Manual on the Basic Set of Environment Statistics of the FDES 2013

Water Resources Statistics

(Sub-component 2.6 Water Resources
of the Basic Set of Environment Statistics of the FDES 2013)

Elaborated by the Environment Statistics Section
of the United Nations Statistics Division,
in collaboration with the
Expert Group in Environment Statistics.

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Methodology sheet of the Basic Set of Environment Statistics of the FDES:
http://unstats.un.org/unsd/environment/FDES/Manual_BSES.htm
http://unstats.un.org/unsd/environment/fdes.htm

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2. Introduction/ Relevance

Management of water resources in terms of quantities, distribution and quality is one of the world's most important priorities today. Appropriate management becomes necessary to tackle key issues of water scarcity and water quality. Water management addresses the competing demands among water users arising from uneven spatial and temporal distribution of water; competing demands between water users and ecological uses; degradation of water quality due to pollution generated during use; and the impacts of climate change on water.[1]

Water users span all sectors and economic activities; of these, agricultural uses for irrigation, livestock and food production place one of the greatest pressures on freshwater resources. Water is used to produce and make use of energy such as in extraction of minerals, cooling within power plants or direct use in hydroelectricity. People require access to safe drinking water and sanitation, and increased urbanization and subsequent population increase in cities requires improvements to supplies of water and sanitation services.

Continued increases in demand result in increasing pressures on water and can lead to issues such as over-abstraction of groundwater resources, depriving other users of water and challenging ecosystem functions. Over abstraction can results in falling water tables, water quality degradation and land subsidence.

After its abstraction, water is used by different production and consumption activities. During its use water may become polluted and, if returned to the environment without treatment, water quality can be affected.

Ecosystems, including forests, wetlands and grasslands depend on water to function and water stress reduces, or even eliminates, the benefits of ecosystems. In turn, ecosystems are required for water availability and help control its quality, and water is required by ecosystem services, such as food production, climate regulation, soil fertility and functions, carbon storage and nutrient recycling and all aquatic ecosystems. Ecosystems face competition from other water users, but can also provide solutions to water problems.

Climate change has potential impacts on water resource availability through more severe and frequent droughts and floods, changes in rainfall distribution, soil moisture, glacier and ice/snow melt, and river and groundwater flows. Extreme weather events are likely to increase, including floods, droughts and storms. Climate change affects the quantity and quality of water resources available. Changes to precipitation and temperatures can result in changes

[1] UN Water (2012) *Managing Water under Uncertainty and Risk: The United Nations World Water Development Report 4, Vol 1*, UNESCO, Paris, http://www.unesco.org/fileadmin/MULTIMEDIA/HQ/SC/pdf/WWDR4%20Volume%201-Managing%20Water%20under%20Uncertainty%20and%20Risk.pdf

to the levels of groundwater recharge, seasonal flows, and minimum flows in rivers and affect water availability. Rising sea levels would affect coastal aquifers. In addition, water composition and quality can be affected by the impact of rising temperatures on plant forms such as algal bloom.[2] Water resource management will need to develop adaptation measures to plan for these impacts.

Policy makers need statistics on water resources, their abstraction, use and returns for many reasons, including to estimate the amount of available water resources; monitor abstraction from key water bodies to prevent overutilization and monitor renewal of stocks; ensure equitable usage of abstracted water in matching supply and demand; and track the volume of water returned to the environment. Water statistics should give an overall view of water resources and their use, including management and use by society. Therefore, the statistics should represent the total cycle of water in the environment in terms of inflows, outflows, stocks, abstraction, use and returns.[3]

As water is essential to all aspects of the environment, the society and the economy, the environment statistics necessary to inform on issues related to water are found throughout the FDES, not only in Sub-Component 2.6. Component 1 on Environmental Conditions and Quality includes statistics on the physical aspects of water relating to hydrography, ecosystems, biodiversity and water quality issues. Component 3 includes statistics on water pollution and management of wastewater. Component 4 includes statistics on extreme events and disasters, including water-related disasters such as floods. Component 5 includes water statistics related to human settlements including access to water and sanitation, and health. Component 6 includes statistics on the expenditures and governance of water management.[4]

[2] UN Water (unknown) *Climate Change Adaptation: the Pivotal Role of Water,* Policy Brief, http://www.unwater.org/downloads/unw_ccpol_web.pdf

[3] United Nations Statistics Division (2014) *DRAFT Guidelines for the Compilation of Water Accounts and Statistics,* http://unstats.un.org/unsd/envaccounting/WCG14.pdf

[4] United Nations Statistics Division (2013) *Framework for the Development of Environment Statistics,* http://unstats.un.org/unsd/ENVIRONMENT/FDES/FDES-2015-supporting-tools/FDES.pdf (accessed 11 February 2017)

3. Definitions and description of the statistics

The International Recommendations for Water Statistics (IRWS)[5] were developed by the United Nations Statistics Division (UNSD) as a reference document for water statistics and water accounting and is therefore used as the main reference document for the following terms and definitions. In some case a few definitions are taken from the OECD/Eurostat Joint Questionnaire[6] or the United Nations Statistics Division/United Nations Environment Programme Questionnaire.[7] However, when there are differences between the definitions from the IRWS and these questionnaires, an explanation is provided.

In the FDES when the term territory is used it means the territory or area of reference, which can be a country, other administrative area below national level, or a natural area such as a watershed or river basin, depending on the context.

The FDES covers all **inland water resources**, regardless of quality, (e.g., all freshwater, brackish water, saltwater and polluted water) but excludes marine water resources.[8] Inland water is the part of the hydrosphere that is located on or under the land surface.[9]

Water resources consist of water that flows over or is stocked in inland water bodies, including surface water, groundwater and soil water.[10] Water resources are either renewable or non-renewable. Renewable water resources are replenished by precipitation and are represented by the annual flow of surface water and groundwater. Non-renewable water resources are contained in groundwater bodies (usually deep aquifers) that

[5] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[6] OECD and Eurostat (2014) *OECD/Eurostat Joint Questionnaire on the State of the Environment 2014*

[7] United Nations Statistics Division/United Nations Environment Programme (2016) *United Nations Statistics Division/United Nations Environment Programme Questionnaire 2016 on Environment Statistics,* http://unstats.un.org/unsd/ENVIRONMENT/questionnaire2016.html (accessed 11 January 2017)

[8] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[9] World Meteorological Organization and UNESCO (2012) International Glossary of Hydrology. WMO-No. 385, http://www.wmo.int/pages/prog/hwrp/publications/international_glossary/385_IGH_2012.pdf

[10] United Nations Statistics Division (2013) *Framework for the Development of Environment Statistics,* http://unstats.un.org/unsd/ENVIRONMENT/FDES/FDES-2015-supporting-tools/FDES.pdf (accessed 11 February 2017)

have a negligible rate of recharge relative to the size of the aquifer (i.e., the storage or stock), and cannot be replenished.[11]

The classification of inland water bodies used in statistics is below:[12]

1. Surface water bodies:
   - Artificial reservoirs
   - Lakes
   - Rivers and streams
   - Wetlands
   - Glaciers
   - Snow and ice
2. Aquifers
3. Soil water

Remark:

- It should be noted that slightly different groupings are found in other publications, such as the System of Environmental-Economic Accounting (SEEA). In the SEEA wetlands are not included as a separate category but included under other surface water bodies.

Surface water comprises all water that flows over or rests on the ground's surface.[13] Surface water is contained in:[14]

- Artificial reservoirs which are man-made reservoirs used for storage, regulation and control of water resources;
- Lakes which are depressions in the Earth's surface containing bodies of standing water, for example, lakes, ponds and lagoons;
- Rivers and streams which are channels where water flows continuously or periodically;
- Wetlands which are areas of marsh, fen, peatland, swamp or shallow water that are permanently, intermittently or seasonally saturated with water.[15]
- Snow and ice which include permanent and seasonal layers of snow and ice on the ground surface; and
- Glaciers which are defined as accumulations of snow of atmospheric origin, generally moving slowly on land over a long period.

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[11] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[12] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[13] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[14] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[15] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

Overland flows, which are the flows of water over the ground before entering a channel, are also part of surface water but the stock of these flows at any one time is small and hence not separately recorded.

Remarks:

- Artificial watercourses such as irrigation, industrial and navigation canals, and drainage systems would fall under the definition of rivers and streams although these are not natural features.
- In some cases it is difficult to differentiate between certain types of surface water bodies and wetlands. The Ramsar Convention includes marine areas under wetlands; the FDES includes only inland wetlands in water resources.[16]

Groundwater is water that collects in porous layers of underground formations known as aquifers. An aquifer is a geologic formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield significant quantities of water to wells and springs. It may be unconfined, bounded below by an aquitard and with no overlying confining layer, or may be confined being bounded above and below by an aquitard.[17]

Remark:

- Groundwater can be non-renewable when contained in aquifers (usually deep aquifers) that have a negligible rate of recharge relative to the size of the aquifer; this non-renewable groundwater is expressed as the storage or stock. Groundwater can also be renewable when it can be replenished from precipitation.[18]

Soil water consists of water suspended in the uppermost belt of soil, or in the zone of aeration near the ground surface. Soil water can be discharged into the atmosphere by evapotranspiration (the process whereby a quantity of water is transferred from the soil to the atmosphere by evaporation and plant transpiration), absorbed by plants, flow to groundwater, or flow to rivers (run-off). Some part of transpiration and absorption of water by plants is used in production (e.g., the growing of crops).[19]

[16] http://www.ramsar.org/

[17] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[18] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[19] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

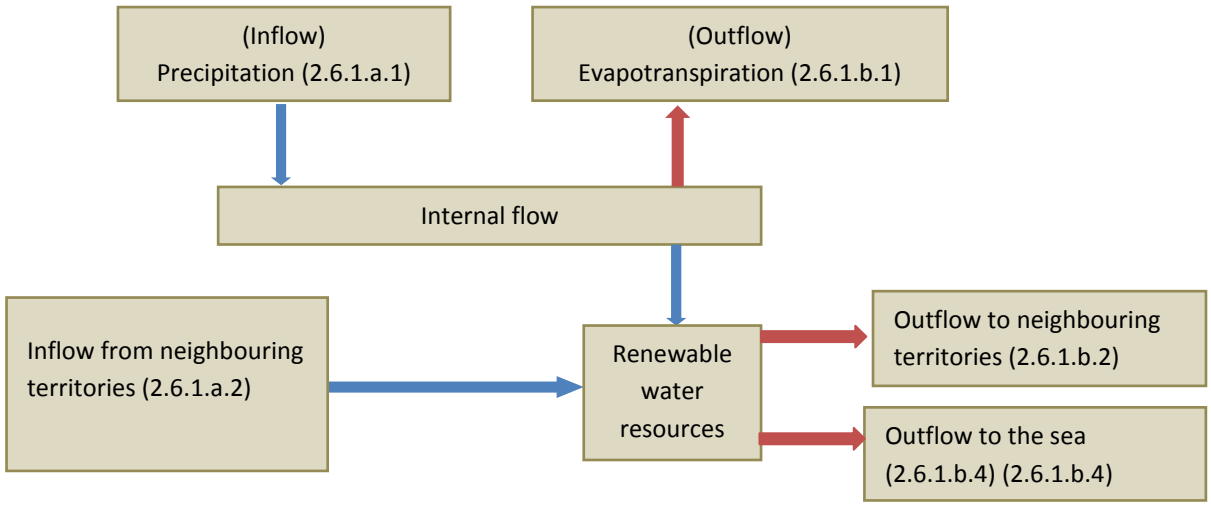
Remark:

- The concept of soil water has been introduced in water statistics and water accounting because of its importance for rain-fed agriculture and it is an important component of natural water resources. However, stocks and flows related to soil water are difficult to determine. Existing national and international water statistics often do not include stocks and flows of soil water, and they are not included in the Basic Set of Environment Statistics of the FDES.

3A. Water Resources (Topic 2.6.1)

This topic includes statistics that are necessary to estimate the amount of renewable water resources to describe how they are generated. It also includes statistics that describe the stock of water in the various water bodies. Figure 2.1 illustrates the flows of water, highlighting the statistics from the FDES which apply.

