



Environmental Methodology 2:
Water Consumption
Topic Methodology

Basis for Conclusions

Table of Contents

BACKGROUND.....	4
1 INTRODUCTION.....	7
1.1 DOCUMENT PURPOSE	7
1.2 TOPIC DESCRIPTION	7
1.3 KEY CONCEPTS AND DEFINITIONS	7
1.4 SCOPE AND ASSUMPTIONS	7
2 IMPACT PATHWAY	9
2.1 SUMMARY	9
2.2 DESCRIPTION AND NOTES	9
3 IMPACT DRIVER MEASUREMENTS	11
3.1 DATA REQUIREMENTS	11
3.2 DATA SOURCES, GAPS, AND UNCERTAINTY	11
4 OUTCOMES, IMPACTS, AND VALUATION	13
4.1 HOW TO CALCULATE IMPACTS	13
4.2 OUTCOMES AND IMPACTS.....	15
4.3 MONETARY VALUATION	17
5 FUTURE DEVELOPMENT	19
6 APPENDICES.....	22
7 PRELIMINARY NATIONAL VALUE FACTOR ANALYSIS AND VALUE FACTOR CHARACTERISTICS.....	26
8 BIBLIOGRAPHY.....	32

Note to readers:

In this document, references to paragraph numbers and sections refer to the final version of *Water Consumption Topic Methodology* that was approved by the Valuation Technical and Practitioner Committee of IFVI on October 23rd, 2025. References to paragraph numbers and sections in the Exposure Draft of *Water Consumption Topic Methodology* are explicitly stated.

Background

- BC1. The *Water Consumption Topic Methodology* was developed as the second environmental Topic Methodology and establishes a framework for valuing the impacts of water consumption. The Water Consumption Methodology was developed in partnership with the International Foundation for Valuing Impacts (IFVI) and the Value Balancing Alliance (VBA) and serves as the second in a series of Topic Methodologies.
- BC2. The Water Consumption was developed by the technical staff and the VTPC beginning in January 2024. The development process involved a comprehensive review of the Water Consumption literature, including methods used previously by the Impact Weighted Accounts (IWA) project at Harvard Business School and VBA. Subsequent research sought alignment with established protocols, frameworks, and disclosure requirements by relevant standard setters. Throughout the process, expert consultation was regularly sought from various entities to better understand key technical aspects and to build strong relationships with peers in the ecosystem.
- BC3. A priority of the Water Consumption Methodology was to align to the greatest extent possible with data requirements for European Sustainability Reporting Standards (ESRS) E3: Water and marine resources¹ and Global Reporting Initiative (GRI) 303: Water and effluents.² Impacts caused by water contamination or chemically altered water are included in the Water Pollution Methodology (currently, the Water Pollution Interim Methodology),³ and does not fall within the scope of the Water Consumption Methodology.
- BC4. As a starting point for the determination of outcomes, impacts, and monetary valuation, the Water Consumption methodology of the VBA was assessed.⁴ VBA modelled three impacts of water consumption: malnutrition caused by reduced water available for agricultural users, infectious diseases resulting from reduced domestic access to clean water, and future impacts associated with unsustainable groundwater extraction. VBA's methodology noted additional impacts, including impacts to ecosystem services, increased financial burden of taxation, and lost market/non-market benefits of economic production. However, it was determined that these additional impacts were not feasible for quantification given the state of research and available studies at the time.
- BC5. Upon reviewing the literature since the release of VBA's environmental impact statements, significant advancements were noted and implemented within the Water Consumption Methodology. For malnutrition caused by reduced water for agricultural users, newly published replication studies allowed for the application of similar analyses with more up-to-date inputs.⁵ For infectious diseases caused by the reduction of clean

¹ ESRS. (2022). *E3: Water and marine resources*.

² GRI. (2023). p. 303. *GRI 303: Water and effluents 2018*.

³ International Foundation for Valuing Impacts. (2024). *Interim Methodologies: Water Pollution*.

⁴ Value Balancing Alliance. (2021). *Methodology Impact Statement. Focus: Environment*.

⁵ Within the VBA Methodology statements, a study by Pfister et al. (2009) was utilized. Since the publication of this document, studies with very similar methods were repeated by ReCiPe in 2016 and LC-Impact in 2020/2021.

water availability for domestic users, VBA used a quantile regression analysis to explain variation in DALYs associated with water-borne, infectious diseases using a series of explanatory variables. This analysis was replicated by the technical team with the same but updated explanatory variables and found that the relationship was no longer significant. As a result, the analysis was replaced with characterization factors provided by Motoshita et al. 2011.⁶ FAO's AQUASTAT,⁷ used to estimate the future impacts associated with unsustainable groundwater consumption was replaced with a baseline and future predictive model of sub-basin level water stress changes over time produced by WRI's AQUEDUCT Water Risk Atlas.⁸ Many additional updates were incorporated, including an updated report regarding the Value of a Statistical Life⁹ and the use of a 2% discount rate to align with *Environmental Methodology 1: Greenhouse Gas Emissions*.¹⁰

- BC6. The Water Consumption Methodology identified new ways to incorporate the impacts of ecosystem services by utilizing estimates provided by the Ecosystem Service Valuation Database (ESVD),¹¹ noted as a significant development from previous water consumption impact iterations.
- BC7. The technical team completed research on additional impacts, including the impact of domestic users needing to switch to bottled water due to insufficient local water resources, heightened infrastructure requirements due to water scarcity (e.g., desalination), and subsidence caused by unsustainable groundwater extraction. However, it was determined that the current state of research and available studies were insufficient for quantification at this time, due to a lack of comprehensive global studies, insufficient valuation techniques, or a combination of both.
- BC8. Geographical specificity is essential for the proper evaluation of Water Consumption impacts. However, detailed locations of water consumption are often unavailable. To combat these two realities, the Water Consumption Methodology provides two options: the *preferred option*, where entities have water consumption data tied to specific locations, and the *minimum option*, when entities do not have knowledge of water consumption in a subnational geographic unit.
- BC9. Following the research phase, the technical staff, with guidance from the VTPC, prepared a draft of the Water Consumption Methodology for public exposure. At the VTPC meeting on February 22, 2024, the technical staff and the VTPC discussed a new impact pathway, new ways to evaluate water consumption impacts, and proposed the tiered approach (i.e., the minimum and preferred options) to allow for flexibility in the use of the methodology. Based on this conversation an Exposure Draft was prepared

⁶ Motoshita, M. et al. (2011). *Development of impact factors on damage to health by infectious diseases caused by domestic water scarcity*.

⁷ Food and Agriculture Organization. n.d. *AQUASTAT - FAO's Global Information System on Water and Agriculture*.

⁸ Kuzma, S. et al. (2023). *Aqueduct 4.0: Updated decision-relevant global water risk indicators*.

⁹ OECD. (2025). *Mortality Risk Valuation in Policy Assessment: A Global Meta-Analysis of Value of Statistical Life Studies*.

¹⁰ International Foundation for Valuing Impacts & Value Balancing Alliance. (2024). *Environmental Methodology 1; Greenhouse Gas Emissions Topic Methodology*.

¹¹ ESVD. (2025). *Ecosystems Services Valuation Database (ESVD)*.

and reviewed by the VTPC, leading to discussion at the June 26, 2024, VTPC meeting. The Exposure Draft was approved by the VTPC for a public comment period by virtual ballot and released for public comment on September 24, 2024.

BC10. The Exposure Draft contained a series of proposals for public comment. The Exposure Draft solicited targeted feedback on five aspects:

- a. The overall usability of the water consumption methodology;
- b. Clarity on the rationale and scope of the water consumption methodology;
- c. Clarity and feasibility of providing two options of application based on data availability;
- d. Framing of the impact pathway and methodological approaches; and
- e. Approach and clarity for local application and aggregating impacts.

BC11. A total of 7 comment letters were received, containing 70 individual comments and representing a range of geographies and stakeholder groups. The largest number of responses came from those in academics, sustainability consulting, impact investing, and non-profit organizations. The comment letters were generally supportive of the overall content and scope of the methodology. Many comments sought additional clarity or context, particularly around handling uncertainty in reporting and data gaps related to the geographical context of water consumption. Another theme of the public feedback letters related to the need for practical examples to aid methodological application. One respondent was particularly critical of equity issues in the Exposure Draft Value Factors, citing a significant positive relationship between the country-level value factors and GDP. All comments letters were reviewed in their entirety and taken into consideration for potential revisions to the Water Consumption Methodology. This document does not provide a response to every comment submitted but instead emphasizes areas of convergence in the feedback. Full comment letters can be read on the IFVI website.¹²

BC12. The basis for conclusions drawn by the VTPC is summarized below for each section of the Water Consumption Methodology. Conclusions were based on research conducted prior to publishing the Exposure Draft and in response to the public comment period, the feedback received during the public comment period, the feedback received from the VBA piloting period,¹³ and the objective of fulfilling the mandate of the IFVI and VBA partnership. Additional structural changes have been made, in alignment with changes to other Topic Methodology statements, to improve clarity and alignment with General Methodologies. The final version of the Water Consumption Methodology was approved by the VTPC on October 23, 2025.

¹² <https://ifvi.org/methodology/environmental-topic-methodology/>

¹³ The feedback from the VBA piloting can be read on the VBA website: <https://www.value-balancing.com/>

1 Introduction

1.1 Document purpose

- BC13. The Water Consumption Methodology was developed to establish a standardized approach for quantifying the impacts of water consumption. Its purpose and scope were defined through analysis of other environmental impact approaches within the ecosystem including VBA methodologies, discussions among the technical staff, and approval by the VTPC as part of the environmental topics work plan. The Water Consumption methodology functions as one topic-specific methodology within the broader impact accounting frameworks being developed by IFVI and VBA.
- BC14. Section '1.1 Document Purpose' of the Water Consumption Methodology saw no updates between the Exposure Draft and Approval Draft.

