



Proprietary standard

for water footprint certification

ISO 14046 · AWS · ESRS E3 · GRI 303 · CDP Water

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Annex I

Water footprint calculation methodology

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VERSION HISTORY

Rev.	Date	Description of changes	Status
v1.0	15/03/2018	Initial release of the Aquafides Protocol	Superseded
v2.0	10/03/2022	Incorporation of AWARE factor and grey footprint	Superseded
v3.0	20/01/2025	Modular rewrite: CORE + compatible modules	Superseded
v3.1	15/09/2025	Incorporation of the M-ESRS E3 module (CSRD)	Superseded
v3.2.0	15/02/2026	Simultaneous coverage ISO 14046 + AWS + ESRS E3 + GRI 303 + CDP Water	ACTIVE

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ANNEX I

Water footprint calculation methodology

Technical manual for Aquafides Authorized Advisors and Auditors — Aquafides Protocol v3.2

Introduction and purpose of the Annex

This Annex develops the technical methodology for calculating the water footprint of organisations, products, processes and services under the Aquafides Protocol v3.2. It constitutes the technical reference manual for the professional activity of Aquafides Authorized Advisors and Auditors, and for the independent verification of certification files.

The Aquafides methodology integrates and harmonises the approaches of the leading international references — ISO 14046:2014 and the Water Footprint Network Manual (Hoekstra et al.) —, complements them with the mandatory quantification of the water-energy nexus and of the indirect water footprint of the supply chain, and produces the Aquafides Protocol-specific KPIs applicable to the typology and sector of the certified organisation.

This Annex does not replace detailed study of the Water Footprint Network Manual or ISO 14046:2014. Prior knowledge by the Aquafides Authorized professional is assumed, and the Annex develops the elements specific to the Aquafides scheme.

1. Reference methodological framework

The calculation rests on four integrated methodological pillars:

- ISO 14046:2014 — Four-phase study structure: definition of goal and scope; inventory analysis; impact assessment; interpretation.
- Water Footprint Network (Hoekstra et al. Manual, 2011) — Operational definition of blue, green and grey footprint, and accounting procedures.
- Aquafides Protocol v3.2 — Additional quantification of the water-energy nexus (Requirement 4.12), inventory of indirect value-chain footprint (Requirement 4.13) and territorial analysis linked to catchment water stress (Requirement 4.14).
- Disclosure reference frameworks: ESRS E3 (Delegated Regulation (EU) 2023/2772), GRI 303 (2018), AWS Standard v2.0 and CDP Water Security.

2. Definition of the study goal and scope

2.1 Goal

The study goal is defined at file registration and set out in the initial documentation: to certify the organisation's compliance with the requirements of the Aquafides Protocol v3.2 in relation to the scope expressly declared.

2.2 Temporal scope

The assessment period is one (1) full calendar year, unless documented motivated justification in the file. When the organisation's activity is seasonal, the temporal scope shall cover the complete operating cycle.

2.3 Geographical and territorial scope

The geographical scope identifies all physical installations included in the certificate, with their exact location and assignment to a hydrographic catchment in accordance with the official sources of Requirement 4.14.

2.4 Functional unit

The functional unit is the quantitative reference against which water KPIs are reported. It is selected according to the typology and sector of the organisation in accordance with the applicable Aquafides Sectoral Operating Manual. For guidance:

Sector	Typology	Typical functional unit
Hospitality (hotels)	SP	L/stay · L/guest · L/m ² built
Restaurants	SP	L/cover served
Agri-food (production)	SP	L/kg product · L/L beverage
Manufacturing industry	SP	L/unit of product
Industrial laundry	SP	L/kg linen processed
Wholesale distribution	CS	L/€ invoiced · L/m ² warehouse
Retail distribution	CS	L/€ invoiced · L/customer
Municipal administration	AP	L/inhabitant·year
Irrigation community	AP	L/ha cropped · L/m ³ applied
Healthcare centres	SP	L/patient stay
Education and sports	SP	L/user·day

3. Direct water footprint inventory

3.1 Inventory structure

The inventory differentiates water flows according to the criteria harmonised by GRI 303 (2018) and CDP Water Security:

- By origin of extracted water: municipal public network · surface water (rivers, lakes) · groundwater (wells, boreholes) · treated seawater · captured rainwater · regenerated water · third-party water.
- By destination of discharged water: public sewer network · surface water · groundwater · seawater · third parties without further treatment · internal reuse.
- By operational use: production · cooling · DHW · sanitary · cleaning · irrigation · pools and SPA · HVAC · others.

