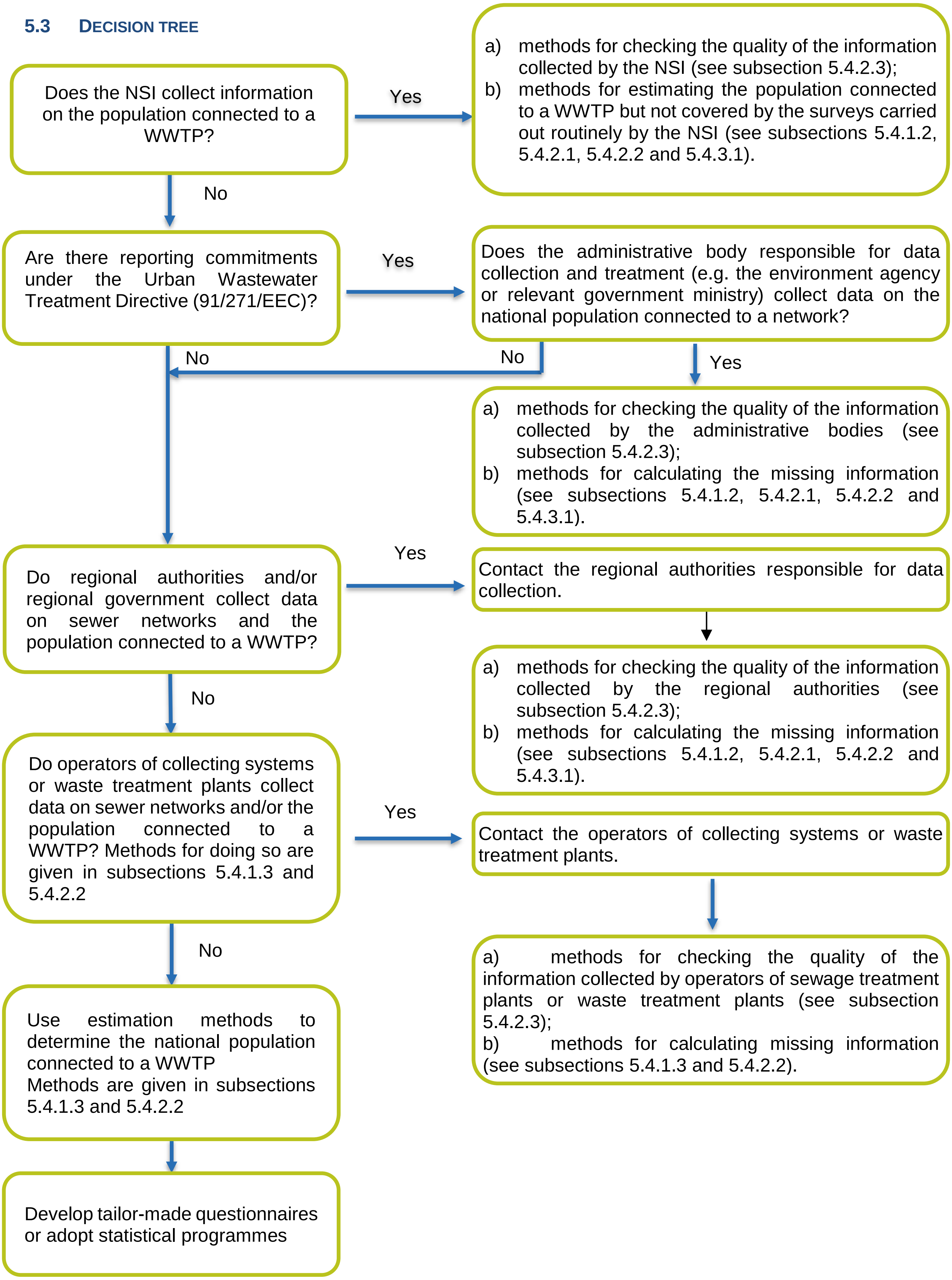


Other WWTP = Other wastewater treatment plant
UWWTP = Urban wastewater treatment plant

D.0+N.1+I.1	1. **Urban wastewater** - total generated (Def.37)	A.1	3. **Agricultural wastewater** (incl. forestry + fisheries) - direct discharges
(U.0-U.2)+T	Treated in WWTPs (Def.36, 44) : total inflow (Def.34)	N.2	Direct discharges from non-point sources
U.1+U.2+D.3+D.4	Discharged - Total (Def.52)	(A.1+I.3+I.4+U.1+U.2 +D.3+D.4+N2)	Total discharges to Inland waters (52) if discharged into inland waters
U.1	Discharged after treatment in WWTPs	(A.1+I.3+I.4+U.1+U.2 +D.3 +D.4+N2)	Total discharges to the sea (52) if discharged into the sea
D.3	Discharged after independent treatment (Def.46)	T	Transport to WWTP by truck
D.4+U.2	Discharged without treatment	R	Water for re-use after wastewater treatment
I.0	2. **Industrial wastewater** - total generated (Def.39) *(note8e)*	S	Sewage Sludge
I.2	Treated in 'Other' WWTPs: total inflow (Def.34, 44)	I.4	industrial WW treated in Other WWTP
I.3+I.4	Discharged - Total (Def.52)	U.1	urban wastewater treated in UWWTP or Other WWTP
I.4	Discharged after treatment in 'other' WWTPs		
I.3	Discharged without treatment		
U.1+I.4	**Total discharges** of WWTP's (urban (Def.36) and other (Def.44))*(note8f)*		

Flows / discharges indicated with dotted lines are not accommodated in table 8!

5.3 DECISION TREE



5.4 GOOD PRACTICES

This sub-chapter presents a method for checking the information available and sets out good practices at administrative and local level.

The good practices and recommendations for local level presented in the third part of this sub-chapter also apply at administrative level. The good practices relating to estimating the population connected to WWTPs or collecting systems at local level are also relevant at national level.

5.4.1 GENERAL PRACTICES

5.4.1.1 METHODS FOR DATA COLLECTION

<u>Good practices at administrative level (NSI, national authorities, water associations and regional authorities)</u>

Questionnaires

A questionnaire could be sent out to operators of WWTPs and collecting systems. Questions relating to data acquisition should cover all areas of JQ-IW Table 5, i.e. the national resident population connected to all types of WWTP and collecting systems. It is preferable for the questionnaire to be mandatory, in order to obtain representative results.

Data are generally reported on the basis of responses to the questionnaire (missing data can be estimated on the basis of statistical surveys).

Statistical surveys

If systems for communicating data on a regular basis are not already in place, a statistical survey is recommended. A survey should be designed/conducted solely collecting data for this purpose, with most resources devoted to collecting information from the biggest sources and fewer resources devoted to characterising the smaller sources. The data on these can then be completed using extrapolation.

The resident population of an urban area is often known to a sufficient degree of accuracy (from demographic or fiscal statistics). If there is no available data for a specific area, e.g. a rural area, the data for the smaller areas and villages within the area can be aggregated. It is assumed that the resident population in towns will be known to a sufficient degree of accuracy.

Example: France

France undertook an extensive survey of water and wastewater in local authority areas in 1998, 2001, 2004 and 2008 (approximately every three years). In 2008, a sample of 5 215 local authority areas (out of a total of 36 686) was taken, from across the whole country, including overseas territories. The samples were stratified according to the size of the regional and local authority areas. The survey rate ranged from full coverage, for local authority areas with more than 10 000 inhabitants, to 5 %, for areas with under 400 inhabitants. This selection is statistically valid sample, and the data can therefore be grossed up to reflect the country as a whole, and the results used for reporting.

The survey included data on price, the type of services, their organisation and characteristics, and the volumes of water and wastewater. This type of survey is primarily used for gathering data on the population connected to urban and independent WWTPs and urban collecting systems.

This water and wastewater survey will not be performed again. It has been replaced by the national observatory on water and sewerage public services (SISPEA – Système d'Information sur les Services Publics d'Eau et d'Assainissement), which makes its results available via the national portal for water services. The local authorities contribute directly to this information system.

This observatory cannot however produce exactly the same indicators, as the load rate is not complete.

5.4.1.2 METHODS FOR CALCULATING AND ESTIMATING DATA

The questionnaire asks for the percentage of the population connected to the respective types of systems. This is partly based on population estimates, which can be made using census and survey data, or, using property ownership and tax records that identify the number of properties, or, using connection counts and actual flow measurements.

The quality of the census information must be checked in the way described in subsection 5.4.2.3.

5.4.1.3 OTHER GOOD PRACTICES

Classification of the UWWTP

Three different approaches can be used to classify UWWTPs:

- a classification according to the real measured efficiency of the processes;
- a classification according to the average theoretical treatment efficiency of the system; or
- a national classification according to the three treatment types, to be used as a default classification (in the absence of data on the individual performance of the plant).

The first approach is used only for the largest systems, which are generally reported individually. The second method is suitable for smaller systems.

It is a good practice to:

- assess the real performance of the treatment system, especially for the largest systems, based on the UWWT in-out balance and not on the techniques used, as systems' performance can be poor even when they are well designed;
- link each UWWTP as far as possible to the population treated;
- for WWTPs smaller than 2 000 PE and when there is no other reliable approach, use a default classification of the treatment techniques according to the three treatment types (primary, secondary and tertiary).

If the individual performance of a treatment plant is known, the following approach should be considered:

1. For EU Member States (or a country intending to become an EU Member State):

➡ use the national categorisation where this complies with the UWWTD, as described in the methodological notes to JQ-IW Table;

➡ if the country applies requirements stricter than those listed in the UWWTD, classification should be made according to those requirements.

PART II - TABLE 5

2. For non-EU countries:

If BODeff > 95 % **and** COD/TOCeff > 85 % **and** (Neff > 70 % or Peff > 80 % **or** faecal coliform count < 1000 / 100 ml)

– then **WWTP**$_{cat}$ = **tertiary**

If BODeff > 70 % **and** COD/TOCeff > 75 %

- then **WWTP**$_{cat}$ = **secondary**

If BODeff > 20 % and TSSeff > 50 %

- then **WWTP**$_{cat}$ = **primary**

Otherwise, **WWTP**$_{cat}$ = **no treatment**

If no information is available on either the real efficiency measured or on the average theoretical treatment efficiency for a UWWTP, a default classification should be used. Table 5-1 gives an example of the default classification used in France (Sandre). However, this repartition might differ for other countries.

Table 5-1: Example of correspondence between treatment process and treatment category for France (Sandre, 2002)

Treatment process	Treatment category
Mechanical treatment	Primary
Physicochemical treatment	Secondary
Aerated lagoon	Secondary
Natural lagooning	Secondary
Anaerobic lagoon	Secondary
Activated sludge — low load	Secondary
Activated sludge — middle load	Secondary
Activated sludge — high load	Secondary
Activated sludge — extended aeration	Secondary
Trickling filters — low load	Secondary
Trickling filters — high load	Secondary
Nitrification	Secondary
Biological discs	Secondary
Biological filters	Secondary
Biological denitrification process	Tertiary
Physicochemical denitrification process	Tertiary
Biological denitrification process	Tertiary
Physicochemical denitrification process	Tertiary
Disinfection (including effluent polishing pond)	Tertiary
Planted filter	Secondary

In principle, the most reliable method for determining the percentage of the population connected to each treatment type is to identify the type of each treatment system and report the real population connected to it.

However, some countries, such as Sweden, are not able to link the population to specific treatment plants, at least for the smaller plants (smaller than 2 000 p.e. for Sweden). The only available data are on how much pollution is treated in each plant, and this is sometimes based on design capacity rather than real data.

Being able to link the pollution reduction and treatment systems to the sources responsible for the pollution is, however, very useful when applying the ‘polluter pays’ principle.

Some countries also consider the population served (i.e. those connected to the system, irrespective of whether they make use of it) as connected and treated: **this is not a reliable approach** and should, as far as possible, be avoided. If this approach is used, it should be mentioned in the footnotes to avoid misleading comparison with other countries.

Another major challenge is being able to link the treatment techniques used (e.g. activated sludge or trickling filter), the individual performance of the treatment plant and the three types of treatment. The statistical system in France, for example, collects the treatment techniques used and then classifies them into the three types (primary, secondary or tertiary), the performance of the plants are registered as conformed or not in terms of concentration and yield regarding the criteria of the European directive 91/271/EEC, whereas the Netherlands also considers the real performance of the systems.

Distinction between urban, other and independent WWTPs

UWWTPs

The Joint Questionnaire defines an urban wastewater treatment plant (UWWTP) as a plant treating urban wastewater and *usually operated by public authorities or by private companies contracted by public authorities*.

This means that WWTPs for hotels, army camps, hospitals, etc. are *other WWTPs* (see subsection 5.4.1.3), because they are not operated by, or on behalf of public authorities.

Generally, plants with a capacity of between one and 50 p.e.s are to be considered under *independent wastewater collecting system - of which with independent treatment* and are, therefore, not to be counted as UWWTPs.

Note:

The UWWTD does not define the term ‘urban wastewater treatment plant’, only the term ‘urban wastewater’ (Article 2 UWWTD). This means that under certain circumstances (e.g. if the load of the urban area served by the urban, other or independent WWTP is ≥ 2 000 p.e.) the UWWTD could be relevant for plants which are considered for the purpose of the JQ-IW as ‘other WWTPs’.

It is good practice to:

- concentrate resources on the largest systems, especially where the accuracy of the data is the priority, but also to assess the smaller ones;
- implement a data collection and reporting system at national level that allows a distinction to be made between the various polluting agents produced through the existence of the population and all economic activities.

Other WWTPs

The JQ-IW defines 'other wastewater treatment plant' as one that is NOT operated by, or on behalf of, any public authority (definition 44). Typically, this includes urban wastewater treated in industrial plants (clusters or conurbations connected to industries), but also treatment by hotels, army camps, hospitals, etc. that have their own treatment plants (which, because the treatment plants are not operated by, or on behalf of, public authorities, would be considered as UWWTPs (see above)).

See definition 46 (independent wastewater treatment) of Table 5 for the definition of septic tanks. This should also exclude any other small independent treatments covered by definition 46. This treatment category, which is defined on the basis of ownership or management, is not to be confused with the 'other wastewater treatment' category as defined in the 'waste water treatment vocabulary' publication (ref. EN 1085, April 2007) on the basis of the process used.

The population connected to other WWTPs should include only the actual population connected to this treatment type (i.e. connected to industrial WWTPs also treating urban wastewater) or an estimate of this population based on the number of households connected or on any other reasonably reliable estimate. This information is often available, at least locally, as it is needed for implementing the 'polluter pays' principle.

The best way to be sure to report all networks relating to the wastewater collecting system is to report only the resident population connected to industrial WWTPs. In the case of army camps and hotels, there is usually no resident population connected to these plants, and this is therefore not relevant for Table 5.

5.4.2 Good practices for reporting on the variable 'connected to a wastewater treatment plant (WWTP)'

5.4.2.1 Methods for data collection

At local level (operators of WWTPs and collecting systems)

<u>Distinction between collecting systems:</u>

Urban wastewater collecting systems where treatment is carried out

For most of the countries that reported on their wastewater systems, this is the most common case, if not the only one. Most often, therefore, the entire population that is connected to a treatment plant, as described above, is also included in this row of the table. Considering the situation from a technical and economic point of view, it seems unlikely that the data provide an accurate picture, especially for countries that have developed their wastewater systems in recent decades. (In hilly regions, for example, part of the household may be so low-lying as compared with the altitude of the sewer network that it is not economical for it to be connected. It is therefore served but only partly connected).

To improve the comparability of data, the method used to estimate the population of this row should be checked and the data reported more accurately if possible, e.g. reporting the population served and the population connected separately. This should be done as follows:

- check the method used, explain it in the notes accompanying the JQ-IW table and report the population connected if possible.

Urban wastewater collecting systems without treatment

- Gross up the results of a statistical survey to cover the population related to the survey

As mentioned in the UWWTD, connecting the sewer network to a plant is, or should be, the final goal, even when the discharge is made into the sea. As a result, this information is important, but it can be difficult to collect. The best approach in the absence of a mandatory reporting system is a statistical one, using a survey of a test area and grossing up the results to regional or national level.

Total urban wastewater collecting system

The most common and reliable method for determining the percentage of the population connected to each type of collecting system is a complete census, as reported for France until 2016 or the use of administrative data, as reported for Austria. Regular reporting under the Urban Waste Water Treatment Directive (91/271/EEC) and the Water Framework Directive (2000/60/EC) requires surveys as regards the population connected to urban waste water collecting systems. The usefulness of this method is, however, limited by the cost (figures often being updated through statistical methods with the help of coefficients) and by the extent of the population's knowledge as to how on their wastewater is collected and treated.

Where an authority is responsible for the wastewater tax, and if the tax is per person, the real population connected is very accurate. Otherwise, it is only an estimate, most often made on basis of the assumption that the population of urban areas and/or that served by a collection system is equivalent to the population connected.

It is good practice to:

- use information on the population connected to networks and the taxes paid;
- in their absence, include a specific question in the national census and make annual extrapolations, on the basis of the statistical laws commonly used in the field of population censuses.

5.4.2.2 Methods for calculating and estimating data

Methods for estimating the population connected to a UWWTP

The population connected to a UWWTP can be estimated by combining data from a database on sewerage and treatment works, and data on household dwellings (building registers). In the building registers information about the water sources and wastewater system (sewer, septic, etc.) are included as descriptive variables in the registers. Norway has this information in their building register. By combining the population register which includes unique references to the dwellings/buildings where each person lives, to the building register, the connection rate to the different types of treatment can be determined using administrative registers. An alternative method for estimating the population connected to a UWWTP is to use the PE of each UWWTP. A new approach being developed uses statistical laws to reduce the quantities of data that need to be collected in order to be able to extrapolate the results to apply to the whole country. The population connected to UWWTPs can be broken down to show the respective proportions connected to treatment plants carrying out each of the three levels of treatment. This is done on the basis of the population connected to the various UWWTPs and the performance of these plants.

Methods for estimating the population connected to independent WWTPs or collecting systems

See subsection 5.4.3.1.

Measuring the population connected to the network

Populations are measured in a range of different ways to produce the data in JQ-IW Table 5, and this has a considerable effect on the comparability of the data, both with regards to the population itself and the link between this and the percentages reported in the other rows of the table.

Before estimating a population, it is important to decide whether the non-national resident population is significant, relative to the overall national population, or whether it can be ignored.

Tourists and other seasonal populations should not be included in the national resident population. In practice, it is not possible to distinguish them when considering who is served by the wastewater system.

Some countries, such as France, have reliable methods for estimating tourist numbers, but the seasonal variations in the country's population as a whole are not accounted for in statistics. The whole population connected to the treatment system should therefore be expressed as a percentage of the total local population. In the absence of reliable estimates of the seasonal local population, tourists and the non-national population, a uniform correction factor can be introduced if the total population to which the JQ-IW table refers is higher than the actual national population.

Table 5-2: Inhabitant equivalence in France (JOCE 1999, Decree 75-996 of French legislation, last modified November 1998)

Type of accommodation	Equivalent
Hotel	2 occupants per room
Tourist accommodation: e.g. holiday complex or holiday village, sports centre, self-catering holiday cottage	1 occupant per bed
Outdoor accommodation: e.g. campsite or caravan site	3 occupants per site
Second home	5 occupants per home

Other main points that affect comparability are:

- the assumed number of occupants per house, apartment or household;
- the way in which 'being connected' is defined and reported, i.e. as either: a) houses served by the collecting system — the network is there; or b) houses actually connected to the system — the household installations are physically connected and paid for; and
- the way in which the population, network and WWTP are linked.

<u>Link between houses and occupants</u>

Some countries estimate the number of occupants based on the simple assumption that this will be the average (often the national average) number of occupants per house. Other methods used are:

- to consider the aggregate population to be equivalent to the population connected to the network;
- to use census data giving the exact number of occupants.

In the absence of the exact number of occupants of housing, and especially due to the wide variation possible in the average population per connected house (a building with several flats being counted as only one house), it is advisable to adopt an approach based as far as possible on local data (e.g. to consider the aggregate population as being equivalent to the population connected to the network).

<u>Connection of houses to the network</u>

The connection of houses to the network is often measured using census data and tax statistics.

Some countries consider the population served as being connected, often based on the fact that the population served is asked for a tax or a similar fee, and thus is more or less committed to being connected, at least in the future.

In the absence of reliable data on the population actually connected to the network, it is advisable to use this assumption.

<u>Connection between network and WWTP</u>

The link between the network and the WWTP can be more difficult to measure, especially where there are multiple WWTPs carrying out different levels of treatment. The treatment levels of the various WWTPs in an area are, however, often the same, as a result of the UWWTD.

In the absence of more reliable information (i.e. on the actual level of usage of each plant), the total population connected to an urban wastewater collecting system where treatment is carried out should be attributed to the various treatment systems located in the area on the basis of their all being used to the same percentage of their capacity.

It is good practice to:

- use the national resident population reported by the national statistical institute, especially for expressing as a percentage of the total population the population connected to the different treatment types;
- in the absence of data on the different types of population connected (e.g. tourists and non-national residents), to report the figures on the national population using either a national uniform correction factor or a regional correction factor, if the expertise exists to produce a set of such factors;
- use the actual population connected or estimate this population on the basis of the most disaggregated ratio available linking houses and the population permanently resident (i.e. the ratio for the smallest area for which this is calculated);
- in the absence of data on the actual population connected to the network, to use census data and tax statistics on households to estimate the population connected;
- for large cities, if no information is available on the respective levels of usage (as a percentage of capacity) of the various plants, attribute the population connected to the various WWTPs using a unique level of occupation of the treatment plants.

5.4.2.3 Methods for checking data quality

The quality of information on the connected population presented in JQ-IW Table 5 can be checked as follows:

- The information relates to the national resident population, not the number of households connected, and irrespective of the type of household (e.g. flats or houses) and location (e.g. urban or rural). This means that the non-resident population also needs to be estimated (for examples of methods for doing this see subsection 5.4.2.2 on measuring the population connected), as does the link between the number of households and the number of occupants per household.
- The population connected to a WWTP is different from the population connected to the collecting systems. This needs to be checked for urban, independent and other treatments.
- The population considered is the population connected to a sewer (and not the population served, i.e. households where a network is present but the household is not connected to it for whatever reason are not included).

5.4.3 Good practices for reporting on the variable ‘independent wastewater treatment’

5.4.3.1 Methods for calculating and estimating data

Methods for estimating the population connected to independent WWTPs or collecting systems.

The population connected to independent collection and treatment systems is generally estimated, using a combination of census data, demographic data and information from statistical surveys, administrative data, tax registers and assumptions. This is the approach used by Sweden and France. Another possible method is to make a simple assumption of the population connected on the basis of national regulations, as has been done in Austria, where it is obligatory to be connected to some form of treatment and thus the population connected to independent systems is calculated as a residual, or in other words, calculated as the portion of the population that is not connected to a UWWTP.

5.5 Situation in individual reporting countries

Romania

Method for assessing the population connected:

Since 2005, every local authority area with a collecting system has been required to complete a survey on the population connected to wastewater collection, treatment and discharging systems. The population figures given in Table 5 are then either taken directly from the survey results, or estimated from them: any areas without sewers are considered to have independent treatment facilities.