1.2 Topic Description

- BC15. Section '1.2 Topic Description' proposed an organizing definition for Water Consumption, provided context for water consumption, and described the impacts and importance they have both regionally and globally.
- BC16. Section '1.2 Topic Description of the Water Consumption Methodology saw no updates between the Exposure Draft and Approval Draft.

1.3 Key Concepts and Definitions

- BC17. Section '1.3 Key Concepts and Definitions' provides standardized definitions for four concepts that are important for using the Water Consumption Methodology. The definitions were sourced from well-established organizations including the ESRS and GRI.
- BC18. One update was made between the Exposure Draft and the Approval Draft in the *Key Concepts and Definitions* section. The term *green water* was added and defined as precipitation on land that does not run off or recharge groundwater but is instead stored in soil or temporarily held on the soil surface or in vegetation. It was clarified that green water was not considered as part of water withdrawal in the Water Consumption Methodology since this portion of precipitation typically evaporates or transpires through vegetation.

1.4 Scope and Assumptions

- BC19. Section '1.4 Scope and Assumptions' proposed what is and is not included within the boundaries of the Water Consumption Methodology. The definition of water consumption used was aligned with examples provided by GRI,¹⁴ and scope of the methodology was aligned with General Methodology 1.¹⁵ This alignment outlines that a comprehensive assessment should include upstream, direct operations, and

¹⁴ GRI. (2023). *GRI 303: Water and effluents 2018*.

¹⁵ IFVI. (2024). *General Methodology 1: Conceptual Framework for Impact Accounting*.

downstream water consumption while simultaneously recognizing the challenges with collecting these data, necessitating guidance on addressing data gaps in Section 3.2.

- BC20. Comments related to the Scope and Assumptions section of the Water Consumption Methodology were generally positive, citing a clear rationale. One commenter raised concerns about cases where rainwater harvesting appears in an entity's discharge but not in its water withdrawal. The commenter cited a hypothetical example in which an entity withdraws 100 m³ of water annually, bottles and ships 100 m³, and reports 100 m³ of rainwater harvesting as discharge, resulting in a calculated water consumption of zero m³ instead of the correct 100 m³. To address this, the Approval Draft clarifies that rainwater harvesting is considered equivalent to water usage and should therefore be included in an entity's water withdrawals, rather than being used to offset or reduce total water consumption. Another commenter noted that the Exposure Draft did not clearly define what was inside and outside of the scope of the Water Consumption Methodology but did not provide a description or justification.
- BC21. Multiple comments mentioned the importance of including water quality indicators such as contamination levels, chemical composition, and pollutants in water bodies, as simply measuring water and discharge fails to capture the broader environmental and social consequences of water related issues. The technical staff acknowledges this concern, as water pollution remains a serious vector of disease and ecotoxicity globally. However, current IFVI/VBA methodologies treat Water Pollution and Water Consumption separately in two distinct methodologies¹⁶, where Water Pollution is addressed in the IFVI Water Pollution Interim Methodology,¹⁷ which was released shortly after the closure of the Water Consumption public comment period. The Water Pollution Interim Methodology provides value factors for 104 water pollutants that affect human health, distinguishing between whether they were discharged into freshwater or seawater. It also includes value factors assessing how phosphorus and nitrogen inputs into waterways impact the environment through eutrophication. Thus, the Water Consumption Approval Draft now includes commentary clarifying that water pollution impacts are out of scope, pointing readers to the Water Pollution Interim Methodology for water quality related assessments.
- BC22. While the IFVI/VBA methodologies treat water pollution and water consumption separately, it is acknowledged that these two stressors do interact with one another, representing a point to consider for future iterations.
- BC23. A key theme in the Approval Draft revisions response to public feedback highlighting the positive relationship between GDP and the value factors provided in the Exposure Draft. To respond to this concern, Section 1.4 introduces two perspectives for conducting Water Consumption assessments: a local perspective, where water consumption impacts are expressed using country-specific benchmarks and price levels, and a global perspective, which adjusts all key variables based on purchase power parity (PPP) and

¹⁶ See Methodology Architecture in IFVI/VBA (2025). A Vision for the Impact Accounting Methodology

¹⁷ International Foundation for Valuing Impacts. (2024). *Interim Methodologies: Water Pollution*.

anchors calculations to global benchmarks. A discussion of how these perspectives have been used to address equity concerns discussed in the public comment period can be found in Section 7 of this Document.

- BC24. One commenter noted a missing reference in a footnote in the Key Concepts and Definitions section of the Exposure Draft. This footnote (footnote 25) has been edited in the Approval Draft to fix this error.

2 Impact Pathway

2.1 Summary

- BC25. The Exposure Draft proposed the impact pathway for Water Consumption following the framework outlined in Section 4.5 of GM1.¹⁸ The impact pathway is the foundational framework for measuring and valuing impacts.
- BC26. Comments regarding the Water Consumption Impact Pathway were generally positive. One commenter recommended expanding the scope of the methodology to include indirect effects, such as the impacts on agricultural productivity and energy use related to water availability. Agricultural productivity is currently represented in the Approval Draft as part of the malnutrition pathway, where the lost opportunity of water use for agriculture leads to lower food production, increasing malnutrition rates. The technical team also discussed the potential for incorporating increased energy consumption as a way to value lost water access for future generations, recognizing that future societies may rely on high-energy systems (e.g., desalination) to extract potable water. However, uncertainties surrounding when infrastructure transitions would occur on a local or national level, how local and national desalination costs would evolve, and the likelihood of future technological innovation create challenges in applying such costs. As a result, the Approval Draft continues to apply a present-day estimate of water unit operation costs to produce water supplied from utilities,¹⁹ representing a conservative lower bound of potential impacts.
- BC27. In consultation with Capitals Coalition, the impact pathway figure in the Approval Draft was streamlined for clarity and simplicity. *Outcomes* in the figure are now more directly linked to environmental outcomes, and *impacts* are more clearly connected to the valuation of these environmental outcomes. These revisions ensure consistent presentation according to General Methodology 2 and are for presentation only, thus, had no effect on the underlying quantification of impacts in the Approval Draft.

2.2 Description and Notes

- BC28. The proposed inputs, outputs, outcomes, and impacts as well as the causal relationships linking each step were developed based on an extensive literature review and expert consultations. The research and consultations largely fell into two categories: (1) primary academic research that linked Water Consumption to environmental or health related outcomes, or (2) existing Water Consumption

¹⁸ IFVI. (2024). *General Methodology 1: Conceptual Framework for Impact Accounting*.

¹⁹ The International Benchmarking Network. (2023). *Country Profile United States*.

frameworks that synthesize and organize primary research into impact principles. Existing frameworks used to develop the impact pathway included those from the Impact Weighted Accounts Initiative,²⁰ the Value Balancing Alliance,²¹ Capitals Coalition,²² Transparent Project,²³ and WifOR.²⁴

- BC29. No respondents suggested that revisions should be made in the descriptions and notes section of the methodology. Changes were made to paragraph 26 to align with language proposed by Capitals Coalition, and to properly distinguish between outcome and impacts.

²⁰ Impact-Weighted Accounts Project. (2022). *Practitioner Guide to Calculating Corporate Environmental Impact*.

²¹ Value Balancing Alliance. (2021). *Methodology Impact Statement. Focus: Environment*.

²² Natural Capital Coalition. (2021). *Natural Capital Protocol*.

²³ Project Transparent. (2023). *Standardized natural capital management accounting: A methodology promoting the integration of nature in business decision making*.

²⁴ WifOR Institute. (2023). *Underlying valuation approach, assumptions, and extrapolation*.

3 Impact Driver Measurements

BC30. Section 3 of the Exposure Draft was designed to guide preparers and users through the data requirements for developing Water Consumption impact accounts. It included two sections outlining the necessary data, methods for sourcing data, and approaches for addressing data gaps.

3.1 Data Requirements

BC31. Section ‘3.1 Data Requirements’ outlines the data needed to utilize the Water Consumption Methodology, including an entity’s total water consumption, locations of water withdrawal, local water stress and/or national water stress metrics provided by AQUEDUCT,²⁵ and local pressure on biodiversity metrics provided by the WWF Biodiversity Risk Filter.²⁶ The Section also introduces two options for utilizing the Water Consumption Methodology: the *Preferred Option*, used when entities have water consumption data that is tied to specific locations, and the *Minimum Option*, when entities do not have knowledge of water consumption in a subnational geographic unit.

BC32. One commenter suggested that the minimum option should not be applied to large countries with significant variations in water stress. The technical team explored potential modifications to the Minimum Option to account for countries with such characteristics. For example, the technical team explored the idea of applying the 75th percentile of water stress within countries with larger geographies for the Minimum Option. However, it was concluded that no practical or universally applicable rule could define what constitutes a ‘large country’ or specify which percentile should be used. Consequently, only one revision was made: it was clarified that the Preferred Option provides the most accurate assessment of an entity’s water consumption impact and is particularly relevant for large countries with substantial variability in water stress. The comment regarding the application of the Minimum Option to large countries is also discussed in the *Future Developments* Section (see Section 5 of this Document).

