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THE VALUES OF WATER

What values of water are articulated in Dutch strategy documents for foreign aid and trade?

Graciela Luteijn, Machteld Schoolenberg, Clara Veerkamp, Sabine de Haes, Anteneh G. Dagnachew & Lucy Oates

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Corresponding author
Graciela.luteijn@pbl.nl

Author(s)
Graciela Luteijn, Machteld Schoolenberg, Clara Veerkamp, Sabine de Haes, Anteneh G. Dagnachew & Lucy Oates.

Supervision
Jeannette Beck, Koen Overmars.

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Aaldrik Tiktak. Water has many functions.

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Contents

Summary

The Government of the Netherlands dedicates attention to 'valuing water'

Over the last decade, 'valuing water' has received global and Dutch attention. This concept refers to the recognition of the full range of direct and indirect benefits and risks associated with water, be it cultural, spiritual, emotional, economic, environmental, or social. A High-Level Panel on Water, convened by the United Nations and the World Bank Group, argued in 2017 that valuing water could provide foundations for a broader integrated water management agenda. It proposed five so-called Bellagio Principles on Valuing Water, which gained global attention. In 2019, to demonstrate how to put these principles to practice, the Government of the Netherlands launched the Valuing Water Initiative. After that, valuing water gained even more traction, on both a national and international level. Examples include the 2021 United Nations World Water Development Report (on Valuing Water), the work of the Global Commission on the Economics of Water (convened by the Government of Netherlands), and the 2023 UN Water Conference (co-chaired by the Government of Netherlands and the Government of Tajikistan). This PBL report contributes to the growing body of literature on valuing water. It was conducted by the Netherlands Environmental Assessment Agency (PBL) as part of a covenant with the Directorate-General for International Cooperation (DGIS) of the Dutch Ministry of Foreign Affairs.

This study identifies multiple values of water contained in a selection of Dutch strategy documents for foreign aid and trade

This study builds on the first Bellagio Principle for Valuing Water, which states that it is necessary to '*identify and take into account the multiple and diverse values of water to different groups and interests in all decisions affecting water*' (HLPW 2018, p.17). Those values are at the core of how people think about and relate to water, how important they consider water to be, and how they (wish to) manage and use water. The study makes three contributions. Firstly, we synthesise a selection of literature on valuing water. Secondly, we propose a framework to identify values of water in the content of a document. A prominent element in that framework are the specific values of nature, which are justified as instrumental, intrinsic, and relational (IPBES 2022). Applied to water, they provide information on the expressed importance of water. Our third and final contribution is an identification of the values of water present in nine Dutch strategy documents for foreign aid and trade (dating from 2022 to 2025). Focusing on recent strategy documents allows us to identify the values of water that are explicitly included in the intended direction of Dutch policy for foreign aid and trade. This provides context for follow-up analyses of programmes or instruments.

The strategy documents emphasise that water benefits humans

The strategy documents frequently mention access to (or lack of) drinking water, sanitation, and hygiene and discuss other (dis-)services of water to people, development, or the economy. Those values, known as instrumental values, can be either positive or negative. Examples of positive values include water for food production or energy generation, while negative instrumental values can take the shape of risks or harms to humans, such as floods, drought, or pollution. Instrumental values are also articulated in connection with non-physical aspects of water. For example, water management is considered a theme in Dutch foreign aid and trade and is to be used to advance Dutch interests such as trade and economy, security and stability, and migration. This choice emphasises the value of water *know-how* and what such *know-how* allows for, rather than the value of physical water alone.

Water and non-human purposes or sense of place, and reciprocal relationships between humans and water, receive limited attention and remain, at best, implicit

The strategy documents mention water as benefiting non-human entities, yet typically as a means rather than an end. For example, they mention that the government will anchor the theme of biodiversity in development cooperation policy on water. Similarly, water is a prominent policy theme in the strategy documents yet often chosen for predominantly instrumental reasons. Although existing literature indicates that relational values of water (such as a sense of place) are part of Dutch national identity, relational values remain, at best, implicit in the documents. Finally, although there are two passages in the documents that might indicate non-instrumental values, they do not articulate such values explicitly. The first one mentions water as fundamental to life, but does not refer to non-human life explicitly. The second one links conflicts to water and interethnic tensions, but is not explicit about non-instrumental links.

Other than the Netherlands itself and the Dutch water sector, the documents seldom mention water-related actors, despite various mentions of water-related conflicts

Other (groups of) persons and organisations are seldom mentioned as acting or exerting influence on decisions. This is notable because the documents discuss water-related conflicts. They mention positive values such as conflict prevention, conflict-sensitive approaches to climate action, and water as contributing to stability and sustainability. They also mention negative values playing a role in conflict through water access, scarcity, or distribution. Such conflicts would typically involve actors and their values, but the documents, except one mention of the role of civil society in foreign aid and trade, seldom elaborate on this.