Bulgaria

A comprehensive NSI statistical survey on public water supply and sewage provides quantitative data on water services at LAU2 level. The list of towns and villages connected to public sewage and UWWTPs is matched to the LAU2 code with the annual average population from the current demographic statistics. This approach leads to some overestimation of the population in areas with partially built water supply or sewerage networks. The population with independent wastewater treatment is calculated as the difference between the total population and the population connected to the public sewage network. UWWTPs are classified according to the available treatment technology.

England and Wales

Method for assessing the population connected:

The numbers of establishments that are or are not connected to sewer and the number of these which are domestic properties are known from water companies in England and Wales. Assumptions are made about occupancy rates in order to derive the percentage of the population connected or the number of people not connected. Population estimates would be used for the latter calculation.

The Netherlands

To estimate the population connected to a UWWTP, the Netherlands use data on connected p.e.'s per UWWTP. The aggregation P.E. per treatment method is converted to shares (%) per method. To determine the percentages of population connected to independent treatment, data from an external institute on sewer management are used. This organisation (called RIONED) compiles this data on the basis of a survey of municipalities conducted every 3 years.

6 JQ-IW TABLE 7: SEWAGE SLUDGE (50) PRODUCTION AND DISPOSAL (IN DRY SUBSTANCE (DS))

6.1 DEFINITIONS AND REMARKS

Name	Urban wastewater treatment
Number	36
Definition	Urban wastewater treatment is all treatment of urban wastewater (37) in urban wastewater treatment plants (UWWTP's). UWWTP's are usually operated by public authorities or by private companies working by order of public authorities. For the purpose of this questionnaire, it includes the treatment of wastewater transported periodically by trucks from independent storage tanks to urban wastewater treatment plants. (Term used in the legislation of the European Union).
Remarks	A distinction is made in the UWWTP category in the JQ-IW between total sludge production and total sludge disposal. This serves to account for sludge remaining in the treatment centre or other facilities at the beginning or end of a specific reporting year.

Name	Other wastewater treatment
Number	44
Definition	Treatment of wastewater in any non-public treatment plant, e.g. industrial wastewater treatment plants or treatment facilities of hotels, army camps etc. that do not fall under Independent Treatment. Excluded from 'other wastewater treatment' is the treatment in septic tanks.
Remarks	A distinction is made in the 'other treatment' category in the JQ-IW between total sludge production and total sludge disposal. This serves to account for sludge remaining in the treatment centre or other facilities at the beginning or end of a specific reporting year.

Name	Sewage sludge
Number	50
Definition	The accumulated settled solids separated from various types of water either moist or mixed with a liquid component as a result of natural or artificial processes. For reporting to this questionnaire, sewage sludge should be calculated as dry substance.
Remarks	For reporting to this questionnaire, the level of production of sewage or wastewater treatment sludge is defined as the quantity of decanted matter resulting from wastewater treatment, including sludge treatment. Depending on the methods of water treatment and sludge treatment, e.g. digestion or filter-pressing, the concentration of dry substance can be very variable. For this reason, information is requested only on dry substances that are to be disposed of. Any information available on the physical or chemical composition of the sludge should be sent with the questionnaire. ▪ Agricultural use: all use of sewage sludge as fertiliser on arable land or pastures, irrespective of the method of application. ▪ Compost and other uses: all use of sewage sludge after mixing it with other organic material and composting, e.g. in parks or for gardens. ▪ Landfill: all sludge that is disposed of in tips, landfill areas or special depot sites and that serves no useful function. ▪ Dumping at sea: all sludge that is disposed of in the sea, either directly by pipeline or indirectly after treatment. (Note for EU countries: dumping of sewage sludge at sea has been prohibited since 1998). ▪ Incineration: all sludge that is disposed of by direct incineration or by incineration after mixing with other waste.

6.2 GENERAL INFORMATION

Information on sewage sludge production can be obtained in two main ways: **measurement (direct and/or indirect)** and **estimation**. Provided that measurement techniques are sound and correctly implemented, measured data have a high confidence level, as they are obtained from observation of the actual situation and because the statistical accuracy (or confidence level) can be derived from the uncertainty of the measurement method.

Where data are not directly measured, estimation coefficients can be used to derive results for sewage sludge production. An important prerequisite for calculating estimates is, however, some basic information on the incoming load BOD_5 of the WWTP (in terms of BOD_5, COD or p.e.), the type of sludge stabilisation and the dewatering technique used. If data are not available, the methods for calculating estimates are described in subsections 6.4.2.2 and 6.4.3.1.

Estimation coefficients for sewage sludge production are closely related to the technical infrastructure, climate and economic structure of a country, and it is therefore strongly recommended that you derive country-specific coefficients (e.g. from WWTPs, where data are measured) and update them frequently.

In addition to being used for estimating information that is not directly or indirectly measured, estimation coefficients relating to sewage sludge production can also be used for checking the quality of measured data (see subsections 6.4.4.2 and 6.4.5.1).

The terminology describing sewage sludge disposal can often lead to misunderstandings if such ‘disposal’ is considered to include the use of sewage sludge in agriculture or for compost. For the purpose of this questionnaire, total sludge disposal is defined as the total amount of sewage sludge which leaves WWTPs after sludge treatment. This should include any sludge which will be disposed of by means of incineration, landfill or dumping or which will be reused in agriculture, for compost or for any other purpose.

If sewage sludge is stored for a limited time period at a WWTP, this **should not** be regarded as sludge disposal and may shift the balance between total sludge production and total sludge disposal if, in practice, storage exceeds one year (see subsection 6.4.5.2).

6.3 DECISION TREE

Index:
b) when major parts of information are available
c) when only minor parts of information are available

1. Does the NSI collect information on sewage sludge production and disposal? Please check with the NSI departments responsible for waste, agriculture and soil.

Yes →
a) methods for checking the quality of the information collected by the NSI (subsections 6.4.4.2 and 6.4.5.1);
b) methods for calculating the missing information (subsection 6.4.4.1);
c) for the missing information, please proceed to question 2.

No ↓

2. Are there reporting commitments under the Urban Wastewater Treatment Directive (91/271/EEC) and/or the Sewage Sludge Directive (86/278/EEC)?

Yes →
Contact the administrative body responsible for data collection and treatment (e.g. the environment agency or relevant government ministry).
a) methods for checking the quality of the information collected by the administrative bodies (subsections 6.4.4.2 and 6.4.5.1);
b) methods for calculating the missing information (subsection 6.4.4.1);
c) for the missing information, please proceed to question 3.

No ↓

3. Are data collected on sewage sludge?

Yes →
a) methods for checking the quality of the information collected (subsections 6.4.4.2 and 6.4.5.1);
b) methods for calculating the missing information (subsection 6.4.4.1);
c) for the missing information, please proceed to question 4.

No ↓

4. Are there national or regional water associations that collect data on sewage sludge?

Yes →
a) methods for checking the quality of the information collected (subsections 6.4.4.2 and 6.4.5.1);
b) methods for calculating the missing information (subsection 6.4.4.1);
c) for the missing information, please proceed to question 5.

No ↓

5. Do regional governments or government authorities collect data on sewage sludge production or disposal?

Yes →
a) methods for checking the quality of the information collected (subsections 6.4.4.2 and 6.4.5.1);
b) methods for calculating the missing information (subsections 6.4.4.1);
c) for the missing information, please proceed to question 6.

No ↓

6. Do operators of WWTPs or waste treatment plants collect data on sewage sludge production and disposal on the basis of direct measurement (e.g. flow metres or tanker movement)?

Yes →
a) methods for checking the quality of the information collected by water associations (subsection 6.4.4.2);
b) methods for calculating the missing information (subsections 6.4.4.1 and 6.4.4.3);
c) for the missing information, please proceed to question 7.

No ↓

7. As a short-term solution, estimate the sludge production and disposal (see subsection 6.4.4.1).

→

8. As a long-term solution, develop tailor-made questionnaires or adopt statistical programmes (see subsection 6.4.1.1).

6.4 GOOD PRACTICES

6.4.1 GENERAL PRACTICES

6.4.1.1 METHODS FOR DATA COLLECTION

Questionnaires

A questionnaire could be sent out to owners or operators of WWTPs. In general, the questionnaire should cover information not only on sewage sludge production, but also on wastewater treatment (e.g. the incoming load BOD_5 of the WWTP and the treatment type). Using a comprehensive questionnaire designed to gather information on both wastewater treatment and sewage sludge production has the advantage that there is only one data collection step. This approach also recognises that having information on wastewater is a prerequisite for assessing sewage sludge production. The main questions requesting specific data should cover the following areas:

- the total sludge disposal volume or weight ('wet' and 'dry' solids) for each disposal route;
- the type of wastewater treatment, sludge stabilisation and dewatering technique used;
- the incoming load (in terms of BOD_5 or p.e.) of the WWTP.

Data are generally reported based on responses to the questionnaire and missing data are not usually estimated. This is because of the wide variety of treatment types, i.e. treatment being for the most part multi-stage, some types involving anaerobic and/or chemical treatment, and the varying nature of industrially processed wastewater.

The accuracy of the reported data on dry substance is likely to vary considerably, as the frequency of analysis can range from one to 100 times per year.

Great emphasis is placed on recovering the cost of sludge disposal; the generation and disposal of sewage sludge can be most accurately measured at the point where it is transferred to the sludge disposer (see subsection 6.4.4.3 for methods of measurement).

Sending questionnaires to industrial sewage sludge producers may be a useful way of obtaining data on industries producing sludge that is not processed at larger treatment centres. In general, a small number of economic sectors accounts for a large proportion of the total industrial sewage sludge produced. It is therefore advisable to focus data collection on these sectors. The most intensive sewage sludge sectors typically include:

- manufacture of paper and paper products (NACE 17);
- manufacture of chemicals and chemical products (NACE 20);
- manufacture of sugar (NACE 10.81).

At a secondary level but one that is creating problems for some WWT systems are breweries and the manufacture of other fermented beverages as well as slaughterhouses and food manufacturing.

- Manufacture of beer (NACE 11.05) and Manufacture of other non-distilled fermented beverages (NACE 11.04)
- Processing and preserving of meat (NACE 10.11)

A questionnaire used in the Netherlands is annexed to this document as an example (Annex 2 — Draft questionnaire on wastewater sludge (the Netherlands)). The questionnaire used in Romania (Annex 3 — Statistical survey on the population connected to wastewater collection systems and treatment plants (Romania)) may also be useful as an example.

Stratified surveys

An example of stratified surveys as used in various countries is the survey conducted in France as described under section 5.4.1.1.

6.4.2 GOOD PRACTICES FOR 'INCOMING LOAD BOD_5'

6.4.2.1 METHODOLOGIES FOR DATA COLLECTION

The method most recommended in terms of accuracy involves using flow meters, as described for **large treatment plants** in France, and sampling points at both inlet and outlet points within wastewater treatment plants. Sampling methodology should however be used carefully to provide figures representative over the year. This enables total incoming load BOD_5 to be determined by adding up all plants. Figures obtained should then be cross-checked with the BOD produced per person per day for population equivalents served by the treatment plant, to check overall accuracy. The same should be applied for the largest other treatments.

For direct measurement of incoming load BOD_5 and effluent BOD_5, it is recommended to:

- Implement and respect legislation and/or technical guidance for WWTP monitoring (a document which specifies good practices, methods, organisation, devices, etc. for sampling and flow rate measurements at the inlet and outlet of WWTPs) (see Guide de l'Autosurveillance des Systèmes d'Assainissement, 1996, and/or 'Autosurveillance des réseaux d'assainissement'[5] 2015);
- Carry out BOD_5 analyses according to EN 1899-1 and 2 standard (Method by dilution);
- Use services of an accredited laboratory (for example, see Program N° LAB GTA 05 of COFRAC for accreditation of laboratory in physiochemical analysis of water in France).

These previous recommendations are very important as BOD_5 is not a very accurate measurement. 30% error is quite common!

There is a BOD_5 micro method (analysis in micro tubes) and for some supplier(s) results are rather good. But in many countries, such as in France, this micro method is not officially accepted (contrary to COD micro methods, which are accepted by the French River Basin Agencies and ISO 15 705).

For **smaller other treatments,** there is a large number of plants — small and medium-enterprises (SMEs). For this reason, it is difficult to have individual figures. It is thus recommended to use other reliable approaches like estimations based on emission factors per unit of product or per size of treatment: France already has a long experience in this with databases of coefficients.

Example: Situation in France:

The Tableau d'Estimation Forfaitaire has been used by the French Water Agencies since the early 1970s with regular updates and the possibility to use measured data from monitoring once correctly implemented. In addition, article R2224-6 from the Code général des collectivités territoriales defines the equivalent polluting load as 60 g BOD_5 / P.E. / d. (Decree on wastewater collection and treatment systems and Decree establishing the technical requirements for individual wastewater facilities responding to an organic pollution less or equal to 1.2 kg/d of BOD_5).

The EU institutions set up a database with environmental data from industrial facilities in EU-MS and in Iceland, Liechtenstein, Norway, Serbia and Switzerland. This database is called 'European Pollutant Release and Transfer Register' (E-PRTR).

6.4.2.2 METHODOLOGIES FOR DATA CALCULATION/ESTIMATION

Due to the lack of data collected on wastewater collection and treatment aspects, and the heterogeneity of data, particularly for small systems, some countries reported estimation methods. The use of surveys with statistical approaches like those used for national censuses is reported, with the figures being reliably extrapolated.

For the largest UWWTPs, the information is individually reported. However, if data are not available, the WWTP's incoming load BOD_5 can be estimated based on the design capacity (P.E.) or on the

[5] Additional guidelines on self-monitoring of sewerage systems have been published by 'Agence de l'eau Rhin-Meuse' in 2016 and 'Agence de l'eau Loire-Bretagne' in 2015.

number of inhabitants connected (P). This methodological approach is described in more detail in the following examples:

Example (Austria, 2006):

Average load of WWTP (in terms of BOD, COD or total number of population equivalents (P.E.)) is not known

a) Estimation based on design values concerning the average degree of utilisation of the WWTP:

a)	Design capacity of the WWTP (1 .PE. = 60 g BOD_5/d):	100,000 P.E.
b)	Average degree of utilisation of WWTPs in Austria (Zessner et al., 2005):	64%
c)	Average load: 100,000 P.E. * 0.64	64,000 P.E.

a) Estimation based on number of inhabitants (P) connected:

a)	Number of inhabitants connected	40,000 P
b)	Average ratio P.E. load / P connected in Austria (Zessner et al., 2005):	1.6
c)	Average load: P connected * 1.6	64,000 P.E.

For smaller treatment plants (not individually reported) an emission factor applied to the whole population connected to small treatment plants can be used. (see below formula for calculating the incoming load BOD_5).

Effluent BOD_5 = Actual occupation x [1 – (% of BOD_5 removal / 100)]

The ratio of BOD_5 / P.E. (examples given in Table 6-1 and Table 6-2[6]) could vary in time and space as function of:

- climate conditions[7],
- municipality size,
- rate of impervious area for combined sewer,
- type of commercial connected activities,
- inhabitants standard of life,
- way of water using,
- type of sewer (combined or separate), etc.

[6] For more examples from several countries in the world, please consult 'L'équivalent habitant: Définitions, mesures et pratiques en France et à l'étranger' Cyrille EUVERTE, Polytech Lille, 2007.

[7] In the long run, impact of climate change is also a concern for sewage systems (see for instance Conséquences des changements climatiques sur les systems d'assainissement, TSM numéro 12 - 2007 - 102e année)

Table 6-1: Ratio for calculation of incoming load BOD_5 loads for UWWTP

	Ratio for calculation of incoming BOD_5 load	Source
Large towns	70 g BOD_5 / P.E./ d	Guide de l'assainissement, 2011. France.
Combined sewer	70 to 80 g BOD_5 / P.E. / d	
Size of UWWTP > 2,000 P.E.	60 g BOD_5 / P.E. / d	UWWTD, 1991.
Size of UWWTP < 1,000 P.E.	35 g BOD_5 / P.E. / d	Cahier technique FNDAE N°5, 1986.

Table 6-2: Ratio for calculation of design capacity BOD_5 loads for UWWTP

	Ratio for calculation of design capacity BOD_5 load	Source
Large towns	70 g BOD_5 / P.E. / d	Guide de l'assainissement, 1985. France.
Combined sewer	70 to 80 g BOD_5 / P.E. / d	
Size of UWWTP more than 2,000 P.E.	60 g BOD_5 / P.E. / d	UWWTD, 1991. Recherche et quantification des paramètres caractéristiques de l'équivalent-habitant : étude bibliographique. Etude Inter Agence N° 23, 1993. France. Common practice in France
Size of UWWTP less than 2,000 P.E.	54 – 60 g BOD_5 / P.E. / d	Common practice in France
Size of UWWTP more than 5,000 P.E.	60 g BOD_5 / P.E. / d	Dimensioning of single stage activated sludge plants upwards from 5 000 total inhabitants and population equivalents.
Size of UWWTP less than 5,000 P.E.	60 g BOD_5 / P.E. / d	Principles for dimensioning, construction and operation of wastewater Lagoons for communal Wastewater.

For 'Other wastewater treatment', a method using a complete set of coefficients trying to estimate the load for almost all industries of the country is reported (**Error! Reference source not found.**).

Table 6-3: Ratio for calculation of design capacity BOD_5 and incoming BOD_5 loads for several industrial activities and services

Activity	Ratio	Remarks	Source
Vegetable cannery	10 to 30 g BOD_5 / kg produced	Peas, salsify	Technical Assistance Service of Finistère Department, 1996. France.
Fish cannery	10 to 20 g BOD_5 / kg	According type of fish	
Trout packaging	3,7 g BOD_5 / kg	Killing and preparation	
Caterer	15 to 25 g BOD_5 / kg	According type of production	
Pastry factory	3,5 g BOD_5 / kg		
Slaughterhouse	16 g BOD_5 / kg	Killing, cutting and catering of cows and pigs	
	6,5 g BOD_5 / kg	Killing and cutting of pigs	
	12 g BOD_5 / kg	Poultry	
Dog and cat food	1 g BOD_5 / kg		
Quartering	15 g BOD_5 / kg		
Dairy	2,4 g BOD_5 / kg	Drying, cheese, butter	
Dairy	2,5 kg BOD_5 / m^3	Average values observed after clean technologies implementation	Agence de l'Eau Loire Brittany. France.
Vegetable cannery	13 kg BOD_5 / t		

Activity	Ratio	Remarks	Source
Animal cannery	12 kg BOD_5 / t		
Wine production	5 2,5 kg BOD_5 / m^3		
Slaughterhouse	10 kg BOD_5 / t	Pigs, cows. Average values observed after clean technologies implementation.	ISIM/Office International de l'Eau, 2002
	8 kg BOD_5 / t	Poultry. Average values observed after clean technologies implementation.	
Slaughterhouse	10 kg BOD_5 / t	Poultry.	IRSTEA[8] France.
Pig farm	300 g BOD_5 / pig / d		Lisiers porcins et traitements. Technical Assistance Service of Finistère Department, 1997. France.
Cheese factory	1080g BOD_5 / ton of milk used	Data from Canton de Fribourg, Switzerland (more sectors available in the document 'Définition et calcul des équivalents-habitants')	Définition et calcul des équivalents-habitants Notice d'information 4.2.024 2017, Etat de Fribourg
Bakery	90g BOD_5 / employee		
Camping	480g BOD_5 / $1000m^2$		
Hospital	60g BOD_5 / bed		
Brewery	120g BOD_5 / hl of drink		

This method allows taking into account all industries, and at the same time is less resource intensive than direct measurement at the level of each industry.

For **'Other wastewater treatment'** (industrial wastewater treatment plant) a useful methodology to achieve significant response rates and generate data are to carry out an exhaustive statistical survey. This type of survey could be carried out using two sources of information:

a) All the large industrial companies in the Netherlands were legally obliged until 2018 to make an Environmental Annual Report (also used for EPER/IPPC/IPCC/Kyoto/Waste regulation reporting). Because of the legal obligation, response in this group is between 90 and 100%. Since this covers all main industrial WWTPs, approximately 70% of total sludge production and design capacity can be found in this group.

b) A questionnaire is sent to other companies with an industrial wastewater treatment plant (not in group a). Major sludge producers are questioned each year. Small producers are questioned, alternating once every three years. Response rates are between 70 and 80%.

In some countries, design capacities of WWTPs are described by taking into account **hydraulic characteristics** of wastewater. Thus, it is necessary to define a conversion rule with the aim to transpose m^3/day in kg BOD_5 / day. One hypothesis, relating to France, is to take into account an average BOD_5 content equal to 300 mg/l (e.g. 0.3 kg BOD_5/m^3) — even if this value is very variable (between 150 to 500 mg/l for example in France). The French average content would need to be checked to see if it is representative of local conditions for other European countries. However, in all cases, the conversion rule is the following:

[8] Formerly CEMAGREF

Design capacity (kg BOD5/d)
=
Yearly average BOD5 content (kg/m3)
X
Design capacity (m3/day)

In addition to this conversion rule, the following hydraulic ratios are quite common in France, (source: *L'assainissement des agglomérations: techniques d'épuration actuelles et évolutions*. Etude interagences N° 27, 1994):

- Less than 2,000 inhabitants: 150 litres/inhabitant/day,
- Between 2,000 and 10,000: 180 litres/inhabitant/day,
- Between 10,000 and 50,000: 200 litres/inhabitant/day,
- More than 50,000 inhabitants: 250 litres/inhabitant/day.

These ratios may change over time and water consumption in European cities tends to decline.

In some other European countries, **BOD_7 is used instead of BOD_5**. For the JQ-IW, BOD_5 needs to be reported. The following calculation allows the transformation of BOD_7 into BOD_5:

$$BOD_7 = BOD_5 * 1.16$$

(Source: European Environment Agency)

If design capacity and actual occupation are described by **COD parameter** measurement, it is useful to follow the biodegradability ratio (COD / BOD_5 ratio) for transforming these COD values in BOD_5 load:

$$BOD_5 \text{ load} = \text{COD load} / \text{Biodegradability ratio}$$

For urban wastewater, the COD / BOD_5 ratio is roughly between 2.2 and 2.7 (*Cahier des Clauses techniques générales*, France. Fascicule 81. Titre II, 2003).

In the Netherlands, BOD is not used for characterising industrial wastewater. For quantifying the design capacity of industrial wastewater treatment plants, the **Total Oxygen Demand (TOD)** is used.

The design capacity data are available as Pollution Equivalents (P.E.). 1 P.E. is equal to 136 g of TOD.

Total Oxygen Demand/day = (COD + 4.57 * N-Kjeldahl).

Thus, to fill in the JQ-IW for industrial wastewater treatment plants for the Netherlands, the following formula needs to be used:

$$BOD_5 = (TOD – 4.57 * \text{N-Kjeldahl}) / \text{Biodegradability ratio}$$

Then, the N-Kjeldahl load and Biodegradability ratio are required in addition to the TOD load.

6.4.2.3 Methodologies developed for data quality checks

Quality check on institutional level

The incoming load BOD_5 of a given year fluctuates considerably for different time scales, depending on the day or the season. Two main factors are involved: the precipitation state and the seasonal population.