Figure 2.1: Renewable Water Resources[20]



Statistics on water resources include the flows of renewable water generated within the country or territory as the result of precipitation, the volume of water lost to evapotranspiration, the inflow of water from neighbouring

[20] Adapted from United Nations Statistics Division/United Nations Environment Programme (2016) *United Nations Statistics Division/United Nations Environment Programme Questionnaire 2016 on Environment Statistics*, http://unstats.un.org/unsd/ENVIRONMENT/questionnaire2016.html (accessed 11 January 2017)

territories, and the outflow of water to neighbouring territories or the sea.[21] They also include the stocks of non-renewable water.

The statistics can be aggregated to show:

- Internal flow = *(Precipitation: 2.6.1.a.1) – (Evapotranspiration: 2.6.1.b.1)*
- Renewable water resources = (*Precipitation: 2.6.1.a.1) – (Evapotranspiration: 2.6.1.b.1) + (Inflow from neighbouring territories: 2.6.1.a.2).*

Internal flow is not a statistic of the FDES but is described as part of the relationships illustrated in figure 2.1. Internal flow is the total volume of river run-off and groundwater generated over the period of a year, in natural conditions, exclusively by precipitation into a country. The internal flow is equal to precipitation less actual evapotranspiration and can be calculated or measured. If the river run-off and groundwater generation are measured separately, transfer between surface and groundwater should be netted out to avoid double counting.[22] Internal flow plus inflow from neighbouring territories results in the renewable water resources.

The terms water stocks and water resources do not have the same meaning. **Inland water stocks** refers to the water located within the territory at a point in time. However, water is a flow that enters and leaves a territory many times within a year. It can be stocked into lakes, aquifers, artificial reservoirs or rivers. However, the water stocked in rivers at a point in time represents only a small part of the amount of water going through rivers over a year. Thus stocks of water do not represent the amount of water that can be used in a territory over a year.

3A1. Inflows

Inflow of water to inland water resources (FDES 2.6.1.a)

Inflow of water to a territory's inland water resources is an aggregate of statistics on precipitation and inflows from neighbouring territories as stated in the Basic Set of Environment Statistics of the FDES.[23]

Precipitation (FDES 2.6.1.a.1)

The volume of water that flows from the atmosphere to inland water resources via rain, snow, sleet, hail, dew, mist, etc., per year.[24] The total volume of atmospheric wet precipitation falling on the territory of the country over one year is usually displayed in millions of cubic metres.

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[21] United Nations Statistics Division (2013) *Framework for the Development of Environment Statistics*, http://unstats.un.org/unsd/ENVIRONMENT/FDES/FDES-2015-supporting-tools/FDES.pdf (accessed 11 February 2017)

[22] United Nations Statistics Division/United Nations Environment Programme (2016) *United Nations Statistics Division/United Nations Environment Programme Questionnaire 2016 on Environment Statistics,* http://unstats.un.org/unsd/ENVIRONMENT/questionnaire2016.html (accessed 11 January 2017)

[23] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[24] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91,

Inflow from neighbouring territories (FDES 2.6.1.a.2)

The volume of surface water and groundwater that moves into a territory from other territories, during a year. This includes all water crossing into a territory and a portion of the water moving into artificial reservoirs, lakes, rivers or aquifers that lie along the territory's border.

Remark:

- If a river borders two countries without eventually entering either of them, each country could claim a percentage of the flow to be attributed to their territory. If no formal agreement exists between territories, a practical solution is to attribute half (50 per cent) of the flow to each country.[25]

Inflow subject to treaties (FDES 2.6.1.a.3)

The volume of surface water and groundwater that moves into a territory of reference from other territories, or along its border, that is protected (guaranteed) by formal agreements with upstream territories, per year.[26]

Remark:

- Inflow subject to treaties is not a separate inflow but is a subset of Inflow from neighbouring *territories* (FDES 2.6.1.a.2).

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http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[25] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[26] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

3A2. Outflows

Outflow of water from inland water resources (FDES 2.6.1.b)

Outflow of water from a territory's inland water resources consists of evapotranspiration of water from inland water resources and the outflow of water to neighbouring territories and the sea.[27] In the FDES item 2.6.1.b is an aggregate of statistics on evapotranspiration, outflow to neighbouring territories, and outflow to the sea.

Remarks:

- Outflow of water from a territory's inland water resources excludes exported water and sewage as these are flows between resident economic units and the rest of the world, after having been abstracted from the environment.[28]
- Some of the renewable water resources are used in the territory (see Abstraction, use and returns of water: FDES 2.6.2). Thus the sum of the internal flow and the inflow from neighbouring territories is bigger than the total outflow to neighbouring territories and to the sea.

Evapotranspiration (FDES 2.6.1.b.1)

The volume of water that enters the atmosphere by vaporization of water into a gas through evaporation from land and water surfaces and transpiration from plants, per year.[29]

Water statistics use *actual evapotranspiration*, which represents the amount of water that evaporates from land and water surfaces, as well as that which is transpired by vegetation/plants when the ground is at its natural moisture content as determined by precipitation.[30]

Remarks:

- It is important to provide statistics on ACTUAL evapotranspiration, which reflects the "real" situation. Potential evapotranspiration (which is the potential maximum evapotranspiration) must not be used here.
- In the definition of actual evapotranspiration in hydrology the evapotranspiration generated by all human interventions is excluded, except unirrigated agriculture and forestry. 'Actual evapotranspiration' is

[27] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf
[28] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf
[29] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf
[30] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

calculated using different types of mathematical models, ranging from very simple algorithms to schemes that represent the hydrological cycle in detail.[31]

Outflow to neighbouring territories (2.6.1.b.2)

The volume of surface water and groundwater that flows from within a territory to another territory or territories, per year. This includes water flowing out of artificial reservoirs, lakes, rivers or aquifers that lie along the territory's border.[32]

Remark:

- If a river borders two countries without eventually entering either of them, each country could claim a percentage of the flow to be attributed to their territory. If no formal agreement exists between territories, a practical solution is to attribute half (50 per cent) of the flow to each country.[33]

Outflow subject to treaties (2.6.1.b.3)

The volume of surface water and groundwater that moves out of a territory of reference and is made available to downstream territories by formal agreement, per year.[34]

Remark:

- Outflow subject to treaties is part of **2.6.1.b.2 Outflow to neighbouring territories**.

Outflow to the sea (2.6.1.b.4)

The volume of surface water and groundwater that moves from a territory's inland water resources into sea(s) and ocean(s), per year.[35]

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[31] United Nations Statistics Division/United Nations Environment Programme (2016) *United Nations Statistics Division/United Nations Environment Programme Questionnaire 2016 on Environment Statistics,* http://unstats.un.org/unsd/ENVIRONMENT/questionnaire2016.html (accessed 11 January 2017)

[32] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[33] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[34] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[35] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

3A3. Stocks

Inland water stocks (FDES 2.6.1.c)

The volume of water contained in surface water, groundwater and soil water within the territory of reference at a particular point in time. This includes freshwater, brackish water and saline water and water of all types of quality.[36] In the FDES item 2.6.1.c is an aggregate of statistics on surface water stocks in artificial reservoirs, lakes, rivers and streams, wetlands, snow, ice and glaciers and groundwater stocks.

Surface water stocks in artificial reservoirs (FDES 2.6.1.c.1)

The volume of water contained in man-made surface water bodies used for storage, regulation and control of water within the territory of reference at a particular point in time.[37]

Surface water stocks in lakes (FDES 2.6.1.c.2)

The volume of water contained in generally large bodies of standing water occupying a depression in the Earth's surface within the territory of reference at a particular point in time.[38]

Surface water stocks in rivers and streams (FDES 2.6.1.c.3)

The volume of water contained in bodies of water flowing continuously or periodically in channels within the territory of reference at a particular point in time. This includes water flowing through artificial watercourses, such as canals for irrigation, drainage or navigation.[39]

Remark:

- Water in rivers and streams is not really significant as a stock, but it is as a flow and is therefore an important resource. The amount of water contained in rivers and streams at one point in time is not important compared to the amount of water going through rivers and stocks over a year. This is due to the fact that water is a flow.

Surface water stocks in wetlands (FDES 2.6.1.c.4)

The volume of water found in transitional areas where soils are frequently saturated or flooded, including swamps, marshes, playas and bogs, within the territory of reference at a particular point in time.[40]

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[36] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[37] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[38] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[39] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[40] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91,

Surface water stocks in snow, ice and glaciers (FDES 2.6.1.c.5)

The volume of water found in a naturally frozen state (ice and ice crystals), measured in water equivalent, within the territory of reference at a particular point in time. This includes seasonal layers of snow and ice on the ground surface and accumulations of ice (i.e., glaciers) that move slowly over land.[41]

Groundwater stocks (FDES 2.6.1.c.6)

The volume of water in porous and permeable underground layers, known as aquifers, that can yield significant quantities of water to wells and springs within the territory of reference at a particular point in time.[42]

3B. Abstraction, use and returns of water (Topic 2.6.2)

Abstraction, use and returns of water refer to the flows of water between the environment and the human sub-system and within the human sub-system. **Water abstraction** from inland water resources is the volume of water that is removed by economic units (establishments and households) from surface water, groundwater and soil water. Water can be abstracted for own use or for distribution to other users.[43] It can be removed either permanently or temporarily.[44]

Remark:

- Abstraction from the sea or ocean is referred to as abstraction from other sources because these are not inland water resources. Abstraction from soil water resources is not included in the Basic Set of Environment Statistics as stocks and flows related to soil water are difficult to determine.

Figure 3.2 shows the relationship between water abstraction, use and returns of water. Total water abstraction from inland waters (2.6.2.a) is abstracted from surface water (2.6.2.b) and groundwater (2.6.2.c.1 and 2.6.2.c.2). Rain water collection (2.6.2.i) and abstraction from soil water are other potential components of total water abstraction, with abstraction from soil water included in the SEEA but not the Basic Set of Environment Statistics. Water abstraction from the sea (2.6.2.j) is listed separately as it is not part of surface water or groundwater resources.

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http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[41] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

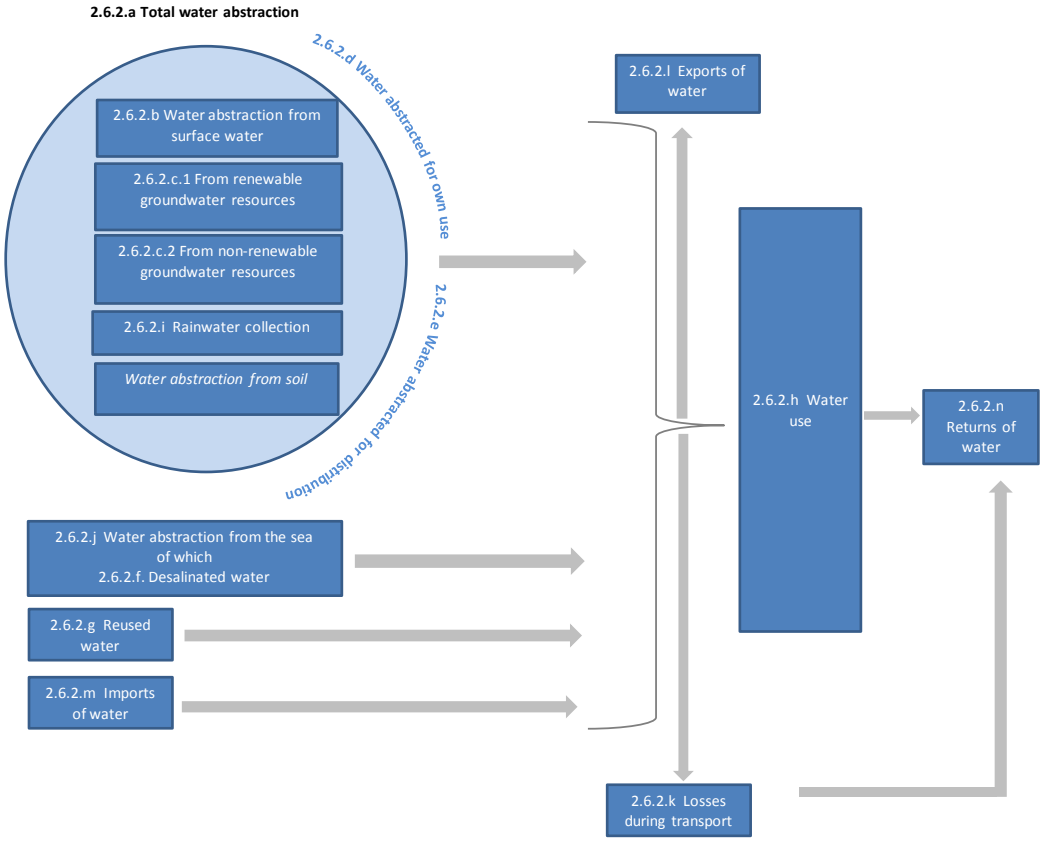
[42] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[43] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[44] United Nations Statistics Division/United Nations Environment Programme (2016) *United Nations Statistics Division/United Nations Environment Programme Questionnaire 2016 on Environment Statistics,* http://unstats.un.org/unsd/ENVIRONMENT/questionnaire2016.html (accessed 11 January 2017)

Water available for use is supplied from total water abstraction from inland waters (2.6.2.a) (which can be either water abstracted for own use (2.6.2.d) or for distribution (2.6.2.e)), water abstracted from the sea (2.6.2.j) of which some is desalinated before use (2.6.2.f), reused water (2.6.2.g) and imports of water (2.6.2.m). However, the water supplied for use (2.6.2.h) would be less any exports of water (2.6.2.f) and losses in distribution (2.6.2.k). The returns of water (2.6.2.n) after use and from losses would be returned to the system.

