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

Wastewater Statistics

(Topics 3.2.1: Generation and pollutant content of wastewater
3.2.2: Collection and treatment of wastewater
3.2.3: Discharge of wastewater to the environment)

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

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Methodology sheet of the Basic Set of Environment Statistics of the FDES

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https://unstats.un.org/unsd/envstats/fdes.cshtml

Acknowledgement

The Manual on the Basic Set of Environment Statistics consists of a series of methodology sheets for the collection or compilation of all environment statistics embedded in the FDES 2013. The work on the Manual of the Basic Set of Environment Statistics is being coordinated by UNSD and is being carried out in a collaborative way with the Expert Group on Environment Statistics and other thematic experts from specialized agencies.

This methodology sheet offers detailed and in-depth methodological guidance including definitions, classifications, statistical methods for collection and/or compilation, dissemination and main uses of the sets of statistics on wastewater statistics. These aspects are provided by the standards and guidelines established by the lead agencies in the field which ensures that the methodology sheets utilize established international best practices. In addition, the sheet contains updates of terminology, definitions, tiers, references and classifications which will be taken into account in future revisions of the FDES 2013.

This methodology sheet was drafted by UNSD. Expert comments and contributions were provided by the Expert Group of Environment Statistics as well as the European Environment Agency, Eurostat, the Food and Agriculture Organization of the United Nations (FAO), the Organisation for Economic Cooperation and Development (OECD), UN-HABITAT, and the World Health Organization (WHO).

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Component 3: Residuals

Subcomponent 3.2: Generation and Management of Wastewater

Topic 3.2.1: Generation and pollutant content of wastewater

	Statistics and Related Information (**Bold Text - Core Set/Tier 1**; Regular Text - Tier 2; *Italicized Text - Tier 3*)	**Category of Measurement**	**Potential Aggregations and Scales**	**Methodological Guidance**
a.	**Volume of wastewater generated**	Volume	▪ By ISIC economic activity ▪ By tourists ▪ National ▪ Sub-national	▪ UNSD: IRWS ▪ ISIC Rev. 4, Section E, Divisions 35-37 ▪ SEEA Water ▪ UNSD: Environment Statistics Section-Water Questionnaire
b.	Pollutant content of wastewater	Mass	▪ By pollutant or pollution parameter (e.g., biochemical oxygen demand (BOD), chemical oxygen demand (COD), nitrogen, phosphorous, total suspended solids (TSS)) ▪ By ISIC economic activity ▪ National ▪ Sub-national	

Topic 3.2.2: Collection and treatment of wastewater

a.	**Volume of wastewater collected**	Volume	▪ National ▪ Sub-national	▪ UNSD: IRWS ▪ ISIC Rev. 4, Section E, Division 35 and 36 ▪ UNSD: Environment Statistics Section-Water Questionnaire
b.	**Volume of wastewater treated**	Volume	▪ By treatment type (e.g., primary, secondary, tertiary) ▪ National ▪ Sub-national	
c.	Total urban wastewater treatment capacity			
	1. Number of plants	Number		
	2. Capacity of plants	Volume		
d.	Total industrial wastewater treatment capacity			

	1. Number of plants	Number		
	2. Capacity of plants	Volume		
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a.	Wastewater discharge		▪ By treatment type (e.g., primary, secondary, tertiary) ▪ By recipient (e.g., surface water, groundwater, wetland, sea, land) ▪ By ISIC economic activity ▪ National ▪ Sub-national ▪ By source (point/non-point source)	▪ UNSD: IRWS ▪ ISIC Rev. 4, Section E, Division 35 and 36 ▪ UNSD: Environment Statistics Section-Water Questionnaire
	1. Total volume of wastewater discharged to the environment after treatment	Volume		
	2. Total volume of wastewater discharged to the environment without treatment	Volume		
b.	Pollutant content of discharged wastewater	Mass	▪ By pollutant or pollution parameter (e.g., BOD, COD, nitrogen, phosphorous) ▪ National ▪ Sub-national ▪ Net emission by ISIC economic activity ▪ By source (point/non-point source)	

2. Introduction/Relevance

In an increasingly urbanized and populated world where demand for water is ever increasing, the addressing of wastewater-related issues requires urgent attention. Perhaps more so than ever, during this unprecedented global pandemic time, the availability of reliable, accurate, and relevant wastewater statistics is gaining long-overdue importance and re-dedication around the world. Much interest has been paid to the SARS-CoV-2 virus and other pathogens' viability in freshwater, tap water and wastewater under various environmental conditions.[1,2,3] Water and wastewater data will play a vital role in monitoring viral pandemics in the coming years, and there will surely be strong demand for enhanced data availability, quality, capacity and international collaboration. Furthermore, impacts arising from climate change mean storm and wastewater management are requiring increasing attention from a climate change adaptation perspective.[4] Notions of sustainable water management and an increased focus on a circular economy are gaining much traction and adding to the demand for wastewater statistics for informed policy decision-making, as is the emphasis on water reuse regulations in Europe, which encourage circular approaches to water reuse in agriculture.[5]

An overwhelming majority of wastewater is released to the environment with less than ideal levels of treatment which results in degraded aquatic ecosystems, increased waterborne illnesses, contaminated freshwater supply, etc., all of which have adverse impacts on the environment, society and economy.

If wastewater management is to be improved, potential benefits in addition to those obvious ones leading to direct improved environmental health in the immediate vicinity, are the financial returns which potentially cover all operational costs concerning wastewater management. Such financial benefits can stem from resource recovery from these facilities in the form of energy, nutrients, reusable water, and biosolids, all of which contribute to the sustainability of these systems and the water utilities operating them.

In order to effectively and swiftly respond to the challenge brought by the COVID-19 pandemic, in the near term countries must realize that wastewater generation, collection and treatment is not only important to the watersheds, ecological systems, and the environment, but is also an integrated component of a public health system. The treatment level, and quality of the wastewater discharges are directly linked to the pathogens of this pandemic or the next, which have tremendous implications to entire countries and the globe. A competent national network to collect and monitor quantitative, but also qualitative, wastewater statistics has never been so urgently needed.

Longer term and with a view toward achieving sustainable practices, there is need for a paradigm shift toward business models whereby private investment in infrastructure together with improved efficiency of public financing to promote sustainable service delivery is realised. For such a realisation to occur, the cost associated with neglecting any attention toward wastewater treatment must be factored into consideration by policy makers together with benefits from resource recovery.[6]

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[1] Willemijn Lodder, Ana Maria de Roda Husman, SARS-CoV-2 in wastewater: potential health risk, but also data source, The Lancet, 2020, Vol 5 Issue 6, 533-534. DOI: https://doi.org/10.1016/S2468-1253(20)30087-X (accessed 14 March 2022).

[2] Smriti Mallapaty, How sewage could reveal true scale of coronavirus outbreak, Nature, 2020, http://igims.org/Datafiles/cms/COVID%2017.pdf (accessed 14 March 2022).

[3] Anila Venugopal, et al, Novel wastewater surveillance strategy for early detection of coronavirus disease 2019 hotspots, Current Opinion in Environmental Science & Health, 2020, 17:8-13, https://www.sciencedirect.com/science/article/pii/S2468584420300362 (accessed 14 March 2022).

[4] Intergovernmental Panel on Climate Change, AR5 Synthesis Report: Climate Change 2014, available at: https://www.ipcc.ch/site/assets/uploads/2018/02/SYR_AR5_FINAL_full.pdf see page 27 (accessed 14 March 2022).

[5] European Commission, Circular Economy Action Plan (document 52020DC0098, available at: https://eur-lex.europa.eu/resource.html?uri=cellar:9903b325-6388-11ea-b735-01aa75ed71a1.0017.02/DOC_1&format=PDF (accessed 14 March 2022).

[6] World Bank, Damania, Richard; Desbureaux, Sébastien; Rodella, Aude-Sophie; Russ, Jason; Zaveri, Esha. 2019. Quality Unknown: The Invisible Water Crisis. Washington, DC, https://openknowledge.worldbank.org/handle/10986/32245 (accessed 14 March 2022).