Multiple commenters discussed the potential for a geographically independent ‘global’ value factor. Others noted the current data requirements have mixed levels of feasibility due to difficulties on collecting specific geographical water consumption data. Though the technical team recognizes the difficulties in preparing data with geographic specificity, the team concluded that water consumption cannot be separated from location. Applying the Water Consumption Methodology independently of geography was determined to be out of scope of the Approval Draft (See footnote 49 in the Water Consumption Approval Draft). Future implementation guidance could direct users to approaches for addressing data limitations related to national water consumption.

3.2 Data Sources, Gaps, and Uncertainty

BC33. The Exposure Draft acknowledged that certain barriers may prevent preparers from fully accounting for Water Consumption, particularly in identifying the geographic

²⁵ *Aqueduct Water Risk Atlas*. n.d.

²⁶ World Wildlife Fund. (2023). *The WWF Biodiversity Risk Filter tool methodology*.

location of consumption. In an effort to faithfully represent all water consumption in the value chain, the Exposure Draft points to additional resources for data preparation, including ISO 14046: 2014 Environmental Management Water Footprint,²⁷ CEO Water Mandate Corporate Water Disclosure Guidelines,²⁸ CDP Water Security 2023 Reporting Guidance,²⁹ ESRS E3: Water and marine resources, and GRI 303: Water and effluents 2018.

- BC34. Multiple commenters highlighted the importance of providing practical examples for handling uncertainty and data gaps, with general and specialized use case scenarios. Though the methodology recognizes the importance of additional application guidance, it was decided that guidance was best done in other documents which will be explored in future efforts by IFVI, Capitals Coalition, and VBA. Specific use-case scenarios have been determined to be out of scope of the Water Consumption Approval Draft itself. Language has been added throughout the Water Consumption Approval Draft to note that use cases and practical examples may be explored in a future implementation guide. The concept of a future implementation guide, where additional guidance may be provided for handling data gaps using alternative estimation techniques, was also incorporated into the future development section (discussed further in Section 5 of this Document).

²⁷ ISO 14046. (2020). *Environmental management Water footprint: Principles, requirements and guidelines*.

²⁸ The Global Compact. (2014). *The CEO Water Mandate: Corporate water disclosure guidelines, Toward a common approach to reporting water issues*.

²⁹ CDP. (2023). *CDP water security 2023 reporting guidance*.

4 Outcomes, Impacts, and Valuation

- BC35. In Section '4: Outcomes Impacts and Valuation', the Exposure Draft proposed an approach to calculating entity Water Consumption impacts by providing the necessary equations and value factors to use along with relevant background and context. This section is designed as the final step in the determination of Water Consumption impacts and utilizes the impact driver data described in Section 3.
- BC36. The clarity of the content in this section and the usability of the valuation equations was the subject of a targeted feedback question during the public comment period. Most respondents were supportive of the clarity of the equations and the calculation approach. One respondent did not agree with the impacts included in the impact pathway, methodological approaches, or guidance in sections 4.2, 4.3 or Appendix B, but did not elaborate further. Several respondents as well as piloting VBA member companies asked for more clarification around various components of value factor development. Updates were made to further clarify details of the calculations in Sections 4.1, 4.2, and 4.3 as described below. Further clarifications were made in Appendix B, described in Section 6 of this Document.

4.1 How to Calculate Impacts

- BC37. The Exposure Draft proposed five equations to use to calculate the preferred method using Water Consumption data. Equations 3 – 5 demonstrated how to adjust national value factors for ecosystem services, nutrition, and disease, where national-level value factors are adjusted using water stress and biodiversity metrics provided by the preparer.³⁰ Equation 2 provides the method for aggregating impact valuations to the individual site level, where the site-level valuation for access to future water is added to the maximum present-day opportunity cost. Site-level valuations for access to future water were provided at the administrative 1 level³¹ using the Water Consumption Valuation Tool in Appendix E. Equation 1 sums all individual site valuations to calculate an entities' total water consumption impacts.
- BC38. Only minor changes were made in section 4.1 of the Approval Draft as compared to the Exposure Draft, including minor changes to paragraph 43 to align the language around natural capital with definitions and writings provided by Capitals Coalition. One respondent requested tools to aid in preparation of the preferred method. Though this tool was provided in the Exposure Draft, the technical team noted the need to make this more apparent. As a result, the existence of the tool is noted more clearly in the language of Section 4.1. Besides these minor edits, the calculations and definitions of variables in Section 4.1 remain the same as compared to the Exposure Draft.
- BC39. One commenter asked for more flexibility in the presentation of equation 2, when the alternative water use is known by the preparer. Equation 2 selects the maximum

³⁰ Water Stress and biodiversity metrics are applied by using information provided by the AQUEDUCT Water Risk Atlas and the WWF Biodiversity Risk Filter.

³¹ Administrative 1 is defined as the first-level administrative division within a country, such as a state, province or region.

present-day opportunity cost for water consumption, but some preparers may know exactly what the alternative use of water consumption would be (e.g., agriculture or domestic use) if not used by the entity. To address this, an additional footnote was added (footnote 60) which notes that it may be appropriate to provide a complementary analysis to the recommended application of the methodology in unique circumstances where the alternative water usage is known by the entity. In these cases, disclosure and transparency regarding changes to the official recommendations of the Methodology must be carefully documented.

- BC40. One respondent asked about the application of our work to quantify the *positive impacts* of water consumption reduction. The respondent used an example where a company's water consumption impacts were -\$2 million, but interventions caused their actual water consumption impacts to be -\$1 million, thus avoiding \$1 million in water consumption impacts. The technical staff notes that while improving the company's water footprint, this is not of the same as positive water consumption impacts, but instead an example of a reduction in negative water consumption impacts; in the provided example, the company's efforts to reduce water consumption may be valid, but they continue to cause -\$1 million in negative water consumption impacts. While the reduction in negative impacts can be a powerful success story for the sustainability transformation, the negative impacts of -\$1 million in water consumption impacts should be disclosed as part of the impact account. In researching this topic, the technical staff conducted discussions of examples where an entity discharges more water than they intake in the same geographical location. Because the impacts of this positive discharge cannot currently be quantified, a discussion of this point was added to the Future Developments section of the Approval Draft.
- BC41. One respondent did not agree with the quantification of impact valuations provided in Section 4.1, with particular concerns regarding (1) the ethics of the National Value Factors presented in the Exposure Draft, and (2) the uncertainty of translating national costs to local ones. Regarding the ethical concerns, a detailed discussion of how the National Value Factors have been improved to address this concern is provided in Section 7 of this Document. Regarding the uncertainty of translating national costs to local ones, the technical team recognizes that it is indeed challenging to account for highly contextual aspects of each valuation, and this needs to be acknowledged in the use of the general value factors. Ideally, value factors are being adjusted to locally specific contexts as outlined in the Approval Draft of the Methodology. Furthermore, the use of general value factors for investment decisions at local site levels should be complemented by other contextual information. This applies also, for example, to most applications of Life Cycle Assessments (LCA) for informing decision making, as LCAs rely on average values of resource use and related environmental and social impacts. Yet, LCAs are commonly being used as an approach for assessing trends and magnitudes in impacts of resource use. Similarly, approaches of impact accounting are increasingly being used by governments for informing policies and decision making. Still, many decisions are taken in policy making and business steering that do not consider impacts on the environment and society at all, effectively valuing environmental and societal

impacts as zero. Using impact accounting in environmental and regulatory impact assessments, along with contextual and qualitative information, can contribute to a more holistic decision-making process and reveal trade-offs to inform the magnitude of financial effects related to such unintended consequences.

- BC42. The Exposure Draft did not consider separate Local and Global valuation perspectives. Section 4.1 was updated in the Approval Draft to address the inclusion of local and global perspectives, guiding preparers to define and consistently apply which perspective they utilize.

4.2 Outcomes and Impacts

- BC43. Section '4.2 Outcomes and Impacts' proposed how the methodology determined the outcomes and impacts used to justify the quantitative modelling of the Water Consumption Methodology. Though the language of this section remained similar in both the Exposure and Approval Drafts, the section was updated to match changes to the Modelling that occurred within the Approval Draft. Updates to the modelling occurred with a series of themes in mind: (1) ensuring that sources utilized in the Water Consumption Methodology were as up-to-date as possible, and (2) highlighting and addressing modeling decisions that resulted in unintended ethical concerns noted by one commenter in the Public Comment Period. Additional details on outcome and impact modelling can be found in Appendix B.
- BC44. The description of affected health via malnutrition was updated between the Exposure Draft and Approval Draft. In the Exposure Draft, affected health via malnutrition was modelled using *characterization factors* (CFs) outlined by ReCiPe2016.³² In correspondence with the authors of this source, two updates were made to this pathway within the Approval Draft. Firstly, ReCiPe2016 was replaced with the *marginal* CFs (DALY/m³ H₂O consumed) provided by LC-IMPACT.³³ This decision was made in correspondence with one original author of the ReCiPe2016 source, who noted that the LC-IMPACT method provided the most recent representation of the country-level impact factors for malnutrition related to water stress, while retaining the same method as used in the ReCiPe2016 source. One commenter expressed concerns ReCiPe was representing missing information as zeroes for at least 9 countries. In correspondence with a lead author of LC-IMPACT and ReCiPe2016, it was discovered that this was indeed correct for a series of countries represented in both sources. The author of LC-IMPACT noted this will be fixed in a future iteration of their documentation and provided updated CFs for these countries,³⁴ which were incorporated into the Water Consumption Methodology. We thank the commenter for discovering this detailed error.