Figure 3.2: Abstraction from inland water resources, other sources of water, use and returns of water[45]



[45] Note that in the OECD/Eurostat Joint Questionnaire 2014 on the State of the Environment – Inland Waters, and the United Nations Statistics Division/United Nations Environment Programme Questionnaire 2016 on Environment Statistics, rainwater collection is included under abstractions from surface water.

Water abstraction usually refers to the off stream use of water from inland waters which is its physical removal from the environment for production and consumption activities. This can be from surface water, renewable groundwater resources, non-renewable groundwater resources, or rain water.

Also important are low consumption or non-consumption purposes, such as the use of water without moving it from its source, or water is immediately returned with little or no alteration, for example, in hydroelectric power generation (termed in-stream uses in the FDES). Water can also be used without moving it from its original location, termed in situ uses in the FDES (e.g., for transport, recreation and fishing).[46] [47] [48]

The terms "water abstraction", "water use" and "water consumption" are not synonymous. **Water abstraction** is the amount of water that is removed from any surface water or groundwater source (or soil water), either permanently or temporarily, in a given period of time. Water is abstracted by economic units (establishments and households). It can be abstracted for own use or for distribution to other users, for example by a public water supplier.

Water use is the total water used by final users. Water use can be larger than water abstraction, even after accounting for losses in distribution and exports of water. This is due to the fact that the water abstracted is not the only type of water being used. Sea water, desalinated water, reused water and water imported are also components of water use.

Water consumption, or consumptive water use, is not part of the Basic Set of Environment Statistics. The concept of water consumption gives an indication of the amount of water that is lost during use by the economy, 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.[49] This concept should not be mistaken with water use, which includes water returned to either water resources or the sea. If one wants to balance all flows of water, then having a statistic for water consumption is necessary.

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[46] United Nations Statistics Division (2013) *Framework for the Development of Environment Statistics,* http://unstats.un.org/unsd/ENVIRONMENT/FDES/FDES-2015-supporting-tools/FDES.pdf (accessed 11 February 2017)

[47] UNSD (2014) *DRAFT Guidelines for the Compilation of Water Accounts and Statistics*, https://unstats.un.org/unsd/envaccounting/WCG14.pdf

[48] Derived from United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[49] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

Total water abstraction (FDES 2.6.2.a)[50]

Total water abstraction (from inland water resources) is the volume of water that is removed by economic units from surface water, groundwater and soil water within the territory of reference, per year. This includes the abstraction of inland waters that are fresh, brackish, saline or polluted. This excludes abstraction of water from the sea or ocean, since these are not inland water resources.[51] The water can be removed either permanently or temporarily. It includes abstraction by the water supply industry for distribution and direct abstraction by other activities for own use. The volume of water abstracted is broken down by the main groups of economic activity of the abstractors (according to ISIC Rev.4) and households.[52]

Remark:

- All economic units can abstract, use and return water to the environment. The most important activities, in terms of the volume of water abstracted, are agriculture (irrigation and livestock), the generation of electricity (hydropower and cooling) and the water collection, treatment and supply industry (ISIC Rev.4, Section E, Division 36), which includes the collection (abstraction), treatment and distribution of water for household and industrial needs.[53]

Water abstraction from surface water (FDES 2.6.2.b)

The volume of water removed by economic units from artificial reservoirs, lakes, rivers, wetlands and snow, ice and glaciers within the territory of reference, per year. Bank filtration is considered an abstraction of surface water.[54] It can be removed either permanently or temporarily.[55]

Remarks:

- The OECD/Eurostat Joint Questionnaire on the State of the Environment – Inland Waters, like the United Nations Statistics Division/United Nations Environment Programme Questionnaire, considers the collection of rainwater (rainwater harvesting) as abstraction from surface water.

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[50] Named "Abstraction of water from inland water resources" in the IRWS

[51] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[52] United Nations Statistics Division/United Nations Environment Programme (2016) *United Nations Statistics Division/United Nations Environment Programme Questionnaire 2016 on Environment Statistics,* http://unstats.un.org/unsd/ENVIRONMENT/questionnaire2016.html (accessed 11 January 2017)

[53] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[54] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[55] United Nations Statistics Division/United Nations Environment Programme (2016) *United Nations Statistics Division/United Nations Environment Programme Questionnaire 2016 on Environment Statistics,* http://unstats.un.org/unsd/ENVIRONMENT/questionnaire2016.html (accessed 11 January 2017)

- The SEEA considers the collection of rainwater as abstraction from other sources, as it is collected before touching the ground.

Water abstraction from groundwater (FDES 2.6.2.c)

The volume of water removed by economic units from aquifers and springs within the territory of reference, per year.[56] The water can be removed either permanently or temporarily.[57]

(Water abstraction) From renewable groundwater resources (FDES 2.6.2.c.1)

The volume of water removed by economic units from aquifers and springs that are naturally recharged, within the territory of reference, per year.[58]

(Water abstraction) From non-renewable groundwater resources (FDES 2.6.2.c.2)

The volume of water removed by economic units from aquifers and springs that are not recharged, within the territory of reference, per year.[59]

Water abstracted for own use (FDES 2.6.2.d)

The volume of water removed or collected from any source by an economic unit for use by the same economic unit, within the territory of reference, per year.[60]

Water abstracted for distribution (FDES 2.6.2.e)

The volume of water abstracted by an economic unit for the purpose of being supplied to other economic units, often after treatment, within the territory of reference, per year.[61]

Desalinated water (FDES 2.6.2.f)

The volume of water produced by an economic unit through the process of desalination, within the territory of reference, per year. This includes desalinated sea water and desalinated brackish waters from estuaries, rivers and

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[56] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[57] United Nations Statistics Division/United Nations Environment Programme (2016) *United Nations Statistics Division/United Nations Environment Programme Questionnaire 2016 on Environment Statistics,* http://unstats.un.org/unsd/ENVIRONMENT/questionnaire2016.html (accessed 11 January 2017)

[58] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[59] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[60] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[61] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

aquifers.[62] Desalinated water is water that has been purified from brackish or saline water abstracted from the sea, ground or surface water.[63]

Reused water (FDES 2.6.2.g)

Used water (wastewater) directly received from another user with or without prior treatment for further use. It also includes treated wastewater received for further use from treatment plants. However, it excludes water discharged into a watercourse and used again downstream and water which is recycled within industrial sites.[64] It is also commonly referred to as "reclaimed wastewater."[65]

Rainwater collection (FDES 2.6.2.i)[66]

The volume of water collected by economic units directly from falling rain, snow, sleet and hail or collected by contact with dew and mist within the territory of reference, per year. A typical example of collection of precipitation is roof rain harvesting by households. The collection of precipitation includes urban run-off.[67] This water can be collected, or harvested from such surfaces as roofs, paved surfaces and other types of impermeable surfaces that direct water into storage tanks.

Remarks:

- The OECD/Eurostat Joint Questionnaire on the State of the Environment - Inland Waters considers the collection of rainwater as an abstraction from surface waters, thus as an abstraction from an inland water resource.
- In contrast, in SEEA (Central Framework/Water Accounting) the direct collection of precipitation (rainwater, hail, snow) is considered as an abstraction from "other water sources", thus not an abstraction from an inland water resource.

[62] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[63] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[64] United Nations Statistics Division/United Nations Environment Programme (2016) *United Nations Statistics Division/United Nations Environment Programme Questionnaire 2016 on Environment Statistics,* http://unstats.un.org/unsd/ENVIRONMENT/questionnaire2016.html (accessed 11 January 2017)

[65] United Nations Statistics Division (2012) *System of Environmental-Economic Accounting for Water (SEEA-Water),* http://unstats.un.org/unsd/envaccounting/seeaw/seeawaterwebversion.pdf (accessed 11 February 2016)

[66] Called "Collection of precipitation" in the IRWS.

[67] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

Water abstraction from the sea (FDES 2.6.2.j)

The volume of saline water removed by economic units from the sea and ocean within the territory of reference, per year.[68]

Losses of water (FDES 2.6.2.k)

The volume of water that is lost during distribution and transportation, between the point of abstraction and the point of use, or between the points of use and reuse (e.g., from mains, artificial open channels and trucks), within the territory of reference, per year.[69]

Exports of water (FDES 2.6.2.l)

The total volume of bulk water that is exported to other countries as a commodity through pipelines or on ships or trucks or through artificial open channels, drains or other means. It excludes bottled water.[70] For accounting purposes, exports of water is the volume of water that is provided by resident economic units, typically of the water supply industry (ISIC 36), to other non-resident economic units (rest of world) through mains, artificial open channels, drains, trucks or other means, per year. This also excludes bottled water.[71] This definition differs from the former in that it refers to resident and non-resident economic units rather than countries.

Imports of water (FDES 2.6.2.m)

The total volume of bulk water that is imported from other countries as a commodity through pipelines or on ships or trucks or through artificial open channels, drains or other means. It excludes bottled water.[72] For accounting purposes, imports of water is the volume of water that has been delivered to resident economic units by non-resident economic units (rest of world) through mains, artificial open channels, drains, trucks or other means. This excludes water abstracted directly from the environment and bottled water.[73] This definition differs from the former in that it refers to resident and non-resident economic units rather than countries.

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[68] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91 http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[69] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91 http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[70] United Nations Statistics Division/United Nations Environment Programme (2016) *United Nations Statistics Division/United Nations Environment Programme Questionnaire 2016 on Environment Statistics,* http://unstats.un.org/unsd/ENVIRONMENT/questionnaire2016.html (accessed 11 January 2017)

[71] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[72] United Nations Statistics Division/United Nations Environment Programme (2016) *United Nations Statistics Division/United Nations Environment Programme Questionnaire 2016 on Environment Statistics,* http://unstats.un.org/unsd/ENVIRONMENT/questionnaire2016.html (accessed 11 January 2017)

[73] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

Water use (FDES 2.6.2.h)

Water use is the total volume of water, either self-abstracted or received from a water supplier, which is used by final users, such as households or economic activities (establishments) for their production or consumption processes. The volume of water used is broken down by the main groups of economic activity of the final users (according to ISIC Rev.4) and households.[74]

Remarks:

- Typically, in water resources management, water used for hydroelectricity and for the operation of locks is not considered an abstraction (termed in-stream uses in the FDES). However, it is important to record this separately, particularly for use for hydroelectricity, because it can be considered as water abstracted depending on the purpose of the analysis and is important to note due to the large volumes involved. Indeed hydroelectricity can have an impact on water quality or on the ecosystem of the river. In the IRWS and SEEA-Water, water turbinated in hydroelectricity and water for the operation of waterway locks are considered abstractions of water.
- In situ uses of water are not considered abstractions of water in the FDES, SEEA-Water and IRWS, since water is never moved from its original location. In situ uses include navigation, fishing, swimming, and recreational activities on water.
- For more information about off-stream uses, in-stream uses and in situ uses, see the UNSD Guidelines for the Compilation of Water Accounts and Statistics.[75]

Returns of water (FDES 2.6.2.n)

A large part of the water used by economic units is returned to the environment with or without treatment. Returns of water corresponds to the volume of water that flows from economic units directly to inland water resources, the sea or to land, within the territory of reference, per year.