The influence of rain runoff is particularly determinant for combined collecting systems, with a unique pipe collecting together domestic water and rain runoff. The first flush of rainwater after a precipitation event is very loaded, especially with the suspended solids and organic matter that have settled in the collecting system during the previous period of time without precipitation. Washing-off of substances from the surfaces is also a significant source of pollutants during precipitation events This concerns the material of the surfaces (e.g. metal roofs) as well as substances from dry deposition. The influent's

BOD_5 therefore fluctuates widely, according to the precipitation, not only on a daily basis, but also seasonally and geographically. Organic matter availability as well as the precipitation frequency is different from season to season and to area.

Another seasonal variation concerns tourist resorts, where the population can be multiplied by 10 during the tourist seasons. The actual usage of a plant during winter, for example, to treat wastewater from a ski resort can thus increase significantly.

The method used to calculate actual occupation takes into account the different variations due to precipitation and seasonal changes. The most reliable method recommends measurements over 24 hours throughout the year, during dry and wet weather. Analysing the samples and processing the resulting data can firstly give the mean BOD_5 over 24 hours and also the mean BOD_5 over the whole year for a given plant.

6.4.3 Good practices for 'Effluent BOD_5'

6.4.3.1 Methodologies for data calculation/estimation

As already mentioned for incoming load BOD_5, some countries report estimation methods.

For UWWTPs, a simple assumption can be used such as a uniform removal coefficient for all small plants (see table above: *Percentages of BOD_5 removal for several examples of urban wastewater treatments*). Note that the value of such coefficient may evolve over time (see for instance BIPE 2015, page 35).

Table 6-4: Percentages of BOD_5 removal for several examples of wastewater treatments[9]

	Treatments	% of BOD_5 removal
Primary treatments	Septic tank Imhoff tank Primary settling lagoon	25 - 30
	Physicochemical treatment (settling or flotation)	50 – 70
Secondary treatments	Activated sludge process with high F/M ratio	70 - 85
	Activated sludge process with average F/M ratio	90
	Trickling filter	90
	Biological discs	90 - 95
	Biofilters	85
	Sand Filters	90 - 95
	Sand Filters planted with reeds	90 - 95
	Natural lagoon	85
	Aerated lagoon	85 - 90
Tertiary treatment	Activated sludge process with low and very low F/M ratio	95 - 97
	Biofilters	95

$$\textbf{Effluent } BOD_5 = \textbf{Actual occupation} * \left(1 - \left(\frac{\%\ of\ BOD_5\ removal}{100}\right)\right)$$

[9] Additional tables with percentages of BOD_5 removal of wastewater treatments are available in technical documents such as 'Performance des filières de traitement adaptées aux petites collectivités en Seine-et-Marne' from Observatoire de l'eau

Example (France):

To implement the WFD (Directive 2000/60/EC), a dedicated national guidance for pressures and impact reporting (French IMPRESS guidance) was developed, based on the European guidance (Impress guidance No 3) with many guidelines on various aspects. The guide proposes to use the most recent census data, and, in particular, a dedicated question on the type of wastewater disposal of the household the people lives in. Associated with this, a table of emission factors and performance on the main indicators has been proposed. A distinction is made between treatment that conforms to the legislation (the national legislation defines the authorised systems that always combine the septic tank with a spreading system adapted to soil permeability) and treatment not conforming, the latter being defined as only a septic tank that directly discharges into surface water (ditches) or groundwater. It is considered that 10% of systems conform and discharge into surface water (1), 10% do not conform and discharge into surface water (2), and all other systems (3), whether conforming or not discharge as groundwater, with soil allowing good performance in all indicators

6.4.3.2 Methodologies developed for data quality checks

Quality check on institutional level

The effluent BOD_5 of a treatment plant is the BOD_5 of the water treated, which will be discharged into the natural environment. The calculation method based on ongoing monitoring is the same as the one used to determine actual occupation, the measurement carried out after the treatment plant instead of before the plant.

6.4.4 Good practices for reporting on the variable 'Total sludge production'

6.4.4.1 Methods for calculating and estimating data

Estimation coefficients for the amounts of sewage sludge produced (in DS)

The most commonly used method for estimating sludge production is based on the incoming load of a WWTP and assumes specific amounts of sludge solids to be produced per p.e. and per day. In cases where the information available is limited to the population connected to a WWTP, the incoming load (in p.e.) should be estimated according to the methods presented in subsections 6.4.2.2 and 6.4.3.1.

Estimation coefficients can be derived from Table 6-5, which shows the levels of sludge production for the different methods of sludge stabilisation used in WWTPs. The conclusion that can be drawn from the literature considered in Table 6-5 is that the type of wastewater treatment (e.g. for secondary treatment, whether trickling filters or the activated sludge process is used) has only a minor influence on the amount of sewage sludge produced. Tertiary treatment with P-precipitation does increase sewage sludge production, however, because of the amount of precipitation agents used. The main differences in the level of sewage sludge production result from the different stabilisation processes used and the addition of calcium for sludge conditioning. As Table 6-5 gives a wide range of values for the different types of sewage sludge stabilisation, country-specific coefficients (e.g. from WWTPs where data are measured) should be derived and updated frequently.

It should be emphasised that information on the incoming load of the WWTP (in terms of BOD_5, COD or p.e.) is an important prerequisite for the assessment of sewage sludge production via estimation coefficients. If the data are not available, they can be estimated using the methods described in subsections 6.4.2.2 and 6.4.3.1.

Table 6-5: Dry substance of activated sludge for different types of sludge stabilisation (in p.e.) (ATV, 1996; IWAG, 2005; Baas, personal communication, 2003)

Sewage sludge from treatment plants with	kg DS/p.e./a	
	without calcium addition	with calcium addition
Complete stabilisation*, without P-precipitation	11 – 18	14 – 24
Complete stabilisation*, with P-precipitation	13 – 22	16 – 27
Simultaneous aerobic stabilisation without P-precipitation	13 – 25	16 – 29
Simultaneous aerobic stabilisation with P-precipitation	14 – 29	18 – 32

1 p.e. = 60 g BOD_5/d

* complete stabilisation refers to all methods of anaerobic sludge stabilisation and separate aerobic stabilisation.

If no information is available on WWT, an average coefficient for sludge production per person per day could be used, in combination with census data. In Austria, for example, an average coefficient of 20 kg DS/p.e./year is used, on the basis of experience and research.

Estimation coefficients for volumes of sludge produced (in m³)

If data on the amount of sewage sludge produced (in DS) are available (see subsection 6.4.4.1), information on the volumes of sewage sludge produced can be obtained using estimation coefficients. The relevant estimation coefficient should be chosen from Table 6-6, according to the dewatering technique used. As estimation coefficients for dewatering techniques are closely related to the technical infrastructure and climate in a country, it is strongly recommended that you derive country-specific coefficients (e.g. from WWTPs where data are measured) and update them frequently. A wide range of values for estimation coefficients can be found in the literature, especially for the method of static thickening.

Table 6-6: Efficiency of dewatering techniques to dry substance percentage (%) (ATV, 1996; IWAG, 2005; Baas, personal communication, 2006)

Dewatering technique	D.S. (%)
Drying beds*	30
Static thickening	2 – 7
Mechanical excess sludge thickening	6 – 10
Lagoons	24
Belt filter press	18 – 30
Centrifuges	18 – 30
Pressure filter (e.g. chamber filter press) with polymer or metal salt conditioning	
without lime/aggregate	28 - 38
with lime/aggregate	35 - 45
Full-thermal drying	90 – 95

* This method was described by the Netherlands. In drying beds, sludge is dried in the open air on a drained field. The sludge can sometimes remain in the drying beds for over a year. This technique is now rarely used in the Netherlands.

Example: Austria, 2006

Actual occupation of the WWTP in terms of BOD5 or COD (t/a) or total number of population equivalents (p.e.) is known

Calculation of the amount of sewage sludge (in DS) and of the volume of sewage sludge produced

a)	Actual occupation: 1 402 t BOD_5/a (1 p.e. = 60 g BOD_5/d)	64 000 p.e.
b)	Treatment performance: nitrification/denitrification with P-precipitation	
c)	Sludge stabilisation: mesophilic sludge digestion	
d)	Sludge dewatering: chamber filter press with iron and lime conditioning	
e)	Average amount of sewage sludge (see Table 6-5) in kg DS / p.e./a	21.5
f)= a) * e) / 1000	Average amount of sewage sludge in the treatment plant (t DS/a)	1 400
g)	Average amount of DS in sewage sludge after dewatering (%) (see Table 6-6)	40 %
h)= f) *100 % / g)	Average amount of sewage sludge after dewatering (m^3/a)	3 500

6.4.4.2 Methods for checking data quality

Quality-check at institutional and operational level

A simple quality check involves comparing measured data for sewage sludge generated in a WWTP (DS in t/a) with the estimation coefficients given in Table 6-5 and Table **6-6**. The results of the calculation should be in the same range as the value indicated by WWTP operators.

A further quality check recommended at WWTP level is based on mass balances for carbon (as COD), nitrogen, and phosphorus. These methods are described in detail in Nowak *et al.* (1999) and Svardal *et al.* (1998).

6.4.4.3 Other good practices

Good practices for collecting data in WWTPs and sludge treatment centres

Measuring the flow rate of liquid sludge

The total volume of dry sludge is determined by recording the volume at various sampling points in sludge treatment centres. The flow rate of the sludge is typically measured using electromagnetic measuring (IDM) methods, and the proportion of dry substance in the sludge should then be determined according to EN 12880:2000 *(Characterisation of sludges. Determination of dry residue and water content)*. This method, which tends to be used primarily for larger urban areas, can be used to determine the total sludge production by aggregating the volumes treated at all treatment centres.

Data accuracy: Provided that the instruments used are correctly calibrated and the techniques used for reading the data are reliable, IDM methods for measuring the flow, as described above, can be expected to give the most accurate and consistent results. The data obtained can be assumed to be accurate to within 6–10 % (Krekel *et al.*, 1998).

Dewatered sludge: tanker movement/weight, method 1

This method can be used if weighbridges are installed at WWTPs or sludge treatment centres. The wet weight of sludge in a tanker taking its load to a specific disposal route (e.g. landfill) can be determined, and the quantities of sludge going to landfill or agriculture, for example, can be cross-referenced against contractors' invoices and information from weighbridges at landfill sites.

The dry-substance content of the sludge can be determined by taking samples from inside the tanker. This process is described in EN 12880:2000 *(Characterisation of sludge. Determination of dry residue and water content)*. The formula below gives the total dry substance of sludge for each disposal route:

$$Total\ DS\ of\ sludge\ (t) = \frac{wet\ weight\ of\ sludge\ (t)\ *\ \%\ DS}{100}$$

Dewatered sludge: tanker movement/weight, method 2

This method can be used if weighbridges are not available. The tanker is checked to determine if it is empty when arriving at the sludge treatment centre. Volumes of sludge can be estimated on the basis of the known capacity of each tanker. This again is cross-referenced with details from the weighbridges at landfill sites.

Dry-substance content is calculated as described in subsection 6.4.4.3. (EN 12880:2000). To obtain the total dry substance of sludge for each disposal route, a density of 1:1 (i.e. 1 t = 1 m^3) must first be assumed. The following formula is useful when converting volumes to weight:

$$Total\ DS\ of\ sludge\ (t) = \ vol.(m3) * \ \%\ DS$$

The destination of the tanker and its weight are recorded in order to determine the quantities of sludge produced per disposal route.

Sludge coefficients for the various wastewater treatment categories and/or dewatering techniques

National mean coefficients for the various wastewater treatment categories and/or de-watering techniques are used for estimating the dry substance content. Sludge coefficients are given in Table 6-5 and Table **6-6** (see subsection 6.4.4.1).

6.4.5 Good practices for reporting on the variable 'total sludge disposal'

6.4.5.1 Methods for checking data quality

Quality-checks at institutional level

An initial quality check would involve ranking the amounts of sewage sludge (DS) disposed of via the various disposal routes (e.g. Austria (2014): 50% incineration, 32% reuse others/disposal others, 17 % agricultural use, 1% landfill[10]). The ranking should be checked by experts for plausibility. In the case of EU Member States, data can also be compared with the statistics on sewage sludge provided in accordance with reporting obligations under the UWWTD (Article 16) or with the waste statistics under the European codes 19 08 01, 19 08 02, 19 08 05, 19 08 09, 19 08 10, 20 03 04 and 20 03 06.

A further quality check would consist of comparing the volume of sewage sludge used in agriculture and the data reported under the Sewage Sludge Directive (86/278/EEC), which regulates the use of sewage sludge in agriculture. In addition, data on the production of sewage sludge collected by WWTPs could be compared with data from sewage sludge treatment facilities.

6.4.5.2 Other good practices

Total sewage sludge production is defined, for the purpose of this questionnaire, as the quantity of dry substance resulting from wastewater treatment including sludge treatment. The sewage sludge produced must be disposed of via appropriate disposal routes. This means that total sludge production should, in general, correspond to total sludge disposal.

Interim storage of sewage sludge at WWTPs is not considered to be a sludge disposal route. In practice, the difference between sludge production and sludge disposal should be equal to the amount of sludge stored at the WWTPs for the time period in question.

Total sludge disposal should include all disposal routes, and specifically both of the following types of disposal:

[10] For more information, read 'Österreichischer Bericht über Kläranlagen'.

- reuse of sludge in agriculture or for compost or other uses, where the sludge contains nutrients or organic dry substances;
- disposal of sludge by means of incineration, landfill or dumping at sea for permanent storage, where no further benefit is provided and no future use envisaged.

Example:

a)	*Total sludge production [t/a]*	*100*
b) = c)+d)+e)+f)	*Total sludge disposal [t/a]*	*99*
c)	*Reused in agriculture [t/a]*	*40*
d)	*Disposed of by means of incineration [t/a]*	*30*
e)	*Reused as compost [t/a]*	*20*
f)	*Disposed of or used in another way [t/a]*	*9*
g)=a)-b)	*Stored [t/a]*	*1*

6.5 SITUATION IN INDIVIDUAL REPORTING COUNTRIES

Romania

Data on sewage sludge production and disposal is taken from the *Statistical survey concerning wastewater collecting, treatment and discharge* questionnaire sent out by the Romanian National Institute of Statistics and the Romanian water board.

Czech Republic

A survey of wastewater treatment systems is carried out, covering all WWTP operators (100 % or full coverage), a representative sample of local authorities that operate water supply systems and/or independent WWTPs (stratified sampling), and local authorities with neither water supply systems nor WWTPs. The stratification is based on the population and the number of sewerage system connections, for example. Areas with fewer than 50 inhabitants are not included in the survey.

PART II - TABLE 8

7 JQ-IW TABLE 8: GENERATION AND DISCHARGE OF WASTEWATER

7.1 DEFINITIONS AND REMARKS

Name	Wastewater
Number	33
Definition	Water which is of no further immediate value to the purpose for which it was used or in the pursuit of which it was produced because of its quality, quantity or time of occurrence. However, wastewater from one user can be a potential supply to a user elsewhere. Cooling water is not considered to be wastewater for purposes of this questionnaire.
Remarks	

Name	Wastewater treatment
Number	34
Definition	Process to render wastewater fit to meet applicable environmental standards or other quality norms for recycling or reuse. Three broad types of treatment are distinguished in the questionnaire: primary, secondary and tertiary. For purposes of calculating the total amount of treated wastewater, and in order to avoid double counting, volumes and loads reported should be shown only under the ‘highest’ type of treatment to which it was subjected.
Remarks	

Name	Urban wastewater treatment
Number	36
Definition	Urban wastewater treatment is all treatment of urban wastewater (37) in urban wastewater treatment plants (UWWTP’s). UWWTP’s are usually operated by public authorities or by private companies working by order of public authorities. For the purpose of this questionnaire, it includes the treatment of wastewater transported periodically by trucks from independent storage tanks to urban wastewater treatment plants. (Term used in the legislation of the European Union).
Remarks	

Name	Urban wastewater
Number	37
Definition	Domestic wastewater or the mixture of domestic wastewater (38) with industrial wastewater (39) and/or runoff rain water. (Term used in the legislation of the European Union).
Remarks	

Name	Domestic wastewater
Number	38
Definition	Wastewater from residential settlements and services which originates predominantly from the human metabolism and from household activities.
Remarks	

Name	Industrial (process) wastewater
Number	39
Definition	Water discharged after being used in, or produced by, industrial production processes and which is of no further immediate value to these processes. Where process water recycling systems have been installed, process wastewater is the final discharge from these circuits. To meet quality standards for eventual discharge into public sewers, this process waste-water is understood to be subjected to ex-process in-plant treatment. Cooling water is not considered to be process wastewater for purposes of this questionnaire. Sanitary wastewater and surface runoff from industries are also excluded here.

Remarks	For the purpose of this questionnaire, discharges from industrial activities are defined as the wastewater that leaves the plant site, which includes process water and sanitary wastewater. Wastewater treatment inside a plant site is seen as part of the production process and only effluent (see Section 5.1) is to be included here.

Name	Primary treatment
Number	40
Definition	Treatment of wastewater by a physical and/or chemical process involving settlement of suspended solids, or other process in which the BOD5 of the incoming wastewater is reduced by at least 20% before discharge and the total suspended solids of the incoming wastewater are reduced by at least 50%.
Remarks	Stage of treatment involving the removal of suspended solids from raw wastewater or from wastewater having undergone preliminary treatment (EN 1085, September 1997), where preliminary treatment is defined as: the stage of treatment involving the removal of gross solids, sand, grit or floating matter from wastewater (EN 1085, September. 1997).

Name	Secondary treatment
Number	41
Definition	Treatment of wastewater by a process generally involving biological treatment with a secondary settlement or other process, resulting in a BOD removal of at least 70% and a COD removal of at least 75%.
Remarks	Stage of treatment by biological processes such as activated sludge, biological filtration or other processes giving equivalent results. (EN 1085, September 1997).

Name	Other wastewater treatment
Number	44
Definition	Treatment of wastewater in any non-public treatment plant, e.g. industrial wastewater treatment plants or treatment facilities of hotels, army camps etc. that do not fall under Independent Treatment. Excluded from 'other wastewater treatment'' is the treatment in septic tanks.
Remarks	

Name	Independent treatment
Number	46
Definition	Facilities for preliminary treatment, treatment, infiltration or discharge of domestic wastewater from dwellings generally between 1 and 50 population equivalents (54), not connected to an urban wastewater collecting system. Examples of such systems are septic tanks. Excluded are systems with storage tanks from which the wastewater is transported periodically by trucks to an urban wastewater treatment plant. These systems are considered to be connected to the urban wastewater system. For examples of types of independent treatment, see the 'Note 5a' in the guidelines.
Remarks	This includes septic tanks, other types of independent treatment (such as those listed in the questionnaire) and dry sanitation. Septic tank: closed sedimentation tank in which settled sludge is in direct contact with the wastewater flowing through the tank and the organic solids are partially decomposed by anaerobic bacterial action (EN 1085, September 1997); not to be confused with a cesspool. Cesspool: underground watertight tank with no outflow, used for collecting domestic wastewater (EN 1085, September 1997). For the purpose of the JQ-IW, cesspools are classified as independent collecting systems, but the population in question is otherwise considered as being connected to an urban treatment system.

Name	BOD5 Capacity
Number	47
Definition	The total quantity of oxygen-demanding material that a wastewater treatment plant is designed for which can be treated daily with a certain efficiency. For secondary treatment plants the BOD_5 capacity is mostly limited by the oxygenation capacity, i.e. the quantity of oxygen that can be brought into the water to keep the oxygen concentration on a suitable level.
Remarks	

Name	UWWTP effluents
Number	51
Definition	Treated wastewater discharged from an urban wastewater treatment plant (UWWTP).
Remarks	Please specify whether the UWWTP effluents include run-off rainwater or only wastewater generated by the domestic sector or industry. If possible, please provide an estimate of the volume of rainwater included.

Name	Wastewater discharge
Number	52
Definition	The amount of water (in m^3) or substance (in kg BOD/d or comparable) added /leached to a (fresh or non-fresh) water body from a point or a non-point source.
Remarks	Total discharges to inland waters are the sum of: • urban wastewater discharged: → after treatment in WWTPs → after independent treatment → without treatment • industrial wastewater discharged → after treatment in ‘other’ WWTPs → effluent discharged without treatment • wastewater from agriculture, forestry and fisheries; • any other discharges reaching inland waters, e.g. leakages in the network or stormwater overflows. In some countries, the inflow of treated or non-treated wastewater into surface waters is referred to as ‘immission’; this would be immission to inland waters.

Name	Chemical Oxygen Demand (COD)
Number	53
Definition	The mass concentration of oxygen consumed under specific conditions by the chemical oxidation with bichromate of organic and/or inorganic matter in water.
Remarks	

Table 8 covers concepts such as ‘emission’, i.e. the direct or indirect release of substances, vibrations, heat or noise from individual or non-point sources into the air, water or land (adapted from IPPC Directive).

It distinguishes between point and non-point sources, but these terms are not precisely defined. ETC/WTR (2002) defines them as follows:

Source: the origin of an emission, which may be natural or anthropogenic and a physical entity or process or a set of such entities or processes defined according to some common characteristic (human activities such as industry, agriculture, or metabolic activities), which generates emissions of pollutants. Sources are usually classified into categories, for example urban, industrial, agricultural, forestry, transport, wastes and natural contributions.

Non-point source: a source of one or more pollutant(s) that cannot be geographically located on a map as a point but originating from a certain area. Non-point sources cannot be assessed by monitoring. This is because there is no precise point where water can be sampled. Different quantification approaches (e.g. modelling, lysimetry, small monitored watershed) can be used and made comparable to obtain a reasonably reliable result.

Point source: a source of one or more pollutant(s) that can be geographically located and represented as a point on a map, for example the point of discharge of a sewer into a river. Direct sampling is the most common method used to estimate point source discharges from municipal and industrial treatment plants. A distinction is sometimes made with areal sources that are an aggregation of small point sources apportioned on a territorial basis and not individually monitored. The aggregation rule aims at optimising the cost and effort of the collection of data by taking into account the relative quantity of emissions compared with the total quantity emitted by all the sources. (Source: ETC/WTR, 2002).

Areal sources are commonly considered as ‘non-point sources’ and generally distinguished using expert judgment and/or emission factors and statistics to assess their contribution to emissions.

The table also implicitly covers the concept of ‘pollution load’, i.e. ‘the amount of stress placed on an ecosystem by pollution, physical or chemical, released into it by man-made or natural means’ (*EEA Glossary*). By extension, the pollution load is a quantity of a substance that can be calculated, at any stage along any pathway, from the water flow and the concentration of the substance. The second part of the table focuses mainly on pollution loads.

Wastewater is considered to be ‘pollution’ when it reaches the aquatic environment – before this, it represents a ‘pressure’ on the aquatic environment (potential pollution) which needs to be addressed. Wastewater is collected and treated through various pathways before being discharged into the natural water environment (rivers, lakes, coastal, transitional or marine water). There are many possible pathways and combinations of collection and treatment steps, but in general:

- collecting (and treating) the water directly at the source and then discharging it into the natural environment is often referred to as direct discharge; and
- discharging wastewater (into wastewater collection systems) and treating it in different places is often referred to as indirect discharge.