The focus on instrumental values aligns with existing literature

The strategy documents largely include water because of its potential or perceived contributions or connections to foreign aid and trade. Therefore, water is included from an instrumental perspective. Those findings coincide with existing literature indicating that instrumental values are (more) present in policy, in contrast to other values.

Attention to multiple values can contribute to decision-making

The climate and biodiversity crises are expected to increase the urgency of water-related challenges, and thereby the relevance of broad approaches to the values of water. International literature indicates that identifying and recognising multiple values can contribute to decision-making. It can make intangible costs and benefits of environmental policy visible and allow for better understandings of the sources of environmental conflicts. In Dutch foreign aid and trade, instances such as the Valuing Water Initiative seem to adopt and encourage broad approaches to the values of water.

This study offers building blocks for future research

As mentioned above, this study builds on the first Bellagio Principle for Valuing Water. We identify what values of water are articulated in a selection of Dutch strategy documents and find those values to often be instrumental. It was beyond our scope to examine and evaluate whether the documents and the corresponding programmes and instruments are effective, efficient, or in line with the first (or any other) Bellagio Principle. However, the study does offer building blocks that future research could apply to the identification of the values of water that are included in initiatives, programmes, and instruments for Dutch foreign aid and trade, whether they address the Bellagio Principles, and whether they are effective and efficient.

FINDINGS

The values of water

About this study

This study identifies what values of water are explicitly mentioned in Dutch strategy documents for foreign aid and trade

As part of Dutch foreign aid and trade, the Directorate-General for International Cooperation (DGIS) of the Ministry of Foreign Affairs has dedicated attention to the values of water. The multiple values of water are at the core of how people think about and relate to water, how important they consider water to be, and how they manage and use it. This study was conducted by the Netherlands Environmental Assessment Agency (PBL) as part of a covenant with DGIS. It makes three contributions to the recognition and understanding of the multiple values of water:

1. It provides an overview of definitions of the values of water in a selection of studies.
2. It synthesises those definitions into a framework for document analysis.
3. It applies the framework to identify what values of water are articulated in nine recent strategy documents for Dutch foreign aid and trade (dated 2022-2025).

The values of water in a selection of studies

In science and society, definitions of the values of water vary

The concepts of 'value' and 'valuation' have different definitions and interpretations (UN 2021, IPBES 2022). While valuation is the process to determine how much value something has, or the output of that process, value itself can refer to importance or significance. There are different methods and metrics to estimate and express value, which often stem from different disciplinary traditions. They may integrate different values of water to varying extents, which can lead to different valuation outcomes. Moreover, some values may stem from incompatible understandings across cultures and contexts, which complicates valuations.

Recognising the values of water can contribute to successful water governance

The synthesis of UN (2021) indicates that recognising the multiple values of water can contribute to successful water governance. The failure to fully value water is seen as a primary reason for the limited success of water-related goals and targets, as well as failures in water governance. In IPBES (2022), a review of national biodiversity strategies and action plans revealed that instrumental values tend to appear more frequently than relational or intrinsic ones. IPBES (2022) adds that taking nature's diverse values into account can increase inclusion, legitimacy, allow for better understandings of environmental conflicts, and make intangible costs and benefits of environmental policy visible, which would otherwise be neglected. Other international literature conveys similar messages, such as UN 2021, Haileslassie et al. 2024, Schulz et al. 2019 and 2024, Pacetti et al. 2020.

Identifying the values of water requires multi-disciplinary approaches

In the selection of academic articles that we reviewed, not many studies offer multi-disciplinary frameworks to define and investigate the values of water. Exceptions include the water systems organisations from Haileslassie et al. (2024), which build on the concept of socio-ecological systems, and the Value Landscapes Approach by Schulz et al. (2024 and 2019). Other articles often

mention the value or values of water but leave their definition implicit or approach it from a single discipline, such as economics. Nonetheless, the synthesis of UN (2021) emphasises that economics remains a '*highly relevant, powerful and influential science*' (p.21) and broad economic valuations already integrate methods from other disciplines. For example, natural capital accounting uses input from the natural sciences on the physical aspects of water. The literature also states that multi-disciplinary approaches call for the inclusion of relevant stakeholders (UN 2021).