At time of writing, there is a notable lack of timely wastewater data that cover the various source of generation, including households, services, and industrial wastewater, which contributes to the difficulty in managing wastewater. At the same time, addressing the issue of wastewater management is clearly gaining interest via policy demands. The Sustainable Development Goal (SDG) indicator 6.3.1: "Proportion of domestic and industrial wastewater flow safely treated", has drawn attention from multiple international institutions and country level administrations and organizations, both governmental and otherwise. This indicator has recently been upgraded from a Tier III SDG indicator to Tier II, which indicates that the indicator is now "conceptually clear, has an internationally established methodology and standards are available, but data are not regularly produced by countries."[7] To adapt to this change, stakeholders are increasingly assigning resources toward using statistics to measure wastewater (by volumes generated, treated, discharged to the environment, etc.) in order to make better-informed policy decisions.

Practices among more advanced countries is revealing a movement toward the promotion of measures needed to make a paradigm shift toward sustainable service delivery a reality.[8] Such practices include advocating for adequate legislation, innovative financing, inter-sectoral regulations and policies and integrated basin planning. A holistic approach (e.g., analysis of a basin or watershed that considers the end-to-end passage of water from precipitation, surface and groundwater abstraction, supply and use, to wastewater generation, treatment and discharge) rather than a siloed one (e.g., analysis of an individual wastewater treatment plant's finance sheet) is increasing in popularity.

A set of globally harmonized, standardized definitions on the various components of wastewater flows is a key starting point and foundation to ensure the wastewater data from around the world are comparable, compatible, and in good quality. In the UNSD/UNEP Questionnaire on Environment Statistics' definition, "Total wastewater" consists of all agricultural, industrial and domestic flows, with the exception of non-point agricultural activities and cooling water (ISIC class 3530).[9] In principle, domestic wastewater includes wastewater generated by services (ISIC codes 45-96) and wastewater generated by private households. However, because of the difficulty to separate service wastewater from household wastewater, at present, "domestic wastewater" is taken as the combination of wastewater produced by services and by households. It should also be noted that, other international organization that collect wastewater data may have harmonized, yet not identical, definitions for domestic and household wastewater.

The successful compilation and monitoring of wastewater statistics is not a task that can be accomplished by a single country, ministry, or one international institution alone. Instead, it requires a truly global collaboration. Take one SDG indicator for example, indicator 6.3.1: "Proportion of domestic and industrial wastewater flow safely treated." In order to compile data for this indicator, multiple national and international entities have to be mobilized altogether. The Indicator has two equally important components: domestic wastewater flow, and industrial (non-domestic) wastewater flow. For the domestic component, data need to be compiled and extracted from official open sources and national statistical offices, or even from municipal level government sources, then validated through country consultations with responsible line ministries, institutions, and authorities, with support from UNICEF and WHO regional and country offices. For its industrial (non-domestic) component, data need to be compiled and extracted from official open sources, collected and analysed by UNSD, UNEP, OECD and Eurostat, and complemented through regional and country consultations. No entity could achieve all this single-handedly.

Not only do wastewater statistics require international collaboration among different institutions, they should also be viewed as an integrated, holistic part of the water cycle. Wastewater is not only crucial to every aquatic ecosystem and watershed, it is also closely knitted with other environmental components, including air, greenhouse gas emissions, soil, energy, agriculture, etc. Water will be one of the most scarce and valuable natural resources in the 21st century, and water stress has already been raised to record high levels in many regions, with countries, municipalities, and local residences competing over ever limited

[7] IAEG-SDGs, Tier Classification for Global SDG Indicators, https://unstats.un.org/sdgs/iaeg-sdgs/tier-classification/ (accessed 14 March 2022).
[8] UNESCO, Water Reuse within a Circular Economy Context, https://unesdoc.unesco.org/ark:/48223/pf0000374715.locale=en (accessed 14 March 2022).
[9] Rainwater run-off as a non-point source is also extremely difficult to measure and is another known exception.

water resources.[10] The accelerated impacts of climate change, in particular the irregular and unequal distribution of precipitation, will only further worsen the water stress for many countries.[11] This risks de-stabling peace and growth, inducing conflicts and creating humanitarian crises in some of the most vulnerable regions of the world. Wastewater is therefore much more than just a water issue.

This methodology sheet is closely related to those also available on the UNSD website on water resources[12] and on marine water quality.[13] The definitions, classifications and terminologies used throughout this methodology sheet have taken into consideration those applicable to SDG indicator 6.3.2: Proportion of bodies of water with good ambient water quality.[14]

[10] Subramanian, Ashok, Bridget Brown, and Aaron Wolf. Reaching Across the Waters: Facing the Risks of Cooperation in International Waters. Washington DC: The World Bank Press, 2012. http://documents1.worldbank.org/curated/en/135061468337194710/pdf/717480WP0WPS0B0aching0Across0Waters.pdf (accessed 14 March 2022).

[11] World Water Development Report 2020 – Water and Climate Change, UNESCO, https://en.unesco.org/themes/water-security/wwap/wwdr/2020 (accessed 14 March 2022).

[12] United Nations Statistics Division, Manual on the Basic Set of Environment Statistics – Water Resources Statistics, https://unstats.un.org/unsd/environment/FDES/MS%202.6%20Water%20Resources.pdf (accessed 14 March 2022).

[13] United Nations Statistics Division, Manual on the Basic Set of Environment Statistics – Marine Water Quality Statistics, https://unstats.un.org/unsd/envstats/fdes/MS1.3.3_Marinewaterquality.pdf (accessed 14 March 2022).

[14] United Nations Statistics Division, SDG indicator metadata, SDG indicator 6.3.2: Proportion of bodies of water with good ambient water quality, https://unstats.un.org/sdgs/metadata/files/Metadata-06-03-02.pdf (accessed 14 March 2022).

3. Definitions and description of the statistics

Wastewater and related statistics have been collected at the international level by Eurostat, OECD and UNSD for some decades, focusing on the volumes of wastewater generated, collected, treated or discharged; number and treatment capacity of treatment plants; and pollutant content of wastewater. All three international institutions have contributed to these international collections and the data collected form an invaluable basis for informing on the status of wastewater and related statistics in all UN member states. Refer to section 4C of this methodology sheet for references to these three institutions' which regularly publish outputs on wastewater and related statistics.

The publication of the Framework for the Development for Environment Statistics and its Basic Set of Environment Statistics in 2013 took into full consideration the existing status of wastewater statistics as collected to that point in time, by the three international institutions.

Following below are definitions and descriptions of the wastewater statistics sourced from either:

1. Topics 3.2.1: Generation and pollutant content of wastewater, 3.2.2: Collection and treatment of wastewater, and 3.2.3: Discharge of wastewater to the environment; of the Basic Set of Environment Statistics; or
2. The UNSD/UNEP Questionnaire on Environment Statistics (water section).

Many, but not all the definitions contained in this methodology sheet feature in the UNSD/UNEP Questionnaire.

3A. Generation and pollutant content of wastewater (FDES 3.2.1)

Volume of wastewater generated (FDES 3.2.1.a)
Refer to the definitions of wastewater and total wastewater generated below. When making reference to volume, the standard measurement is in metres cubed. Different organisation measure volume in either thousands of metres cubed per day or millions of metres cubed per year.

Remarks

- **Wastewater:** Wastewater is water which is of no further value to the purpose for which it was used because of its quality, quantity or time of occurrence.