The table covers the quality of wastewater by reporting the quantities of substances released, i.e. individual substances and groups of substances (e.g. total nitrogen), or parameters (e.g. BOD or COD) dependent on measurement methods.

7.2 General information

The first part of the table covers only the production of wastewater and eight associated polluting substances, including organic pollution, suspended solids, eutrophication and heavy metals. The subchapter below includes five sections based on groups of sources (agriculture, all industrial activities, services, private households and non-point sources). The division has been made, since in general the sources in JQ-IW Table 8 are the same for all substances. The decision tree is therefore applicable to all main groups of sources.

The second part of the table covers the urban, independent and industrial treatment of urban and industrial wastewater and its discharge to inland waters. It also covers direct discharges from agriculture (including forestry and fisheries) and discharges into the sea. The following four main groups of sources are reported: domestic sector, industry, agriculture and non-point sources, including where there is no treatment. It thus gives an overview of the various routes through which discharges reach the receiving freshwater.

For this part, special care must be taken to avoid **double counting of pollution** due to the existence of multiple possible pathways from the emitting source to the receiving water. The table covers the most common pathways; any other situation should be reported in the most similar category in Table 8.

The JQ-IW identifies **wastewater generated by all industrial activities and by the domestic sector** in the two parts of Table 8: wastewater generated and wastewater discharged. For the purpose of this manual, it is assumed these are the same and are repeated in the table.

WASTEWATER GENERATED BY ALL INDUSTRIAL ACTIVITIES
+
WASTEWATER GENERATED BY DOMESTIC SECTOR
=
TOTAL URBAN WASTEWATER GENERATED
+
TOTAL INDUSTRIAL WASTEWATER GENERATED

Data accuracy

The best way of generating accurate figures with confidence is to apply direct or indirect measurement methods to derive pollution quantities. Continuous direct measurement is rare, however, as it is costly, so indirect measurement methods are used, extrapolating instantaneous pollution measurements to longer time periods using the volume that passes through, either measured directly or derived from pump capacity and duration of pumping. Provided that the selection of the stations is sound and monitoring is in line with internationally recognised (CEN, ISO) norms and good laboratory practices, including quality assessment and control (especially using field blanks and inter-laboratory calibration exercises), good data quality will be achieved.

When filling in Table 8, please refer to the wastewater loading diagram in Figure 5-1, which shows where and how it fits into the overall flow chart, and includes:

1. the main physical components of the system, i.e.:
   - the sources — the emitters of substances;
   - the collecting systems — all networks through which the wastewater flows;
   - the treatment systems – all systems for reducing the quantities of substances finally discharged to water; and
   - the final recipient: all flowing and standing surface waters; and
2. the main flows and pathways/routes, possibly considering respective leakages and transfers and final discharge, being the only flows directed to water.

The first part of Table 8 covers sources and the second covers the main pathways and the quantities of substances that pass through the entry and the outlet at each stage. There are similarities with JQ-IW Table 5 (sewer network, wastewater treatment system and discharge) and good practices mentioned for Table 5 should also be used here. This is a very ambitious part and should be filled in step by step, prioritising substances mentioned, to focus first on efforts and dataflow already in place for other reporting purposes.

The complexity of pathways and monitoring costs are such that monitoring stations cannot be set up everywhere. According to the *Guidance document for the implementation of the European Pollutant Release and Transfer Register (E-PRTR)* (EC DG Environment (2006)), the main approaches to deriving the data can be classified in three groups; these can be used alone or combined to fill in Table 8:

- *Class M — release data based on measurements **('M')**. Additional calculations are needed to convert the results of measurements into annual release data. For these calculations the results of flow determinations are needed. 'M' should also be used when the annual releases are determined based on the results of short-term and spot measurements. 'M' is used when the releases of a facility are derived from direct monitoring results for specific processes at the facility, based on actual continuous or discontinuous measurements of pollutant concentrations for a given release route;*
- *Class C — release data based on calculations **('C')**. 'C' is used when the releases are based on calculations using activity data (fuel used, production rate, etc.) and emission factors or mass balances. In some cases, more complicated calculation methods can be applied, using variables such as temperature, global radiance, etc.; and*
- *Class E — release data based on non-standardised estimations **('E')**. 'E' is used when the releases are determined by best assumptions or expert guesses that are not based on publicly available references or in the absence of recognised emission estimation methods or good practice guidelines.*

(European Commission, Directorate-General for the Environment, 2006)

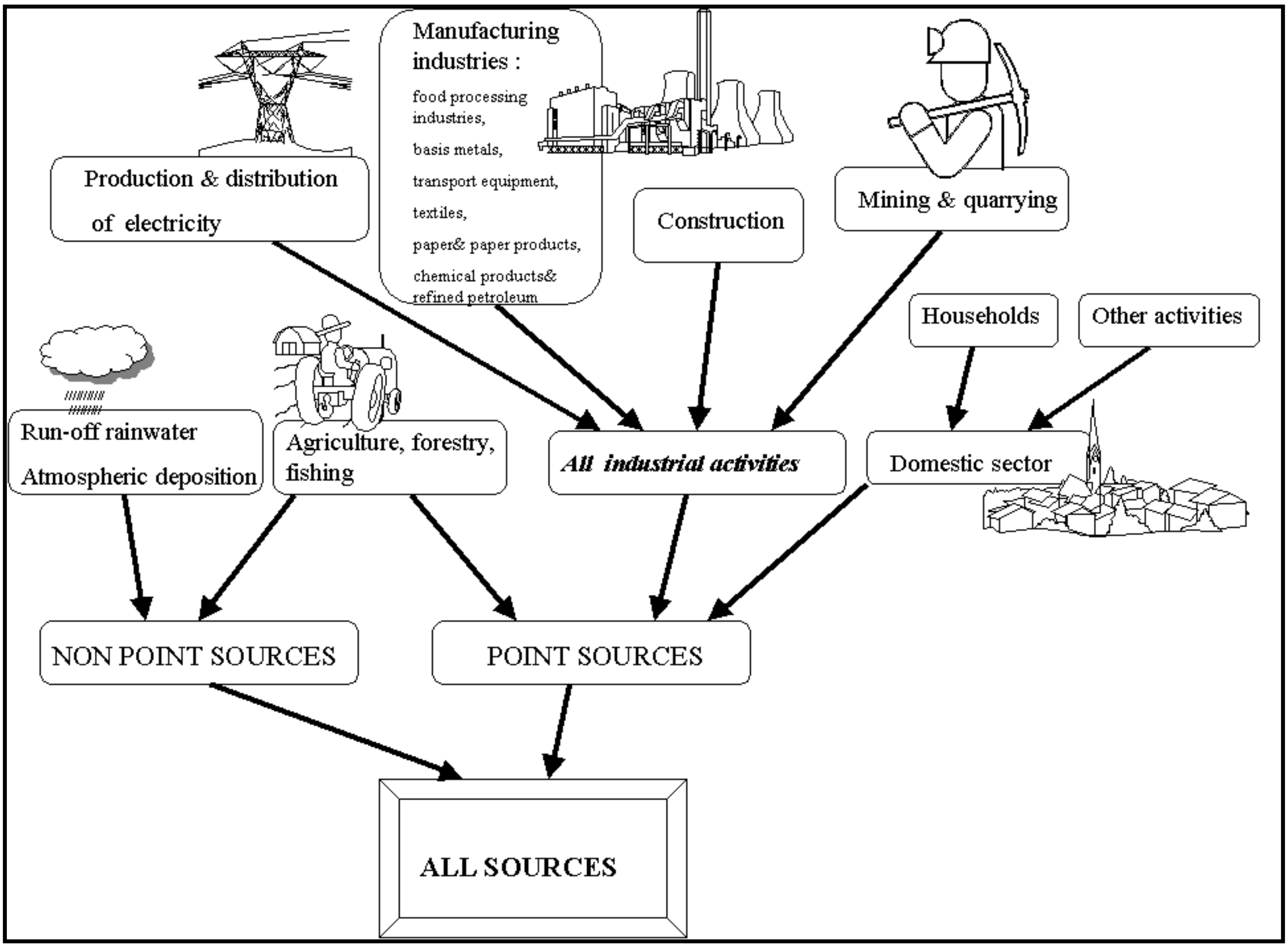
The easiest way to complete the datasets is to use emission factors. These are based on a process output, land use or possibly also on population, and can be used for any pollutant or source and expressed in almost any unit. Most are developed by taking the average measured emission rate during a representative time interval and relating it to the extent of the activity in question. This method is very simple to understand, implement and adapt over time or in the light of technology used or improved knowledge of the underlying processes. It is highly flexible, so can be applied to individual processes or whole plants or any other technical or geographical aggregation with any possible unit. It can, for example, be based on statistics such as the quantity of a product used in the process or, for an industry, the number of employees or final products. It can be based on case studies and, if correctly applied, provide a reliable estimate for similar situations.

Many emission factors are based on the assumption that the release of a substance is linked to the characteristic value used (number of inhabitants, employees, etc.), with a strong linear dependence. This may not always reflect reality, however – for example, two inhabitants will not necessarily produce twice the amount of pollution as one. It is highly recommended that you gather enough information on how the emission factor was established, so that it can be applied in similar situations and not when the situation differs too much.

In Table 8 (as in Tables 2 to 4), NACE economic classification is widely used at the aggregation level of two digits to organise the datasets. The overall organisation is schematically described in Figure 7-1, where the usual main polluting sectors, i.e. urban, industry and agriculture, are broken down into the main categories relevant for water pollution.

PART II - TABLE 8

Figure 7-1: Main water polluting sources



7.3 DECISION TREE

1. Does the NSI collect information on the generation and discharge of WW in fresh water?

Yes →

a) methods for checking the quality of the information collected by the NSI (see subsection 7.4.1.3);

b) methods for estimating generation and discharge not covered by regular NSI surveys (see subsection 7.4.1.2, for agricultural point sources subsection 7.4.2.2, for industrial point sources subsection 7.4.3.2, for services point sources subsection 7.4.4.2, for household point sources subsection 7.4.5.2, for non-point sources subsection 7.4.6.1 and for WW discharged by collecting system subsection 7.4.7.2).

No ↓

2. Are there reporting commitments under the Urban Wastewater Treatment Directive (91/271/EEC) and/or the EPER in your country?

Yes → Contact the administrative body responsible for data collection and treatment (e.g. environment agency, ministry).

↓

a) methods for checking the quality of the information collected by the administrative bodies (see subsection 7.4.1.3);

b) methods for estimating generation and discharge not covered by regular NSI surveys (see subsection 7.4.1.2, for agricultural point sources subsection 7.4.2.2, for industrial point sources subsection 7.4.3.2, for services point sources subsection 7.4.4.2, for household point sources subsection 7.4.5.2, for non-point sources subsection 7.4.6.1 and for WW discharged by collecting system subsection 7.4.7.2)

No ↓

3. Do provincial authorities/governments collect data on the generation and discharge of WW into fresh water? (WWT and PER reports)

Yes → Contact the provincial authorities responsible for data collection

↓

a) methods for checking the quality of the information collected by the provincial authorities (see subsections 7.4.1.3 and 7.4.7.3);

b) methods for estimating generation and discharge not covered by regular NSI surveys (see subsection 7.4.1.2, for agricultural point sources subsection 7.4.2.2, for industrial point sources subsection 7.4.3.2, for services point sources subsection 7.4.4.2, for household point sources subsection 7.4.5.2, for non-point sources subsection 7.4.6.1 and for WW discharged by collecting system subsection 7.4.7.2).

No ↓

4. Do operators of WWTPs and/or industrial plants collect data on the generation and discharge of WW into fresh water?

Methods for doing so are given in subsection 7.4.1.1; for agricultural point sources see subsection 7.4.2.1, for industrial point sources subsection 7.4.3.1, for services point sources subsection 7.4.4.1, for household point sources subsection 7.4.5.1 and for WW discharged by collecting system subsection 7.4.7.3.

Yes → Contact the operators of wastewater treatment plants and/or industrial plants.

a) methods for checking the quality of the information collected by operators of sewage treatment plants or waste treatment plants (see subsection 7.4.1.3);

b) methods for estimating generation and discharge not covered by regular NSI surveys (see subsection 7.4.1.2, for agricultural point sources subsection 7.4.2.2, for industrial point sources subsection 7.4.3.2, for services point sources subsection 7.4.4.2, for household point sources subsection 7.4.5.2, for non-point sources subsection 7.4.6.1 and for WW discharged by collecting system subsection 7.4.7.2).

No ↓

5. Use estimation methods to determine the generation and discharge of WW into fresh water in your country.

For methodologies to estimate generation and discharge not covered by regular NSI surveys, see subsection 7.4.1.2, for agricultural point sources subsection 7.4.2.2, for industrial point sources subsection 7.4.3.2, for services point sources subsection 7.4.4.2, for households point sources subsection 7.4.5.2, for non-point sources subsection 7.4.6.1 and for WW discharged by collecting system subsection 7.4.7.2.

↓

6. Develop tailor-made questionnaires/adopt statistical programmes.

7.4 GOOD PRACTICES

7.4.1 GENERAL PRACTICES

7.4.1.1 METHODS FOR DATA COLLECTION

Monitoring

As stated in subchapter 7.2, direct continuous measurement is rare except as regards the volume of wastewater. Indirect measurement is often used instead by combining continuous flow metering and concentration monitored at regular intervals, or using samples averaged over 24 hours or other sampling methods. While this approach is the most common and seems the easiest, care should be taken as:

- discharge of wastewater can follow many different routes and the location of the monitoring station(s) can have a noticeable impact on how the resulting data are represented; and
- it is not always easy to assess the load when the concentration varies, and some natural patterns may also interfere with the results (e.g. the geochemical background, especially for heavy metals, can influence the assessment of the anthropogenic input. Some parameters also show specific behaviour, e.g. nitrate concentration in natural water has a typical sinusoidal pattern throughout the year and may therefore vary in the nitrate concentration of the water used and then discharged). In addition, input from some (especially non-point) sources can be greatly influenced by climatic conditions and can vary over the year.

In the absence of exhaustive data on water pollution, it is recommended that you focus on the largest emissions within a country, which are often those reported in official registers. In particular in the industrial sector, a very small number of plants often accounts for a large proportion of total pollution.

Example: France

In France, it is estimated that around 80% of the population is connected to UWWTP. The remaining 20% is connected to Independent treatment facilities. These plants (within urban areas over 2000 p.e.) represent around 90% of the total treatment capacity of the all UWWTP (2016 data).

In the French database on the industrial sites registered under environment protection, around 30% of the BOD5 stem from industrial sites registered under the E-PRTR (the treatment capacity is over 100.000 p.e., excluding UWWTP). However, such industrial plants are of course major polluters regarding chemicals and heavy metals.

If your country has a national or EPER register, try to obtain the aggregated data per sector, classified according to the national economic classification and broken down into direct and indirect emissions. Also try to secure details of the performance of the treatment plants that receive the indirect emissions for the respective substances, or apply a default performance to indirect emissions before aggregating direct and indirect emissions. To check consistency, compare the list of activities in Annex I to the IPPC Directive (96/61/EC) and the main sectors using water, as listed in subsection 2.4.3.1. If some activities are not covered in the national register, check production or economic statistics to see whether they are significant for your country and if so, try to collect data on loads.

Circulation of questionnaires

This method involves the circulation of a questionnaire/statistical survey among owners or operators of industrial and agricultural facilities and WWTPs. In general, the questionnaire should cover information on the size of the facility, production, associated wastewater treatments, flows and loads of substances of concern discharged and quantities of sewage sludge.

An example of a questionnaire is given in Annex 2 — Draft questionnaire on wastewater sludge (the Netherlands).

Data accuracy

Emission registers can be expected to give the most accurate and consistent results, mostly based on measurement in effluent from industrial sites. If such registers are carefully implemented and validated, and consistently applied in consecutive years, the increments of pollution load components can be trusted as accurate to within a few percentage points. However, such registers collect only the biggest loads based on thresholds (relating to activity level or loads discharged), whereas some activities are conducted mainly by small economic units that come under the thresholds individually, but together may emit significant quantities.

Under Article 5 of the WFD, EU Member States have to produce, for all river basin districts identified within their territory, a 'review of the environmental impact of human activity' (Article 5 report) that involves identifying significant point and non-point sources and the associated pollution discharged. This document, published in March 2005, may be used to identify relevant datasets and collect and aggregate them at national level.

7.4.1.2 Methods for data calculation/estimation

If wastewater volume or pollution load are not measured directly, various approaches can be used.

As regards the main wastewater discharges in the natural environment, most countries have established a permit system that lays down the main rules for users discharging wastewater over certain thresholds. This can include manufacturing industries, but also UWWTPs and some agricultural activities. The permit is for the maximum discharge allowed in terms of quantities of substances. If a central database exists, combining all the discharge limits for the substances of concern for Table 8 would produce a first estimate of the quantities. Otherwise, it should be possible to assess the order of magnitude of such emissions on the basis of data generally required under national law and thus collected and stored by the authority in charge of checking for compliance. Also, the agencies in charge of the permit systems have developed expertise in this area and are often able to assess the situation as regards the maximum allowed discharge.

Since adoption of the WFD, the maximum discharge for Member States is now referred to as the 'emission limit value' (ELV):

'Emission limit value' means the mass, expressed in terms of certain specific parameters, concentration and/or level of an emission, which may not be exceeded during any one or more periods of time. Emission limit values may also be laid down for certain groups, families or categories of substances, in particular for those identified under Article 16. The emission limit values for substances shall normally apply at the point where the emissions leave the installation, dilution being disregarded when determining them. With regard to indirect releases into water, the effect of a wastewater treatment plant may be taken into account when determining the emission limit values of the installations involved, provided that an equivalent level is guaranteed for protection of the environment as a whole and provided that this does not lead to higher levels of pollution in the environment.

The ELV is determined using the concept of 'environmental quality standards' (EQS), i.e. *the concentration of a particular pollutant or group of pollutants in water, sediment or biota which should not be exceeded in order to protect human health and the environment.*

If a national register exists, the reporting thresholds may differ from the thresholds for this permit system, so the respective coverage can be compared.

However, the ELV includes only the sites above thresholds, so this (over-)estimate of the quantities of substances released by the sites included in the system must be accompanied by an additional estimate for smaller sites. For this, statistics such as production figures, most often organised using the national nomenclature of activities (sub-details of the NACE), can be combined with emission factors to derive the quantities of the respective substances.

Indirect measurements can also be applied, such as:

- (where the wastewater is transferred using pumps) pump capacity multiplied by duration of pumping and pollution concentration;
- energy consumption of pumps multiplied by a specific factor (m^3/MWh) and pollution concentration; or
- production capacity or quantity of product multiplied by a specific emission factor.

Apart from the methods mentioned above, which apply to all sources and their sub-categories, specificities apply to each group of sources and are addressed below.

7.4.1.3 METHODS FOR CHECKING DATA QUALITY

Quality-check at institutional level

The Urban Wastewater Treatment Directive (91/271/EEC) requires national authorities to provide data on individual UWWTPs covered by the Directive and its implementation therefore led to the collection of the necessary data. In particular, under Article 15, the Commission collected data on past emissions of BOD_5, COD, TSS, N-tot and P-tot. These can be checked for consistency with those already provided in the table: generally, they represent more than 80 % of the domestic sector and food industry loads.

Annex III to the Nitrates Directive (91/676/EEC) requires the implementation of action programmes that include measures to ensure that, for each farm or livestock unit, the livestock manure applied to the land each year, including by the animals themselves, does not exceed the amount per hectare that contains 170 kg N. The reporting system does not include specific data on quantities spread, but some Member States have implemented a national information system to assess compliance with this objective.

More recently, the adoption of the Integrated Pollution Prevention and Control (IPPC) Directive (96/61/EC) led to the setting-up of the European Pollutant Emission Register (EPER)[11]. To help implement these two important pieces of legislation, the Commission asked the Joint Research Centre (JRC) to develop sector-specific best available technology (BAT) reference documents (BREF documents). More than 30 documents provide detailed descriptions of good practices for particular sectors, including how to assess the generated wastewater and associated emission. In parallel, the UNECE protocol on pollutant release and transfer register (PRTR) was adopted and, in line with this, the EU institutions proposed a shift from EPER to E-PRTR; this was adopted in 2006 (Regulation (EC) No 166/2006) for implementation in 2007 and first reporting in June 2009. The OECD also started activities on PRTR in 1996 and various documents and activities were established. Currently, DG ENV is working on the register and a new version of the E-PRTR is anticipated.

In association with the above, several countries have established national emission and discharge registers in recent years, focusing on major industrial and agricultural sites and also sometimes on UWWTPs and the main substances, as there is organic pollution and heavy metals. A first rough check is to compare for the 10 parameters that are common to EPER and the JQ-IW reported to EPER or any national register data: every facility is identified with a NACE four-digit code in EPER; the NACE two-digit codes needed for Table 8 should allow rough aggregations if NACE is not available in the register. You should take care when comparing between years, as the reporting thresholds often mean that facilities are included one year but not the next. The objective of EPER is to cover 90 % of emissions from the sectors registered, and the objective of a national register would also be to identify most of the pollutant loads. The sector-specific list of pollutants can be used to check whether the national register covers all pollutants in a given sector (see Table 2 on p. 94 of the EPER guidance).

The WFD requirement of a good status for all waters by 2015 has triggered many activities relating to the release of substances that constitute one of the main pressures threatening the objective. Article 5 requires a review, for each river-basin district, of the impact of human activity on the status of surface waters and groundwater. This should identify the significant pressures and impacts and thus enable the release of substances to be addressed as needed. The greater need for knowledge on the volume and quantities of pollution released will be a key pressure point in the broad reorganisation of the monitoring network and associated databases.

The associated datasets are most often available at river-basin level; they can be aggregated at national level and used to check, complete and update the reported data. The economic analysis and cost recovery required under the Directive (see Articles 5 and 9) will have to be based on economic statistics, which in turn will lead to an improved understanding of the relationship between the release and the emission sources identified by their NACE code.

Quality-check at operational level

The first stage here is checking for coherence within the JQ-IW, using:

- the formula proposed in the JQ-IW (see Figure 5-1); and

[11] Commission Decision 2000/479/EC of 17 July 2000 on the implementation of a European pollutant emission register (EPER) according to Article 15 of Council Directive 96/61/EC concerning integrated pollution prevention and control (IPPC) (OJ L 192, 28.7.2000, p. 36).

- the flow charts presenting the links between variables, especially the wastewater loading diagram and source categories.

The tables are then combined and first checked as regards volumes, using Table 4 for the sum of uses for each group of sources identified in Tables 4 and 8, i.e. agriculture, industrial activities (of which the various manufacturing industries, production and distribution of electricity) and the domestic sector (of which households and services). The figures obtained should be similar or of the same order of magnitude: water use and wastewater discharge are closely linked and differences are due to product coverage, infiltration and losses.

Coherence can also be checked for BOD generation in the domestic sector, using the figures in Table 5 and the standard PE coefficient (60 g BOD/day/inh.).