Remark:

- This includes urban storm water, losses of water, irrigation water that infiltrates into groundwater or ends up in surface water, and the discharges of cooling water and water used for hydroelectricity generation (if accounted as an abstraction of water). It excludes evaporation because evaporation is consumption.[76] All

[74] United Nations Statistics Division/United Nations Environment Programme (2016) *United Nations Statistics Division/United Nations Environment Programme Questionnaire 2016 on Environment Statistics,* http://unstats.un.org/unsd/ENVIRONMENT/questionnaire2016.html (accessed 11 January 2017)

[75] United Nations Statistics Division (2014) *DRAFT Guidelines for the Compilation of Water Accounts and Statistics*, pg. 109, http://unstats.un.org/unsd/envaccounting/WCG14.pdf

[76] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irswebversion.pdf

wastewater is included. The volume of returned water should be disaggregated by recipient (e.g., surface water, groundwater, soil and sea).[77]

[77] United Nations Statistics Division (2013) *Framework for the Development of Environment Statistics,* http://unstats.un.org/unsd/ENVIRONMENT/FDES/FDES-2015-supporting-tools/FDES.pdf (accessed 11 February 2017)

4. International sources and recommendations

4A. Classifications and groupings

All economic activities and households are involved in abstraction and/or use and/or return of water. ISIC is the international classification that is used for all economic activities relevant for Topic 2.6.2 Abstraction, use and returns of water.

There are certain industries which can be considered as "water industries" because they are defined by their specific water-related activities. It is recommended to keep data and to present statistics for these industries separately (ISIC Rev.4, division level).

The concerned industries under ISIC Rev.4[78] are:

- ISIC Division 36 - Water collection, treatment and supply. This division includes the collection, treatment and distribution of water for domestic and industrial needs. Collection of water from various sources, as well as distribution by various means is included.
- ISIC Division 37 - Sewerage. This division includes the operation of sewer systems or sewage treatment facilities that collect, treat, and dispose of sewage.

Figure 4.1 ISIC Rev.4 Divisions directly related to water

Division	Group	Class	Description
Division 36			**Water collection, treatment and supply**
	360	3600	Water collection, treatment and supply
Division	**Group**	**Class**	**Description**
Division 37			**Sewerage**
	370	3700	Sewerage

[78] United Nations (2008) *International Standard Industrial Classification of All Economic Activities Revision 4*. Series M No. 4/Rev.4, http://unstats.un.org/unsd/cr/registry/isic-4.asp

It is also recommended to present statistics for ISIC (Rev.4) section D, Division 35 Electricity, gas, steam and air conditioning supply) separately, as large amounts of water use can be related to it.

4B. Reference to international recommendations, frameworks and standards

The most recent documents and resources that have been produced are described below:

- **Framework for the Development of Environment Statistics (FDES 2013)**[79]: Chapter 3, Component 2, Sub-component 2.6 Water resources, includes statistics on water resources, its use and returns to the environment. In turn, Chapter 5.1 Water and the Environment presents the components, sub-components and topics as well as the individual environment statistics that are needed to inform about water and its relation to the environment using two approaches. The first is a holistic approximation that spans across the six components of the FDES, and it includes all water-related statistics in the FDES, including physical characterization (atmospheric, hydrographic, geographic dynamics) of both inland and marine systems, quality of water (for both fresh and marine water environments), aquatic resource activities, water resources and their use, and water-related extreme events, disasters and its impacts. The second approach treats water exclusively from the human use perspective, referring to Component 2, as developed in this methodology sheet.

- **The United Nations Statistics Division/United Nations Environment Programme Questionnaire on Environment Statistics**[80], Section on Water: For the relevant statistics concerning water resources and use, the questionnaire contains definitions and diagrams in five languages that can be used to understand the concepts and relations among them, as well as the units of measurements and conversion factors. The questionnaire is used as the instrument for the biennial data collection of environment statistics carried out by UNSD.

- **International Recommendations for Water Statistics (IRWS)**[81] (UNSD, 2012): The IRWS provides detailed guidance on the use of statistical units, classifications and data items for the production of water statistics. It is fully aligned with the UN-FDES, SEEA Water, the United Nations Statistics Division/United Nations Environment Programme Questionnaire on Environment Statistics (section: Water) (version 2016), the OECD/Eurostat Joint Questionnaire on Inland Waters (version 2014) and FAO Aquastat.

[79] United Nations Statistics Division (2013) *Framework for the Development of Environment Statistics*, http://unstats.un.org/unsd/ENVIRONMENT/FDES/FDES-2015-supporting-tools/FDES.pdf (accessed 11 February 2017)
[80] United Nations Statistics Division/United Nations Environment Programme (2016) *United Nations Statistics Division/United Nations Environment Programme Questionnaire 2016 on Environment Statistics,* http://unstats.un.org/unsd/ENVIRONMENT/questionnaire2016.html (accessed 11 January 2017)
[81] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

- **System of Environmental-Economic Accounting for Water (SEEA Water)**[82] (UNSD, 2012): The System of Environmental-Economic Accounting for water is a SEEA sub-system which provides compilers and analysts with agreed concepts, definitions, classifications, tables, and accounts for water and water-related emission accounts.

- **Guidelines for the Compilation of Water Accounts and Statistics**[83] (UNSD, 2014): The *DRAFT* Guidelines provide country experts and trainers with a comprehensive set of practical materials to assist in the compilation of water accounts and statistics, in order to develop a monitoring system for water policies. The document is intended for staff of National Statistical Offices, Water Ministries and Agencies, and other stakeholders in countries. The tables and accounting methods presented are based on the System of Environmental-Economic Accounting for Water (SEEA-Water) and the SEEA Central Framework (SEEA-CF). The Guidelines provide additional and more detailed guidance to that provided by the International Recommendations for Water Statistics (IRWS).

Other international documents:

- **The UNECE Standard Statistical Classification of Water Use (1989)**[84] provides an early classification for international surveys of water use relating to annual data for countries as a whole or for the most important regional river basins.
- **The Data Collection Manual for the OECD/Eurostat Joint Questionnaire on Inland Waters**[85] (Eurostat) is a manual on how to complete the OECD/Eurostat Joint Questionnaire on the State of the Environment: Inland Waters.

4C. Sources of global and regional environment statistics and indicators series

- **UNSD Environment Statistics and Indicators.** The tables cover data on water resources by year and long-term annual averages, including precipitation, actual evapotranspiration, internal flow, inflow of surface water and ground water from neighbouring countries, renewable freshwater resources and renewable freshwater resources per capita; the water supply industry covering net freshwater supplied by the water

[82] United Nations Statistics Division (2012) *System of Environmental-Economic Accounting for Water (SEEA-Water)* http://unstats.un.org/unsd/envaccounting/seeaw/seeawaterwebversion.pdf (accessed 11 February 2016)
[83] United Nations Statistics Division (2014) *DRAFT Guidelines for the Compilation of Water Accounts and Statistics* http://unstats.un.org/unsd/envaccounting/WCG14.pdf
[84] United Nations Economic Commission for Europe / United Nations (1993) *Readings in International Environment Statistics*, http://www.unece.org/fileadmin/DAM/env/documents/1993/esc.pdf
[85] Eurostat (2008) *Data collection manual for the OECD/Eurostat Joint Questionnaire on Inland Waters. Tables 1-7*. http://ec.europa.eu/eurostat/ramon/coded_files/OECD_ESTAT_JQ_Manual_version_2_21.pdf

supply industry and net freshwater supplied by the water supply industry per capita, total population supplied by the water supply industry and net freshwater supplied by the water supply industry per capita connected; freshwater abstracted; and wastewater generation, treatment and proportion of wastewater treated. Available from http://unstats.un.org/unsd/environment/qindicators.htm

- **FAO: AQUASTAT** covers a time series of statistics for water resources including precipitation, internal and external renewable water resources and exploitable water resources and dam capacity; and water use including water withdrawal by sector and source, wastewater and pressure on water resources. Available from http://www.fao.org/nr/water/aquastat/data/query/index.html?lang=en

- **OECD database**: The database contains time series of statistics for freshwater resources (long-term averages), freshwater abstractions, wastewater treatment (% population connected), treatment capacity of wastewater treatment plants, generation and discharge of wastewater; and lake and river quality. Available from http://stats.oecd.org/

- **Eurostat Water Statistics main tables and database.** The tables contain data on the water exploitation index, water resources long-term annual average, fresh water abstraction by source, fresh water abstraction by source per capita, water abstracted by sector or use, water productivity, population connected to public water supply, water use from public water supply and from self-supply, population connected to urban water collection and treatment systems and connected population with secondary treatment, design capacity of urban wastewater treatment plants with advanced treatment, sewage sludge production and disposal from urban wastewater and biochemical oxygen demand in rivers. Available from http://ec.europa.eu/eurostat/web/environment/water/main-tables

- **Eurostat: Resource Efficiency Scoreboard –** Water Exploitation Index and Water Productivity. It presents indicators covering themes and subthemes of the Roadmap to a Resource Efficient Europe. The scoreboard aims to monitor the implementation of the roadmap, to communicate the link between resources and economy and to engage stakeholders. Indicators are arranged in three groups – lead, dashboard and theme-specific indicators. Available from http://ec.europa.eu/eurostat/web/europe-2020-indicators/resource-efficient-europe

5. Data collection and sources of data

Water data that are relevant to environment statistics are primarily generated by a variety of institutions, methods and source types. For secondary compilers, the quality and comparability of the primary sources of water related data is not always known. The producers of both data and statistics related to water may include hydrologists, meteorologists, researchers and scientists, water administrators, industries, regulators, municipalities and statisticians with different languages and working methods. It is therefore very important that inter-agency collaboration and data sharing mechanisms are constructed and sustained over time in order to regularly produce environment statistics related to water resources and its use.

5A. Water Resources (Topic 2.6.1)

The main producers of primary data on water resources are usually the national hydro and/or meteorological institutions (hydro meteorological institutions). Other important data providers may include water authorities and environmental authorities. Hydrological/meteorological data and research data are used mostly to produce the data items related to the environmental units (their stocks and flows). If these data do not exist, it is important that a technical dialogue be established between NSOs, the environment authorities and hydro meteorological institutions on which data and compilations are needed for environment statistics. A good starting point is annual aggregates (calendar year) for the entire national area. However, in large countries or countries with seasonal water stress it will be necessary to also produce statistics for individual river basins and the main seasons of the year. See also temporal and spatial aspects below.

In many cases hydro meteorological institutions already produce water balances (i.e., consisting of the elements precipitation, actual evapotranspiration, external inflow, external outflow) and/or data about water stocks (usually water in reservoirs and lakes, sometimes also groundwater stocks) which can be used directly for environment and other statistical purposes. However, environmental authorities may need to produce additional compilations such as Water Resource Assessments.

Scope

Water resources comprise all inland water resources of a country.

Statistical unit

The statistical units for water in the environment are the inland water bodies (the areas or spaces that contain the water). The IRWS[86] lists the statistical units of the environment for inland waters as surface water bodies (including artificial reservoirs) and aquifers, with a number of divisions below these levels. For example, a river may be divided into stretches or segments and a large lake may be divided into parts. Water is also contained in soils and although they are also part of water resources, it is not necessary to include soil as a statistical unit for the purposes of water statistics.

Reporting unit

The reporting unit is the unit that reports the information about the statistical unit. For example, a lake can be a statistical unit but any information about the lake will have to be reported by a unit of the economy that owns, manages or monitors the lake or any part thereof (e.g., a water authority).

Measurement unit

In water resources statistics the measurement unit for water volumes is cubic metres (m^3). When data are obtained from hydro meteorological institutions or other sources, often different units of measurement are used (for example height, e.g., mm of rainfall per year or flow, e.g., m^3 average inflow/second). The conversion to volumes (per year in case of annual aggregates) has to be done by hydro meteorological experts according to statistical methods in hydrology. It is not a trivial task and usually cannot be performed by experts from NSOs or the environmental authority.