However, wastewater from one user can be a potential supply to another user elsewhere. For instance, treated wastewater can be used for agricultural irrigation.[15]

1. **Total wastewater generated:** Total wastewater generated is the total volume of wastewater generated by economic activities (agriculture, forestry and fishing; mining and quarrying; manufacturing; electricity, gas, steam and air

[15] Food and Agriculture Organization of the United Nations, AQUASTAT, FAO's Global Information System on Water and Agriculture, available at: https://www.fao.org/aquastat/en/databases/glossary/ (accessed 14 March 2022).

conditioning supply; construction; and other economic activities) and households. Cooling water is excluded as it is not considered to be wastewater.[16]

Pollutant content of wastewater (FDES 3.2.1.b)

Pollutant content of wastewater can usually be obtained from monitoring at the place of generation or from estimates based on technological parameters. e.g., biochemical oxygen demand (BOD), chemical oxygen demand (COD), nitrogen, phosphorous, total suspended solids (TSS). Where possible, the quality of the wastewater discharged in the environment is routinely evaluated by utilities, by analysing the concentrations of some contaminants released in the treated effluents, i.e., individual substances and groups of substances (e.g., total nitrogen and phosphorus), or parameters (e.g., BOD or COD) dependent on measurement methods. Based on the wastewater flow, the mass of pollutants discharged to the environment can be thereby estimated from four main sources: domestic sector, industry, agriculture and non-point sources (OECD/Eurostat, 2018).

3B. Collection and treatment of wastewater (FDES 3.2.2)

Volume of wastewater collected (FDES 3.2.2.a)

Wastewater may be discharged directly to the environment by the generator or may be collected in sewerage systems and treated in wastewater treatment plants (urban, industrial or other). This topic includes statistics describing volumes of wastewater collected and transported to its final place of discharge or treatment facilities.

Volume of wastewater treated (FDES 3.2.2.b)

This topic includes: volume of wastewater treated by type of treatment (primary, secondary and tertiary); physical infrastructure related to wastewater collection and treatment (e.g., number of treatment plants and capacities of plants); and pollutant content extracted in the treatment facilities.

Remarks

- **Urban wastewater treatment:** Urban wastewater treatment is all treatment of wastewater in urban wastewater treatment plants (UWWTP's). UWWTP's are usually operated by public authorities or by private companies working by order of public authorities. Includes wastewater delivered to treatment plants by trucks. UWWTP's are classified under ISIC 37 (Sewerage).[17]

- **Other wastewater treatment:** Treatment of wastewater in any non-public treatment plant, i.e., industrial wastewater treatment plants (IWWTP). Excluded from "other wastewater treatment" is the treatment in septic tanks. IWWTPs may also be classified under ISIC 37 (Sewerage) or under the main activity class of the industrial establishment they belong to.[18]

- **Independent wastewater treatment:** Collection, preliminary treatment, treatment, infiltration or discharge of domestic wastewater from dwellings generally between 1 and 50 population equivalents, not connected to a wastewater collection system. An example is septic tanks. Excluded from here are systems with storage tanks from which the wastewater is transported periodically by trucks to a wastewater treatment plant which are part of urban wastewater treatment.[19]

[16] United Nations Statistics Division/United Nations Environment Programme (2020), UNSD/UNEP Questionnaire 2020 on Environment Statistics, https://unstats.un.org/unsd/envstats/questionnaire (accessed 14 March 2022).
[17] *Ibid.*
[18] *Ibid.*
[19] *Ibid.*

- **Primary wastewater treatment:** Treatment of wastewater by a physical and/or chemical process involving settlement of suspended solids, or other process in which the biochemical oxygen demand (BOD_5) of the incoming wastewater is reduced by at least 20% before discharge and the total suspended solids of the incoming wastewater are reduced by at least 50%. To avoid double counting, water subjected to more than one type of treatment should be reported under the highest level of treatment only.[20]

- **Secondary wastewater treatment:** Post-primary treatment of wastewater by a process generally involving biological or other treatment with a secondary settlement or other process, resulting in a biochemical oxygen demand (BOD_5) removal of at least 70% and a chemical oxygen demand (COD) removal of at least 75%. To avoid double counting, water subjected to more than one type of treatment should be reported under the highest level of treatment only.[21]

- **Tertiary wastewater treatment:** Treatment (additional to secondary treatment) of nitrogen and/or phosphorous and/or any other pollutant affecting the quality or a specific use of water: microbiological pollution, colour etc. The different possible treatment efficiencies ('organic pollution removal' of at least 95% for BOD_5, 85% for COD, 'nitrogen removal' of at least 70%, 'phosphorous removal' of at least 80% and 'microbiological removal') cannot be added and are exclusive. To avoid double counting, water subjected to more than one type of treatment should be reported under the highest level of treatment only.[22]

- **Sewage sludge production (dry matter):** The accumulated settled solids, either moist or mixed, with a liquid component as a result of natural or artificial processes, that have been separated from various types of wastewater during treatment. Data on dry weight should be provided.[23]

Total urban wastewater treatment capacity; Number of plants (3.2.2.c.1)
A count of the urban wastewater treatment plants.

Total urban wastewater treatment capacity; Capacity of plants (3.2.2.c.2)
Expressed in volume (either millions of metres cubed per day, or millions of metres cubed per year).

Total industrial wastewater treatment capacity; Number of plants (3.2.2.c.1)
A count of the industrial wastewater treatment plants.

Total industrial wastewater treatment capacity; Capacity of plants (3.2.2.c.2)
Expressed in volume (either millions of metres cubed per day, or millions of metres cubed per year).

3C. Discharge of wastewater to the environment (FDES 3.2.3)

Discharge of wastewater to the environment; Total volume of wastewater discharged to the environment after treatment (FDES 3.2.3.a.1)
As implied, and apply as relevant, definitions above for: “Volume of wastewater generated”; “Wastewater” “Total wastewater generated”; “Primary wastewater treatment”; “Secondary wastewater treatment”; and “Tertiary wastewater treatment”.

Discharge of wastewater to the environment; Total volume of wastewater discharged to the environment without treatment (FDES 3.2.3.a.2)

[20] *Ibid.*
[21] *Ibid.*
[22] *Ibid.*
[23] *Ibid.*

As implied, and apply as relevant, definitions above for: “Volume of wastewater generated”; “Wastewater”; and “Total wastewater generated”.

Discharge of wastewater to the environment; Pollutant content of discharged wastewater (FDES 3.2.3.b)

As implied, and apply as relevant, definitions above for: “Pollutant content of wastewater”.

Remarks

Reused water is a related term, which is defined as: Used water directly received from another user with or without treatment for further use. It also includes treated wastewater received for further use from treatment plants. Excludes water discharged into a watercourse and used again downstream. Excludes recycling of water within industrial sites.

At present, per the structure of the UNSD/UNEP Questionnaire on Environment Statistics, reused water falls within the scope of freshwater abstraction and use.

4. International sources and recommendations

4A. Classifications and groupings

In so far as all economic activities and the International Standard Industrial Classification of All Economic Activities (ISIC Rev. 4)[24] is concerned, all economic activity related to the collection and treatment of wastewater (FDES topic 3.2.2), and the discharge of wastewater to the environment (FDES topic 3.2.3) is contained within Division 37: Sewerage. Per ISIC, this division includes the operation of sewer systems or sewage treatment facilities that collect, treat, and dispose of sewage.

However, with respect to generation and pollutant content of wastewater (FDES topic 3.2.1), the economic activity of all industries is within scope.

Some of the statistics referenced in this methodology sheet which refer to pollutant content are measured in terms of mass, e.g., pollutant content of wastewater and pollutant content of discharged wastewater. While no classification or grouping is provided for expressing mass in absolute terms, refer to definitions in section 3B of this document for primary, secondary and tertiary treatment. Those definitions spell out percentage removal of, for instance, biochemical oxygen demand, that corresponds to one of the three treatment levels.

4B. Reference to international statistical recommendations, frameworks and standards

- **Framework for the Development of Environment Statistics (FDES 2013)[25]**: Chapter 3, Component 3, Sub-component 3.2 Generation and Management of Wastewater. This includes statistics on generation and pollutant content of wastewater, collection and treatment of wastewater, collection and treatment of wastewater, and discharge of wastewater to the environment.

- **The United Nations Statistics Division/United Nations Environment Programme Questionnaire on Environment Statistics**[26], section on Water: The questionnaire is used as the instrument for the biennial data collection of environment statistics carried out by UNSD. One table in particular, table W4: Wastewater Generation and Treatment, collects statistics on wastewater.