Simple quality checks can also examine plausibility, e.g. dividing the quantities of substances reported by the volume reported to see whether the calculated 'average concentration' is in a plausible range. The reverse approach can also be used: figures for the release of specific substances per type and unit of product (e.g. BOD_5/t product) can be combined with the corresponding production statistics to determine the theoretical emission. The specific coefficients (derived in the first case or used in the second) should be checked by experts (e.g. from water associations, administrations, etc.) and against the literature, and compared with standard coefficients for the sector. The latter, also called emission factors, can be collected directly at operational level or from the administrations in charge of pollution taxes or applying the 'polluter pays' principle (river basin authorities, authority in charge of controlling wastewater treatment, etc.). Table 7-1 and Table 7-2 provide some figures for France (to be adapted to the local situation).

Table 7-1: Average normal concentration of domestic wastewater before treatment (FNDAE, 2004)

BOD_5	300 mg/l
COD	700 – 750 mg/l
TSS	250 mg/l
N-tot	75 mg/l
P-tot	15 – 20 mg/l

Table 7-2: Quality of domestic wastewater produced by small rural areas (agglomerations below 2 000 p.e.)

BOD_5	60 p.e.
COD	157.2 p.e.
TSS	72.0 p.e.
N-tot	15.5 p.e.
P-tot	2.1 p.e.

Source: France, ONEMA (Office National de l'eau et des Milieux Aquatiques[12])

Additional checks can be made using lists of substances normally discharged by an activity to see whether they are reported in the table.

7.4.2 Good practices for 'wastewater generated by agricultural point sources'

7.4.2.1 Methods for data collection

Circulation of questionnaires

National statistics always include a very detailed section on agriculture and especially on the number and types of livestock bred each year and on milk and meat output (see subsection 2.4.2.1). They may include data on the production of secondary products such as wine, cheese, etc. that generate wastewater. There are also regular mandatory surveys on specific aspects of agriculture that usually provide a national overview. Additional questions can of course be included in the national part of the surveys to gather datasets for the JQ-IW.

[12] Qualité des eaux usées domestiques produites par les petites collectivités

Effluent analysis

The spreading of effluents (manure, wastewater from wine production, etc.) is generally subject to authorisation, which involves reporting quantities spread and effluent analysis on organic content, N-tot, P-tot and heavy metals to a local or regional authority. These data can be used to calculate quantities spread for four substances in Table 8 (except TSS, BOD_5 and COD).

7.4.2.2 METHODS FOR DATA CALCULATION/ESTIMATION

Estimates can be made using the quantities of effluents produced by type of animal and applying the average concentration of the respective substances.

Use of statistics and models

Implementation of the Nitrate Directive has given rise to a great deal of activity in this area, including the development of various methods, models and calculations to derive the quantities released into the environment. Among these, the calculation of nitrogen surplus is the most advanced. Generally linked to soils and artificial fertiliser inputs, these surpluses are calculated at soil level and thus mostly linked to diffuse pathways and emission; they should therefore not be used for this part of the JQ-IW table. However, the animal effluents data used for this calculation, which often focus on nitrogen and other substances (often P and K, less often for other substances) produced by type of animal, can be used for a simple calculation based on livestock numbers to derive the quantities of animal effluent produced and the associated quantities of substances. If data are available, it is preferable to combine these figures with an assessment of manageable effluents (manure quantities spread) rather than the raw animal production of substances. These data can be used for filling in the part dedicated to N-tot, and possibly for other substances if the national system includes them.

Care should be taken to avoid double counting of wastewater generated by non-point sources.

7.4.2.3 METHODS FOR CHECKING DATA QUALITY

Quality-check at institutional level

EPER has data on the intensive rearing of poultry and pigs, but national permit systems may also cover the intensive rearing of cattle and dairy, fish hatcheries and fish farms, and side activities relating to food processing that, due to the NACE aggregation rules, are classified as agricultural point sources (e.g. the on-farm processing of vegetables, milk, wine, etc.).

A simple quality-check is to calculate the sum of the amounts for each substance reported in the national register(s) for all these sources and compare it with the data already reported. If these data are available and not already reported, it is recommended that they be used as a basis for reporting, possibly together with data for smaller point sources. These data may be handled directly by the NSI or by an institution responsible for agricultural activities.

7.4.3 GOOD PRACTICES FOR 'WASTEWATER GENERATED BY INDUSTRIAL POINT SOURCES'

7.4.3.1 METHODS FOR DATA COLLECTION

As for water use (see section 2.4.3), a small number of (usually the same) economic sectors accounts for a large proportion of total water volume and pollution quantities. It is therefore recommended that you focus data collection on these sectors. Care should be taken to avoid double counting, as the existence of many different thresholds and associated data collections may lead to facilities close to the thresholds being covered by more than one data collection system. It should help to use internationally recognised nomenclatures such as NACE and its national implementation, NUTS for the geographical units and EINECS/ELINCS for the chemical substances.

Countries that have also implemented permit systems include:

- the Czech Republic, with its Water Act requiring yearly individual reporting for every discharge above 6 000 m3/year and associated emission standards;
- France, with its water agencies system; and

- National Emission Inventory for the Netherlands, with its emissions register[13].

The systems include lists of substances to be reported and generally cover most of the industry sectors emitting substances to water. The figures are reported yearly and are used as a basis for fees or fines. These data can be aggregated at NACE two-digit level and used for reporting. Care should be taken in the aggregation, as national systems may use a different definition of wastewater or include measurements within industrial sites to assess the performance of treatment systems on the site itself — only what leaves the site is required for JQ-IW Table 8.

For the parameters on wastewater generated by industrial activities, reporting should cover the loads connected to a wastewater collection system, after any internal treatment (i.e. what leaves the plant).

Table 8 covers total wastewater generated by industry. This means not only industrial process water, but also sanitary wastewater from workers, which can be regarded as part of the production process. Therefore, sanitary wastewater should be included in Table 8 with industrial activities. In many cases, the fraction of sanitary wastewater from industry is likely to be small in relation to total wastewater volumes generated by industry.

Where reporting is based on measurements, the values can be taken as they are. Where it is based on emission factors, process wastewater should be calculated and the sanitary wastewater load from employees should be added for Table 8.

Monitoring and statistics

Apart from the largest facilities, where a combination of monitoring and a permit system will produce datasets that can be used to fill in the JQ-IW table, smaller facilities (SMEs) also need to be assessed for the generation of wastewater. This can be done through a mandatory monitoring system for facilities above locally or nationally defined thresholds that are lower than those for the E-PRTR. An extension of this approach is to select a representative sample of industrial sites to be subject to an extensive monitoring programme, the results of which can then be extrapolated to the entire industrial sector with a reasonable level of confidence.

7.4.3.2 Methods for data calculation/estimation

The easiest method of estimation is to derive the volume of wastewater from the water used by the sector (see section 2.4.3). The figures should be checked against expert assessment as to whether all the water used is afterwards discharged as wastewater and whether a significant proportion is not consumptive in products or cooling water.

For SMEs not subject to monitoring, estimation methods include consulting business registers and production statistics in combination with sectoral water-use coefficients. Member State NSIs should have business registers and (PRODCOM classified) production statistics in accordance with EU legislation. The volumes and quantities of substances released depend largely on the type of industry. Country-specific or sector-specific factors can be derived from data collected via sample surveys or other means, such as scientific studies, and should be updated frequently. The coefficients relate volume and pollution to another available characteristic, in particular type of use, number of employees and product used or sold, and can be correlated with industry sectors or production units within a country.

7.4.4 Good practices for 'wastewater generated by services point sources'

7.4.4.1 Methods for data collection

Like industrial activities, services may be covered by permit systems and/or emission registers. This applies particularly to the maintenance of transport infrastructure, the discharge of wastewater from hospitals and hotels, and large public or sports infrastructures. The same methods as described in subsection 7.4.3.1 are applicable.

7.4.4.2 Methods for data calculation/estimation

The easiest method of estimation is to derive the volume of wastewater from the water used by these activities (see section 2.4.3). The figures should be checked against expert assessment as to whether

[13] www.prtr.nl

all the water used is afterwards discharged as wastewater and whether a significant proportion is not cooling water reused for other purposes (e.g. irrigation, remote heating, sanitary use, etc.). In the services sector, the uses of water are similar to those of households and the water is afterwards discharged as wastewater (domestic-like wastewater), but the existence of gardens, washing installations (especially for transport) and cooling Installations for air conditioning (e.g. in trade, retail trade, hotel restaurants, banks and insurance offices, hospitals) should be taken into account to exclude the volumes used for these purposes.

In the absence of such figures, the number of employees, tourists, patients, students or users by NACE code can be combined with the volume of water used (see Table 2-2), associated wastewater produced and concentration. These figures are usually available at NSI level or at the level of sectoral public services (e.g. ministry of tourism, education, etc.). If the concentration is not monitored, these types of wastewater can be considered as similar to urban wastewater and sharing the same average concentration. Tourists are essentially a seasonal non-resident population and are mainly covered by service activities including hotels, restaurants and other types of service dedicated to tourism. In the case of transport, careful attention should be paid to the generation of heavy metals (especially zinc from the wearing of tyres).

In sewage activities, the production of wastewater is marginal, as wastewater is taken from other sources and processed up to the level required for discharge.

In transport, estimates for vehicles can be made by combining transport statistics and emission factors (as with the air emissions assessment). The statistics can be found at the level of the administrative body responsible for reporting emissions to air and emission factors can be taken from the literature and scientific studies. The figures obtained should then be complemented with estimated wastewater from fixed installations: airports, ports, truck services, etc., which may come from washing facilities and employees' sanitary facilities.

7.4.5 Good practices for 'wastewater generated by private household point sources'

7.4.5.1 Methods for data collection

Methods of direct and indirect measurement

Wastewater from this source is produced by the population living in the households in question. Measurement methods are the same as in subsection 5.4.1.1, from NSI to local level, but here it is necessary to consider not only national residents but the whole population. Tourists are covered under 'services' and should be excluded here.

7.4.5.2 Methods for data calculation/estimation

The first and most common form of estimation is to estimate the population and its various components on the basis of census data and to combine it with various emission factors.

In France, one population equivalent (1 p.e.) is defined as the organic biodegradable load having a five-day biochemical oxygen demand (BOD_5) of 60 g of oxygen per day[14].

However, the literature (*Etude InterAgences*, 1993; Zessner, 2007) shows the wide variation that is possible for some of these substances:

Substance	Value
Flow	150 to 300 l/inh/d
BOD5	54 to 80 g/inh/d
COD	75 to 130 g/inh/d
TSS	70 to 100 g/inh/d
N-tot	10 to 13 g/inh/d
P-tot	1.6 to 5 g/inh/d

The main variables include behavioural aspects (e.g. inhabitants' social level and way of life, how water is used, main activities), physical aspects of the systems themselves (e.g. level of urbanisation,

[14] http://www.assainissement.developpement-durable.gouv.fr/documents/2013_06_G_def_ERU_version_2-0-1.pdf

agglomeration size, sewer network type, level of clean water intrusion) and aspects linked to the receiving environment (e.g. climatic data). These are often not publicly available and thus difficult to take into account.

For the volume, it is in principle possible to use the water-use figures from JQ-IW Table 4. However, these should be checked against climatic conditions and local water consumption habits to assess whether car washing, garden watering or swimming pools bias the consumption figures too much and, if so, to introduce correction factors.

The French IMPRESS guidance recommends using the following values:

Substance	Value
TSS	70 g/inh/d
BOD_5	60 g/inh/d
COD	135 g/inh/d
N-NK	12 g/inh/d
P-tot	2.5 g/inh/d

The non-national but resident population must be considered together with the national resident population. To avoid double counting with services activities, the seasonal population (tourists, businessmen, students, etc.) is not to be considered here.

7.4.6 Good practices for 'wastewater generated by non-point sources'

7.4.6.1 Methods for data calculation/estimation

The first point to check is the list of non-point sources covered. Over the past three decades, several pieces of EU legislation and international agreements (e.g. UWWTD, Nitrates Directive) have addressed the pollution of aquatic ecosystems by nutrients. In order to assess the effectiveness of current policies and agreements and identify further measures, various studies have looked into source apportionment (i.e. the estimation of contributions from different sources to pollution). In addition, models have been developed for estimating nutrient inputs into river basins from point sources and various diffuse pathways. Taking into consideration the Water Framework Directive, which calls *inter alia* for harmonised methods/tools to quantify nutrient losses from non-point sources, a quantification model/tool should be available, at least in EU Member States, from which nutrient data can be sourced for the JQ-IW. Non-EU countries can apply one of the following quantification tools currently used in Europe: NL-CAT, REALTA, N-LES, MONERIS, TRK (SOIL-N/HBV), SWAT, EVENFLOW, NOPOLU, SOURCE APPORTIONMENT.

Good practices

When filling in Table 8 for nutrients in wastewater generated by non-point sources, it is recommended that you contact the administrative bodies responsible for implementing the WFD.

Besides being used to estimate nutrients from non-point sources, some of the quantification models listed above (e.g. MONERIS) can be upgraded to estimate heavy metal emissions from non-point sources. For this purpose, typical transport processes for heavy metals and specific pathways are integrated in the basic module of the MONERIS framework, for example.

Other approaches to estimating nutrients and heavy metals from non-point sources (apart from quantification models) include the following:

- for runoff from impervious areas, it is first necessary to have information on the pollutant content of the rainwater and then to focus on the different types of area where the rainwater runs off and takes up additional pollutants. The pollutant content of runoff rainwater can be found in scientific studies or compilations of coefficients;
- for transport, the estimate can be made by combining:
  - statistics on transport infrastructure (number and types of vehicle on the respective infrastructures, and cover material);
  - statistics on land cover (Corine Land Cover is one possible data source); and
  - emission factors.

Such statistics are available at NSI level and also from the administration responsible for building infrastructures and/or implementing transport policies. Emission factors can be found in the literature and in scientific studies on the wearing of tyres, roads and brakes;

- for other impervious areas such as roofs, or commercial or industrial zones, you can take the approach described above, using estimates of the dedicated emission factors and the percentage of the area that is not 100 % impervious.

The loads from point sources do not exclude background load, so the parameter 'non-point sources' should comprise both the anthropogenic load and the natural background load.

7.4.7 Good practices for 'urban and industrial wastewater discharged'

7.4.7.1 Methods for data collection

In general, the approach in this part of the table, on the main routes for wastewater from source to final discharge, is similar to that in Table 5 and most of the good practices there also apply here.

Due to the existence of combined or partially combined sewer systems (see definitions above), especially in town centres, it is often difficult to distinguish clearly, along the pathway, between wastewater originating in the domestic sector and that originating from rainwater flowing over impervious areas. In the absence of other data, it is recommended that you report on wastewater in the urban network, without distinctions as to origin.

Methods of direct and indirect measurement

As indicated at the beginning of this chapter, various EU laws require reporting on one or other area of the wastewater treatment system. This has given rise to monitoring and reporting systems, which should also be used here, although they seldom provide the complete figures required in this table, but rather only those for the biggest systems.

In the case of EPER data, for example, direct emission to water is linked to total discharges from the identified sites, but the figures can be used only if additional data can be found to first disaggregate these into discharge to inland and to marine waters. As EPER gives the location of each facility, geographical treatment using a GIS may help to complete this information. Of the 'total wastewater generated by industry', the proportion discharged to inland waters should be classified as 'industrial wastewater discharged without treatment' and the proportion treated in the industrial WWTP as 'discharged after treatment in other WWTP'.

For indirect emission to water, the figures should also be first disaggregated into discharge to inland and to marine waters and the proportion of 'total wastewater generated by industry' discharged to inland waters should be classified as 'urban wastewater — total generated'. If additional information is available as to treatments applied and their performance, this should be used to fill the rows for the various treatment systems (UWWTP, industrial WWTP, or discharged with no treatment) and added to 'total discharges of WWTPs (urban and other)' and 'total discharges to inland water'.

Individual countries may have established national permit systems that also cover some or all the steps in the pathways identified in the first part of the table.

Example: France

France has implemented such a system for all stormwater overflows above UWWTD thresholds (requirement of declaration for those discharging more than 2 000 p.e. and authorisation for those discharging more than 10 000 p.e.) and the same for UWWTPs applying the same thresholds. They are often associated with monitoring systems to assess the performance and/or the correct implementation of the policy.

In addition, local or regional authorities may also be interested in the performance of the systems for which they are responsible or to which they provide subsidies. This applies particularly with subsidies to protect the aquatic environment, where monitoring (generally through water quality stations) may include performance monitoring.

Finally, countries usually report the reuse of wastewater as not significant. This should be checked at national level, as there may be more reuse than reported in the past. If reuse is really negligible, simplification is possible by considering UWWTP effluent as integrally discharged.

7.4.7.2 METHODS FOR DATA CALCULATION/ESTIMATION

As for Table 5, a statistical survey on wastewater services, sent to all services or to a representative selection, can be used to derive each figure. The statistical secrecy required for such surveys is especially valuable with regard to aspects that may be problematic, such as wastewater discharged without treatment, where the answer may be biased by the possibility of targeting one specific service.

As this part of the table involves a complete flowchart with a coverage extending beyond that of some national data and information systems, simplifications can be considered, e.g. only 'urban wastewater - total generated', if figures for industrial wastewater connected to urban collecting systems are not available.

7.4.7.3 METHODS FOR CHECKING DATA QUALITY

Quality-check at institutional level

The first check is to use the simple formula given with the table to assess if the methods apply and/or help identify the remaining elements to complete the table. This part of the table considers all transfers within the system. All the rows in this part are connected, thus allowing simple quality checks at each level from production by the sources to collection, treatment or discharge. This should help paint an overall picture of the performance of the system, with in- and outflow for most of the steps, allowing ultimately for the national average performance to be calculated for each parameter.

Many countries are party to international conventions for the protection of rivers (e.g. the Rhine, the Scheldt, the Danube) or marine areas (e.g. OSPAR, HELCOM, MAP, BSC). These conventions often involve emission reporting and lay down guidelines for good practices and methods. The resultant datasets can be used to check the plausibility of the figures in this table.

If no data are reported for heavy metals from urban collecting systems, check local or national practices concerning the connection of industrial sites to urban sewers, and major types of sewer network (combined or separate system). The quantities discharged in this way are negligible where industries are authorised to connect to urban sewers only if the composition of their discharged wastewater is similar to that of domestic wastewater, or where systems are mainly separate.

Quality-check at operational level

You should first check whether a significant part of the wastewater is directed to the sea. If so, this distinction needs to be addressed at each level in this part of Table 8. Whatever the substance, the sum of 'urban wastewater - total generated' and 'industrial wastewater - total generated' should be in line with (or, where a significant proportion is directed to the sea, lower than) the sum of 'domestic sector - total' (private households and services) and 'industry - total' respectively, in the first part of the table.

7.5 SITUATION IN INDIVIDUAL REPORTING COUNTRIES

Romania

Generation of wastewater

Data on the generation of wastewater is collected through an annual statistical survey (*Wastewater collecting, treatment and discharge*) carried out by the NSI together with Romanian Waters.

Loads (including heavy metals) in sewer outflows for economic activities and domestic wastewater have to be monitored. The annual load is derived as follows: annual volume of wastewater discharged * arithmetic average of concentrations monitored. The substances are those listed in Table 8.

Discharge of wastewater

Data are collected by means of the same survey. Questionnaires are sent to all economic units discharging wastewater (whether or not treated) into natural receivers.

Bulgaria

The volume of wastewater generated and discharged is calculated by combining data from statistical surveys, conducted by NSI. Data on wastewater generated by business are collected via statistical a survey on ‘water use’. The survey covers the larger enterprises using over 36 000 m^3 water annually, and also those below this criterion - on a voluntary basis. The statistical questionnaire requires data for all water flows leaving the territory of enterprises – wastewater generated by origin (industrial, domestic, cooling, rainwater), technology of treatment and place of discharges (water body, public sewage with or without UWWTPs).

Statistical survey on public water supply and sewage (exhaustive) provides data on wastewater collected into UWWTP/sewerage by origin - business and households, and also wastewater collected from non-point sources. Data on wastewater generated by households not connected to public sewerage are estimated on the base of water delivered.

Czech Republic

Dedicated national legislation (the 2001 Water Act) provides for a system of permits for abstraction and discharge. The permit and associated reporting thresholds are based on volumes: yearly individual reporting is triggered by exceeding 6 000 m^3 in one calendar year or 500 m^3 in one calendar month. A dedicated decree sets out a framework, including minimum requirements for the delivery of a permit, how to assess emission standard and limit values, and banned discharges. The permit issuer determines the monitoring methods and frequency and subsequently submits these to the river basin administration and the water authority in charge of the permit system. Monitoring is carried out at the point of discharge (to public sewers or water) and involves *inter alia* recording the volume and pollution of wastewater and minewater. The definition of wastewater includes cooling water and percolation water from the sludge bed and landfills.

A national database is to be established containing all the data collected in this area. The substances covered are COD, BOD_5, dissolved inorganic salts, undissolved substances, P-tot, ammonium nitrogen and inorganic nitrogen.

8 JQ-IW SUMMARY TABLE: WATER-USE BALANCE

8.1 DEFINITIONS AND REMARKS

Name	Consumptive water use
Number	31
Definition	Water abstracted which is no longer available for use because it has evaporated, transpired, been incorporated into products and crops, or consumed by man or livestock. Water losses due to leakages during the transport of water between the point or points of abstraction and the point or points of use are excluded.
Remarks	

Name	Total water consumption
Number	32
Definition	Water abstracted which is no longer available for use because it has evaporated, transpired, been incorporated into products and crops, consumed by man or livestock, ejected directly to the sea, or otherwise removed from freshwater resources. Water losses due to leakages during the transport of water between the point or points of abstraction and the point or points of use are excluded. For the purpose of this questionnaire, total water consumption equals consumptive water use plus discharges to the sea.
Remarks	

8.2 General information

Most of the parameters in these tables are derived from JQ-IW Tables 2, 3, 4 and 8. Only three parameters have to be filled in:

- Losses during use - total;
- Total cooling water discharged;
- Cooling water discharged to inland waters; and
- Cooling water discharged to marine waters.

All the other parameters will be calculated automatically from data reported in the other tables.

PART III — DETAILED INFORMATION FOR EACH REGIONAL TABLE

Water resources and their management are closely linked to spatial parameters. Geo-referenced data is important for policymakers because water management decisions must take into account regional variations in water supply.