3.2 Minimum measurement frequency

The minimum frequency for measurement and recording of each water flow is monthly, in accordance with Requirement 4.3 of the Protocol, except for documented motivated justification for discontinuous or seasonal processes that allow another temporal resolution without substantial loss of information.

3.3 Blue water footprint calculation

Blue Footprint (m³) = Σ Volume Extracted – Σ Volume Returned to the same catchment with the same quality and in the same period

The blue water footprint corresponds to the net volume of surface or underground freshwater extracted from the system and not returned to the same origin in the same period. It includes water incorporated into the product, evaporated water and water transferred to another catchment or returned with altered quality.

3.4 Green water footprint calculation

Green Footprint (m³) = Σ Productive evapotranspiration of the crop or managed vegetation during the assessment period

Mainly applicable to agricultural and livestock organisations. Productive evapotranspiration is calculated through validated agro-hydrological models (FAO CROPWAT, AquaCrop or equivalent) based on territorial climate data and crop characteristics.

3.5 Grey water footprint calculation

Grey Footprint (m³) = $L \cdot (c_{\text{eff}} - c_{\text{nat}})^{-1}$

Where:

- L (kg/year) = pollutant load discharged in the period, for the critical pollutant identified.
- c_{eff} (kg/m³) = maximum allowed concentration of the pollutant in the receiving body according to applicable environmental regulation.
- c_{nat} (kg/m³) = natural background concentration of the pollutant in the receiving body.

When more than one relevant pollutant exists, the grey footprint is calculated for the critical pollutant (the one yielding the highest dilution volume required). The set of pollutants assessed is documented.

4. Quantification of the water-energy nexus (Requirement 4.12)

4.1 Net thermal energy for domestic hot water (DHW) production

$$Q \text{ (kWh)} = m \cdot c_p \cdot \Delta T / 3600$$

Where:

- m (kg) = mass of water to be heated (1,000 kg per m^3 , given that the density of water is practically constant in the range 15-60 °C).
- c_p (kJ/(kg·K)) = specific heat of water = 4.186 kJ/(kg·K).
- ΔT (K or °C) = temperature increment. By default, $\Delta T = 60 - 15 = 45$ K, in accordance with the Spanish Regulation on Thermal Installations in Buildings (RITE) and standard practice in the Iberian hotel sector.

Reference result: for $\Delta T = 45$ K, net $Q = 52.3$ kWh per m^3 of DHW.

4.2 Primary energy according to generation equipment

$$E_{\text{primary}} \text{ (kWh)} = Q \text{ (kWh)} / \eta \text{ (combustion systems)}$$

$$E_{\text{electric}} \text{ (kWh)} = Q \text{ (kWh)} / \text{COP (heat pumps)}$$

Reference seasonal efficiencies:

- Condensing natural gas boiler: $\eta = 0.95$.
- Standard natural gas boiler: $\eta = 0.88$.
- Diesel oil boiler: $\eta = 0.85$.
- Electric resistance water heater: $\eta = 0.95$.
- Aerothermal (air-water heat pump): COP = 3.0 to 4.0 (reference 3.5).
- Solar thermal: free contribution up to the installation coverage rate, complemented by backup system.
- District heating: $\eta = 0.90$ (includes distribution network losses).

4.3 Emission factors associated with energy consumption

The emission factors used to quantify the carbon footprint associated with the water cycle's energy consumption are those officially published by the territory's reference body. In Spain:

- Natural gas: 0.202 kgCO₂eq/kWh NCV (MITECO – National GHG Inventory).
- Diesel oil C: 0.267 kgCO₂eq/kWh NCV (MITECO).
- National electricity mix: annual factor published by Red Eléctrica de España (REE), reference 0.150 kgCO₂eq/kWh for the 2024 financial year.
- Electricity mix — standard retailer: range 0.16 - 0.32 kgCO₂eq/kWh according to CNMC labelling.
- Electricity mix — certified 100% renewable origin: 0.000 kgCO₂eq/kWh.

4.4 Water-energy nexus KPIs

- kWh per m³ of DHW produced.
- kWh per m³ of total water consumed.
- € of energy cost per m³ of water.
- kgCO₂eq per m³ of water.
- % of total energy bill attributable to the water cycle.