Aggregation

Aggregation can be by classes, such as, aggregation according to the type of resources, e.g., water body, surface/non-surface, kind of water bodies, renewable/non-renewable resource.

Temporal aspects

Information on water resources may not be available for the calendar year (or month if further temporally disaggregated). Instead some countries use a "hydrological year" for their water balances which is not necessarily identical with the calendar year, in which case data can be re-calculated for calendar years if possible. When re-calculation is not possible meta-information can be provided about the start and end dates of the hydrological year. A hydrological year is a continuous twelve-month period during which a complete annual climatic cycle occurs, and which is selected to provide a more meaningful comparison of meteorological data.[87]

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[86] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[87] World Meteorological Organization and UNESCO (2012) *International Glossary of Hydrology. WMO-No. 385,* http://www.wmo.int/pages/prog/hwrp/publications/international_glossary/385_IGH_2012.pdf

In cases where no annual statistics on water resources are available, there might be long-term annual average (LTAA) statistics available. If this is the case, additional meta-information about the time-period should be provided (often 30-year averages are used).

Water statistics are usually compiled and disseminated on an annual basis, per country or region. However, annual water statistics may often hide seasonal variability in data, which in many cases is important to understand for water management purposes. Some water statistics, such as precipitation and other meteorological and hydrological data, are compiled more frequently, e.g., daily, weekly or monthly, to address these needs. However, while sub-annual data for aggregate water statistics would be ideal for the analysis of intra-annual variations, they are very resource-intensive to collect and, for the time being, are not considered feasible in many countries. For some water statistics, such as those on renewable water resources, long-term annual averages are the most appropriate temporal references. The temporal references for particular data items should be addressed in a data-collection strategy.

Spatial aspects

Data collected by hydro meteorological institutions usually originates from a large number of measurements from different measuring points across the country. It is not a trivial task to aggregate the data and this has to be done by hydro meteorological experts based on nationally or internationally agreed methods.

Data may be aggregated to various spatial areas depending on use, including natural areas such as a watershed or river basin, or to national level or other administrative areas at sub-national level. Or they can be aggregated to the economic territory or other area of reference.

Validation

Validation of water resources statistics is usually conducted by hydro meteorological institutions and experts. Validation processes are covered under section 5B. Abstraction, use and returns of water.

5B. Abstraction, Use and Returns of Water (Topic 2.6.2)

The main producers of primary data on abstraction, use and returns of water are water authorities and regulators, environmental authorities, municipalities, industries, and agricultural and irrigation authorities, and national statistical offices. There are usually issues of overlap and non-comparability in the production of primary data about water abstraction, since each final use has a different institution which regulates and records the water abstraction. For example, water abstraction for agriculture is usually recorded by agricultural and/or rural municipal or irrigation authorities; for households it is usually distributed and recorded by municipalities and/or local governments or delegated supplier companies or entities; and for industries it is usually recorded by the urban municipality, irrigation authorities and/or supplier of the water.

Even within a sector inconsistencies can arise. For example, in the case of agriculture, which is the main user of water in many developing countries, the production of water abstraction and use data rests on a number of supplier companies, irrigation authorities or municipal agencies. It is common in developing countries that their data can be inconsistent, dispersed and it can be very difficult to establish quality and comparability over space and time.

The source of data is usually water surveys and administrative data sources as the data on water abstraction and use is from or about economic units such as manufacturing industries, service industry, forestry and agriculture, governmental entities or households. However, other sources, such as specialized statistical estimation procedures or a combination of the above methods may be used. Quality of data varies according to type of source but can be assessed considering criteria such as availability of metadata describing the water data produced, comparability of data series among different sources, collection and validation methods and availability of data points within the series.

To assess data availability, it is important to first find out if there are national or sub-national systems of water rights of usage/concessions that authorize given quotas of water abstraction to users. When in place, these systems allocate water use rights and quotas over the main water sources of a country, usually producing a register of these water abstraction/use rights. The data in these administrative records would refer only to the potential abstraction by each user (as opposed to actual abstraction) and its quality can be rather uncertain, but it is a good first step to establish the order of magnitude of abstraction over the main rivers and lakes, and even groundwater. The second step will be to determine how good is the enforcement or control mechanism and register of the actual abstraction by the regulator.

When the final user abstracts water for his own use, for example from wells, rivers and lakes, the abstractor's own administrative registers can also be a source of data for these individual establishments, although if no regulation or rights are in place, the data quality can be difficult to assess because of the lack of independent verification and the incentives to sub-register the abstraction of water.

Many countries have established pay per use water systems, where actual metering systems record the usage in the entrance to the household and to each establishment for the calculation of the monthly bill for the amount of m^3 used per household or business. These systems produce actual use data and can be utilized to construct aggregated series, although its coverage might be restricted to urban areas and to the household and industry users.

In some countries, the data are produced according to ISIC economic activity (see Section 4. International Sources and Recommendations), or else can be associated with it, which is important since using this classification will enable determination of the type of supplier and also the final use of the water.

Scope

All water abstracted and used at national, sub-national, regional and/or river basin level. In-situ water uses, such as fishing, navigation etc., are often not considered in statistics about abstraction or use. As referred to in Section 3, Section 3B under the definition of Water use (FDES 2.6.2.h), it is recommended, to record separately certain in-stream uses, such as hydroelectricity.

Statistical unit

The statistical units are the units of the economy which abstract, use and return water are the establishments and households. These are referred to as economic units in IRWS.[88]

Reporting unit

Reporting units are public and private enterprises and establishments and municipalities that abstract, supply and/or use water.[89] Reporting units are also households, in particular for water uses from self-abstraction or water returns on their own land (no connection to public water supply or public wastewater collection).

Measurement unit

In water resources statistics the measurement unit for water volumes is cubic metres (m^3). For the collection of primary data, other units of measure may also be used, such as units typically used by farmers to measure abstraction, but for the purposes of presenting data and for comparison, it is important to convert data into standard scientific measurement units (i.e., the metric system). A list of measurement units and conversion factors is provided in Annex VI of the IRWS.[90]

Aggregation

Water abstraction, use and return statistics should be disaggregated by:

- Type of water source whether from surface water or groundwater.
- Use, such as for own use, or for distribution.
- For water abstraction the volume of water abstracted can be broken down by main groups of economic activity of the abstractors according to ISIC Rev.4 and households.[91]
- Water use should be disaggregated into economic activity according to ISIC Rev.4 and household use. The most significant water uses (e.g., irrigation in agriculture, hydropower generation and cooling) should be specified. Water use by tourists may also be captured to measure tourism's environmental impact.
- For returned water the volume of water returned should be disaggregated by recipient, for example, surface water, groundwater, soil and sea.

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[88] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[89] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[90] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[91] United Nations Statistics Division/United Nations Environment Programme (2016) *United Nations Statistics Division/United Nations Environment Programme Questionnaire 2016 on Environment Statistics,* http://unstats.un.org/unsd/ENVIRONMENT/questionnaire2016.html (accessed 11 January 2017)

Temporal aspects

In general, the periodicity of primary data production on water abstraction can be annual and on occasion quarterly or monthly, depending on the institutional setup and the functioning of abstractors, distributors and suppliers to end users.

Usually the compiled data on water statistics are expected to be available as an annual aggregate. However, as water stress can be time-limited (e.g., seasonal) it might be useful to disaggregate the statistics for seasons or even calendar months.

Spatial aspects

Primary and compiled data may differ in terms of spatial aspects. Spatial coverage of the primary data can expand to the whole country, but it usually originates at the sub-national level, such as from local authorities regulating or supervising water access and rights; or at the municipal or local level from the supplier or distribution agencies for households, agriculture and other industry. However, the statistics can be presented aggregated to national level, by economic activity.

However, national aggregates, especially in the case of large countries, tend to not reflect the actual situation as problems might balance out over the country (e.g., large amounts of rainfall in one part of a country do not necessarily compensate for lack of water in another part of a country). Therefore, for water policies statistics for basin or catchment areas or sub-national administrative units usually are of greater importance.[92]

Validation

Validation will need to be carried out by NSOs after receiving data from primary producers. This will help to identify major issues such as the wrong units of measurements, decimal errors, or errors in data entry. Other validation processes check the expected magnitude of key values, the supply use balances and implausible time series. It should also examine whether technical terms were used according to their definition, for example, the treatment of inflows in allocation to neighbouring countries, or if the value for total water abstracted includes or excludes water used for hydropower. Good validation practices particular to water resources and abstraction are listed below:

Check of expected order of magnitude

For most of the statistics a certain order of magnitude can be expected. For example water use by households is directly linked to the population size of a country. Water supply associations can provide good data (or expert assessments) on average water losses and net water supply to final users (e.g., households). For example 160 l/capita/day household water use and 25% losses of water during transport (from water supply associations) can be

[92] OECD/Eurostat (2008) Data Collection Manual for the OECD/Eurostat Joint Questionnaire on Inland Waters Tables 1-7.version 2.21 http://ec.europa.eu/eurostat/ramon/coded_files/OECD_ESTAT_JQ_Manual_version_2_21.pdf

compared against the water statistics by dividing the volume of water used by households connected to public water supply by the total number of persons in those households.

Another example is the calculation of precipitation in terms of height (mm) by dividing the precipitation volume by the concerned area (e.g. national territory). This is compared with average precipitation data: annual average precipitation can be found for example on the website such as the World Bank.[93] National averages between 50 mm/year (extremely dry countries, such as Egypt) up to about 3,500 mm/year (in tropical countries such as Costa Rica) are realistic.

Consistency of time series

The check of consistency of time series is mainly based on expert judgement. Implausible outliers or unexpected trends (e.g., decreasing connection rates to water supply or very strong variations over years) can be easily identified and have to be clarified with the original data source.

Cross-data checks, calculation of water balances and water use balances

Use of some simple formulas to check data coherence, for example:

- Total water use = total water abstraction plus imports plus desalinated water plus reused water, minus exports minus losses.

This method requires a relatively complete set of water statistics to calculate the balances. For example, if the returns of water are bigger than the total abstractions, then a valid reason should be identified, such as water imports or there may be a problem with the data. The important thing is to examine all the data together and to bring them into their conceptual relationship.

More on data validation, data gap filling and case examples can be found in the UNSD Guidelines for the Compilation of Water Accounts and Statistics.[94]

[93] http://data.worldbank.org/indicator/AG.LND.PRCP.MM

[94] UNSD (2014) *DRAFT Guidelines for the Compilation of Water Accounts and Statistics, Chapter 3*, http://unstats.un.org/unsd/envaccounting/WCG14.pdf

6. Uses and dissemination

6A. Potential presentation/dissemination formats

It is useful to show water statistics not only by country or region but also by river basin (catchment) area, by economic activity of the water user and/or water abstractor, and by source type. Seasonal differences can also be shown. Indicators could be presented per capita or related to economic output of the water using activity. Water exploitation indices could be calculated and presented.

The following are examples of visualizations for water statistics such as water resources, including inflows, outflows, and stocks, water use, and water supply. When national terms are used an explanation is provided of the relevant term used in the FDES.

Figure 6.1: Evapotranspiration Totals for selected stations, Guyana, October 2016

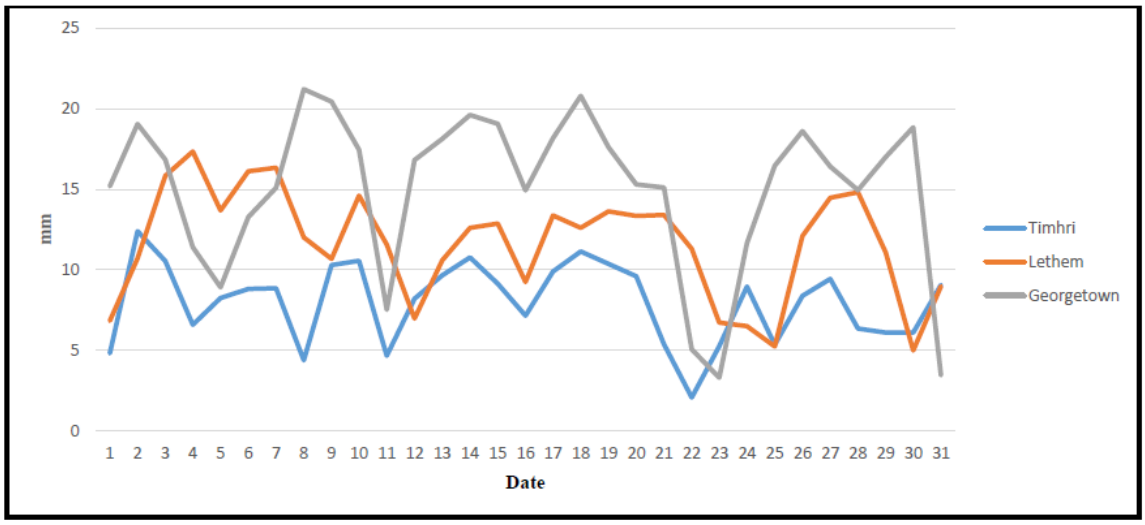


Figure 6: Comparison of the Reference Evapotranspiration of selected stations for October, 2016.