³² Huijbregts, M. A. J. et al. (2017). *ReCiPe2016: a harmonised life cycle impact assessment method at midpoint and endpoint level*.

³³ LC-Impact. n.d. *LC-Impact: A spatially differentiated life cycle impact assessment method*.

³⁴ This applies to a total of 20 countries: Fiji, Finland, Guinea-Bissau, Iran, Jamaica, Kenya, Madagascar, Malaysia, Niger, Nigeria, Romania, Russia, Senegal, Serbia, Montenegro, Sudan, Suriname, Thailand, Uganda, and Zambia.

- BC45. In the Exposure Draft, Affected Health via Water-borne Disease was represented using supplementary information from Motoshita et al., which used a multiple regression analysis to link water consumption to DALYs of affected health.³⁵ This source was retained and used in a similar fashion within the Approval Draft. An outlier exclusion method, which was applied universally across all impact pathways in the methodology, affected the final value applied to South Africa. This point is discussed further in Section 6 of this Document.
- BC46. In the Exposure Draft, altered ecosystem services were represented by (1) applying biome-level estimates of ecosystem service valuations to biome locations around the globe,³⁶ (2) aggregating these values to the country level, and (3) dividing these valuations by a proxy for water requirements for ecosystem functioning. In the preparation of the Exposure Draft, two options were favored to represent water requirements for ecosystem functioning; *Actual Evapotranspiration (AET)*³⁷ and *Potential Evapotranspiration (PET)*.³⁸ The Exposure Draft used PET on the rationale that it represented the amount of water ecosystems would use under ideal conditions of unlimited water availability. However, subsequent review for the Approval Draft revealed that using PET caused the systematic undervaluation of arid regions around the globe. Because PET reflects atmospheric demand rather than actual water use, its values are highest in dry climates, where water limitation constrains ecosystem activity. As a result, dividing ecosystem service valuations by PET disproportionately lowers estimated values for arid regions. This issue was resolved by adopting AET instead, as it reflects real-world ecosystem water use and thus provides a more accurate representation of water's role in sustaining ecosystem functioning under actual climatic conditions. This decision, in part, mitigated issues addressed by one commenter, who expressed concerns with under-representation of arid, low-income country national value factors.
- BC47. The description of the financial costs to access future water did not change substantially in this Section between the Exposure Draft and Approval Draft. However, some methods of quantification were updated during this period. Descriptions of these updates can be found in Appendix B of the Approval Draft and are discussed in further detail in Section 6 of this Document.
- BC48. Other updates to the underlying quantification of outcomes were made but not discussed here. For more information of the quantification changes made to the methodology, see Section 6 of this Document.

³⁵ Motoshita, M. et al. (2011). *Development of impact factors on damage to health by infectious diseases caused by domestic water scarcity*.

³⁶ Brander, L. M. et al. (2024). *Economic values for ecosystem services: A global synthesis and way forward*.

³⁷ AET is defined as the transfer of water from land to the atmosphere through transpiration and evaporation under prevailing soil moisture and vegetation conditions.

³⁸ PET is defined as the maximum rate at which water can be transferred from the land surface to the atmosphere through evaporation and transpiration, assuming an unlimited water supply.

4.3 Monetary Valuation

- BC49. Similar to Section 4.2, Section '4.3 Monetary Valuation' provides added details about how the value factor is derived and is organized by describing the valuation technique used for each category of impact. More detailed descriptions can be found in Appendix B.
- BC50. In the Exposure Draft, the *Value of a Statistical Life (VSL)*³⁹ was the basis for valuing outcomes for affected Health via Malnutrition ($VF_{\text{nutrition}}$) and Water-borne Disease (VF_{disease}). The VSL applied in the Exposure Draft utilized a single globally representative VSL of \$4,889,008 USD (2023), based on a VSL of \$3,135,447 USD (2005)⁴⁰ from the OECD, adjusted for inflation.⁴¹ The VSL was then converted to the valuation of one year of life lost by considering life expectancy and multiplied by the outcomes for both pathways. Though the structure of this calculation remains the same in the Approval Draft, the valuation now relies on a recently updated valuation described by a 2025 paper published by the OECD of \$2.7 million USD(2023).⁴² This decision was made to align with OECD updates, publications and standards.
- BC51. In the Exposure Draft, altered ecosystem services were valued using summary statistics described directly by the ESVD website.⁴³ However, the technical team notes that the ESVD is constantly evolving, adding new studies that cause fluctuations in the summary statistics used. In order to limit fluctuations and inconsistencies between the valuations utilized in the Water Consumption Methodology and those described by updates to the ESVD, the Approval Draft instead aligned its ecosystem service valuations with the most recent peer-reviewed publication associated with the database.⁴⁴ This publication provides the added benefit of thorough quality control into the biome-ecosystem averages that are published via the inclusion of a transparent outlier exclusion rule (OER) and manual examination of biophysical and socio-economic representativeness of studies included in the final analysis. The OER outlined in the study was also applied to all other pathways in the Water Consumption Approval Methodology for consistency. A description of this OER, and other application decisions that were made in the altered ecosystem services pathway were described in deeper detail in Appendix B.
- BC52. In the Exposure Draft, the Financial Costs to Access Future Water Pathway was valued using a present-day estimate of unit operation costs to produce water supplied from water utilities. The technical team discussed alternatives to this valuation approach for the Approval Draft, including associated costs related to switching to bottled water and heightened infrastructure requirements due to water scarcity (e.g., desalination).

³⁹ Biaisque, V. (2012). *The Value of Statistical Life: A meta-analysis*.

⁴⁰ See Table 1 in Biaisque, V. (2012). *The Value of Statistical Life: A meta-analysis*.

⁴¹ Inflation adjusted using OECD's Inflation (Consumer Price Index) and Inflation Forecast data series, which can be accessed via: <https://data.oecd.org/price/inflation-cpi.htm>

⁴² OECD. (2025). *Mortality Risk Valuation in Policy Assessment: A Global Meta-Analysis of Value of Statistical Life Studies*.

⁴³ ESVD. (2025). *Ecosystems Services Valuation Database (ESVD)*.

⁴⁴ Brander, L. M. et al. (2024). *Economic values for ecosystem services: A global synthesis and way forward*.

However, uncertainty in these valuation methods exists, including a lack of comprehensive global studies, insufficient valuation techniques, or a combination of both. As a result, the operational cost to produce water remained the valuation method applied in the Approval Draft, with the justification that it represents a conservative lower bound estimate of potential impacts. However, alternatives to this valuation method will continue to be discussed and were represented in the Future Developments Section of the Approval Draft.

5 Future Development

- BC53. Section '5 Future Development' proposed several areas that had been identified as avenues of future development during the research process. These include the potential advancements of valuation approaches and data quality for water consumption accounting, techniques for modeling additional impacts (i.e., subsidence), and methods for impact accounting at finer spatial resolutions. While no respondents provided feedback directly on this section, a few changes were made that addressed broader comments. The Approval Draft included additional developments for methodological improvement, many based on points brought up during the public comment period, that will be explored as updates in subsequent iterations of the Water Consumption Methodology.
- BC54. Many respondents requested more guidance on handling data gaps and uncertainty in the development of water consumption accounts. As this subject requires extensive explanation and unique circumstances, it has been noted as an important topic for future development but currently sits outside of the scope of the Water Consumption Methodology itself. This point was addressed in paragraph 57a.
- BC55. One respondent commented about water discharge, noting scenarios exist where a company discharges more water than it consumes, and whether the impacts of such a scenario would be positive. The technical team noted that the methodology is designed to measure and value the negative impacts from water consumption, rather than to quantify ecosystem benefits derived from additional water availability. It remains deeply context-specific whether the impacts of discharge are indeed positive and thus is currently considered out of scope. This point was addressed in paragraph 57e.
- BC56. The Approval Draft provided additional commentary around the valuation method for the Financial Costs of Access to Future Water in paragraph 57f. Multiple respondents commented on alternatives to the valuation for future Water Access, including costs surrounding a switch to bottled water, infrastructural developments to combat water scarcity (e.g., desalination), and increased energy requirements to access new sources of water when easily accessible water sources become unavailable. However, modelling future water depletion, requirements and costs of desalination, and even energy requirements and how they change over time lead to major difficulties and margins of error. Thus, the Approval Draft retained its previous valuation techniques for future water as an intentionally conservative and generalized approach but notes this section of the Methodology will be continuously explored for new approaches in future iterations.
- BC57. One commenter expressed concerns around the use of the minimum option for large countries where water availability may be highly variable. The technical team discussed options for modifying large country value factors (e.g., applying the 75th percentile of water consumption impacts for large country x) or disallowing the application of the minimum option for larger countries. However, the technical team concluded that determining an exact definition for what denotes a large country is arbitrary and difficult to fairly implement. As a result, this point was recognized in paragraph 32a and

footnote 49, where the preferred option is highly recommended for locations where this issue is most apparent. Paragraph 57g highlights the issue and notes that new iterations of the Water Consumption Methodology will explore updated recommendations for this issue.