5. Quantification of indirect water footprint (Requirement 4.13)

5.1 Identification of the top ten water-intensive suppliers

The organisation documents the ten (10) suppliers with the highest annual spending on water-intensive goods and services. The identification is performed by cross-referencing annual invoicing with the sectoral categorisation of Annex II of this Protocol.

5.2 Estimation of indirect footprint by product category

When the supplier cannot provide verifiable water footprint data on the products supplied, the sectoral reference factors validated by Aquafides apply. As guidance (litres of virtual water per kilogram of product, consolidated values from international literature):

Product	Water footprint (L/kg or L/L)
Beef	≈ 15,400 L/kg
Lamb	≈ 8,700 L/kg
Pork	≈ 6,000 L/kg
Chicken	≈ 4,300 L/kg
Farmed fish	≈ 3,000 L/kg
Cheese	≈ 5,000 L/kg
Cow milk	≈ 1,020 L/L
Eggs	≈ 3,300 L/kg
Roasted coffee	≈ 18,900 L/kg
Wine	≈ 870 L/L
Olive oil	≈ 14,500 L/kg

Product	Water footprint (L/kg or L/L)
Bread / cereals	≈ 1,600 L/kg
Vegetables (average)	≈ 320 L/kg
Fruit (average)	≈ 960 L/kg
Cotton (textile)	≈ 10,000 L/kg

Primary source: Mekonnen, M. M. & Hoekstra, A. Y. (2011). *The green, blue and grey water footprint of crops and derived crop products*. Hydrology and Earth System Sciences. Data consolidated and harmonised by Water Footprint Network. Aquafides updates these factors annually in line with the most recent scientific publications.

5.3 Aggregated calculation and reporting

The total indirect water footprint of the organisation is calculated as the sum of the footprints attributable to each category of product and service purchased during the assessment period. Indirect footprint is reported separately from direct footprint, avoiding double counting, and in accordance with the principles of transparency and traceability of the Protocol.

6. Territorial analysis and linkage with water stress (Requirement 4.14)

For each installation included in the certified scope, the water stress category of its catchment is determined according to the WRI Aqueduct Water Risk Atlas (current version) and to the hydrological plans of the competent administration.

- Category 1 — Low water stress.
- Category 2 — Low to medium water stress.
- Category 3 — Medium to high water stress.
- Category 4 — High water stress.
- Category 5 — Extremely high water stress.

The organisation reports separately the volumes of extraction, discharge and consumption corresponding to installations located in categories 4 and 5, in line with the disclosure requirements of ESRS E3 and CDP Water Security.

7. Interpretation of results and reporting

The interpretation phase translates the quantitative results of the inventory and impact assessment into actionable findings for the organisation. They are formalised in the Audit Report in accordance with Article 6.5 of the Protocol, with the following minimum content:

- Total water footprint of the organisation for the assessment period, broken down into blue, green and grey components.

- Sectoral water KPIs for the applicable functional unit, benchmarked against Aquafides sector benchmarks.
- Quantification of the water-energy nexus and associated carbon footprint.
- Indirect footprint inventory and percentage of Aquafides Recognized Supplier providers.
- Territorial analysis with identification of installations in categories 4 and 5 of water stress.
- Equivalence table with international frameworks under Article 6.10 (umbrella coverage).
- Technical recommendations for the Water Footprint Reduction Plan.

8. Data quality and traceability

In accordance with Guiding Principle 5 of the Protocol (Data integrity and traceability), all data used in the calculation must come from verifiable sources traceable to their origin. Data quality is categorised, in line with WFN good practice, into:

- Primary data (Tier 1) — measured directly at the organisation's installation through calibrated instrumentation.
- Documented secondary data (Tier 2) — invoices, maintenance reports, management system records, technical publications or validated sectoral databases.
- Estimated data with reference factors (Tier 3) — when no primary or secondary data is available. The factors of this methodology apply, explicitly declaring the Tier 3 category.

The Audit Report declares the data category used for each reported figure. The use of Tier 1 and Tier 2 data is prioritised; use of Tier 3 data must be justified and, when exceeding 30% of the aggregated calculation, motivated in the file as an area for improvement in the following three-year cycle.

9. Bibliography and technical references

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— End of Annex I —