Source: Hydro meteorological Service of Guyana (2016) *Farmer's Monthly Weather Bulletin*, Issue 46, November 2016, http://agriculture.gov.gy/wp-content/uploads/2016/11/November-Bulletin-2016-official-draft.pdf

Figure 6.2 Precipitation, monthly and long-term average, Guyana October 2016

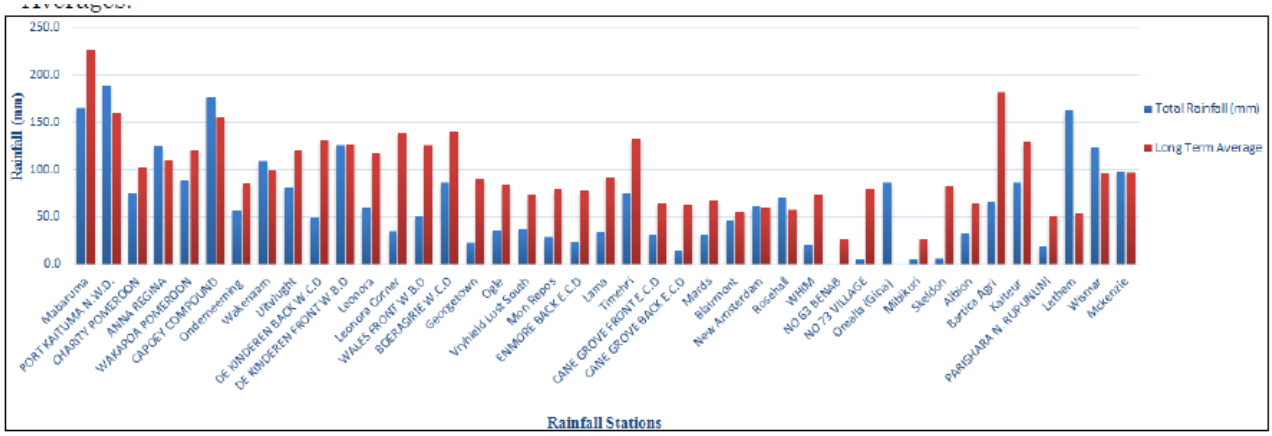


Figure1: Comparison of the accumulated rainfall and the long-term averages for selected stations for October, 2016.

Source: Hydro meteorological Service of Guyana (2016) *Farmer's Monthly Weather Bulletin*, Issue 46, November 2016, http://agriculture.gov.gy/wp-content/uploads/2016/11/November-Bulletin-2016-official-draft.pdf

Figure 6.3: Standardized Precipitation Index, August – October 2016, Guyana

Table 2: The Standardized Precipitation Index for selected stations

Station Name	3 Months SPI Value (August ,September, October)
Georgetown	0.17
Uitvlugt	-0.22
Wales	0.43
Enmore	-0.59
Timehri	-0.06
Blairmont	-0.27
Rose Hall	0.06
Albion	0.31
Skeldon	1.54

Table 3: The Standardized Precipitation Index Classification

SPI Values	Categories
0 to -0.4	Near Normal
-0.5 to -0.7	Abnormally Dry
-0.8 to -1.2	Moderately Dry
-1.3 to -1.5	Severely Dry
-1.6 to -1.9	Extremely Dry
-2.0 or less	Exceptionally Dry
0 to 0.4	Near Normal
0.5 to 0.7	Abnormally Wet
0.8 to 1.2	Moderately Wet
1.3 to 1.5	Severely Wet
1.6 to 1.9	Extremely Wet
2.0 or more	Exceptionally Wet

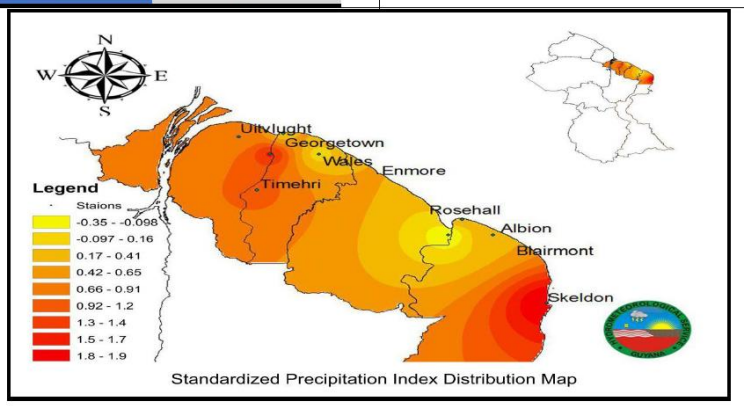
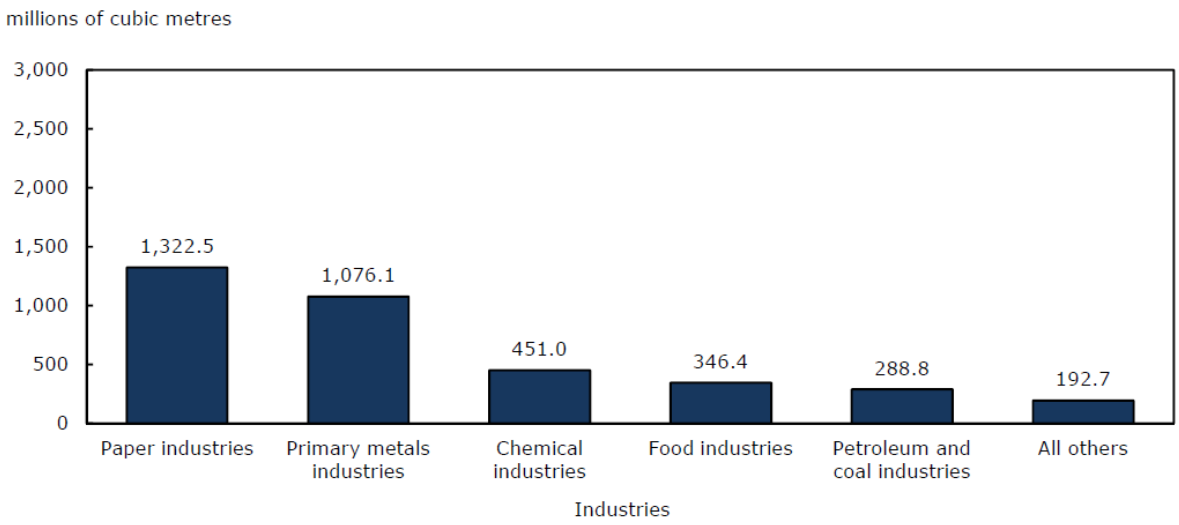


Figure 7: The Standardized Precipitation Index for selected stations for August through October, 2016

Source: Hydro meteorological Service of Guyana (2016) *Farmer's Monthly Weather Bulletin*, Issue 46, November 2016, http://agriculture.gov.gy/wp-content/uploads/2016/11/November-Bulletin-2016-official-draft.pdf

Figure 6.4: Water intake in manufacturing Canada, 2011

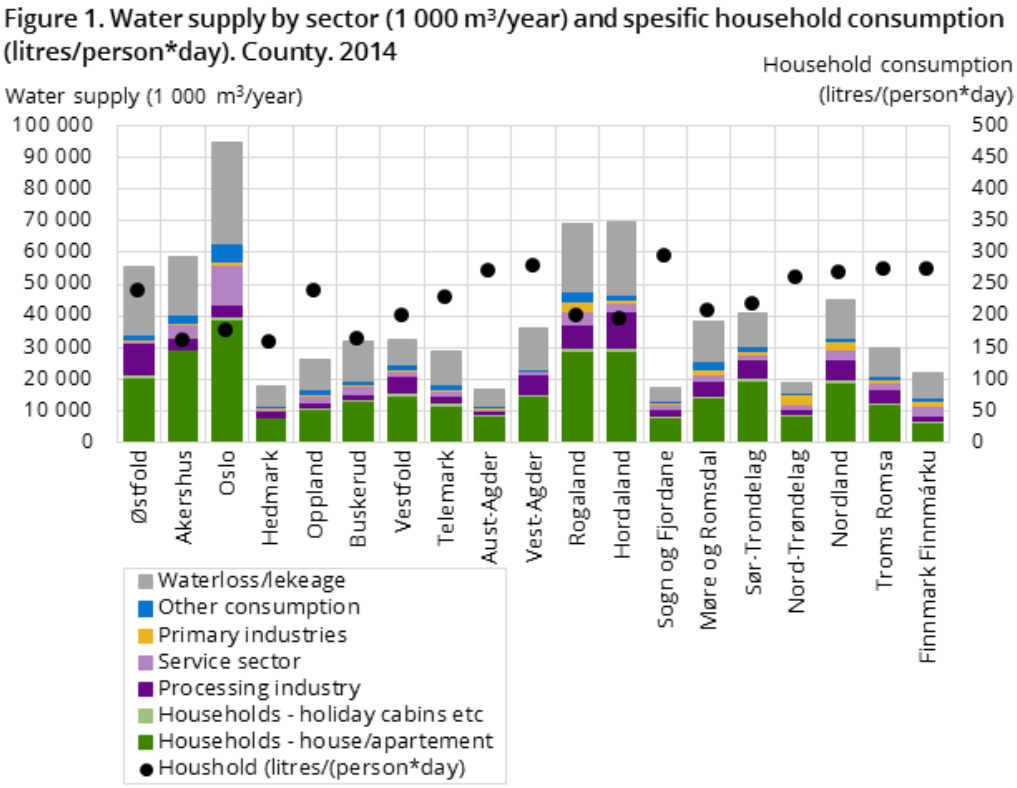
Chart 1
Water intake in manufacturing, 2011



Note: Water use (the term water intake is a national term and is not used internationally) is presented by economic activity of the user using the national classification.

Source: Statistics Canada (2014) Industrial Water Use 2011 (survey no. 5120), http://www.statcan.gc.ca/pub/16-401-x/16-401-x2014001-eng.pdf

Figure 6.5 Municipal water supply Norway, 2014



Note: Water supply refers to the FDES term water use. Household consumption refers to the FDES term water use by households.

Source: Statistics Norway (2015) Municipal water supply 2014, https://www.ssb.no/en/sok?sok=Leaking+water+pipeline+system

Presents statistics on water use by economic sector and households by accommodation type.

Figure 6.6 Water use in Colombia by user, 2012

Tabla 4.11 Uso de agua en Colombia

Usos del agua	Uso Total de agua 2012	Participación porcentual	Flujos de retorno	Pérdidas
	Mm^3		Mm^3	Mm^3
Doméstico	2963,4	8,2%	1670,5	921,6
Agrícola	16760,3	46,6%	s.I	s.I
Pecuario	3049,4	8,5%	s.I	563,4
Acuícola	1654,1	4,6%	1654,1	s.I
Industria	2106,0	5,9%	2000,7	493,5
Energía	7738,6	21,5%	1273,6	364,4
Hidrocarburos	592,8	1,6%	s.I	s.I
Minería	640,6	1,8%	s.I	s.I
Servicios	481,8	1,3%	433,6	137,7
Total Nacional	35987,1	100%	7032,6	2480,5

s.I: Sin Información
Mm^3 = Millones de metros cúbicos.
Los factores de retorno de agua fueron tomados de (BID, IMTA, MINAE, 2008).