- BC58. The technical team noted the importance of highlighting how infrastructural developments (e.g., dams, reservoirs, and diversions) can significantly alter natural water flow, causing changes in water availability downstream. A discussion of this issue was added to paragraph 57h.
- BC59. Green Water was discussed in public feedback sessions, where it was made clear that a discussion of the application of the Water Consumption methodology to Green Water Consumption was apparent. The technical team decided that green water would not be incorporated into this iteration of the Water Consumption Approval Draft. A discussion of this point was incorporated into paragraph 57i.
- BC60. The valuation method used for ecosystem services relies on the Ecosystem Service Valuation Database (ESVD), which represents a state-of-the-art catalogue of ecosystem service studies performed around the globe. However, gaps exist in our knowledge of in-situ studies of ecosystem service valuations for many regions of the globe, most notably the Middle East and North Africa (MENA), central Africa, and central Asia. This limitation caused the analysis utilized within the Water Consumption Methodology to rely on global biome averages. However, a biome in one region of the globe may provide more valuable or less valuable ecosystem services than a similar biome in a different region of the globe. As a result, the ecosystem service estimates utilized in the water consumption methodology may overestimate ecosystem services in some countries while underestimating them in others. This is discussed in paragraph 57j.
- BC61. One commenter noted that the impacts of discharge are distinct from the impacts of Water Consumption and should be incorporated into the methodology. The current Water Consumption Methodology does not provide discharge-related value factors that are unique from those associated with water consumption. However, altered discharge patterns have the capacity for negative impacts (e.g., increased flood risks, shifts in water availability, etc.) that will be considered in future iterations of the Water Consumption Methodology. This is now discussed in paragraph 57k.
- BC62. One commenter expressed concerns about the approach of the Water Consumption Methodology, particularly in how the Methodology uses approximations of average effects at a broad scale. The commenter went on to discuss the difficulty of evaluating shadow costs on even a national scale, and the imprecision that arises from scaling these costs to match local conditions. The technical team agrees that concepts such as the social cost of carbon and related estimates require a range of assumptions and generalizations. This makes such approaches useful for providing general guidance on impacts rather than precise estimates. This distinction should be accounted for when using impact valuation for informing decision making. Many decisions are taken on a daily basis in policy making and business steering that do not consider impacts on the environment and society *at all*; as a result, many effectively value their impacts to the

environment and society as *zero*. The Water Consumption Methodology presents an alternative approach to the status quo that is iterative and continuously being enhanced as better scientific knowledge becomes available.

6 Appendices

- BC63. In the Exposure Draft, the primary text of the methodology was supported by eight appendices that provided a full glossary of relevant terms (Appendix A), additional methodological details around the development of the value factor (Appendix B), guidance on accessing local water stress and biodiversity pressure metrics (Appendix C), Tables describing national value factors (Appendix D), the introduction of a water consumption value factor tool to aid preparers (Appendix E), tables showing value factor valuations for previous years (Appendix F), alignment with reporting standards (Appendix G) and a governance for valuation transparency requirement report (Appendix H). The primary text was intentionally kept concise for clarity with the appendices allowing for additional detail that preparers and users of impact information might find useful. The paragraphs below describe each of these appendices and note what changes have been made between the Exposure and Approval Drafts.
- BC64. ‘Appendix A: Glossary’ proposed a complete list of terms relevant to the Water Consumption Methodology. The Approval Draft saw the updated definitions of outcomes⁴⁵ and impacts⁴⁶ to align with language in the Approval Draft of General Methodology 2. The definition for potential evapotranspiration (PET) was replaced with actual evapotranspiration (AET) to match updated methods used within the Approval Draft. Finally, the definitions for *blue water* and *green water* were added to the glossary.
- BC65. ‘Appendix B: Methodological Details’ proposed all details that may be needed to understand each component of the Water Consumption Methodology. Some respondents asked for more details regarding the methods used in each section of the Water Consumption Model. To provide the needed clarity, some of the information in this section was moved to the body of the Water Consumption Methodology. In other cases, Appendix B was expanded upon to provide added detail. In the Exposure Draft, Appendix B comprised of five sections; (1) Introduction, (2) affected Health from Malnutrition, (3) affected Health from Water-borne Disease, (4) Altered Ecosystem Services, and (5) Financial Costs to Access Future Water. The Approval Draft saw edits to these sections and developed two additional sections; (6) Strategies for gap-filling and Outlier Exclusion and (7) Local vs. Global vs. Utility Weighted Perspectives. Updates to these sections is described below.

⁴⁵ The Exposure Draft used the following definition for outcomes: *The level of well-being experienced by people or condition of the natural environment that results from the actions of the entity, as well as from external factors. Outcomes are used to describe the one or more dimensions of people's well-being that are affected by an input, activity, and/or output.* This was updated in the Approval Draft to read: *The change in the state or condition of capital(s), in physical, biological, psychological, human rights, or equity terms, that results from an entity's activities.*

⁴⁶ The Exposure Draft use the following definition for impacts: *A change in one or more dimensions of people's well-being directly or through a change in the condition of the natural environment.* This was updated in the Approval Draft to read: *A positive or negative change in one or more dimensions of people's well-being directly or through a change in the natural environment. In impact accounting, this is expressed in monetary terms.*

- BC66. Section 1, Introduction, describes the categories of value factors quantified in the Approval Draft, and saw no major edits between Exposure and Approval Drafts.
- BC67. Some respondents asked for more clarity on the calculations behind the Health-related pathways (Section 2, Affected Health from Malnutrition, and Section 3, Affected Health from Infectious Disease). Thus, the Approval Draft incorporates formulas and more detailed descriptions to the quantification of impacts for these sections. These two sections were updated to match changes to the Water Consumption quantification strategy described in the paragraphs above of this Document, including updated sources (i.e., ReCiPe2016 updated to LC-IMPACT), new VSL valuations from the OECD, and a discussion of local, global and utility weights.
- BC68. Section 4 of Appendix B provides a detailed description of the Altered Ecosystem Service Pathway. This section expands on updates to the Ecosystem Service Pathway that were discussed in the body of the Water Consumption Methodology. One update discussed here and not in the body of the Methodology concerns the ecosystem service valuations for deserts and semi-deserts. In Brander et al. 2024,⁴⁷ it is noted that very few studies represented the ecosystem services of deserts and semi-deserts within the ESVD at the time of publication. To combat this, the Water Consumption Methodology used the ecosystem service estimates for shrubland and shrubby woodlands for deserts and semi-deserts. The inclusion of ecosystem services related directly to desert and semi-deserts has been noted as a necessary update in future iterations of the Water Consumption Methodology, when more information on these biomes is published.
- BC69. Section 5 of Appendix B provides a detailed description of the Access to Future Generations Pathway. One respondent asked for more information on how data was aggregated from the watershed level to the province level for this pathway. To address this, more detail was added to paragraph B29-B31 to describe how the pathway was modeled. One methodological update that was not discussed in the main body of the Water Methodology Approval Draft was detailed here, regarding the removal of sub-basins labelled as *arid and low water use* by AQUEDUCT.⁴⁸ The Water Consumption Methodology utilizes Water Stress scores from AQUEDUCT, which measure the total water demand to available renewable surface and groundwater supplies at a sub-basin level. Sub-basins labelled as *arid and low water use* represent some of the driest locations on earth, including portions of the Saharan desert, Namib desert, Western Australia, etc. Though these sub-basins have a very low water supply, they also have a very low water demand, as they represent locations on earth that are currently not utilized as sources of water availability. As a result, the valuation for many of these sub-basins within the Water Consumption is zero or artificially low. When these sub-basins are aggregated to the administrative 1 or country level, they unintentionally lower impact valuations. This is especially true for countries with densely populated urban centers and large swaths of empty, unpopulated dry land, such as the arid countries of North Africa. The removal of arid and low water use sub-basins from the analysis

⁴⁷ Brander, L. M. et al. (2024). *Economic values for ecosystem services: A global synthesis and way forward*.

⁴⁸ World Resource Institute. (2023). *Aqueduct 4.0 Water Risk Atlas Data Dictionary*.

corrects for this issue, mitigating major concerns of low values for MENA countries brought to our attention during the public comment period.

- BC70. Sections 6 and 7 are new additions to Appendix B that describe strategies for gap filling and outlier exclusion, as well as the local, global, and utility weighted perspectives, respectively. Section 6 describes the application of a common outlier exclusion rule (OER), defined as values falling more than 1.5 times the interquartile range (IQR) beyond the first or third quartile of the log-transformed outcomes for each pathway. This method mirrors the main approach used within the Ecosystem Service Valuation Database literature to identify and exclude outliers.⁴⁹ Within the Water Consumption Methodology, this OER approach identified one outlier – that of South Africa for the Infectious Disease pathway – in which an income-region average was used as a replacement. Section 7 describes the methods behind the local, global, and utility weighted perspectives. The Water Consumption Methodology notes that the local and global perspectives are part of the official recommendations, where the utility weighted perspective is not part of the official Methodology but can be used for complementary assessments. A detailed mathematical description of how each of these perspectives is quantified can be found in Table B1.
- BC71. ‘Appendix C: Accessing Local Water Stress and Biodiversity Pressure’ presents guidance on how to obtain local water stress values from WRI’s AQUEDUCT⁵⁰ and biodiversity pressure from WWF’s Biodiversity Risk Filter.⁵¹ No major updates occurred within this Appendix between the Exposure and Approval Drafts.
- BC72. ‘Appendix D: National Value Factors, Water Stress, and Biodiversity Pressure – Global Perspective’ provides the national value factor, water stress, and biodiversity pressure values determined by the Water Consumption Methodology *in the global perspective*.⁵² Though the structure of this Appendix remains similar to that of the Exposure Draft, where national value factors are displayed in Table D1 and Region/Income Class averages in Table D2, the value factors themselves have changed significantly between the two Drafts based on methodological updates. Further, values that are replaced with outliers are now noted with a dagger symbol (†). Access to local⁵³ and/or utility⁵⁴

⁴⁹ Brander, L. M. et al. (2024). *Economic values for ecosystem services: A global synthesis and way forward.*; ESVD. (2025). *Ecosystems Services Valuation Database (ESVD)*.