- **Manual on the Basic Set of Environment Statistics of the FDES 2013 - Water Resources Statistics**[27]: This is a related methodology sheet to this one which focuses on water resources statistics.

[24] United Nations, Department of Economic and Social Affairs, Statistics Division, International Standard Industrial Classification of All Economic Activities (ISIC Rev. 4), 2008, https://unstats.un.org/unsd/publication/seriesm/seriesm_4rev4e.pdf (accessed 14 March 2022).
[25] United Nations, Framework for the Development of Environment Statistics (FDES), 2013, https://unstats.un.org/unsd/envstats/fdes.cshtml (accessed 14 March 2022).
[26] United Nations Statistics Division/United Nations Environment Programme Questionnaire 2020 on Environment Statistics, https://unstats.un.org/unsd/envstats/questionnaire (accessed 14 March 2022).
[27] United Nations, Manual on the Basic Set of Environment Statistics of the FDES 2013 - Water Resources Statistics, https://unstats.un.org/unsd/environment/FDES/MS%202.6%20Water%20Resources.pdf (accessed 14 March 2022).

- **Manual on the Basic Set of Environment Statistics of the FDES 2013 - Marine Water Quality Statistics**[28]: This is a related methodology sheet to this one which focuses on marine water quality statistics.

- **International Recommendations for Water Statistics**[29] (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 broadly aligned with the UN-FDES, SEEA Water, the United Nations Statistics Division/United Nations Environment Programme Questionnaire on Environment Statistics (section: Water), the OECD/Eurostat Joint Questionnaire on Inland Waters and FAO Aquastat. There is ongoing international work progressing toward better aligning these methodologies.

- **System of Environmental-Economic Accounting for Water (SEEA Water)**[30] (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** [31] (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).

- **Progress on Wastewater Treatment: The SDG Indicator 6.3.1 Report**[32]: This report presents a summary of available data on total wastewater generated and treated, as well as separate analyses for wastewater from industrial sources and households.

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

For European Union member states, candidates, and potential candidates, data are available at Eurostat's database online: https://ec.europa.eu/eurostat/data/database. Available data include tables on: Treatment capacity of wastewater treatment plants, in terms of biochemical oxygen demand (BOD_5); wastewater treatment plants by treatment level; sewage sludge production and disposal; generation and discharge of wastewater in volume[33]; generation and discharge of wastewater by pollutant.

[28] United Nations, Manual on the Basic Set of Environment Statistics of the FDES 2013 - Marine Water Quality Statistics, https://unstats.un.org/unsd/envstats/fdes/MS1.3.3_Marinewaterquality.pdf (accessed 14 March 2022).
[29] United Nations, International Recommendations for Water Statistics, ST/ESA/STAT/SER.M/91, 2012, https://seea.un.org/content/seea-water (accessed 14 March 2022).
[30] United Nations, System of Environmental-Economic Accounting for Water (SEEA-Water), ST/ESA/STAT/SER.F/100, https://seea.un.org/content/seea-water (accessed 14 March 2022).
[31] United Nations, Guidelines for the Compilation of Water Accounts and Statistics (Draft), https://seea.un.org/sites/seea.un.org/files/guidelines_comp_water_stats_en.pdf (accessed 14 March 2022).
[32] Progress on Wastewater Treatment – 2021 Update, https://www.unwater.org/publications/progress-on-wastewater-treatment-631-2021-update/ (accessed 14 March 2022).
[33] Eurostat, Generation and discharge of wastewater in volume, http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=env_ww_genv&lang=en (accessed 14 March 2022).

For OECD member states, data are available at OECD's database online: https://stats.oecd.org/. Available data include tables on: Wastewater treatment; treatment capacity of wastewater treatment plants, generation and discharge of wastewater.[34] OECD also has a dedicated page with data, definitions, publications, data sources and references for all indicators concerning wastewater at https://data.oecd.org/water/waste-water-treatment.htm.

For FAO member states, available data are at the AQUASTAT country statistic database: http://www.fao.org/aquastat/statistics/query/index.html?lang=en. Available data include: produced municipal wastewater, collected municipal wastewater, treated municipal wastewater, number of municipal wastewater treatment facilities, capacity of the municipal wastewater treatment facilities, not treated municipal wastewater, treated municipal wastewater discharged (secondary water), not treated municipal wastewater discharged (secondary water), direct use of treated municipal wastewater, direct use of treated municipal wastewater for irrigation purposes, direct use of not treated municipal wastewater for irrigation purposes, area equipped for irrigation by direct use of treated municipal wastewater, area equipped for irrigation by direct use of not treated municipal wastewater.

For all UN member states, available data are at the UNSD webpage: https://unstats.un.org/unsd/envstats/qindicators, under the tab "Inland Water Resources". Available data includes tables on:

- wastewater generated (time series and latest year);
- wastewater treated in (i) urban treatment plants; (ii) other treatment plants; and (iii) independent treatment facilities; non-treated wastewater (time series and latest year);
- non-treated wastewater (latest year);
- percentage of total wastewater generated which is treated (latest year);
- population connected to wastewater collecting system (time series); and
- population connected to wastewater treatment (time series).

Country by country wastewater data can also be found at: https://unstats.un.org/unsd/envstats/country_files.

For all four data sources mentioned above, data availability is not at all comprehensive and in many cases, rather sporadic (See Figure 1 and 2 in Section 6). Many known issues remain such as difficulty in aggregating wastewater plants' data to the national level, disconnect between national statistical offices and municipal level wastewater treatment plants, etc. Continued international collaboration is crucial to provide a greater scope and coverage of wastewater data in the future.

Furthermore, WHO estimate household wastewater generation for 234 countries, areas and regions. This represents a 100% global coverage. Data are reported by some countries, but for the majority of countries are estimated using a function of total population[35]; proportion of households with on- and off-site water supply[36]; average domestic water consumption for households with on- and off-site water supply[37]; and ratio of domestic water used that is translated into wastewater used.[38]

[34] OECD, Generation and discharge of wastewater, https://stats.oecd.org/Index.aspx?DataSetCode=WATER_DISCHARGE (accessed 14 March 2022).
[35] United Nations, Department of Economic and Social Affairs, World Population Prospects (2019 revision). https://population.un.org/wpp/ (accessed 14 March 2022).
[36] Joint Monitoring Programme (JMP) as per SDG Indicator 6.1.1.
[37] Assumptions or reported figures from national sources if available.
[38] World Health Organization, Progress on wastewater treatment - Global status and acceleration needs for SDG Indicator 6.3.1, available at: https://www.unwater.org/publications/progress-on-wastewater-treatment-631-2021-update/ refer page 13 (accessed 14 March 2022).

5. Data collection and sources of data

This section is drafted bearing in mind existing data collections being undertaken at the international level by Eurostat, OECD and UNSD. These international organizations have been at the forefront of data collection on water statistics (including wastewater statistics) in a coordinated manner at the international level for well over 20 years.

Scope

Scope for the purpose of this methodology sheet is in alignment with the topics 3.2.1, 3.2.2, and 3.2.3 of the Basic Set of Environment Statistics of the FDES.

The OECD and Eurostat sends a Joint Questionnaire on the State of the Environment – Inland Water to their respective member states. The Joint Questionnaire collects wastewater data aggregated to the national level. Specifically, indicators include percentages of national resident population connected to:

- urban wastewater treatment plants (UWWTP, i.e., public sewage treatment);
- a wastewater treatment plant (WWTP, and broken down by primary, secondary, tertiary and unspecified treatment);
- not connected to a WWTP (without treatment);
- independent wastewater treatment; and
- total connected to wastewater treatment.