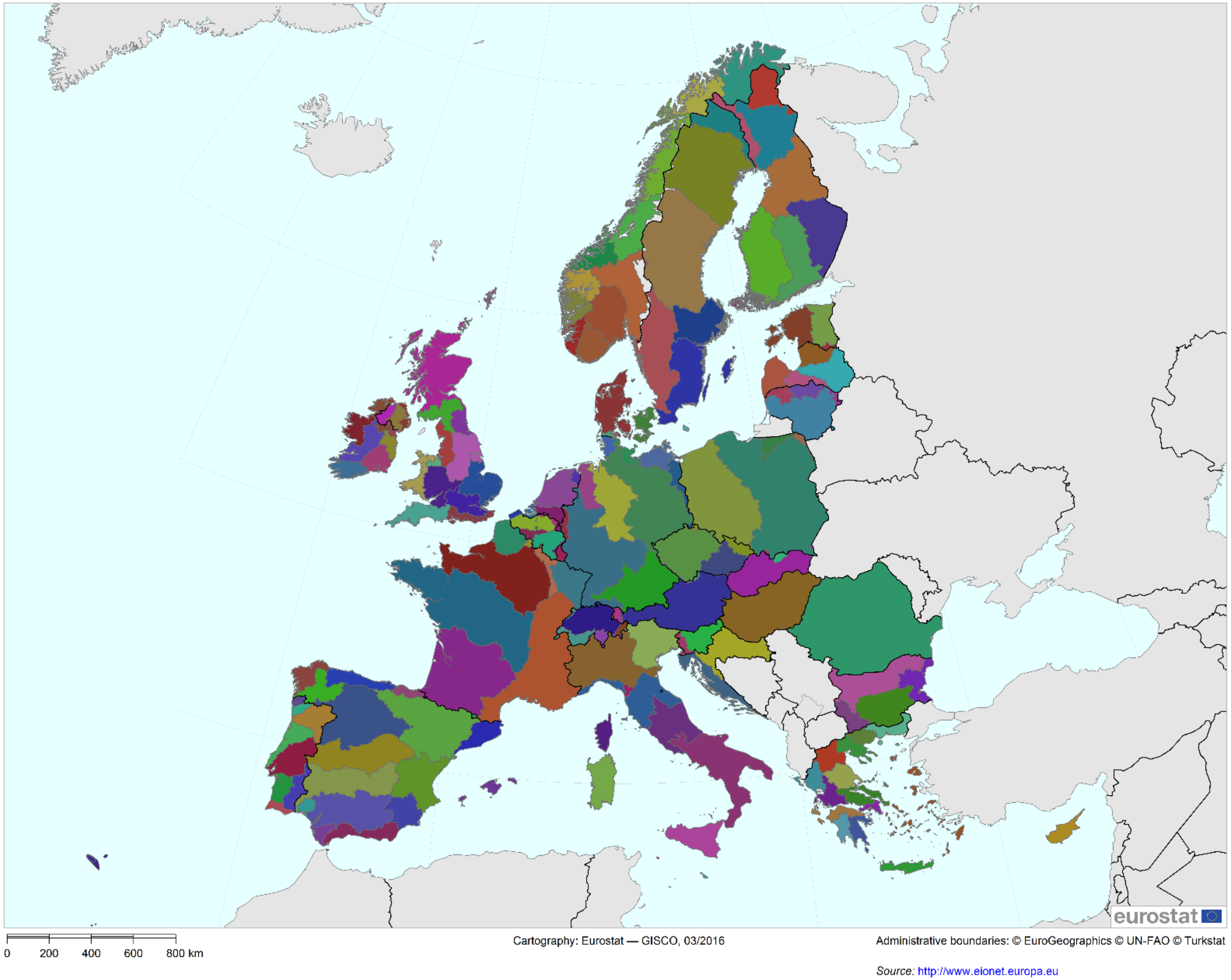
Depending on the type of data and how they are collected, the resultant water statistics can provide data at a number of different geographic levels. Some of these geographic levels include river basin district (RBD), the subunits of the RBD (sub-RBD), the entire river basin or administrative units of government such as municipalities, counties or other basic regions (e.g. for the application of regional policies - NUTS 2 is used). The spatial aggregation requested by JQ-IW corresponds to the national level while the target aggregation for the Water Regional Questionnaire is the River Basin District (RBD).

River Basin District (RBD)

River Basin District is defined in the EU's Water Framework Directive (2000/60/EC) as the main unit for management of river basins. The Water Framework Directive defines 'RBD' in Article 2 definition 15 as an 'area of land and sea, made up of one or more neighbouring river basins together with their associated groundwater and coastal waters …'; in other words, it is the area of land from which all surface run-off flows through a sequence of streams, rivers (and possibly lakes) into the sea. Each river basin district can be divided into smaller, national subunits (sub-RBDs and river basins). The geographic area of some RBDs span more than one country (such as the Danube) and these are known as international RBDs.

PART III – REGIONAL WATER QUESTIONNAIRE

Map 1: River Basin district, Eurostat, 2016



Data sources

Various data sources are needed for producing data items at the RBD level. The data sources include:

- Survey data
- Administrative data
- Hydrological/meteorological data
- Research data

The data sources and collection methods used to produce information depend on the practices in countries and the institutional arrangements. Based on data availability, two general approaches are used; the 'bottom-up' approach or the 'top-down' approach. The 'bottom-up' approach uses detailed data for each river basin within a territory which are then aggregated together to provide a national total. The 'top-down' approach starts with national level data which is then assigned or broken down to the river basin districts level.

Spatial allocation of data

The main challenge for regional aggregates on water quantity is to provide geo-referenced data. Ideally, the area to which data items refer should include a specific geographic reference, thus allowing the aggregation of the data items into different geographic units – for example, municipalities, NUTS 2, or river basins. According to the specificity of the parameter and data availability various methods for spatial aggregation and estimation can be developed. Geographic information systems (GIS) are a useful tool for compiling water data items at different spatial levels.

Regional parameters are a subset of parameters of the JQ-IW. In general, most of recommendations given for the data collection at the national level that is needed for reporting to the JQ-IW, are also valid recommendations for the spatial unit 'River Basin District' (RBD) which is to be reported in the Water Regional Questionnaire, RWQ.

Data on water quantity requested in the regional questionnaire (RWQ) are described under three main tables: Renewable freshwater resources, Water Abstraction, and Water Use.

PART III – TABLE 11

1 TABLE 11: RENEWABLE FRESHWATER RESOURCES (MIO M3)

1.1 DEFINITIONS

Name	Precipitation
Number	1
Definition	Total volume of atmospheric wet precipitation (rain, snow, hail...). Precipitation is usually measured by meteorological or hydrological institutes
Remarks	Please provide the water equivalent, as is usually recorded by rain gauges.

Name	Actual evapotranspiration
Number	2
Definition	Total volume of evaporation from the ground, wetlands and natural water bodies and transpiration of plants. According the definition of this concept in Hydrology, the evapotranspiration generated by all human interventions is excluded, except unirrigated agriculture and forestry. The 'actual evapotranspiration' is calculated using different types of mathematical models, ranging from very simple algorithms (Budyko, Turn Pyke, etc.) to schemes that represent the hydrological cycle in detail. Please do not report potential evapotranspiration which is 'the maximum quantity of water capable of being evaporated in a given climate from a continuous stretch of vegetation covering the whole ground and well supplied with water'. AVERAGE LONG-TERM ACTUAL EVAPOTRANSPIRATION: The average of actual evapotranspiration over a long period, normally 30 consecutive years or more.
Remarks	'Actual evapotranspiration' can be calculated using various mathematical models, ranging from very simple algorithms (e.g. Turc, Penman, Budyko or Turc-Pyke) and methods that make corrections related to vegetal cover and season, to models that represent the hydrological cycle in detail.

Name	Internal flow
Number	3
Definition	Total volume of river runoff and groundwater generated, in natural conditions, exclusively by precipitation into a territory. The internal flow is equal to precipitation less actual evapotranspiration and can be calculated or measured. If the river runoff and groundwater generation are measured separately, transfers between surface and groundwater should be netted out to avoid double counting.
Remarks	Should include both surface and underground flows.

Name	Actual external inflow
Number	4
Definition	Total volume of actual flow of rivers and groundwater, coming from neighbouring territories. AVERAGE LONG-TERM ACTUAL EXTERNAL INFLOW INTO A TERRITORY: The average of the actual external inflow of rivers and groundwater into a TERRITORY, averaged over a period of at least 30 consecutive years.
Remarks	See Part II 1.4.3

Name	Total actual outflow
Number	5
Definition	Actual outflow of rivers and groundwater into the sea plus actual outflow into neighbouring territories.
Remarks	

Name	Total renewable freshwater resources
Number	8
Definition	Internal flow plus actual external inflow.
Remarks	

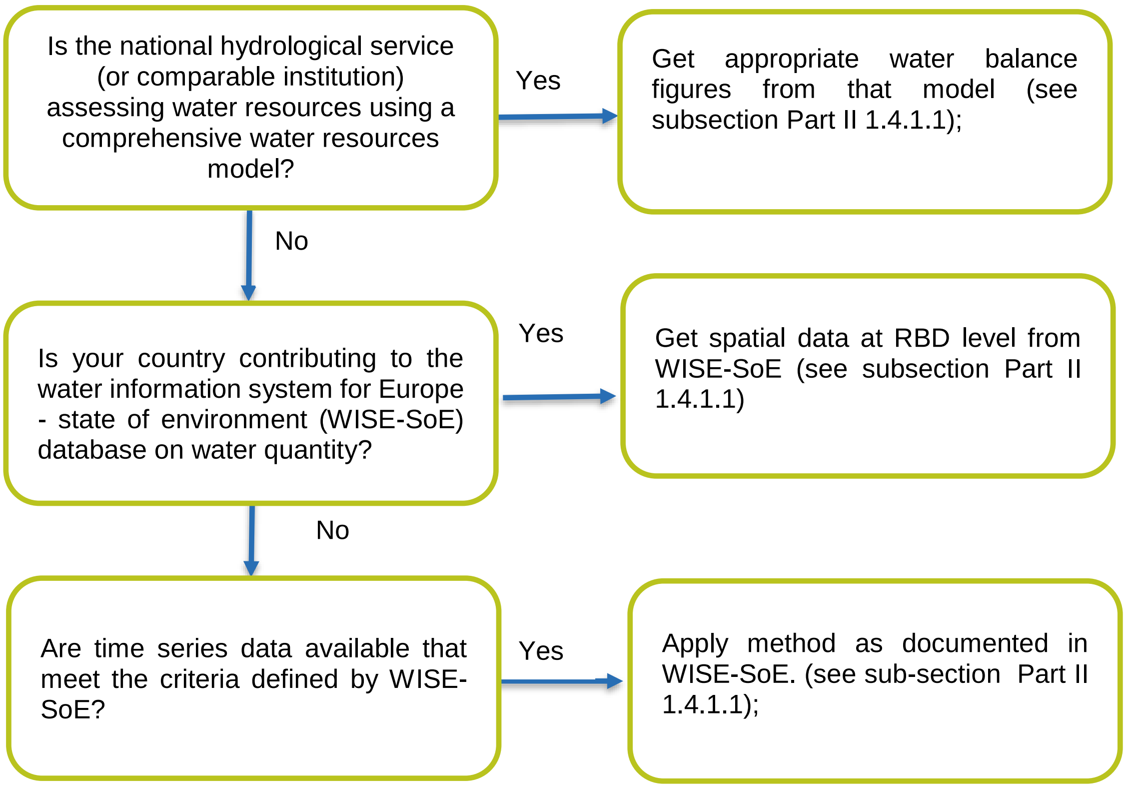
1.2 GENERAL information

The Eurostat Regional water questionnaire, RWQ, requires hydrological and meteorological data on key parameters of the annual water balance at RBD level (Precipitation; Actual evapotranspiration; Internal flow; Actual external inflow; Total renewable freshwater resources). Such data are usually collected by agencies responsible for weather forecasting and water resources management. Data collection methods include the use of field monitoring stations, remote-sensing, and modelling techniques. The water-balance equation and the methods of data calculation/estimation by parameters recommended in the JQ-IW TABLE 1: RENEWABLE FRESHWATER RESOURCES can be used at the River Basin District (RBD) level.

1.3 DECISION TREE

The decision tree for devising the water balance at the River Basin District level is similar to those used for Table 1 of the JQ-IW (Part II 1.3). However, the LTAA data are not required for reporting to the regional questionnaire.

Water balance components



1.4 SITUATION IN individual COUNTRIES THAT REPORT THE RWQ

Good practices used for developing the water balance for the national territory (given in JQ-IW, Table 1 subsection Part II 1.4) are the same for developing the water balance at level of the River Basin District.

The geo-referenced hydrological/meteorological database at the European Environment Agency can be a valuable source for providing regional data on the freshwater resources at the river basin level. If the country already reports such data to EEA through the WISE-SoE, Water quantity (Eionet-Water and Eurowaternet) these data can be used directly because they are derived from statistically stratified monitoring stations and groundwater bodies, and are comparable at European level.

Bulgaria

Information for the Eurostat/OECD JQ 'Inland water' and Regional questionnaire in Bulgaria is provided from statistical data. The NSI conducts several water surveys which exhaustively cover water supply companies (public water supply and irrigation systems) and the larger water users. The survey on Water Use is obligatory for enterprises using over 36 000 m^3 water annually, and voluntary for enterprises below this criterion.

Each local unit/enterprise is geographically referenced to the lowest administrative level (settlement - town, village) according to the location of economic activity. The settlement is accepted as a point object for spatial data aggregation. For Bulgaria the WFD defines four River Basin Districts (RBDs) which are composed of 27 sub-RBDs. The borders of some sub-RBDs do not follow the administrative boundaries. To assign the settlement to the proper sub-RBD area, a special 'Register of settlements' by Sub-RBD' was developed. The Register covers about 5500 towns and villages which are uniquely identified as belonging to a single, specific Sub-RBD territory. The Register is updated annually in accordance with the legal provisions for establishments and for the renaming of settlements.

The availability of geo-referenced and spatial attributes ensures the possibility of making spatial aggregations at both administrative and at geographically defined areas. Specific methods to aggregate, disaggregate, and convert from one special area unit to another are used depending on the conversion required. Statistical data referring to the point object (e.g. place of abstraction, water use and wastewater discharge) are produced using an aggregation approach (from settlement to Sub-RBDs). A 'disaggregation approach' is applied for statistical data which refer to an area unit which is not coinciding with the area of administrative units, or with sub-RBD area (e.g. water losses). And finally, data conversion from one to another spatial area unit is estimated using regionalizing factors (e.g. population, employees or another suitable factor).

Italy: Grant project: Statistics on water resources, water use and wastewater treatment – 'Development of data collections systems and statistical methods for indicators at the sub-national level'[15]

Water resources

Several institutions are responsible for meteorological data, creating a 'problematic situation for all researchers that would like to know and analyse data related to the Italian climate conditions and in general to the resource 'water'. Istat proceeded with the implementation of a geographical data-warehouse with meteorological, agro-meteorological and daily hydrological values provided by more than 600 national, regional and local institutions operating in the meteorological field.'

All basins have been defined 'in ArcInfoTM environment, with the coordinate system WGS84 zone 33 datum WGS84, starting from the basins located by ISPRA and implementing them in the mouth areas and along the watershed limits by comparison with the catchment areas defined by official authorities. 183 river basins have been identified, of which 12 are foreign, but belonging to Italian RBD.'

'For the rivers for which no hydrometric gauging stations were available, the volumes have been calculated estimating the runoff of each basin using the empirical method based on the Curve Number, developed by USDA Natural Resources Conservation Service (USDA – NRCS, 1993; 2004).'

'The calculation of the renewable freshwater resources parameters has been carried out starting from the analysis of the hydrological balance at the scale of river basin in accordance with Directive 2000/60/EC (Water Framework Directive - WFD), which provides that Member States address the protection of water at river basin level and that the territorial unit of reference for the basin management is the river basin district, consisting of one or more neighbouring river basins and of their respective groundwater.'

The balance at RBD level has been subsequently as the sum of the indicators of the constituent basins.

Precipitation

'This indicator has been obtained by the intersection of the river basins map (ESRI shape) with the monthly pluviometric layers, thus deriving 12 layers related to the 1971-2000 (LTAA) and monthly time series 2001-2010, necessary to implement the model. The annual precipitations of each river basin have been calculated as sums of the monthly values.'

Actual evapotranspiration:

'Actual evapotranspiration (E) has been derived indirectly from the monthly water-balance model which is based on the methodology originally presented by Thornthwaite (1948; Mather, 1978; 1979). Inputs to the model are: monthly precipitation, potential evapotranspiration and soil-moisture storage capacity. The sum of the 12 months results in the total annual actual evapotranspiration, in millimeters, for each river basin.'

Internal flow:

'The comparison between the flow of water in and out of a system is the water balance that allows a quantitative estimate of the movements of water.

[15] For more information, see grant report 'Statistics on water resources, water use and wastewater treatment –"Development of data collections systems and statistical methods for indicators at the sub-national level"'

Computed from gauging stations data or indirectly estimated using precipitation and actual evapotranspiration, as follow:

Starting from the equation of water balance

$$P = R + Ie + E$$

where:

P: Precipitation;

R: Runoff;

Ie: Recharge into the aquifer; and

E: Actual evapotranspiration

it is obtained $P - E = R + Ie$, that is the internal flow.'

External flows:

For river basins with only national components, a method based on comparison between effective rainfall and streamflow is used.

For river basin with international components:

- Po River basin: 'the actual external inflow from neighbouring territories has been derived as difference between the effective precipitation on its basin and the flow rate measured at the station Pontelagoscuro, taking the national flow equal to the internal flow. In this way, therefore, the amount that is greater than the effective rainfall is considered external outflow.'
- Adige river basin: For this river basin, 'the actual external inflow has been calculated as a portion of the total flow measured at the gauging station near the mouth of the river, Boara Pisani. The proportion utilised is the ratio between the international part of the parameter to the total for the river basin.'

Total actual outflow:

'The total actual outflows exiting from the river basins are the discharges of rivers that flow into the sea (no discharge to neighbouring countries). 158 hydrometric stations have been used to calculate this indicator, but only some of these stations provided complete data for the river basins that are monitored. The total outflow out of the district is the result of the redistribution of the surplus (or of the deficit) between discharge and effective rainfall of the basins.'

Hungary: Grant project: Statistics on water resources, water use and waste water Treatment Water Statistics of Hungarian Regions and River Basin District Subunits[16]

Precipitation

Based on the database from the Association of Hungarian Amateur Meteorologists', the municipalities with more precipitation measurement stations were taken into account as one 'virtual' measurement station with average values of measured precipitation and temperature in the same municipality. 'The territorial averages of precipitation (mm) by River basin district and subunits (RBDSU) and by NUTS2 regions were estimated from simple arithmetic average of relevant measured precipitation values. The differences from the country data provided for the JQ Inland Water 2012 were distributed among the regions proportionately according to the areas of regions.'

Actual evapotranspiration:

'For determination of actual annual evapotranspiration at the regional (NUTS2) level and at RBDSUs level, the Turc formula was applied, because of the inadequate territorial distribution of the measurement stations of evapotranspiration. Generally, the transpiration surplus of the free water surfaces is not taken into consideration except for the transpiration of Lake Balaton.

The applied Turc formula[17] is:

$$\mathrm{AET} = \text{ß} * \mathrm{P} * (0.9 + P^2/K^2)^{-0.5}$$

where:

AET: annual actual evapotranspiration (mm);

[16] For more information, see grant report 'Statistics on water resources, water use and waste water'

[17] Source: Budapest University of Technology and Economics

P: average annual precipitation (mm);

T: average annual temperature (ºC);

K: 300 + 25*T + c*T^3

c: 0.05 (empirical coefficient);

ß: coefficient depends on land cover, in Hungary for agricultural area: 1.13; for forests: 1.62

For determination of the agricultural and forest areas (for all represented years), the CORINE 2006 land cover categories and data[18] were used. The delimitation of different land cover categories was elaborated with the ArcView 3.2 Geoprocessing Wizard application.'
'For determination of transpiration of Lake Balaton the annual water budget calculations of Balaton Water Authority of Central Transdanubian Water Directorate were applied.
The applied transpiration formula is:

$$P = a * (E - ev) * (0.59 + 0.013 * v) * n$$

where:
P: average daily transpiration of the water surface (mm);

a: seasonal correction coefficient (-);

(E-ev): saturation deficit (mbar)

v: average wind speed (m/s)

n: number of days in the month'

<u>Actual external inflow and total actual outflow:</u>

The Hungarian NSI does not have access to the Hungarian Hydrological Database. To determine the external inflow and outflow at RBDSUs level, the national external inflow and outflow data of JQ on Inland Water 2012 was used.
'For the distribution of the annual national inflow and outflow data they applied the long term annual average inflow and outflow data by main rivers. For the year 2011 the actual external inflow and total actual outflow values were calculated from the LTAA values of actual external inflow and total actual outflow, due to data availability according to the JQ on Inland Water 2012 (v1.0).
By estimation of inflow and outflow for border river they took into account half of the total volume of runoff. E.g. between two countries (River Dráva: Hungary - Croatia) or two NUTS2 regions (Danube: Southern Transdanubia - Southern Great Plain).'
For determining external inflow and outflow at NUTS2 level they applied the LTAA (1991-2000) runoff data from the Hydrological Yearbook of Hungary 2006. This yearbook series is available from 1886 until 2006. Due to the reorganization of Hungarian Hydrological Service and due to lack of financial sources this publication is no longer available.

The Netherlands:

Data and its spatial distribution was calculated by Water Watch Company using radar images calibrated by the dense network of precipitation gauging stations of the Royal Dutch Meteorological Institute (KNMI). The applied method calculates the amount of water in the precipitation being measured every 5 minutes by the KNMI precipitation radar network. The raw images were calibrated using dozens of precipitation gauges in the country. By using a GIS overlay, the precipitation was also broken down to river basins.

[18] http://sia.eionet.europa.eu/clc2006

2 TABLE 12: TOTAL GROSS WATER ABSTRACTION AND WATER LOSSES BY SOURCE (MIO M³)

2.1 DEFINITIONS

Name	Fresh surface water
Number	13
Definition	Water which flows over, or rests on the surface of a land mass, natural watercourses such as rivers, streams, brooks, lakes, etc., as well as artificial watercourses such as irrigation, industrial and navigation canals, drainage systems and artificial reservoirs. For purposes of this questionnaire, bank filtration (induced infiltration of river water through bankside gravel strata (by pumping from wells sunk into the gravel strata to create a hydraulic gradient) with the intention of improving the water quality) is included under fresh surface water. Sea-water, and transitional waters, such as brackish swamps, lagoons and estuarine areas are not considered fresh surface water and so are included under NON FRESHWATER SOURCES.
Remarks	

Name	Fresh groundwater
Number	14
Definition	Fresh water which is being held in, and can usually be recovered from, or via, an underground formation. All permanent and temporary deposits of water, both artificially charged and naturally, in the subsoil, of sufficient quality for at least seasonal use. This category includes phreatic water-bearing strata, as well as deep strata under pressure or not, contained in porous or fracture soils. For purposes of this questionnaire, ground water includes springs, both concentrated and diffused, which may be subaqueous. Resources of fresh groundwater are called RENEWABLE if they receive significant natural recharge over a human lifespan. In contrast, NON-RENEWABLE groundwater resources (also referred to as FOSSIL GROUNDWATER) are those that do not receive natural recharge over a human lifespan (although they may receive artificial recharge).
Remarks	

Name	Gross water abstraction (= water withdrawal)
Number	15
Definition	Water removed from any source, either permanently or temporarily. Mine water and drainage water are included. Water abstractions from groundwater resources in any given time period are defined as the difference between the total amount of water withdrawn from aquifers and the total amount charged artificially or injected into aquifers. Water abstractions from precipitation (e.g. rain water collected for use) should be included under abstractions from surface water. The amounts of water artificially charged or injected are attributed to abstractions from that water resource from which they were originally withdrawn. Water used for hydroelectricity generation is an in-situ use and should be excluded.
Remarks	

Name	Public water supply
Number	16
Definition	Water supplied by economic units engaged in collection, purification and distribution of water (including desalination of sea water to produce water as the principal product of interest, and excluding treatment of wastewater solely in order to prevent pollution). It corresponds to division 36 (NACE/ISIC) independent of the sector involved, but excluding systems operation for agricultural irrigation such as irrigation canals, which should be reported under 'other supply', cf. definition 29. Deliveries of water from one public supply undertaking to another are excluded.