Translation:

- Row headers: Uses of water, total use of water 2012, % share, flows returned, losses
- Uses of water: Domestic, agriculture, livestock, industry, energy, hydrocarbon, minerals, services, national total.

Source Instituto de Hidrología, Meteorología y Estudios Ambientales (IDEAM) (2015) Estudio Nacional del Agua 2014 (Colombia), http://documentacion.ideam.gov.co/openbiblio/bvirtual/023080/ENA_2014.pdf

Presents data on water use by sector together with returns and losses.

Figure 6.7 Water use by hydrographic zones of Colombia 2014

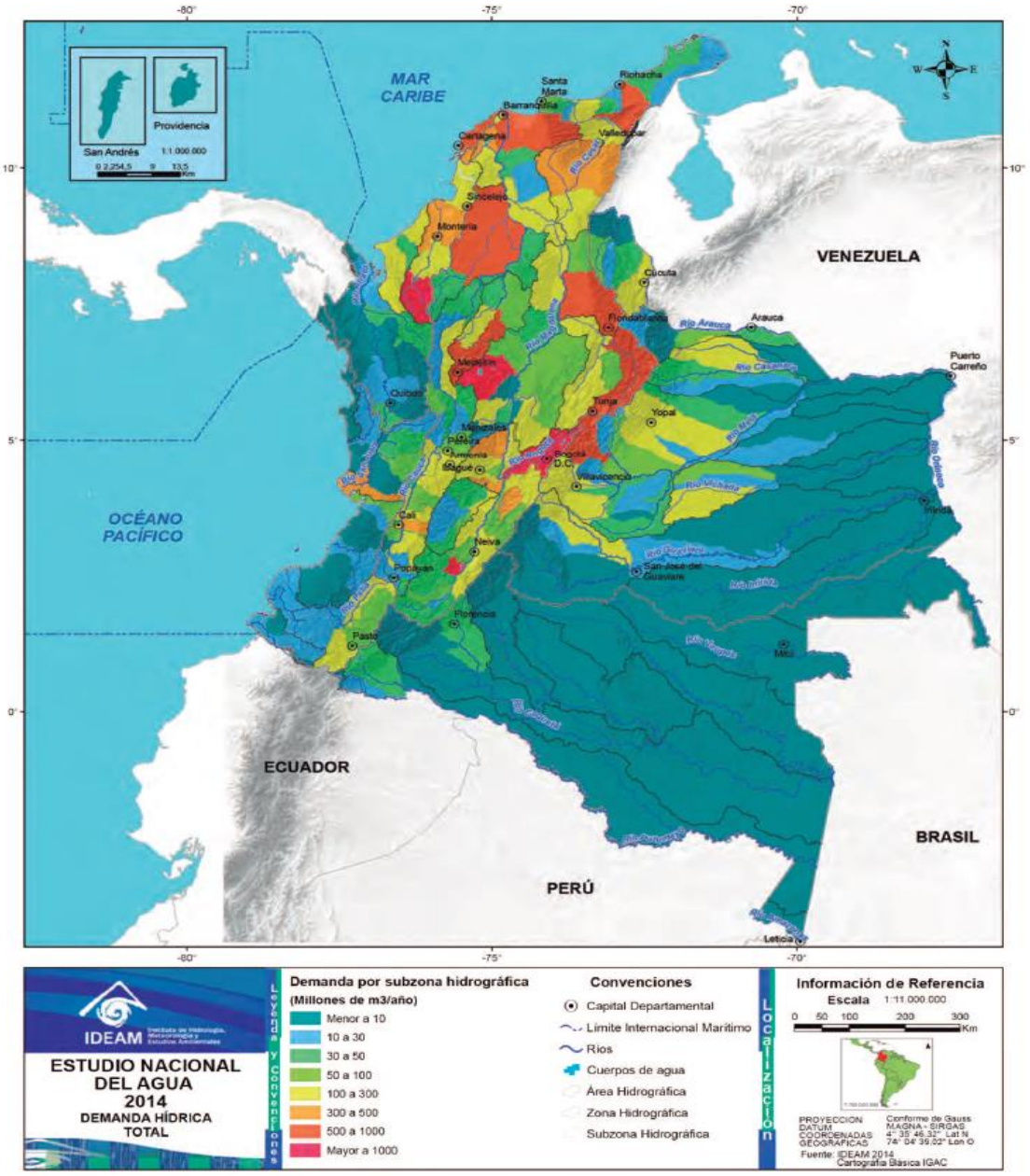
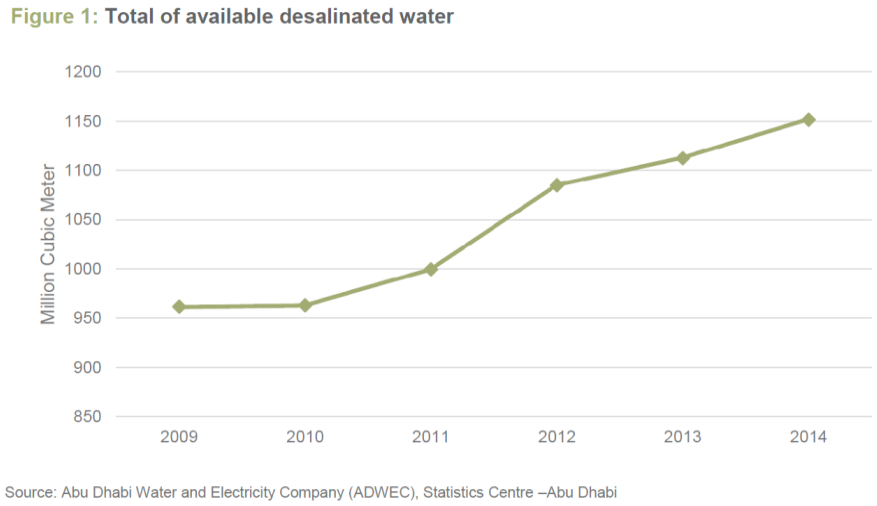


Figura 4.9 Demanda hídrica anual en Colombia

Source Instituto de Hidrología, Meteorología y Estudios Ambientales (IDEAM) (2015) Estudio Nacional del Agua 2014, http://documentacion.ideam.gov.co/openbiblio/bvirtual/023080/ENA_2014.pdf

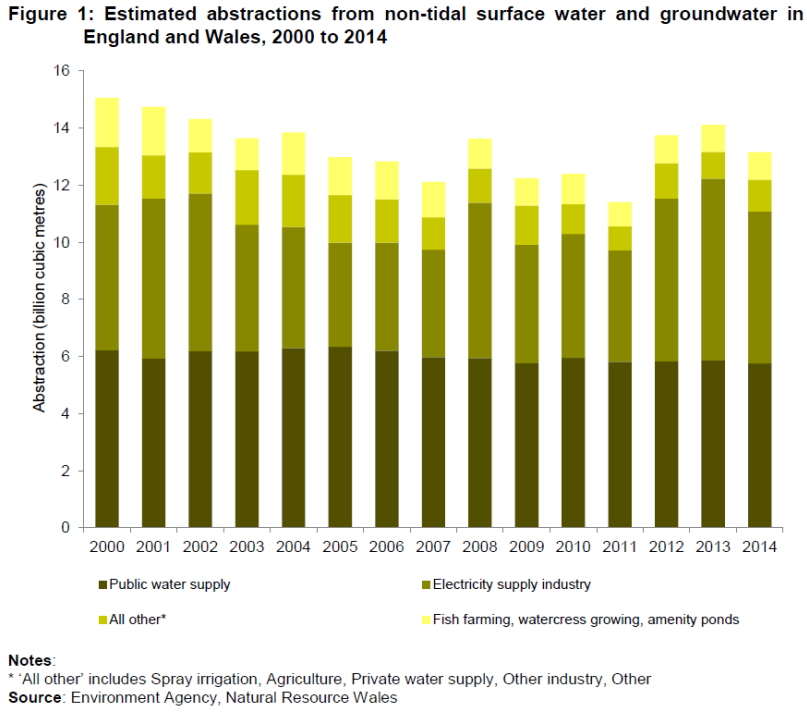
Data on water use by hydrographic zone.

Figure 6.8: Desalinated Water



Source: UAE (2015) *Water Statistics 2014*, WAE Statistics Centre, https://www.scad.ae/_ws/dlSpFile.ashx?_fn=/Release%20Documents/water%202014%20-%20En%20-v3.pdf

Figure 6.9: Water Abstractions by use



Source: DEFRA (2016) Official Statistics Release: Water Abstraction from non-tidal surface water and groundwater in England and Wales, 2000-2014, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/493563/Water_Abstractions_2014.pdf

6B. SEEA accounts/tables that use these statistics

Statistics on water resources, abstraction, use and returns are essential for completing the physical use/supply tables (PSUT) for water and the physical asset accounts for water resources.

Physical supply and use tables (PSUT) for water

A basic PSUT for water contains information on the supply and use of water and provides an overview of water flows. The PSUT is divided into five sections which organize information on:

a) Abstraction of water from the environment
b) Distribution and use of abstracted water across enterprises and households
c) Flows of water and reused water between households and enterprises
d) Return flows of water to the environment
e) Evaporation, transpiration and water incorporated into products

To complete the PSUT for water all statistics about abstraction, use and returns of water (Topic 2.6.2) are needed. However, it is important to consider the following:

- Statistics on abstraction, use and returns have to be available by economic activities (ISIC), households and flows. The basic PSUT aggregates the economic activities, households and flows as follows:
  - ISIC divisions 1-2 Agriculture, forestry and fishing
  - ISIC divisions 5-33 and 41-43 Mining and quarrying, manufacturing and construction
  - ISIC division 35 Electricity, gas, steam and air conditioning supply
  - ISIC division 36 Water collection, treatment and supply
  - ISIC division 37 Sewerage
  - ISIC divisions 38, 39 and 45-99 service industries
  - Households
  - Flows from/to the rest of the world (imports and exports)

  However, in practice, depending on national information needs, more disaggregation of the economic activities is needed (and thus recommended).

- More detailed information is needed on the flows of water within the economy: from economic activities providing water, wastewater or re-used water to other economic activities.

Physical asset accounts for water

Physical asset accounts for water should be compiled by type of water resource and should account for both the stock of water at the beginning and end of the accounting period and the changes in the stock of water.