Data on wastewater flow are collected by the OECD/Eurostat Joint Questionnaire. Flows are measured by generation from point sources (broken down by NACE rev. 2[39] industries (for which there is a correspondence to ISIC rev. 4) and discharge of wastewater. The volumes of wastewater generated, its treatment and discharge are collected. Further, BOD, COD contents are monitored in close detail, although increasing response rates for these variables remains a challenge. The following indicators are collected:

(1) Generation of wastewater, total and by source from:

- Agriculture;
- Industry: by mining and quarrying, construction, and manufacturing (food processing, basic metals, motor vehicles and transport equipment, textiles, paper and paper products, chemical products & refined petroleum); production and distribution of electricity (excluding cooling water);
- Domestic sector: by private households, and services sector.

(2) Treatment and discharge of wastewater:

- Urban wastewater;
    - Treated in WWTP
    - Discharged (by WWTP, independent treatment, or without treatment)
- Industrial wastewater;
    - Treated in “other” WWTP
    - Discharged (after “other” WWTP treatment, or without treatment)
- Agricultural wastewater;
    - direct discharges (including forestry and fisheries)

[39] Eurostat, European Commission, NACE Rev. 2, Statistical classification of economic activities in the European Community, available at: https://ec.europa.eu/eurostat/documents/3859598/5902521/KS-RA-07-015-EN.PDF (accessed 14 March 2022).

- Total discharges to inland waters;
- Total discharges to the sea.

(3) BOD, and (4) COD – generation of wastewater, total and by source from:

- Agriculture;
- Industry: by mining and quarrying, construction, and manufacturing (food processing, basic metals, Motor vehicles and transport equipment, Textiles, paper and paper products, chemical products & refined petroleum); Production and distribution of electricity (excluding cooling water);
- Domestic sector: by private households, and services sector.

FAO AQUASTAT sends an annual questionnaire to national correspondents, which collects data on municipal wastewater generated, collected and treated and also its use in agriculture.

Indicators	**Unit**
Produced municipal wastewater	10^9 m3/year
Collected municipal wastewater	10^9 m3/year
Treated municipal wastewater	10^9 m3/year
Direct use of treated municipal wastewater for irrigation	10^9 m3/year

In the current version of the biennial UNSD/UNEP Questionnaire on Environment Statistics (water section), these key wastewater indicators are collected. This Questionnaire is only sent to UN member states which are not a member (nor a candidate member) of the OECD and the European Union.

Indicators	**Unit**
Total wastewater generated	1000 m^3/day
By:	
Agriculture, forestry and fishing ISIC (01-03)	1000 m^3/day
Mining and quarrying (ISIC 05-09)	1000 m^3/day
Manufacturing (ISIC 10-33)	1000 m^3/day
Electricity, gas, steam and air conditioning supply (ISIC 35)	1000 m^3/day
of which by: Electric power generation, transmission and distribution (ISIC 351)	1000 m^3/day
Construction (ISIC 41-43)	1000 m^3/day
Other economic activities	1000 m^3/day
Households	1000 m^3/day
Wastewater treated in urban wastewater treatment plants	**1000 m^3/day**
Of which:	
Primary treatment	1000 m^3/day
Secondary treatment	1000 m^3/day
Tertiary treatment	1000 m^3/day
Wastewater treated in other treatment plants	**1000 m^3/day**
Of which:	
Primary treatment	1000 m^3/day
Secondary treatment	1000 m^3/day
Tertiary treatment	1000 m^3/day
Wastewater treated in independent treatment facilities	**1000 m^3/day**
Non-treated wastewater	1000 m^3/day
Sewage sludge production (dry matter)	1000 t /year

The following national coverage level data are collected by the UNSD/UNEP Questionnaire on Environment Statistics (water section):

Indicators	Unit
Population connected to wastewater collecting system	Percent
Population connected to wastewater treatment	Percent
of which: at least secondary treatment	Percent
Population with independent wastewater treatment (e.g., septic tanks)	Percent
Population not connected to wastewater treatment	Percent

Statistical unit

To the finest level of fragmentation, typically a municipal level wastewater treatment plant.

Measurement units

There are several very distinct measurement units applicable to the statistics of concern to this methodology sheet. Namely, (i) volume [often expressed in thousands of metres cubed per day; or millions of metres cubed per year]; (ii) mass (typically used for pollutant content of wastewater); (iii) number (most often, a simple count of the number of wastewater treatment plants); and (iv) percentage. Beyond the scope of this document, population equivalents (p.e.) can also be used as a guide for measuring wastewater treatment.

For converting measurement of volume between thousands of metres cubed per day (used in the UNSD/UNEP Questionnaire), and millions of metres cubed per year (used in the OECD/Eurostat Joint Questionnaire), a conversion factor can be applied.

To convert millions of metres cubed per year to thousands of metres cubed per day, multiply by 2.7397 (N.B. 2.7397 = 1,000/365). To convert in the opposite direction, multiply by 0.365 (N.B. 0.365 =365/1,000).

Sources

For aggregation to the national level, typically, collaboration among various levels of government (such as local or municipal, provincial or state, as well as national is necessary. This is to say that very often the root source of data may be from individual wastewater treatment plants, for instance, via administrative records. Alternatively, a national statistical office may have a survey or questionnaire specifically designed to collect data from wastewater treatment plants.

Institutions

As per the experience of UNSD collecting and validating data for wastewater, the most commonly involved institutions with data in its rawest form are municipal level wastewater treatment plants. It is imperative that these treatment plants have a good relationship with federal level government institutions (ideally with the national statistical office). There is every possibility that between municipal and federal level institutions, a state or provincial level institution may be involved in data aggregation or in facilitating liaisons between municipal and federal levels.

Aggregation

Temporal aggregation

Most of the wastewater data collected by international organizations by questionnaires are collected in thousands of cubic metres per day or millions of cubic metres per year. The BOD, COD components are collected in thousands of kilograms of oxygen (O_2) per day. Typically for dissemination, data are presented on an annual basis, and where required, the unit is converted to an annual basis.

Spatial aggregation

Data from the international organizations are aggregated to the national level.

Validation

Data are rigorously and regularly validated by the collecting institutions, including Eurostat, FAO, OECD, UNEP, UN-HABITAT, UNSD and WHO. An effectively run collaborating mechanism featuring regular teleconferences ensures harmonized definitions, data collecting timelines, and data validation among the institutions. This mechanism also aims to ensure minimum data reporting burden for all member states. This mechanism has proved to be successful in enabling a unified message communicated to countries with respect to wastewater statistics.

6. Uses and dissemination

6A. Potential presentation/dissemination formats

Figures 1-5 below are based on data collected via the UNSD/UNEP Questionnaire on Environment Statistics and the OECD/Eurostat Joint Questionnaire on Environment Statistics (wastewater data only).

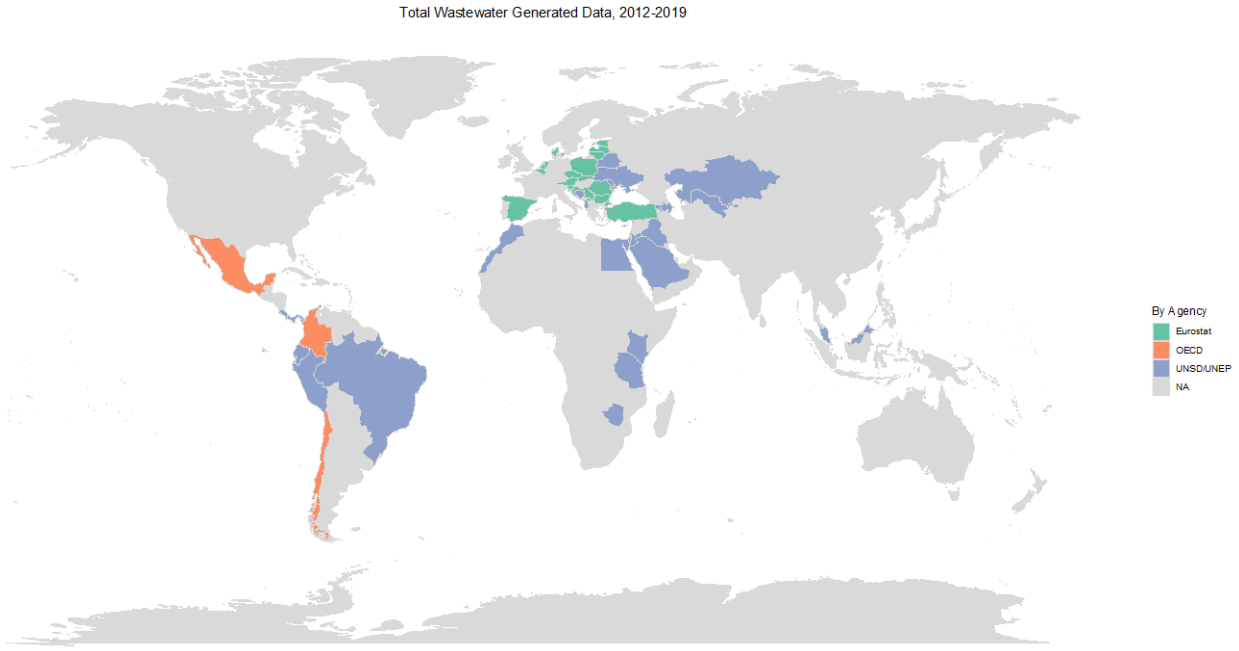


Figure 1. Countries with data available for total wastewater generated (2012-2019).