Remarks	This includes water for domestic use and water used at offices. It also includes small factories, use by local authorities (e.g. for cleaning streets and watering parks), and the watering of private gardens.

Name	Irrigation water
Number	17
Definition	Water which is applied to soils in order to increase their moisture content and to provide for normal plant growth. For purposes of the questionnaire, data reported under this item fit in NACE/ISIC division 01.
Remarks	

Name	Cooling water
Number	19
Definition	Water which is used to absorb and remove heat. In this questionnaire cooling water is broken down into cooling water used in the generation of electricity in power stations, and cooling water used in other industrial processes.
Remarks	Typically, cooling water is not significantly polluted by the cooling process. For the purposes of the JQ-IW, heat is not regarded as pollution.

Name	Non-freshwater sources
Number	22
Definition	Includes sea water and transitional water, such as brackish swamps, lagoons and estuarine areas. Such water resources may be of great importance locally, although in a national context, they are usually of lesser importance as compared to surface and groundwater resources.
Remarks	

Name	Desalinated water
Number	23
Definition	Total volume of water obtained from desalination processes.
Remarks	Includes both sea water and brackish water

Name	Reused water
Number	24
Definition	Water that has undergone wastewater treatment and is delivered to a user as reclaimed wastewater. This means the direct supply of treated effluent to the user. Excluded is wastewater discharged into a watercourse and used again downstream. Recycling within industrial sites is excluded.
Remarks	

Name	Water losses
Number	27
Definition	Volume of water lost during transport (through leakage or evaporation) between a point of abstraction and a point of use, between a water supplier/distributor and a point of use or between points of use and reuse. Water lost through evaporation during use is excluded and should be reported under consumptive water use (31)
Remarks	Process water used by waterworks (NACE 36) must not be reported as water losses, but has to be reported under industrial activities (NACE 05 – 43).

Name	Water transfer
Number	55
Definition	Water transfer (to/from other regions) includes transfer of water across the borders of the region in pipelines, artificial channels, as well as bulk transfer by ships or trucks. Transfer of bottled water is excluded.
Remarks	

2.2 GENERAL INFORMATION

Data on water abstraction can be collected with reference to a number of different spatial levels. Ideally, the statistical units to which data items refer should include a specific geographic reference, allowing compilation of the data items at a number of geographic levels. For regional questionnaire data on water abstraction should be compiled, at a minimum, at the RBD level. This is particularly important for international or transboundary water resources. Countries are also encouraged to compile data items at the lower level (e.g. sub-RBD, river basins, administrative areas), to facilitate the intranational spatial analysis of water information.

The regional Table 12 requires data on the total water available for use within the RBD which corresponds to the parameters of JQ-IW Table 2 and 3. The total water abstracted for own use, water abstracted for distribution, and imported water from other RBD, represent the total water available for use within the RBD. According to the type of water resources (surface and groundwater) the parameters requested are: 1) water abstraction for distribution by public water supply, and 2) water abstraction for irrigation and cooling in electricity production (from self and other supply). In addition, there are some other parameters from the JQ-IW Table 2 and 3 should be broken down at RBDs level: non-fresh water sources, desalinated water, reused water, and losses during transport.

Additional indicators referring to water transfer are included in the RWQ questionnaire, as part of the water available for use. This issue will become more and more important in view of climate changes, combined with population growth and economic development.

In many countries there is substantial spatial variation in the available water resources; there may be a surplus of water in one region while there is too little in another. One method of increasing water supply to regions with too little water is water transfer. In broad terms, water transfer is the physical movement of water from one location to another, on any scale and by any means, to satisfy water needs. The transfer may be carried out by river diversion, pipeline or even by sea tankers. The water transfer may take place within one water company or water provider's resource area or may involve movement of water between separate water companies or providers (interconnection).

In the context of the RWQ, water transfer is defined as the transmission of water from one River Basin District to another, by way of pipelines, artificial channels or bulk transfer by ships or trucks. The water may originate from a surface water source or from groundwater. The water transferred may have been treated to drinking water quality standards or may be raw water.

Reporting countries should provide data on water transfer where relevant infrastructure for water transfers between different River Basin Districts/sub-basins exists. Typically, relevant sources for information on water transfer include water resources management authorities, research institutes, universities or other organisations tasked with securing water supply. Such information may be found in River Basins Management Plans, investment and financial plans of water management firms or other publications on water availability and water management. If a suitable information source cannot be found, a possible way to collect data on water transfer is a survey addressed to the relevant water supply companies, combined with development of appropriate methods for modelling and calculations.

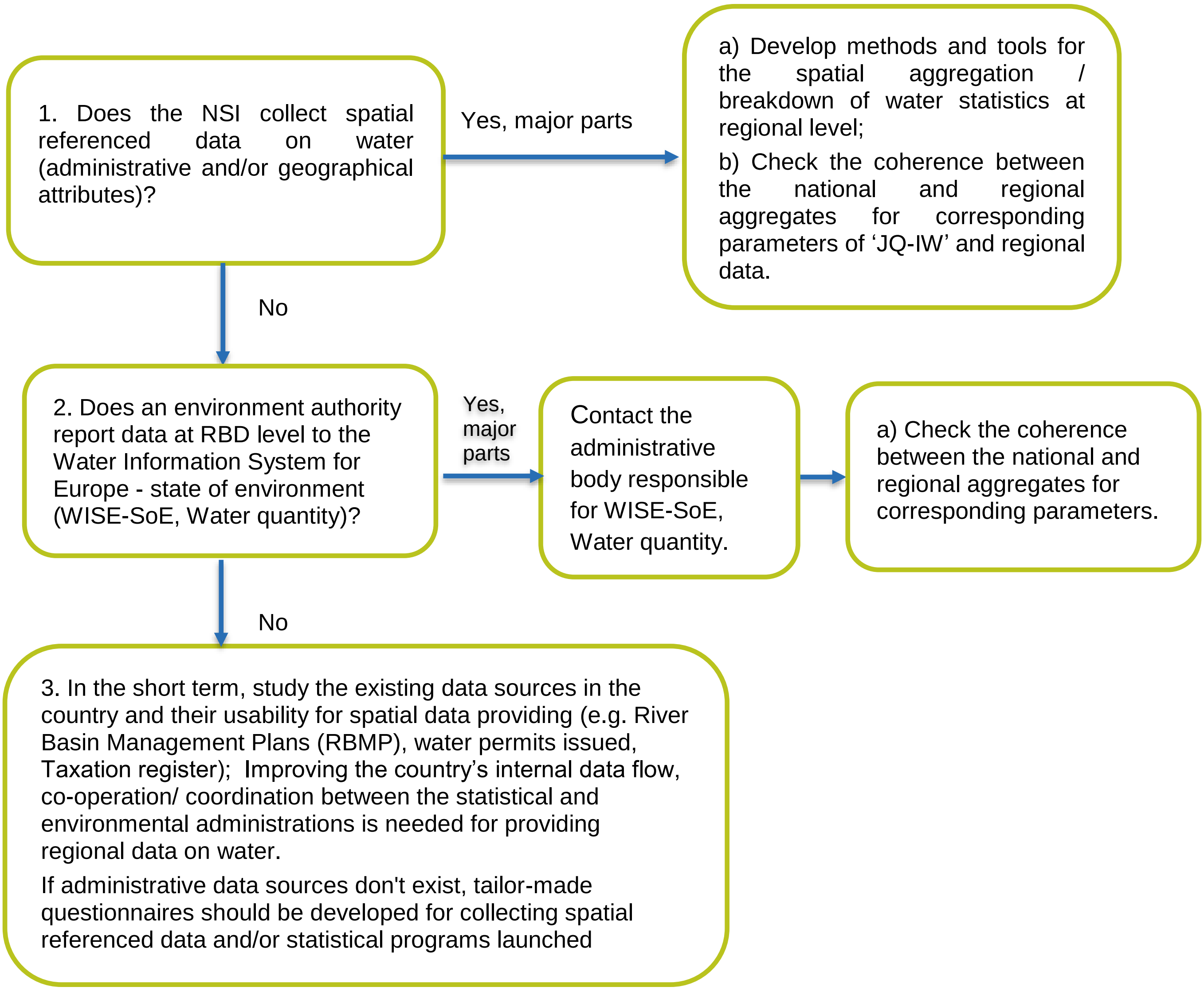
The general information for water abstraction parameters and data accuracy within the national territory (given in the JQ-IW Table 2) is valid for the River Basin District, too.

The data sources and collection methods used to produce the data items depend on the practices in countries, including the institutional arrangements. Various methodological approaches can be developed depending on the use of the data.

2.3 Decision tree

If the country has no reported data on water abstraction at a national level, you can follow the solutions given in the decision tree for JQ-IW Table 2. If these data are already reported to the JQ-IW (Table 4) the efforts should be focused on their break-down to regional levels.

Decision tree – Regional water Table 12



2.4 Situation in individual reporting countries

<u>Bulgaria</u>

Abstraction by self-supply, reused water:

The source of data on water abstraction and reused water is the statistical survey on Water Use. Responding to the survey is obligatory for enterprises using over 36 000 m^3 water annually, and voluntary - for enterprises below this criterion. Each local kind of activity unit/enterprise reports data on the volume of water abstracted and the type of water source (surface, groundwater and sea). The records in the database contain two spatial attributes for each local kind of activity unit/enterprise - abstractor: 1) geographical location of the economic activity at the lowest administrative level (settlement), 2) code of the sub-RBD from which the water is abstracted, and 3) NACE code for the economic activity of the enterprise that is abstracting the water. Enterprises extracting water are required to have a permit. The sub-RBD is identified by the enterprise according to the permit issued. Regarding groundwater sources - abstractors report the sub-basin according to the territory where the water extraction takes place. NSI verifies the correctness of indicated sub-RBD codes using GIS and also, the public administrative register for the permit issued. Data on the self-water abstraction and reused water are aggregated by economic activity and published at NUTS2 and at RBD level.

Abstraction for distribution (public water supply and irrigation systems)

In Bulgaria, the amount of water delivered by public water suppliers is almost at the same level as water delivered to irrigation systems. Both types of distributors provide water to households, industries, agriculture and services. Irrigation systems are classified in Agriculture, NACE01. The sources of data for water abstraction are the exhaustive surveys on water suppliers. The suppliers report data according to the sub-RBD, on the volume of water abstracted and type of source (surface and groundwater). The number of sub-river basin districts as sources of water abstraction for one water-supply Company can be as high as 6. Also, distributors report data on water supplied to the main type of users (i.e., households, agriculture, industry, and services) at the lowest territorial level (settlement). Data for all these parameters can be aggregated at various regional levels.

Water losses

Assuming that water losses in self-supply are often negligible, water losses are mainly found in the water supply network and open irrigation canals. Statistical questionnaires contain water balance parameters at 'company level' (Water abstraction, Water transfer between water supply companies, water entering the supply system, Process water used by waterworks, Water delivered to the users by main economic sectors, Water losses, Charges for water services, etc.). Volume of water lost during transport (through leakage or evaporation) between a point of abstraction and a point of use is usually estimated. Data on water balance refers to the area served by distributors which is usually not coinciding with administrative territories and river basin regions. Data on the volume of distributed water to main users are reported at settlement level. The available spatial attributes allow identifying the area served by each distributor and then using regionalizing factors, data can be converted from one to another spatial area unit such as sub-RBD.

The conversion of data from one to another spatial area unit is made by a disaggregation approach using the regionalizing factor 'volume of water delivered to the users'. This parameter is known at 'Company' and at 'settlement' level. First, data on water losses are calculated at the settlement level using the ratio 'water losses/water delivered.' These estimates are then aggregated by administrative and sub-RBD level. The assumption is that water losses are evenly distributed around the region served by an individual water supply company. Using suitable regionalizing factors, various regional parameters can be estimated according the available data and sources (e.g. water entering the system, per cent of water losses, price of water services, etc.).

3 TABLE 13: WATER USE (FROM ALL SOURCES: PUBLIC SUPPLY, SELF-SUPPLY, OTHER SUPPLY) (MIO M^3)

3.1 DEFINITIONS

Name	Public water supply
Number	16
Definition	Water supplied by economic units engaged in collection, purification and distribution of water (including desalination of sea water to produce water as the principal product of interest, and excluding treatment of wastewater solely in order to prevent pollution). It corresponds to division 36 (NACE/ISIC) independent of the sector involved, but excluding systems operation for agricultural irrigation such as irrigation canals, which should be reported under 'other supply', cf. definition 29. Deliveries of water from one public supply undertaking to another are excluded.
Remarks	This includes water for domestic use and water used at offices. It also includes small factories, use by local authorities (e.g. for cleaning streets and watering parks), and the watering of private gardens.

Name	Water use
Number	26
Definition	In contrast to water supply (i.e. is delivery of water to final users including abstraction for own final use), water use refers to water that is actually used by end users for a specific purpose within a territory, such as for domestic use, irrigation or industrial processing. Excludes returned water (20)
Remarks	

Name	Self-supply
Number	28
Definition	Abstraction of water by the user for own final use.
Remarks	

Name	Other supply
Number	29
Definition	The part of water supply to agriculture which was not included under 'Public water supply' or 'self-supply' (that means all system operation for agricultural irrigation which are not individual irrigation systems). This might also include some water from self-supply distributed to other users. Double-counting has to be avoided.
Remarks	

3.2 GENERAL INFORMATION

Table 13 requests information on the total volume of water used according to aggregated levels of economic activities of the end users (agriculture, industry, services and households) at River Basin District (RBD) level. The total volume includes the water used from all supply categories.

To complete the spatial aggregation at the level of a River Basin District, the following data are necessary:

- Total water used by all supply categories;
- Economic activity of the end users according to the NACE;
- Spatial location of the users.

The total water used within RBD is defined in the same way as at ‘country level’. It is the sum of water abstracted directly from the environment for own use (self-supply) and water received by distributors (e.g. public water supply, irrigation systems) through systems of pipes (water mains), but other means of transportation are also possible (such as artificial open canals and trucks). Wastewater for further use received from another economic units (see def.24 JQ-IW) should also be included in this category. Households receive water from other economic units (typically public or private waterworks) or they may also abstract water for own use.

The economic units – water users should be classified on the basis of their productive activity using the standard classifications in NACE, or identified as households, as it is required for JQ-IW.

The users should be geo-referenced or spatially located. The location is defined as the place at which the unit is physically performing its activities. The location can also be recorded as geographic coordinates (i.e., a geo-code) but may also be recorded as within the bounds of a particular administrative area and river basin district and sub-RBD.

The amount of water used for a given RBD does not necessarily correspond to the amount of water available for use in the same RBD due to water losses (see JQ-IW, section 4.2.1). Assuming that water losses in self-supply are often negligible, water losses are mainly found in the water supply network and open irrigation canals. In some regions, the level of losses can reach high volumes due to water transferred between water suppliers within the region. Also, in some countries, there may be extensive transfers of water between river basins. Inter-river basin transfers are often quantified according to the use made of the water in the receiving river basin. Good practice guidance for the evaluation of losses during transport is provided in section 3.4.2 for the JQ-IW.

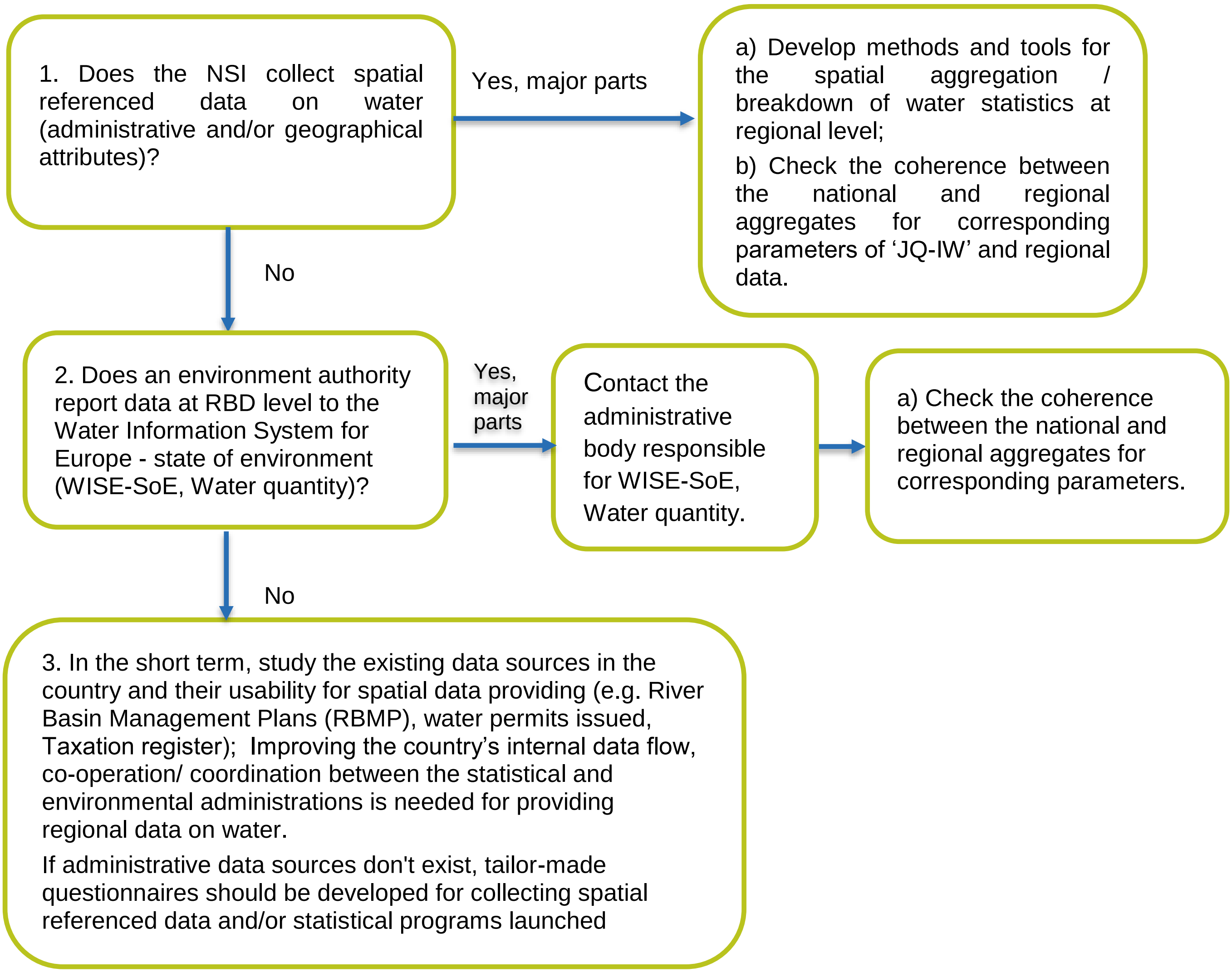
The approaches for providing spatially aggregated data depend on the spatial attributes available in the databases. Various methodological approaches can be developed depending on the use of the data. If the data available on water used refer to an irregular or non-standard spatial area, then the conversion from one to another spatial area unit can be estimated using regionalizing factors (e.g. population, employees or another suitable factor).

The data sources and the collection methods used to produce spatial data items depend on the practices found in each country. The following decision tree can provide some general guidance, including institutional arrangements, for how countries can proceed.

As the regional water data is a subset of the parameters and variables found in the JQ-IW, the sum of data by RBDs should be coherent to the corresponding parameters reported in the JQ-IW.

3.3 Decision tree

If the country has no reported data on water used at national level, you can follow the solutions given in the decision tree for JQ-IW Table 2. If these data are already reported to the JQ-IW (Table 4) the efforts should be focused on their break-down at regional levels. The decision tree presented below is the same as Table 12 and can give an idea about the possible way for providing spatially referenced data for reporting to the RWQ.



3.4 SITUATION IN INDIVIDUAL REPORTING COUNTRIES

Bulgaria

Regional data on water use are calculated on the basis of statistical information. Data sources and general approaches for providing spatial data are described in section 1.3 of part III.

Statistical questionnaire for Water Use provide data on the volume of water use by supply category – including self-supply and water received from distributors (public water supply, irrigation systems or other supply, including reused water). Each user (local kind of activity unit/enterprise) is geographically identified at the lowest administrative level (settlement) according to the place where the economic activity is carried out and also identified by economic activity (NACE). Having both of these categorical identifiers, it is possible to produce spatial data at various regional levels and also by economic activity.

On the other hand, data on water used received from distributors are available only for enterprises, covered by statistical survey on Water use. Data are compiled on the basis of exhaustive surveys of water distributors. Distributors provide data on water delivered to the final users by main activity (households, agriculture, industry and services) at the lowest administrative level (settlement). According to the adopted methodology, water used by NACE activity of consumers is estimated on the base of water supplied to the main sector (reported by distributors) and divided proportionally to the shares of NACE sectors obtained from the survey on Water Use at LAU level. This approach works well for reporting data to JQ-IW and RWQ but there are some disadvantages for the SEEA-water accounts. A possible regionalising factor can be the existing data on expenditures for water supply, if the information is geo-referenced.

PART IV — REFERENCES & ANNEXES

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2 ANNEXES

2.1 ANNEX 1 —GENERAL METHODS USED FOR DATA COLLECTION IN FRANCE

France already has effective systems in place for developing water statistics. The data flows are well identified and regulated by law. The institutions having a in the management of water statistics are all fully operational and work together in a coordinated way. Integrated water management was introduced in national legislation.

The collection of official statistics is very well developed in France and a wide range of data on the water ecosystem is gathered, including on the condition and responsiveness of the system and the water pressure. Official statistics are collated and presented in the French water information system, on the Eaufrance[19] website.

The observation and statistics department within the General Commission for Sustainable Development is the main authority responsible for reporting data to Eurostat and the EEA. The Ministry for Ecology, Sustainable Development and Energy publishes quantitative data on water abstraction by economic activity, drinking water (production, distribution and consumption, including specifically for households), wastewater and sewage (collection, treatment and sanitation), sewage sludge and treatment, and domestic water prices. It should be noted that the observation and statistics department is a recognised statistical authority of the national statistical system for the environment.

The water agencies, which are collectively responsible for the national water systems, produce a significant amount of data. They work in close cooperation with the the French biodiversity agency through the specialist advisory body, *le Secrétariat technique de bassin*.

[19] http://www.eaufrance.fr/

PART IV — ANNEXES

2.2 ANNEX 2 — DRAFT QUESTIONNAIRE ON WASTEWATER SLUDGE (THE NETHERLANDS)

This survey has been discontinued from the Netherlands working programme due to budget cuts in 2018. However, this is still a useful example of a wastewater sludge questionnaire.

Centraal Bureau voor de Statistiek
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E-mailadres: rhwe@cbs.nl

Afvalwaterzuiveringsslib van bedrijven en instellingen 2004

00000000018	Uw CBS-correspondentienummer
111111 002004 BSV 0587	**00018**

Gaarne terugzenden voor **15 juli 2005** in bijgevoegde portvrije retourenvelop. Wilt u controleren of het bovenstaande codenummer in het venster zichtbaar is?