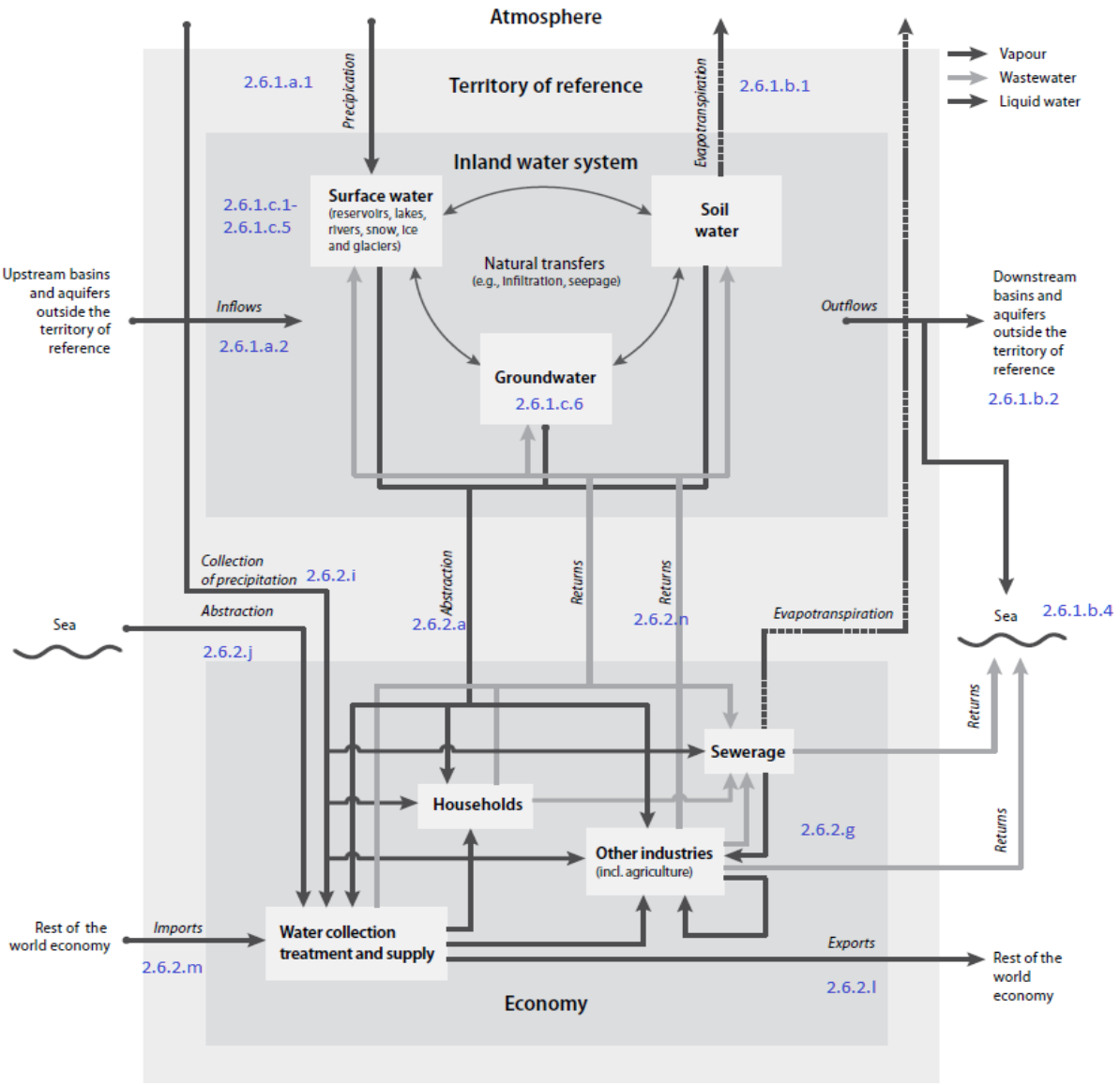
The general structure of the physical asset account for water resources is the following (for each type of water resource:

Structure of physical asset account for water resources	**Remarks and references to the Basic Set of Environment Statistics of the FDES**
Opening stock of water resources	From previous accounting period
Additions to stock	
Returns	2.6.2.n Returns of water
Precipitation	2.6.1.a.1 Precipitation (only the part that directly reaches surface waters and soil water)
Inflows from other territories	2.6.1.a.2 Inflow from neighbouring territories
Inflows from other inland water resources	Not part of FDES
Discoveries of water in aquifers	Not part of FDES
Total additions to stock	Sum of the above
Reduction in stock	
Abstraction	2.6.2.b Water abstraction from surface water; and 2.6.2.c Water abstraction from groundwater; (water abstraction from soil water is not part of FDES)
Evaporation and actual evapotranspiration	2.6.1.b.1 Evapotranspiration
Outflows to other territories	2.6.1.b.2 Outflow to neighbouring territories
Outflows to the sea	2.6.1.b.4 Outflow to the sea
Outflows to other inland water resources	Not part of FDES
Total reductions in stock	Sub of the above
Closing stock of water resources	Opening stocks plus additions to stocks minus reduction in stocks

If physical asset accounts for water are compiled the underlying statistics on water resources (Topic 2.6.1), water abstractions and water returns (Topic 2.6.2) should be available disaggregated for each type of water resource. In countries where it is important to distinguish water resources according to their quality (e.g., salinity) or whether they are renewable or fossil, a further disaggregation is recommended.

The economy, inland water system and their interactions or flows according to the SEEA-Water and IRWS is presented in figure 6.1 together with references to the relevant statistics of the BSES.

Figure 6.1 Main flows within the inland water system and economy[95] [96]



[95] United Nations Statistics Division (2012) *International Recommendations for Water Statistics*. Series M No.91, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

[96] United Nations Statistics Division (2013) *Framework for the Development of Environment Statistics*, pg. 2, http://unstats.un.org/unsd/ENVIRONMENT/FDES/FDES-2015-supporting-tools/FDES.pdf (accessed 11 February 2017)

Note: The codes of the Basic Set of Environment Statistics of the FDES were added and presented in blue.

6C. Commonly used indicators that incorporate these statistics

6C1 EU Resource Efficiency Scoreboard[97]

Water productivity[98]**:** Water productivity is gross domestic product (GDP) divided by the total annual fresh water abstraction:

$$\frac{Gross\ Domestic\ Product\ (GDP)}{Total\ annual\ freshwater\ abstraction\ \ (FDES\ 2.6.2.a)}$$

Total annual freshwater abstraction is the water removed from any fresh water source, either permanently or temporarily. Mine water and drainage water as well as water abstractions from precipitation are included, whereas water used for hydroelectricity generation (in situ use) is excluded.

Water exploitation index[99]**:** The index presents three measures:

i) The annual total fresh water abstraction *(FDES 2.6.2.a)* in a country as a percentage of its long term average available water (LTAA) from renewable fresh water resources *(FDES (Precipitation: 2.6.1.a.1) – (Evapotranspiration: 2.6.1.b.1) + (Inflow from neighbouring territories: 2.6.1.a.2));*

ii) The annual groundwater abstraction *(FDES 2.6.2.c)* as a percentage of the country's long-term annual average groundwater available for abstraction *(FDES 2.6.1.c.6)*; and

iii) The annual surface water abstraction *(FDES 2.6.2.b)* as a percentage of the country's long-term annual average surface water resources available for abstraction. The latter is calculated as the total fresh water resources (external inflow plus precipitation less evapotranspiration) less groundwater available for abstraction *(Precipitation: 2.6.1.a.1) – (Evapotranspiration: 2.6.1.b.1) + (Inflow from neighbouring territories: 2.6.1.a.2) – Groundwater stocks: 2.6.1.6).*

The indicator defines total fresh water abstraction as water removed from any fresh water source, either permanently or temporarily. Mine water and drainage water as well as water abstractions from precipitation are included, whereas water used for hydroelectricity generation (in situ use) is excluded. The minimum period taken into account for the calculation of long term annual averages (LTAA) is 20 years.

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[97] http://ec.europa.eu/eurostat/web/europe-2020-indicators/resource-efficient-europe

[98] Eurostat Resource Efficiency Scoreboard, Water productivity metadata. http://ec.europa.eu/eurostat/cache/metadata/EN/t2020_rd210_esmsip.htm

[99] Eurostat Resource Efficiency Scoreboard, Water exploitation index metadata, http://ec.europa.eu/eurostat/cache/metadata/EN/tsdnr310_esmsip.htm

6C2 OECD Green Growth Indicators[100]

OECD Green Growth Indicators capture the economy's production and consumption, and describe the interaction between the economy, the natural asset base and policy actions. Indicators related to water resources cover:

- **Long term annual average of renewable freshwater resources** (cubic metres per capita)
  Precipitation: 2.6.1.a.1 – Evapotranspiration: 2.6.1.b. + Inflow from neighbouring territories: 2.6.1.a.2.

- **Total freshwater abstractions per capita** *(FDES 2.6.2.a)* / total population
- **Intensity of freshwater resource use (water stress).** Total freshwater abstraction as % total available renewable resources. Note water used for hydroelectricity generation is excluded:
  Gross abstraction from groundwater and surface water bodies (2.6.2.a) / total available renewable freshwater resources (including transboundary flows) ((precipitation – evapotranspiration: 2.6.1.a.1 – 2.6.1.a.2) + (inflows from neighbouring territories: 2.6.1.a.2))

- **Intensity of freshwater resource use (water stress).** Total freshwater abstraction as % total internal renewable resources. *Gross abstraction from groundwater and surface water bodies (2.6.2.a) / internal renewable freshwater resources (precipitation – evapotranspiration: 2.6.1.a.1-2.6.1.b.1)*

6C3 Other OECD indicators[101]

- Abstractions of water by the economic activities and households as percentage of total renewable water resources:
  Total water abstraction (2.6.2a.) by economic activity and households / Total renewable water resources: ((2.6.1.a.1) – (2.6.1.b.1)) + (2.6.1.a.2).

- Amount of water used by the economic sectors and households:
  Water used by economic sector and households (FDES 2.6.2.h, by sector) / total water use (2.6.2.h)

- Abstractions per capita:[102]
  Total water abstraction (2.6.2.a) / population of country

- Proportion of water abstracted that is lost in the water supply network, expressed as a percentage. Losses of water:
  Water losses: 2.6.2.k/total water abstraction: 2.6.2.a

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[100] http://www.oecd.org/greengrowth/greengrowthindicators.htm and http://stats.oecd.org/Index.aspx?DataSetCode=GREEN_GROWTH and http://www.oecd-ilibrary.org/sites/9789264185715-en/01/05/index.html?itemId=/content/chapter/9789264185715-9-en

[101] United Nations Statistics Division (2014) *DRAFT Guidelines for the Compilation of Water Accounts and Statistics* http://unstats.un.org/unsd/envaccounting/WCG14.pdf

[102] OECD (2015) *Environment at a Glance 2015: OECD Indicators*, OECD Publishing, Paris, http://www.keepeek.com/Digital-Asset-Management/oecd/environment/environment-at-a-glance-2015_9789264235199-en#.WH_TC8tOm70#page35

- Total Renewable Water Resources Dependency Ratio*:*
  Renewable water resources originating outside the country (Inflow from neighbouring territories: 2.6.1.a.2) / Total Renewable Water Resources (Precipitation: 2.6.1.a.1 – Evapotranspiration: 2.6.1.b.1 + Inflow from neighbouring territories: 2.6.1.a.2).

- Water productivity by economic activity*:*
  Gross Value added to Water Abstractions: 2.6.2.a or Water Use: 2.6.2.h / Gross Value Added by economic activity

6D. SDG indicators that incorporate these statistics

SDG indicators related to water resources, abstraction, use and returns fall under target 6.4: by 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity.

Indicator 6.4.1: Change in water-use efficiency over time is currently a Tier III indicator which is under development. The indicator will measure the output over time of a given major sector per volume of water withdrawn.[103]

Indicator 6.4.2: Level of water stress: freshwater withdrawal as a proportion of available freshwater resources (also known as water withdrawal intensity), calculated as:

$$\frac{total\ freshwater\ withdrawn\ by\ all\ major\ sectors\ (TWW)}{total\ renewable\ freshwater\ resources, actual\ (TRWR) - environmental\ water\ requirements (Env.)} * 100$$

Total freshwater withdrawn (TWW) = volume of freshwater extracted from its source (rivers, lakes, aquifers) for agriculture, industries and municipalities. Includes primary freshwater (not withdrawn before), secondary freshwater (previously withdrawn and returned to rivers and groundwater, such as discharged wastewater and agricultural drainage water) and fossil groundwater. It does not include non-conventional water, i.e. direct use of treated wastewater, direct use of agricultural drainage water and desalinated water. Total freshwater withdrawal is in general calculated as being the sum of total water withdrawal by sector (2.6.2.a and 2.6.2.g) minus direct use of wastewater, direct use of agricultural drainage water and use of desalinated water.[104]

Total renewable freshwater resources (TRWR) = sum of internal and external renewable water resources. Internal renewable water resources = long term annual average flow of rivers and recharge of groundwater from endogenous precipitation (2.6.1.a-2.6.1.b). External renewable water resources, actual = flows of water entering

[103] UNSD (2016) *Workplans for Tier III Indicators*, 3 March 2017, https://unstats.un.org/sdgs/files/meetings/iaeg-sdgs-meeting-05/TierIII_Work_Plans_03_03_2017.pdf

[104] The FAO term total freshwater withdrawn includes reused water, while FDES does not include reused water in total water abstraction.

the country (i.e. inflows), taking into consideration the quantity of inflows reserved to upstream and downstream countries through agreements or treaties (2.6.1a.2 and 2.6.1.a.4).[105]

Environmental water requirements = the quantities of water required to sustain freshwater and estuarine ecosystems (not included in FDES).

The sectors used by the indicator are defined as municipal (including domestic), industrial and agricultural, rather than the ISIC economic sectors.

[105] The FAO term total renewable freshwater resources of the indicator differs from that in this methodology sheet (termed renewable water resources), in that it excludes quantities reserved for upstream or downstream countries which is secured through treaties or agreements.

F D E S

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