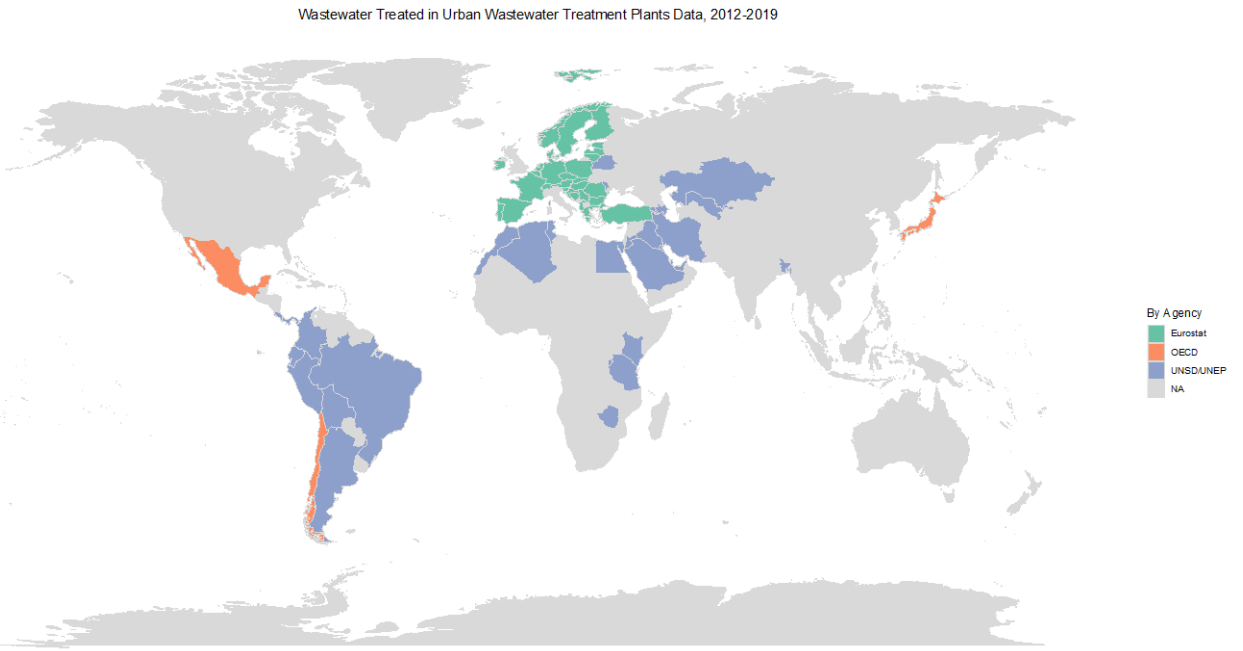
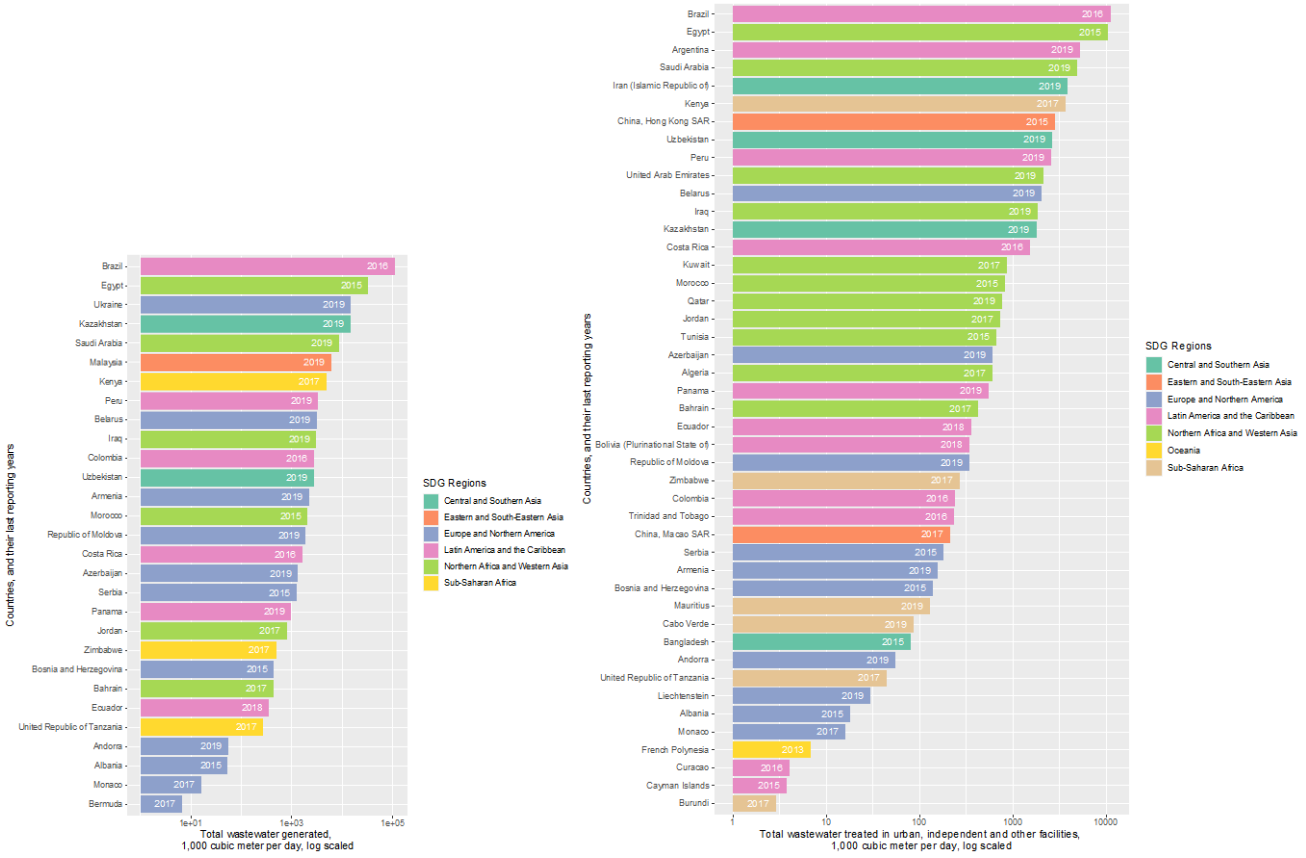


Figure 2. Countries with data available for wastewater treated in urban wastewater treatment plants (2012-2019).



Figures 3 & 4. “Total Wastewater Generated” (volumes) and “Wastewater Treated in Urban Wastewater Treatment Plants” (volumes).