⁵⁰ *Aqueduct Water Risk Atlas*. n.d.

⁵¹ World Wildlife Fund. (2023). *The WWF Biodiversity Risk Filter tool methodology*.

⁵² The global perspective avoids differences in impact accounts that are only driven by price-level differences and not by performance. This perspective is intended to remove disparities related to income effects. This perspective is relevant when using impact accounting across jurisdictions or presenting results to cross-country stakeholders removing the influence of income. In the Water Consumption Methodology, the global perspective value factors should not be utilized when making analyses only within a single country. See

⁵³ In the local perspective, results are aligned with the actual prices and the local context. This perspective is relevant when using impact accounting within a single jurisdiction (e.g., Managers of the entity making decisions at a local context or operating in a single country). In the Water Consumption Methodology, the local perspective value factors should not be utilized when making cross-country comparisons.

⁵⁴ The utility weighted perspective is not part of the official Water Consumption Methodology but can be used for complementary assessments. This perspective is an extension of the global perspective, but accounts for higher

weighted value factors can be found within the Water Consumption Value Factor Tool in Appendix E.

- BC73. 'Appendix E: Water Consumption Value Factor Tool' provides a link to an excel tool that can be accessed by users to ease the preparation of impact accounts. The tool was available in the Exposure Draft but has been updated significantly in the Approval Draft. Updates include drop-down menus to allow users to toggle between local, global, and utility weighted results, as well as all of the updates to the value factors as described in the paragraphs above.
- BC74. 'Appendix F: Previous Year Value Factors' provides a link to an excel file which includes value factors adjusted for inflation to years earlier than 2023. Though the value factors have been updated with all of the information described above, this Appendix has not changed in structure between the Exposure and Approval Drafts.
- BC75. 'Appendix G: Alignment with Reporting Standards' describes the linkages between data needed for reporting standards from sources such as ESRS⁵⁵ and GRI⁵⁶ and the Water Consumption Methodology. This Appendix has not changed significantly between the Exposure and Approval Drafts.
- BC76. 'Appendix H: Governance for Valuation Transparency Requirement Report: Value Factors' presents the Water Consumption Topic Methodology summarized in the form of the Transparency Report proposed by the Governance for Valuation document.⁵⁷ This Appendix has been updated in accordance with the changes described within this Document and the Water Consumption Methodology.

marginal sensibility to impacts in lower income countries and lower marginal sensibility to impacts in higher income countries. The utility weighted perspective provides additional considerations for recognizing different well-being implications from marginal effects. In the Water Consumption Methodology, utility weighted value factors should not be utilized when making analyses only within a single country, similar to the global perspective. Utility weighted value factors can be selected if the entity wishes to present results to stakeholders to illustrate the implications of addressing additional equity concerns.

⁵⁵ ESRS. (2022). *E3: Water and marine resources*. Alignment with ESRS standards is based on EU Commission delegated act of 2023. For information on alignment with ESRS consultation draft released by EFRAG in July 2025, please refer to the VBA's Mapping tool for ESRS datapoints.

⁵⁶ GRI. (2023). *GRI 303: Water and effluents 2018*.

⁵⁷ Capitals Coalition (2025b). Governance for Valuation - Part of the Integrated Decision-Making Framework. <https://capitalscoalition.org/capitals-approach/frameworkintegrated/>

7 Robustness of National Value Factor and Value Factor Characteristics

BC77. One major theme of the Public Comment Period was the necessity for a sensitivity analysis and statistical break-down of final value factors. The technical team concluded that such an analysis would fall outside of the scope of the Water Consumption Methodology itself but may be provided in future documentation. In the interim, this Section provides a preliminary assessment of the differences between the Exposure and Approval Drafts. One major theme discussed in this section is the ethical concerns expressed by one commenter in the Public Comment Period, who noted the strong connection between the Exposure Draft Value Factors and country-level GDP per capita. Here, we provide an analysis of both the Exposure and Approval Drafts, highlighting the relationships between Value Factors and socio-economic variables such as GDP.

Part 1: Analyses and criticisms of Exposure Draft Value Factors

BC78. One respondent provided detailed criticisms of the national value factors provided by the Exposure Draft, citing ethical concerns. In particular, the respondent provided commentary on how value factors provided in the Exposure Draft had a strong positive association with national GDP per capita, and how North African countries (e.g., Mauritania) and Sub-Saharan African nations (e.g., Somalia, Niger, and South Sudan) had low water consumption impacts.

BC79. The commenter presented a graph to visualize these concerns. The technical team recreated this graph (See Figure 1 below) and provided an additional series of linear models (see Table 1 below) to test the relationship between the Exposure Draft Value Factors, national GDP, and national water stress. Table 1 describes and interprets the four models used to analyze the relationship between the Exposure Draft Value Factors and (1) National GDP per Capita, (2) National Water Stress, (3) the joint influence of National GDP and National Water Stress, and (4) the interaction between National GDP and National Water Stress. All four models explained significant variation in the national value factors. All models indicated that both GDP and water stress had a positive relationship with the Exposure Draft National Value Factors. The best fitting model, model 4, showed that wealthier countries with higher water stress tended to have disproportionately high value factors in the Exposure Draft.⁵⁸ These results support the commenter's concerns with the value factors presented in the *Exposure Draft*.

⁵⁸ Model 4, where the interaction between GDP and water stress explained the Exposure Draft Value Factors, was selected as the best fitting model of those presented based on the highest explanatory power and the lowest AIC/BIC values. See Table 1 for more details.

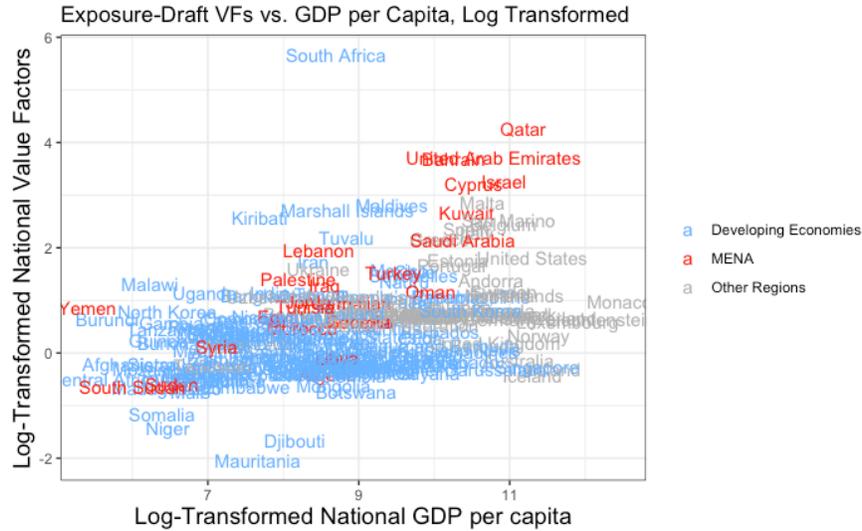


Figure 1. Exposure Draft National Value Factors vs. National GDP per Capita. Countries noted as ‘Developing Economies’ are highlighted in blue, and Middle East/North African (MENA) countries are highlighted in red.⁵⁹ Both axes are log transformed.⁶⁰

Model	Predictors	Adj. R ²	β Coefficients (\pm SE)	p-values	Main Findings
1	GDP per capita	0.161	0.29 \pm 0.05	< 0.001	Wealthier countries had significantly higher <i>Exposure Draft</i> National Value Factors than less wealthy countries.
2	WS	0.245	0.33 \pm 0.05	< 0.001	Nations facing greater water stress showed larger <i>Exposure Draft</i> National Value Factors.
3	GDP per capita + WS	0.391	GDP: 0.27 \pm 0.04 WS: 0.30 \pm 0.04	< 0.001	Wealth and water stress, independently, had positive relationships with <i>Exposure Draft</i> National Value Factors.
4	GDP per capita x WS (interaction)	0.481	Interaction: 0.13 \pm 0.02	< 0.001	The interaction model had the best fit of all four models; countries that were both wealthy and water stressed had dramatically higher impacts in the <i>Exposure Draft</i>.

Table 1. Linear regression model results. GDP = Gross Domestic Product, where WS = Water Stress. Model 4 is highlighted in bold as it was selected as the most fit model (lowest AIC/BIC).

⁵⁹ The terms “Developed economies”, “Economies in Transition,” and “Developing Economies” were utilized in the Exposure Draft. Please note that this language has changed in the Approval Draft to align with the World Bank income classifications, “low income”, “lower middle income”, “upper middle income” and “high income.”

⁶⁰ The variables were log-transformed to make the data easier to compare and understand. Log-transforming the axes reduced skewness and heteroskedasticity, and better represents proportional relationships, making it easier to interpret the results in terms of percentage changes rather than absolute differences.

- BC80. Further, the commenter described a relationship between a countries' Corruption Perception Index (CPI)⁶¹ and the Exposure Draft Value Factors. A similar analysis to that described above was completed using CPI instead of GDP. The results of these linear regressions also showed a positive relationship between CPI scores and the Exposure Draft Value Factors, meaning countries with lower corruption perceptions had higher water consumption value factors in the Exposure Draft.
- BC81. These trends were noted as points of high concern in the research phase of the Approval Draft. Made to the underlying model of the Approval Draft (described throughout Sections 1-5 of this Document) addressed many of these issues. The resulting analysis is discussed below.