ALGEMEEN

Vul hier eventuele wijzigingen in bedrijfsnaam, (post)adres en contactpersoon in. (If needed, mutations in contact adress can be provided here)

1. Naam bedrijf en adres
2. Naam contactpersoon en telefoonnummer

A. KENMERKEN VAN DE ZUIVERINGSINSTALLATIE (Main design features of the waste water treatment plant)

Hieronder staan enkele gegevens van uw afvalwaterzuiveringsinstallatie (awzi) naar de situatie van 31-12-2003. U wordt verzocht deze gegevens te controleren en zonodig te corrigeren naar de situatie op 31-12-2004. Sommige omschrijvingen kunnen afwijken van hetgeen eerder door u is ingevuld. Dergelijke afwijkingen zijn als gevolg van het rubriceren van de gegevens niet te vermijden. Voor sommige onderdelen wordt verwezen naar de toelichting.

This section is prefilled by CBS. The company is asked to check and update this data to the situation at 31 December 2004

1. Type zuiveringsinstallatie (Type of treatment)	OXIDATIETANK DISCONTINU + FYSISCH/CHEMISCH
2. Capaciteit in inwonerequivalenten (capacity, p.e. 136 TOD)	5000
3. Het effluent wordt geloosd op (destination of effluent)	WESTERSCHELDE (surface water name or sewer system with name of UWWTP)
4. Is de awzi ontworpen op: (is the WWTP designed for:)	
extra fosfaatverwijdering? (zie toelichting) (extra P-removal)	CHEMISCH, IN BELUCHTINGSCIRCUIT
extra stikstofverwijdering? (zie toelichting) (extra N-removal)	JA
5. Slibstabilisatie (zie toelichting) (Method of sludge stabilisation)	SIMULTAAN IN BELUCHTINGSCIRCUIT
6. Methode(n) van slibontwatering (Sludge dewatering method)	ZEEFBANDPERS, FILTERPERS

B. AFVALWATERZUIVERINGSSLIB IN 2004 (waste water sludge in 2004)

B1 TOTALE PRODUCTIE, AAN- EN AFVOER (Total production, supply from other sites of the company)

	Natgewicht ton slib (Wet weight, tonnes)	Droge stof ton (Dry solids (tonnes))
1. Slibproductie van de eigen vestiging (sludge production at this site)		
Hiervan is afgevoerd in 2004 (of which transported to final destination)		
2. Slib van andere vestigingen ter verwerking aangevoerd (Sludge supplied from other company sites to this site)		
Hiervan is afgevoerd in 2004 (of which transported to final destination)		
3. In 2004 afgevoerd slib uit voorraad van eerdere jaren (Sludge produced in former years, but transported to final destination this year)		

B2 SLIBHOEVEELHEDEN PER SLIBSOORT EN PER BESTEMMING (sludge quantities per sludge type and destination)

Bij dit onderdeel vult u het slib dat gekarakteriseerd wordt door één bestemming, dezelfde slibsoort en dezelfde ontwateringsmethode als één partij in. De coderingen voor bestemming, slibsoort en ontwateringsmethode vindt u op de toelichting.

	Partijnummer	1	2	3	4
1. Bestemming Destination (see code list)	code invullen				
2. Slibtype Type of sludge (see code list)	code invullen				
3. Gevaarlijk afval? Hazardous waste?	Ja/nee				
4. Ontwateringsmethode Applied dewatering method (see code list)	code invullen				
5. Zuiveringslib (natgewicht) Sludge quantity (wet weight)	Ton				
6. Zuiveringsslib (droge stof) Sludge quantity (dry solids)	Ton d.s.				
7. Droge stofgehalte Dry Solids content	% d.s.				
8. Asgehalte Ash content (inorganic fraction)	% van d.s.				

C. SAMENSTELLING VAN ZUIVERINGSSLIB BIJ AFVOER ALS MESTSTOF (sludge composition when destination = soil, use as fertiliser

Vul hier de gemiddelde gehaltes in indien slib als meststof (destination 1 of 5) wordt afgevoerd. Bij afvoer naar andere bestemmingen hoeft dit onderdeel niet te worden ingevuld

	Totaal stikstof (N)	Fosfor als P_2O_5		
g/kg d.s.				
	Koper (Cu)	Chroom (Cr)	Zink (Zn)	Lood (pb)
mg/kg d.s.				
	Cadmium (Cd)	Nikkel (Ni)	Kwik (Hg)	Arseen (As)
mg/kg d.s.				

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Afvalwaterzuiveringsslib van bedrijven en instellingen 2004

TOELICHTING BIJ DE ENQUÊTE (explanation, code lists)

A. KENMERKEN VAN DE ZUIVERINGSINSTALLATIE

IS DE AWZI ONTWORPEN OP:

- EXTRA FOSFAATVERWIJDERING?
  Beantwoordt deze vraag met "ja" indien voor de verwijdering van fosfaat extra voorzieningen aanwezig zijn, of indien de procesvoering daarop afgestemd is. Vul ook de methode in, bijvoorbeeld "chemisch" of "biologisch".

- EXTRA STIKSTOFVERWIJDERING?
  Beantwoordt deze vraag met "ja" indien de procesvoering op extra stikstofverwijdering is afgestemd, bijvoorbeeld door de aanwezigheid van een denitrificatiezone in het beluchtingscircuit of door aanwezigheid van een aparte denitrificatietank.

SLIBSTABILISATIE
Vul één van de volgende methoden in:

- simultaan in beluchtingscircuit (bij laagbelaste aerobe installaties)
- separate aerobe stabilisatie
- warme- of koude slibgisting
- thermische stabilisatie
- pH-regulering
- niet van toepassing (als het slib grotendeels uit anorganische stoffen bestaat)

B. AFVALWATERZUIVERINGSSLIB IN 2004

BESTEMMING (destination): vul de code in van de van toepassing zijnde bestemming.

Code	*Bestemming*	*Code*	*Bestemming*
1	landbouw (meststof) (Use as fertiliser)	7	verbranden (incineration)
2	natte oxidatie in VerTech installatie (wet oxidation)	8	verwerking op andere vestiging van het bedrijf **(vul de naam van de vestiging in) (treatment at other site)**
3	hergebruik in *eigen* productieproces (re-use at own site)	9	overige bestemming **(geef een omschrijving) (other)**
4	(verwerking tot) diervoeder (animal feed)	10	overige nuttig gebruik **(other** re-use, not at own site)
5	composteren/zwarte grond (meststof) (composting)	11	niet afgevoerd in 2004 (not disposed in 2004)
6	storten, inclusief C2-deponie (landfill)		

SLIBSOORT (type of sludge): vul de code in van de van toepassing zijnde slibsoort

Code	*Slibsoort*	*Code*	*Slibsoort*
a	primair slib uit (voor)bezinktank (primary sludge)	c	slib uit een fysisch/chemische zuivering (chemical treatment)
b	surplusslib uit aerobe biologische zuivering (aerobic treatment)	d	surplusslib uit anaerobe biologische zuivering (anaerobic)

GEVAARLIJK AFVAL?
Beantwoordt deze vraag met "ja" indien het slib wordt getypeerd als gevaarlijk afval volgens de Regeling Europese Afvalstoffenlijst (Eural).

METHODE VAN SLIBONTWATERING (dewatering method): vul de code in van de toegepaste ontwateringsmethode.

Code	*Ontwateringsmethode*	*Code*	*Ontwateringsmethode*
1	niet ontwaterd en niet ingedikt	9	schroefpers
2	ingedikt	10	vacuümfilter
3	droogbed	11	zeefbandpers
4	lagune	12	filterpers
5	decanteerbak/ontwateringscontainer	13	centrifuge
6	drainagezak	14	thermische ontwatering met slibdroger
8	andere natuurlijke ontwatering **(geef een omschrijving van de methode)**	15	andere kunstmatige methode **(geef een omschrijving van de methode)**

2.3 ANNEX 3 — STATISTICAL SURVEY ON THE POPULATION CONNECTED TO WASTEWATER COLLECTION SYSTEMS AND TREATMENT PLANTS (ROMANIA)

Confidential
Only for statistical purposes

Unit name:
....
…………………………………………………………………………………

Fiscal code: ………………………….………………………

County: …………………………….. Code: ………..

Locality: …………………………………………………………….. Code ………..

Street: No: …….

NACE Rev. 2: 8411

ROMANIA

NATIONAL INSTITUTE OF STATISTICS

Statistical survey

Text approved by the National Institute for Statistics under the 226/2009 Law on the organisation of official statistics stipulating the following:
- The services of official statistics are authorised to request and obtain free of charge all the statistical data and information from all the physical or legal persons living, holding capital of any kind or developing any kind of activity on Romania territory;
- The following facts represent minor offences sanctioned by fine 10 to 50 million ROL worth: refusal or willful delaying in transmitting the requested statistical data, refusal to supply to the people authorised by the official statistical services the documents and records needed for checking purposes, transmission of erroneous or incomplete data, failure to apply the measures decided by the official statistical services.

This form has to be transmitted to County Statistical Direction ....
until the date ....

Name of person
responsible for the information ....
written down in this form: (signature of unit manager)
L.S.

Mr. (Ms.) ....
Phone number .... No. .... date ....

Population connected to wastewater collecting systems and treatment plants, in year ....

Crt. No.	Population connected	persons
A	B	1
1	Locality population	
2	Population connected to: **Urban Wastewater Treatment Plant Total (Rd3 + Rd4 + Rd5)**	
3	- primary treatment	
4	- secondary treatment	
5	- tertiary treatment	
6	**to Industrial Wastewater Treatment Plant**	
7	**to urban wastewater collecting system Total (Rd 8 + Rd 9)**	
8	- with treatment (Rd 2 + Rd 6)	
9	- without treatment	
10	to independent wastewater collecting systems	
11	to independent wastewater collecting systems with independent treatment	
12	- of which with secondary treatment	

2.4 ANNEX 4 — STATISTICAL SURVEY ON WATER DISTRIBUTION (ROMANIA)

ROMANIA

NATIONAL INSTITUTE OF STATISTICS

Statistical Survey

Water Distribution

Confidential
Only for statistical purposes

Text approved by the National Institute for Statistics under the 226/2009 Law on the organisation of official statistics stipulating the following: - The services of official statistics are authorised to request and obtain free of charge all the statistical data and information from all the physical or legal persons living, holding capital of any kind or developing any kind of activity on Romania territory; - The following facts represent minor offences sanctioned by fine 10 to 50 million ROL worth: refusal or willful delaying in transmitting the requested statistical data, refusal to supply to the people authorised by the official statistical services the documents and records needed for checking purposes, transmission of erroneous or incomplete data, failure to apply the measures decided by the official statistical services. This form has to be transmitted to County Statistical Direction .... **until the date ....** Name of person responsible for the information .... written down in this form: (signature of unit manager) Mr. (Ms.) .... Phone number .... No. .... date	This form has to be transmitted to County Statistical Direction .... **until the date ....** Name of person responsible for the information .... written down in this form: (signature of unit manager) Mr. (Ms.) .... Phone number ....No. .... date ....

A. IDENTIFICATION INFORMATION

Registration in the Bussines register	Correction
Unit name: .... ………………………………………………………………………………………………..	Unit name: .... ………………………………………………………………………………………………..
Fiscal code: ……………………………….…………………… Subunit code:	Fiscal code: ……………………………….…………………… Subunit code: ....
County: ………………………….. Code: ………..	County: ………………………….. Code: ………..
Locality: ………………………………………………………….. Code ………..	Locality: ………………………………………………………….. Code ………..
Street: No: …….	Street: No: …….
NACE Rev.2: ………..	NACE Rev.2: ………..

Crt. No.	**Locality where water is distributed**		**Population**	**Volumme of distributed water**								**Losses**
				TOTAL (col.3+4+6 +7+8+9)	**Population**	**Industry and construction**		**Agriculture** NACE Rev.2: 01-03	**Water abstraction and distribution** NACE Rev.2: 36	**Production of electricity** NACE Rev.2: 35	**Other consumers** NACE Rev.2: 37,38,45-99	
						TOTAL NACE Rev.2: 05-33 & 41-43	***Of which:*** **Manufacturing industry** NACE Rev.2: 10-33					
	Name	**Code SIRUTA**	**- number -**	**- th. m^3-**								
A	**B**	**C**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1.	**TOTAL** (rd.1+2+...+16)											
2.												
3.												
4.												
5.												
6.												
7.												
8.												
9.												
10.												
11.												
12.												
13.												
14.												
15.												
16.												

Chapter 2 Water supply

- th. m^3 -

Crt. No.	Water supply source	Water volumme
A	B	1
1.	**TOTAL (rd.2+5+7)**	
2.	**Self Supply Total** (rd.3+4)	
3.	- surface water	
4.	- ground water	
5.	**Public Water Supply**	
6.	**Other units with self supply**	

2.5 ANNEX 5 — STATISTICAL SURVEY ON WASTEWATER COLLECTION, TREATMENT AND DISCHARGE (ROMANIA)

Confidential
Only for statistical purposes

Unit name: ....
……………………………………………………………………………………………………..

Fiscal code: ……………………………………………………… Subunit code: ....

County: ……………………………... Code: ………..

River basin: ……………………………………………………… Code: ………..

Water Basin Administration ……………………………………… Code: ………..

Locality: …………………………………………………………….. Code ………..

Street: No: …….

NACE Rev.2: ………..

ROMANIA

NATIONAL INSTITUTE OF STATISTICS

NATIONAL ADMINISTRATION "ROMANIAN WATERS"

Statistical survey

Text approved by the National Institute for Statistics under the 226/2009 Law on the organisation of official statistics stipulating the following:
- The services of official statistics are authorised to request and obtain free of charge all the statistical data and information from all the physical or legal persons living, holding capital of any kind or developing any kind of activity on Romania territory;
- The following facts represent minor offences sanctioned by fine 10 to 50 million ROL worth: refusal or willful delaying in transmitting the requested statistical data, refusal to supply to the people authorised by the official statistical services the documents and records needed for checking purposes, transmission of erroneous or incomplete data, failure to apply the measures decided by the official statistical services.

This form has to be transmitted to Water Basin Administration …….........................
until the date ....

Name of person responsible for the information written down in this form:

....
(signature of unit manager)
L.S.

Mr. (Ms.) ....
Phone number ....

No. .... date ....

WASTEWATER COLLECTING, TREATMENT AND DISCHARGE,
in the year …

Chapter 1 Capacity of wastewater treatment plant

Crt. No.	Treatment plant type			Urban BOD$_5$ kg/d	Urban Flow rate m^3/d	Industrial BOD$_5$ kg/d	Industrial Flow rate m^3/d	Independent BOD$_5$ kg/d	Independent Flow rate m^3/d
A	B			1	2	3	4	5	6
1	**Primary treatment**		**Design capacity**						
2			**Influent**						
3			**Effluent**						
4	**Secondary treatment**		**Design capacity**						
5			**Influent**						
6			**Effluent**						
7	**Tertiary treatment**	Nitrogen removal	**Design capacity**						
8			**Influent**						
9			**Effluent**						
10		Phosphorus removal	**Design capacity**						
11			**Influent**						
12			**Effluent**						

Chapter 2 Wastewater generation

Crt. No.	Type of activity generating wastewater	Flow rate	Pollutants															
			Tones/day					Tones/year										
		Th. m^3/y	BOD_5	CCOCr	MTS	N_T	P_T	Cl	Phenols	Cyanides	As	Cd	Hg	Cu	Cr	Ni	Pb	Zn
A	B	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	**Wastewater generated by economic activities NACE Rev.2 01-43 TOTAL (rd 2 +..12)**																	
2	Agricultuere, forestry, fishing NACE Rev.2 01-03																	
3	Mining and quarrying industry NACE Rev.2 05-09																	
4	Food processing industry NACE Rev.2 10-11																	
5	Metallurgical industry NACE Rev.2 24																	
6	Textiles industry NACE Rev.2 13-16																	
7	Transport NACE Rev.2 29-30																	
8	Cellulose and paper NACE Rev.2 17																	
9	Chemichal and petrochemical industry NACE Rev.2 19-22																	
10	Production and distribution of energy NACE Rev.2 35																	
11	Construction NACE Rev.2 41-43																	
12	Other industrial activities NACE Rev.2 12, 18, 23, 25-28, 31-33																	
13	**Domestic wastewater TOTAL (rd 14+15)**																	
14	Households																	
15	Services NACE Rev2 45-99																	

Cap. 3 Wastewater treatment and discharge

Crt. No.	**Discharge**	Flow rate Th. m^3/y	**Pollutants**															
			Tones/day					**Tones/year**										
			BOD_5	CCOCr	MTS	N_T	P_T	Cl	Phenols	Cyanides	As	Cd	Hg	Cu	Cr	Ni	Pb	Zn
A	B	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	**Urban wastewater generated (rd.2+6),** *of which:*																	
2	- **Influent UWWTP/Independent WWTP**																	
3	- **Total discharge (rd.4+5+6)**, *of which:*																	
4	▪ effluent UWWTP																	
5	▪ effluent Independent WWTP																	
6	▪ discharge without treatment																	
7	**Industrial wastewater generated (rd.8+11),** *of which:*																	
8	- **Influent Industrial WWTP**																	
9	- **Total discharge (rd. 10+11),** *of which:*																	
10	▪ effluent Industrial WWTP																	
11	▪ discharge without treatment																	
12	**Total discharges in natural receivers (rd. 3+9),** *of which:*																	
13	**Discharges in Black Sea**																	

Chapter 4 Sludge processing

Crt. No.	Sludge processing	Treatment plant generating sludge		
		Urban WWTP Tones/year	Industrial WWTP Tones/year	Independent WWTP Tones/year
A	B	1	2	3
1	Total resulted sludge			
2	**Total sludge disposal (rd. 3+4+5+6+7+8),** ***of which:***			
3	- agricultural use			
4	- compost			
5	- landfill			
6	- dumping at sea			
7	- incineration			
8	- others			

2.6 ANNEX 6 — SURVEY ON WATER RESOURCES FOR DOMESTIC USE (ITALY)

Urban Water Census

The survey

Since 1951 the Italian national institute of statistics (ISTAT) has periodically collected information on water resources for domestic use through a specific census, with the aim of describing the state of urban water services in Italy. The respondent units are all water management companies operating in Italy in the urban water services, which were 2 857 in 2015.

The survey contents have been progressively brought up-to-date by considering both the European Directives on water resources and the increasing enquiry of information from public institutions and private stakeholders.

The last census took place in 2016, with reference to year 2015.

Next census is scheduled in 2019, with reference to 2018.

The survey frequency will become biennial, instead of the current cycle of every three years, in order to improve the response to national and international requests (Eurostat/OECD/SDGs indicators/EEA). The use of short and long reporting forms is being discussed. In addition, administrative data is currently being assessed and their use is part of an interinstitutional discussion.

The questionnaire

In the 2015 edition, a web questionnaire with a customised compilation have been developed through the use of in-house software. Questionnaires have been tailored to the respondent with data storage in the ISTAT database (referred to 2012 which is the year of the previous census). The identification activities in 2015 helped revise the list of the management companies and the operating water services.

This type of data-capture (web questionnaire with customised compilation) has limited the statistical burden on the respondents and provided a higher quality of data gathered.

The questionnaire is structured in five sections: (i) water abstraction for each sampling point, (ii) water transmission and water exchanges among management companies, (iii) public water supply network, (iv) public sewerage and (v) urban wastewater treatment plants.

The main variables

The main variables of the questionnaire are listed below.

<u>Water abstraction</u>

- ✓ Water abstracted for drinking water use (volumes in m^3)
- ✓ Source (spring, well, surface watercourse, natural lake, artificial basin, marine and brackish water)
- ✓ Geographical coordinates of water sampling points
- ✓ Water abstracted and treated for drinking water use (volumes in m^3)

<u>Water transmission and water exchanges</u>

- ✓ Water delivered to municipalities (volumes in m^3)
- ✓ Water delivered for different uses (agriculture, industry, water tanks, supply ship; volumes in m^3)
- ✓ Water trading between water management companies (volumes in m^3)

<u>Public water supply network</u>

- ✓ Water input to a municipal distribution system (volumes in m^3)
- ✓ Water supplied for authorised uses (volumes in m^3)

- ✓ Unauthorised water uses (volumes in m^3)
- ✓ Water meter inaccuracies (volumes in m^3)
- ✓ Water invoiced for civil, industrial, agricultural (irrigation and animal husbandry) use (volumes in m^3)
- ✓ Number of users (civil, industrial, agricultural), in total and with water meters
- ✓ Percentage of resident population connected to public water supply
- ✓ Infrastructural features (total pipe length and length calculated with GIS support)

Public sewerage

- ✓ Type of sewerage (separate, mixed, mixed and separate)
- ✓ Final destination of the sewerage
- ✓ Municipalities in which UWWTPs are located
- ✓ Percentage of resident population connected to public sewerage
- ✓ Infrastructural features (total length and length calculated with GIS support)

Urban wastewater treatment plants

- ✓ UWWTPs in operation and non in operation
- ✓ Municipalities connected to the UWWTP
- ✓ Total population equivalent (design and actual)
- ✓ Actual urban population equivalent (domestic, industrial)
- ✓ Geographical coordinates of UWWTP
- ✓ Geographical coordinates of the discharge point
- ✓ Final destination of the discharge
- ✓ Type of wastewater treatment (Imhoff, primary, secondary, advanced)
- ✓ Re-use of urban wastewater
- ✓ Incoming and outgoing wastewater parameters
- ✓ Total sludge production and disposal and percentage of dry substance
- ✓ Type of sludge treatment

In the 2015 edition, as in the previous census, management companies were asked to distinguish volumes in ‘measured’ (with appropriate cubic meters) and ’estimated’ The aim of identifying measured and estimated amount was to improve the understanding of the precision of the figures and to assist in the interpretation of indicators.

Additionally, as usual, ISTAT organised a technical support to water management companies, through a dedicated e-mail and contact centre, in order to reduce the number of non-responses (partial or total) and to detect and discuss specific local issues.

Data report

Statistical reports for the media containing data coming from Urban water census 2015 disseminated by Istat on its official website are listed below:

- World water day 2018 published on March 22th 2018 (also in English), with a focus on wastewater treatment service and on the metering of quantitative variables (from abstraction to supply, also in relation to the type of management);
- Urban water census 2015 - main results published on December 14th 2017 (also in English), with the main results of census, from water withdrawal to wastewater treatment plants;
- World water day 2017 published on March 22th 2017, with a focus on the public water supply characteristics of the provincial capitals (water volumes and losses).

Water losses

On the basis of census data and in accordance with the literature, ISTAT calculates losses by leaky pipes in the water supply system as follows:

- total water losses: difference between the volumes input in the public water supply and the water delivered for authorised uses;
- apparent water losses: sum of unauthorised water uses and metering errors;
- real water losses: difference between total and apparent water losses.

The most common indicator for water losses, calculated and disseminated by ISTAT, is the percentage between water losses (total, apparent or real) and the volumes input in the public water supply. Another indicator (disseminated, for 2015, only for provincial capitals) is the ratio between water losses (total, apparent or real) and kilometres of water distribution pipe system network (linear water losses).