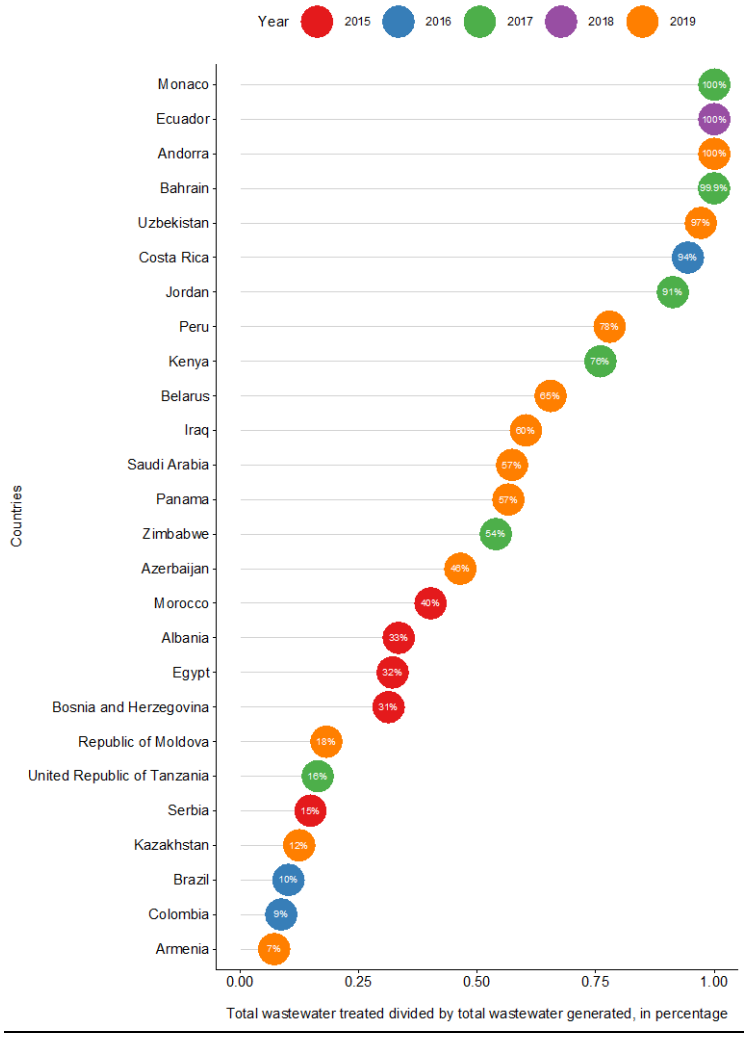
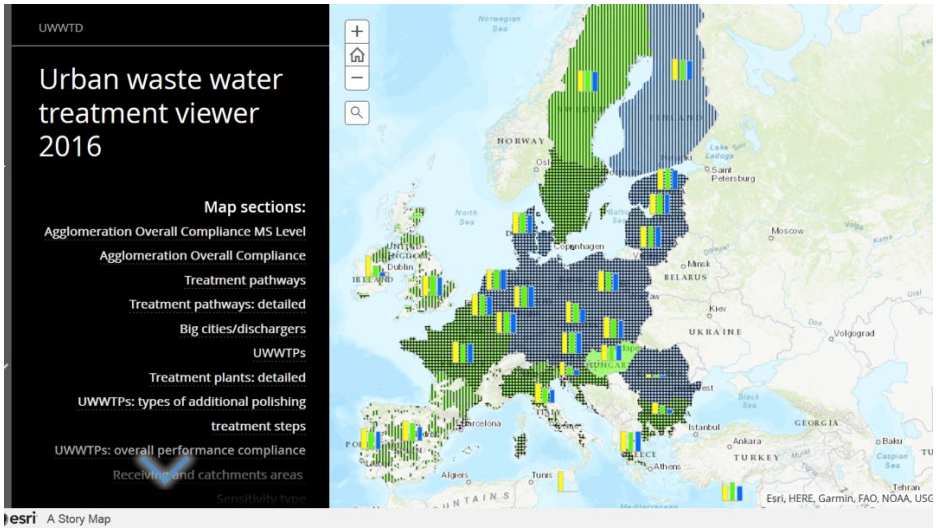


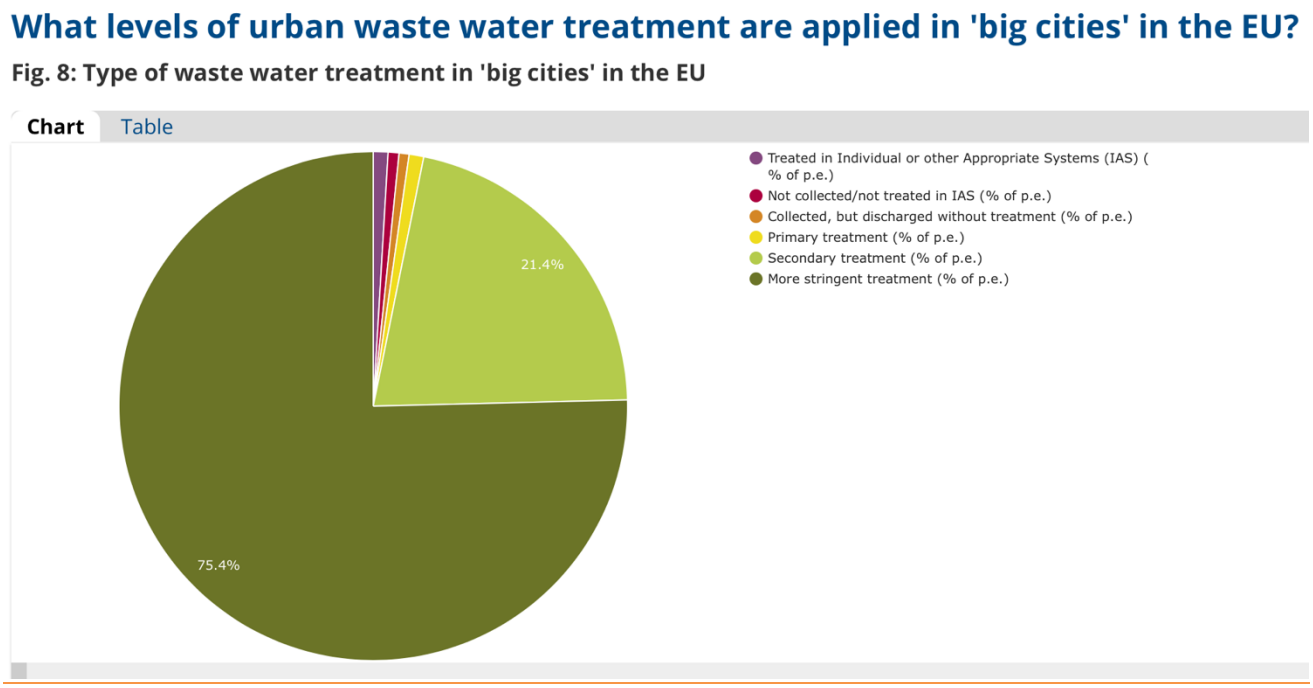
Figure 5. Proportion of wastewater treated, shown as percentage of total wastewater treated over generated.