Part 2: Analysis of the Approval Draft National Value Factors (Global Perspective)

- BC82. After the inclusion of the updates to the Water Consumption Approval Draft described in Sections 1-5 of this Document, similar analyses to Part 1 described above were repeated. One major relevant update between the Exposure Draft and the Approval Draft was the incorporation of two unique valuation perspectives: the Local Perspective, suitable for assessments that prioritize local stakeholder relevance or require alignment with national standards and contexts, and the Global Perspective, suitable for consistent valuation of impacts across countries, enabling comparability by removing distortions caused by income or price level differences. As the Local Perspective is not intended for cross-country comparisons, the Global Perspective value factors are the focus of statistical analysis in this Section.
- BC83. When the effect of GDP per capita and Water stress are analyzed with the Approval Draft's Global Perspective Value Factors (Figure 2 and Table 2), stark contrasts between the Approval Draft and Exposure Draft can be seen. For the Global Perspective, water stress is the primary driver of the National Value Factors, explaining ~59% of the variation alone (see Model 2 in Table 2). GDP per capita alone, in contrast, has virtually zero explanatory power (see Model 1 in Table 2). Adding GDP and water stress to the same model (Model 3) slightly improves fit, and interestingly, the GDP coefficient becomes slightly negative, suggesting that wealthier nations do not have larger Value Factors in the Global Perspective. Overall, water stress has much higher predictive power in the Approval Draft's Global Perspective, where GDP effects are context-dependent and minimal. When the model was run again with CPI instead of GDP, CPI was found to not be a significant predictor of the Global Perspective Value Factors.

⁶¹ *Corruption Perceptions Index*. (2025)

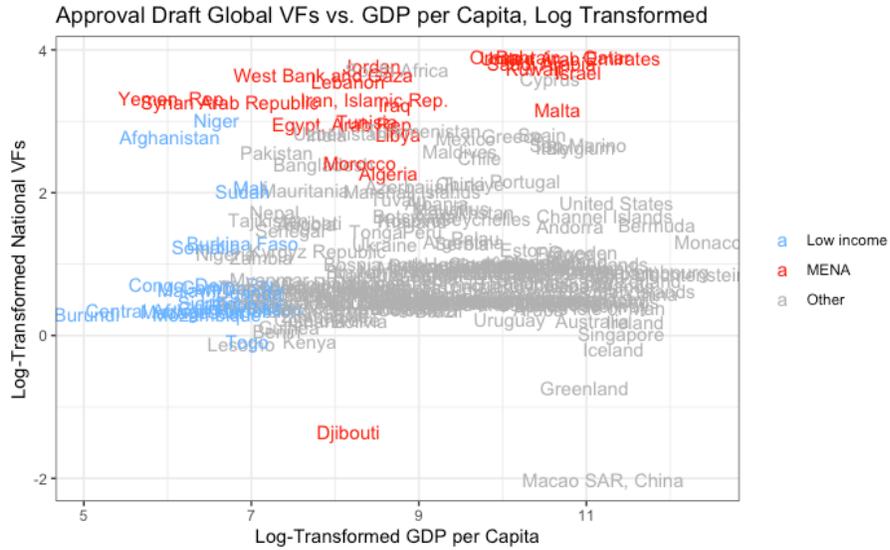


Figure 2. Approval Draft National Value Factors, Global Perspective vs. National GDP per Capita. Countries noted as ‘low income’ are highlighted in blue, and Middle East/North African (MENA) countries are highlighted in red.⁶² Both axes are log transformed.⁶³

Model	Predictors	Adj. R ²	β Coefficients (± SE)	p-values	Main Findings
1	GDP per capita	-0.004	0.0.019 ± 0.050	0.704 (NS)	GDP alone does not explain any significant variation in Global Value Factors in the Approval Draft.
2	WS	0.586	0.565 ± 0.032	< 0.001	Water Stress has a significant positive relationship with Global Value Factors in the Approval Draft.
3	GDP per capita + WS	0.595	GDP: -0.066 ± 0.032 WS: 0.571 ± 0.033	0.039, <0.001	Water stress remains the dominant predictor of Global Value Factors. GDP shows a slight negative association when controlling for water stress.
4	GDP per capita x WS (interaction)	0.594	GDP: -0.097 ± 0.049 WS: 0.408 ± 0.199 Interaction: 0.018 ± 0.022	0.050, 0.042, 0.408 (NS)	Interaction term not significant; effect of GDP does not vary meaningfully by water stress.

Table 2. Linear regression model results. GDP = Gross Domestic Product, WS = Water Stress, and NS = Not Significant. Model 4 is highlighted in bold as it was selected as the most fit model (lowest AIC/BIC).

⁶² The terms “Developed economies,” “Economies in Transition,” and “Developing Economies” were utilized in the Exposure Draft. Please note that this language has changed in the Approval Draft to align with the World Bank income classifications, “low income,” “lower middle income,” “upper middle income” and “high income.”

⁶³ The variables were log-transformed to make the data easier to compare and understand. Log-transforming the axes reduced skewness and heteroskedasticity, and better represents proportional relationships, making it easier to interpret the results in terms of percentage changes rather than absolute differences.

Part 3: Other trends in the Approval Draft Value Factors

- BC84. In the Water Consumption Approval Draft, National value factors are calculated via the following equation:

$$VF_{H2O-national} = MAX(VF_{es}, VF_{nutrition}, VF_{disease}) + VF_{access}$$

Where $VF_{H2O-national}$ is the national value factor, VF_{es} is the impact to ecosystem services, $VF_{nutrition}$ is the health-related impacts caused by malnutrition, $VF_{disease}$ is the health-related impacts caused by infectious disease, and VF_{access} is the impact to future generations. As the impact of each single unit of water could not have been used for all three alternative present-day uses, the largest value factor of the three is taken as the missed opportunity to maximize the value of that water for another use. Within the National Value Factors of the Approval Draft, this maximum cost is typically represented by the impact to ecosystem services.⁶⁴ This trend may change as new data and modelling techniques are utilized in future iterations of the Water Consumption Methodology. Further, $VF_{nutrition}$ and $VF_{disease}$ may represent the maximum value of the three present-day uses when utilizing the preferred method. This is particularly true in locations where the biodiversity risks are lower than the national average and water stress is higher than the national average. A more in-depth analysis of the changes that can occur when utilizing the preferred method may be provided in future complementary implementation materials.

- BC85. Section 7, Part 2 of this Document presents how the Value Factors in the Global Perspective cannot be explained by national GDP per capita alone. This trend is not the case for Value factors in the Local Perspective, where GDP per capita alone explains ~46% of the variation in these National Value Factors. However, this trend is to be expected, as this perspective expresses water consumption impacts using country-specific benchmarks and price levels intended for assessments that prioritize local stakeholder relevance, and are not intended for cross-country comparisons or analysis.
- BC86. Middle East and North African Countries (MENA) typically have the highest National Value Factors in the Global Perspective of the Approval Draft (Figure 2), independent of GDP per capita. This trend is observed in all MENA countries, with the one notable exception of Djibouti, a country known for high water stress. In researching why this is the case, it was found that the reason behind this has to do with the baseline and future water stress values noted by the AQUEDUCT database,⁶⁵ where raw water stress index (WSI) scores are less than or equal to 1 for present day and future water stress. This results in a value factor for Access to Future Generations of zero for Djibouti in

⁶⁴ Currently, the health-related impacts of nutrition are the largest of the three near-term impacts for Egypt and Yemen. The health-related impacts of infectious diseases are the largest for Estonia, Libya, South Africa, and Ukraine. For all other countries, ecosystem services represent the largest impact of the three.

⁶⁵ World Resource Institute. (2023). *Aqueduct 4.0 Water Risk Atlas Data Dictionary*.

both the Local and Global Perspectives. As updates to the AQUEDUCT database become available, the Water Consumption Methodology will be updated to reflect these changes.

8 Bibliography

Aqueduct Water Risk Atlas. (n.d.). Retrieved December 18, 2023, from

https://www.wri.org/applications/aqueduct/water-risk-atlas/#/?advanced=false&basemap=hydro&geoStore=14ff089f2acbebba8b2c41ebb204947f&indicator=w_awr_def_tot_cat&lat=19.476950206488414&lng=-114.96093750000001&mapMode=analysis&month=1&opacity=0.5&ponderation=DEF&predefined=false&projection=absolute&scenario=optimistic&scope=baseline&timeScale=annual&year=baseline&zoom=2

Biausque, V. (2012). *The Value of Statistical Life: A meta-analysis*.