Maps

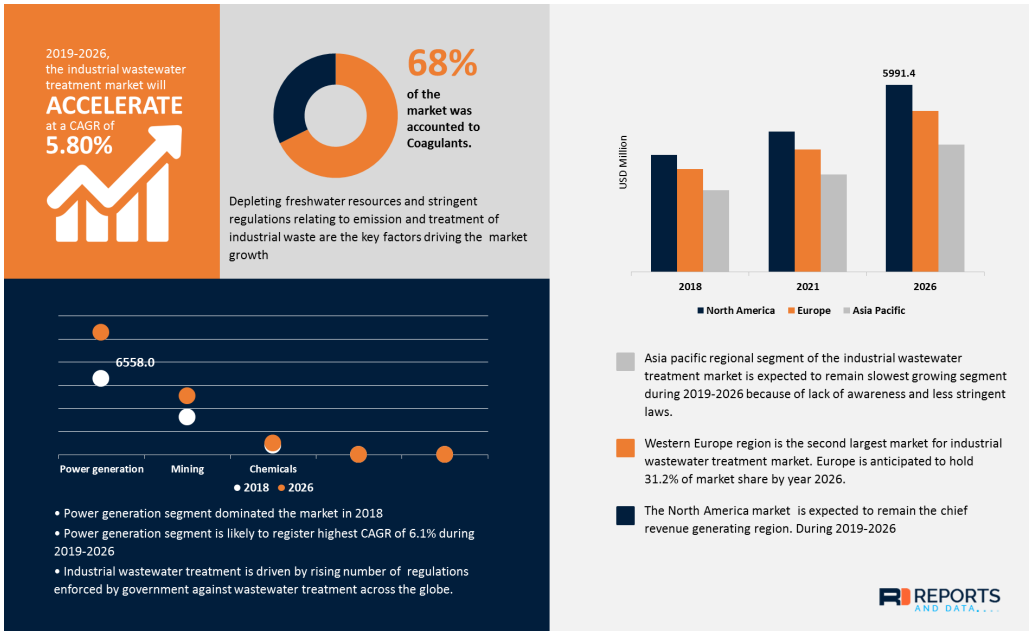


Source: European Environment Agency, Urban waste water treatment map, https://www.eea.europa.eu/themes/water/european-waters/water-use-and-environmental-pressures/uwwtd/interactive-maps/urban-waste-water-treatment-maps-3 (accessed 14 March 2022).

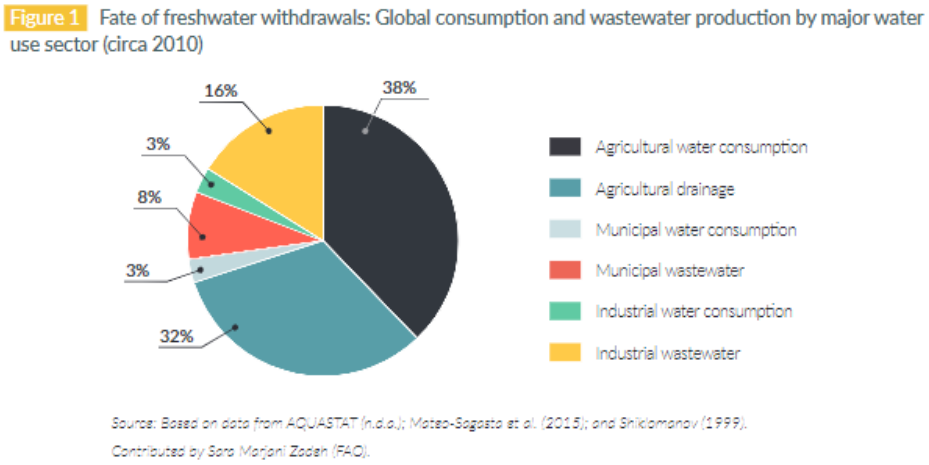
Graphs



Source: European Environment Agency, Urban waste water treatment in Europe, https://www.eea.europa.eu/data-and-maps/indicators/urban-waste-water-treatment/urban-waste-water-treatment-assessment-4 (accessed 14 March 2022).



Source: Industrial Wastewater Treatment Market Analysis, By Type (Coagulants, Biocides & disinfectants) By end use industry (Power generation, mining, chemicals), Forecasts to 2026, https://www.reportsanddata.com/report-detail/industrial-wastewater-treatment-market (accessed 14 March 2022).



Source: WWAP (United Nations World Water Assessment Programme). 2017. The United Nations World Water Development Report 2017. Wastewater: The Untapped Resource. Paris, UNESCO based on data from AQUASTAT.

Diagrams

Source: The World Bank Blog, Wastewater treatment: A critical component of a circular economy, https://blogs.worldbank.org/water/wastewater-treatment-critical-component-circular-economy, (accessed 14 March 2022).

6B. SEEA accounts/tables that use these statistics

SEEA Central Framework defines wastewater as "discarded water that is no longer required by the owner or user." It includes water for treatment and disposal, return flows, and reused water. Wastewater is part of the physical supply and use tables for water, and is of special importance to the industry divisions ISIC 35 (electricity, gas, steam and air conditioning supply), 36 (water collection, treatment and supply; sewerage, waste management and remediation activities), and 37 (sewerage). Wastewater forms a part of the water emissions account, broken down by types of substances, including BOD/COD, suspended solids, heavy metals, phosphorus, and nitrogen.

In the SEEA-Water, gross and net wastewater emissions, including the water pollutants associated within, are part of the emission account. The various expenditures and costs for financing and operating the wastewater management facilities in the country are also considered.

6C. Commonly used indicators that incorporate these statistics

The 2020 *Progress of Wastewater Treatment*[40], co-authored by UN-Water, WHO, and UN-HABITAT, illustrated the importance of an integrated monitoring initiative for water statistics, and especially for SDG indicator 6.3.1. Other UN Water sponsored reports for SDG 6 can be downloaded at: https://www.unwater.org/publication_categories/sdg6-progress-reports/ (accessed 14 March 2022).

In the FAO guidebook "*Wastewater treatment and use in agriculture*"[41], the wastewater quality is measured by the characteristics from the following aspects:

- Major constituents of domestic wastewater
- Chemical composition
- Possible levels of pathogens
- Organic and inorganic constituents

The *Guidelines for the safe use of wastewater, excreta and greywater*[42] provides information on the assessment and management of risks associated with microbial hazards. It explains requirements to promote the safe use of excreta and greywater in agriculture, including minimum procedures and specific health-based targets.

The "*Standard Methods for the Examination of Water and Wastewater*"[43], first published in 1905 and now on its 23rd edition, is a collection of industrial standards for tests, treatments, controls, evaluation, and policy advisory of the physical, chemical, metal, inorganic, organic, radioactive, toxic, biological and microbiological aggregates of water and wastewater. It covers the wide details of wastewater components and quality and is used by various countries.

6D. SDG indicators that incorporate these statistics

Indicator 6.2.1 Proportion of population using (a) safely managed sanitation services, and (b) a hand-washing facility with soap and water

The household component of wastewater contains both sewage water and faecal sludge. They could either be treated on-site or off-site. These components are part of Indicator 6.2.1 which focuses on the access of sustainably managed water and sanitation services, and is a tier II indicator.

Indicator 6.3.1 "Proportion of domestic and industrial wastewater flows safely treated"

Indicator 6.3.1, which is a tier II indicator, tracks the water flowing from households, services, and industrial premises to the wastewater treatment facilities, and eventually discharged back to the environment. These treatment facilities should adhere to the national or local standard. As worded in the target within which this indicator sits, the indicator endeavours to "improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally."

[40] UNESCO World Water Assessment Programme, The United Nations World Water Development Report 2020: Water and Climate Change, https://unesdoc.unesco.org/ark:/48223/pf0000372985.locale=en (accessed 14 March 2022).
[41] FAO, Wastewater treatment and use in agriculture - FAO irrigation and drainage paper 47, Rome, 1992. https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.470.8910&rep=rep1&type=pdf (accessed 14 March 2022).
[42] World Health Organization, Guidelines for the safe use of wastewater, excreta and greywater - Volume 4, available at: https://www.who.int/publications/i/item/9241546859 (accessed 14 March 2022).
[43] American Public Health Association, American Water Works Association, Water Environment Federation, Standard Methods for the Examination of Water and Wastewater, 23rd edition, 2017. https://www.standardmethods.org (accessed 14 March 2022).

Indicator 6.3.2 “Proportion of bodies of water with good ambient water quality”

This is a tier II indicator in which wastewater generation and treatment are directly linked to the ambient water quality of a water basin or territory. Left untreated, most of the pollutant substances such as phosphorus and nitrogen would be directly discharged to fresh and marine water bodies, affecting ecosystems and human beings who depends on these ecosystems. Higher quality and quantity of wastewater treatment would be positively associated with larger concentration and distribution of good ambient water quality and enables the cleaned water to be used by others. This reduces the need to abstract water from non-renewable sources such as groundwater sources.

F D E S

Manual on the Basic Set of Environment Statistics

2022