[https://one.oecd.org/document/ENV/EPOC/WPNEP\(2010\)9/FINAL/en/pdf](https://one.oecd.org/document/ENV/EPOC/WPNEP(2010)9/FINAL/en/pdf)

Brander, L. M., de Groot, R., Schägner, J. P., Guisado-Goñi, V., van 't Hoff, V., Solomonides, S., McVittie, A., Eppink, F., Sposato, M., Do, L., Ghermandi, A., Sinclair, M., & Thomas, R. (2024). Economic values for ecosystem services: A global synthesis and way forward. *Ecosystem Services*, 66, 101606. <https://doi.org/10.1016/j.ecoser.2024.101606>

CDP. (2023). *CDP water security 2023 reporting guidance*. [https://cdn.cdp.net/guidance-](https://cdn.cdp.net/guidance-production/011e0fb1-d8ab-4a50-9d62-9717b96ef071/WS_ReportingGuidance_Full_InvestmentCommunity_SupplyChain_20-03-2024_21-55-17.pdf?sp=r&sv=2017-11-09&sr=b&st=2024-03-20T21%3A55%3A35Z&se=2024-03-20T23%3A55%3A35Z&sig=Dh2IAvk83UkWq%2FP5TVMV2%2FfmQgxWRFukVSxnKjmH4Nw%3D)

[production/011e0fb1-d8ab-4a50-9d62-](https://cdn.cdp.net/guidance-production/011e0fb1-d8ab-4a50-9d62-9717b96ef071/WS_ReportingGuidance_Full_InvestmentCommunity_SupplyChain_20-03-2024_21-55-17.pdf?sp=r&sv=2017-11-09&sr=b&st=2024-03-20T21%3A55%3A35Z&se=2024-03-20T23%3A55%3A35Z&sig=Dh2IAvk83UkWq%2FP5TVMV2%2FfmQgxWRFukVSxnKjmH4Nw%3D)

[9717b96ef071/WS_ReportingGuidance_Full_InvestmentCommunity_SupplyChain_20-](https://cdn.cdp.net/guidance-production/011e0fb1-d8ab-4a50-9d62-9717b96ef071/WS_ReportingGuidance_Full_InvestmentCommunity_SupplyChain_20-03-2024_21-55-17.pdf?sp=r&sv=2017-11-09&sr=b&st=2024-03-20T21%3A55%3A35Z&se=2024-03-20T23%3A55%3A35Z&sig=Dh2IAvk83UkWq%2FP5TVMV2%2FfmQgxWRFukVSxnKjmH4Nw%3D)

[03-2024_21-55-17.pdf?sp=r&sv=2017-11-09&sr=b&st=2024-03-](https://cdn.cdp.net/guidance-production/011e0fb1-d8ab-4a50-9d62-9717b96ef071/WS_ReportingGuidance_Full_InvestmentCommunity_SupplyChain_20-03-2024_21-55-17.pdf?sp=r&sv=2017-11-09&sr=b&st=2024-03-20T21%3A55%3A35Z&se=2024-03-20T23%3A55%3A35Z&sig=Dh2IAvk83UkWq%2FP5TVMV2%2FfmQgxWRFukVSxnKjmH4Nw%3D)

[\[20T21%3A55%3A35Z&se=2024-03-\]\(https://cdn.cdp.net/guidance-production/011e0fb1-d8ab-4a50-9d62-9717b96ef071/WS_ReportingGuidance_Full_InvestmentCommunity_SupplyChain_20-03-2024_21-55-17.pdf?sp=r&sv=2017-11-09&sr=b&st=2024-03-20T21%3A55%3A35Z&se=2024-03-20T23%3A55%3A35Z&sig=Dh2IAvk83UkWq%2FP5TVMV2%2FfmQgxWRFukVSxnKjmH4Nw%3D\)](https://cdn.cdp.net/guidance-production/011e0fb1-d8ab-4a50-9d62-9717b96ef071/WS_ReportingGuidance_Full_InvestmentCommunity_SupplyChain_20-03-2024_21-55-17.pdf?sp=r&sv=2017-11-09&sr=b&st=2024-03-20T21%3A55%3A35Z&se=2024-03-</p></div><div data-bbox=)

[20T23%3A55%3A35Z&sig=Dh2IAvk83UkWq%2FP5TVMV2%2FfmQgxWRFukVSxnKjmH4Nw%3D](https://cdn.cdp.net/guidance-production/011e0fb1-d8ab-4a50-9d62-9717b96ef071/WS_ReportingGuidance_Full_InvestmentCommunity_SupplyChain_20-03-2024_21-55-17.pdf?sp=r&sv=2017-11-09&sr=b&st=2024-03-20T21%3A55%3A35Z&se=2024-03-20T23%3A55%3A35Z&sig=Dh2IAvk83UkWq%2FP5TVMV2%2FfmQgxWRFukVSxnKjmH4Nw%3D)

Corruption Perceptions Index. (2025). Our World in Data. <https://ourworldindata.org/grapher/ti-corruption-perception-index>

ESRS. (2022). *E3: Water and marine resources*. ESRS.

<https://www.efrag.org/Assets/Download?assetUrl=%2Fsites%2Fwebpublishing%2FSiteAssets%2F10%2520Draft%2520ESRS%2520E3%2520Water%2520and%2520marine%2520resources%2520November%25202022.pdf&AspxAutoDetectCookieSupport=1>

ESVD. (2025). *Ecosystems Services Valuation Database (ESVD)*. <https://www.esvd.net/esvd>

Food and Agriculture Organization. (n.d.). *AQUASTAT - FAO's Global Information System on*

Water and Agriculture. Retrieved December 13, 2023, from

<https://www.fao.org/aquastat/en/data-analysis/irrig-water-use>

GRI. (2023). *GRI 303: Water and effluents 2018*.

<https://www.globalreporting.org/standards/media/1909/gri-303-water-and-effluents-2018.pdf>

Huijbregts, M. A. J., Steinmann, Z. J. N., Elshout, P. M. F., Stam, G., Verones, F., Vieira, M., Zijp,

M., Hollander, A., & Van Zelm, R. (2017). ReCiPe2016: a harmonised life cycle impact

assessment method at midpoint and endpoint level. *The International Journal of Life*

Cycle Assessment, 22(2), 138–147. <https://doi.org/10.1007/s11367-016-1246-y>

IFVI. (2024). *General Methodology 1: Conceptual Framework for Impact Accounting*.

[https://ifvi.org/wp-content/uploads/2024/02/IFVI_VBA_General-Methodology-](https://ifvi.org/wp-content/uploads/2024/02/IFVI_VBA_General-Methodology-1_Letter.pdf)

[1_Letter.pdf](https://ifvi.org/wp-content/uploads/2024/02/IFVI_VBA_General-Methodology-1_Letter.pdf)

- Impact-Weighted Accounts Project. (2022). *Practitioner Guide to Calculating Corporate Environmental Impact*. <https://ifvi.org/wp-content/uploads/2023/10/Practitioner-Guide-To-Calculating-Corporate-Environmental-Impact.pdf>
- International Foundation for Valuing Impacts. (2024). *Interim Methodologies: Water Pollution*. <https://ifvi.org/methodology/environmental-topic-methodology/interim-methodologies/>
- International Foundation for Valuing Impacts & Value Balancing Alliance. (2024). *Environmental Methodology 1; Greenhouse Gas Emissions Topic Methodology*. <https://ifvi.org/methodology/environmental-topic-methodology/greenhouse-gas-ghg-emissions-topic-methodology/>
- ISO 14046. (2020). *Environmental management Water footprint: Principles, requirements and guidelines*. <https://www.iso.org/standard/43263.html>
- Kuzma, S., Bierkens, M. F. P., Lakshman, S., Luo, T., Saccoccia, L., Sutanudjaja, E. H., & Beek, R. V. (2023). *Aqueduct 4.0: Updated decision-relevant global water risk indicators*. https://files.wri.org/d8/s3fs-public/2023-08/aqueduct-40-technical-note.pdf?VersionId=G_TxTR2LAnlgXGzy7xtdUP_5lmkXJY7d
- LC-Impact. (n.d.). *LC-Impact: A spatially differentiated life cycle impact assessment method*. <https://lc-impact.eu/>
- Motoshita, M., Itsubo, N., & Inaba, A. (2011). Development of impact factors on damage to health by infectious diseases caused by domestic water scarcity. *The International Journal of Life Cycle Assessment*, 16(1), 65–73. <https://doi.org/10.1007/s11367-010-0236-8>

Natural Capital Coalition. (2021). *Natural Capital Protocol*. https://capitalscoalition.org/wp-content/uploads/2021/01/NCC_Protocol.pdf

OECD. (2025). *Mortality Risk Valuation in Policy Assessment: A Global Meta-Analysis of Value of Statistical Life Studies*. OECD Publishing. <https://doi.org/10.1787/76ca89a2-en>

Project Transparent. (2023). *Standardized natural capital management accounting: A methodology promoting the integration of nature in business decision making*. <https://capitalscoalition.org/wp-content/uploads/2023/06/Transparent-NCMA-Methodology-Final.pdf>

The Global Compact. (2014). *The CEO Water Mandate: Corporate water disclosure guidelines, Toward a common approach to reporting water issues*. <https://ceowatermandate.org/files/Disclosure2014.pdf>

The International Benchmarking Network. (2023). *Country Profile United States*. https://database.ib-net.org/country_profile?ctry=106&years=2023,2022,2021,2020,2019&type=report&ent=country&mult=true&table=true&chart=false&chartType=column&lang=en&exch=1

Value Balancing Alliance. (2021). *Methodology Impact Statement. Focus: Environment (0.1)*. Value Balancing Alliance. https://www.value-balancing.com/_Resources/Persistent/8/a/f/f/8aff8d622d5a09f9af18a062a71b9a3201f2ea3e/20210302_VBA%20Method_paper_Environmentals.pdf

WifOR Institute. (2023). *Underlying valuation approach, assumptions, and extrapolation*. <https://www.wifor.com/en/impact-valuation-factors/>

World Resource Institute. (2023). *Aqueduct 4.0 Water Risk Atlas Data Dictionary*. GitHub.

https://github.com/wri/Aqueduct40/blob/master/data_dictionary_water-risk-atlas.md

World Wildlife Fund. (2023). *The WWF Biodiversity Risk Filter tool methodology*.

<https://cdn.kettufy.io/prod-fra->

[1.kettufy.io/documents/riskfilter.org/BiodiversityRiskFilter_Methodology.pdf](https://cdn.kettufy.io/documents/riskfilter.org/BiodiversityRiskFilter_Methodology.pdf)