We retrieved concepts that capture various definitions of the values of water

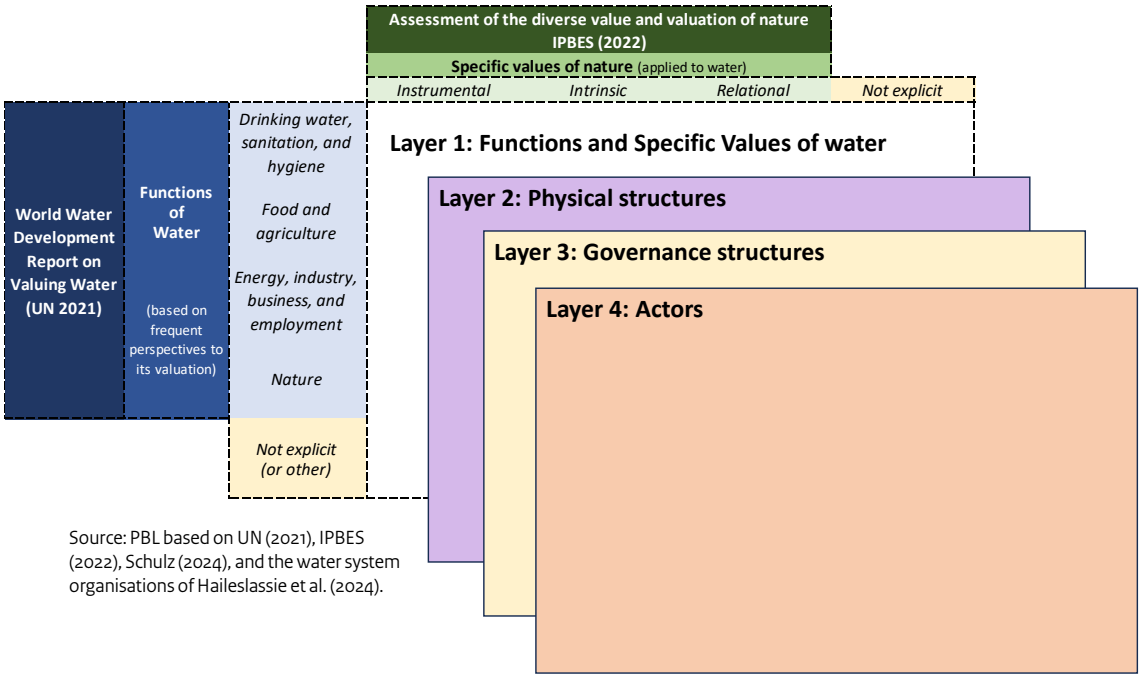
The following concepts are present in one or more of the reports and academic articles included in our overview: perspectives to the value of water, functions of water, life frames, worldviews, broad values, specific values (justified as instrumental, intrinsic, and relational), positive values, negative values, indicators, the Sustainable Development Goals, conflict, governance, physical aspects of water, non-physical aspects of water, actors. We integrated a selection of these concepts into a framework for document analysis, as described in the following section.

A framework for document analysis

We propose a framework that synthesises the following five concepts

a. The *functions of water* are adapted from the perspectives to the valuation of water in UN (2021) and partially based on the water system functions of Haileslassie et al. (2024). UN (2021) explains that water is frequently seen as valuable for being a natural source or part of nature and for its connection or contributions to drinking water, sanitation and hygiene; food and agriculture; energy, industry, business, and employment; and its socio-cultural aspects. Haileslassie et al. (2024) conceptualises water systems as delivering 'functions', which may include but are not limited to water-related ecosystem services.
b. The *specific values of water* are adapted from the specific values of nature in IPBES (2022) but applied to water. They are '*are 'opinions' or 'judgements' regarding the importance of things or situations expressed in particular contexts (e.g. components of nature, human-nature relationships, aspects of well-being)*'. (IPBES 2022). There are justified in three types:
    a. Instrumental values of nature characterise nature as important because they are means to achieve human ends or satisfy human preferences (Himes et al. 2024).
    b. Intrinsic values are expressed independently of any reference to people as those who value nature (Himes et al. 2024).
    c. Relational values of nature characterise the importance assigned to meaningful and often reciprocal relationships between humans and nature, and among people through nature (Himes et al. 2024; IPBES 2022).
c. *Physical structures related to water* are adapted from the water system structure by Haileslassie et al. (2024). They include structures that are natural, human-made, or a combination of both. They include but are not limited to water as a substance, water bodies, and hydraulic infrastructure.
d. *Governance structures related to water* are adapted from the water governance in Schulz et al. (2024 and 2019); however, water governance is mentioned by other selected studies. Schulz et al. (2024) defines water governance as '*the combination of water policy (the content of decision-making), water politics (the power play between different actors), and water polity (the institutions within which decisions are being taken)*'.
e. *Actors related to water*, which are mentioned across the selected studies. We borrow the definition by Enserink et al. (2022, p.78), which refers to '*a social entity, a person or an organisation, able to act on or exert influence on a decision*'.

Figure 1
Our conceptual framework to identify the values of water in strategy documents



Source: PBL based on UN (2021), IPBES (2022), Schulz (2024), and the water system organisations of Haileslassie et al. (2024).

The concepts are organised in layers

Layer 1 integrates the functions of water and the specific values of water.

- We see these functions and values as not mutually exclusive; water can have more than one function at the same time and be important for more than one specific value.
- While some functions of water are always instrumental (such as agriculture), they may also have intrinsic or relational components.
- Note that values can be positive or negative. For example, water can perform functions and deliver 'services' but also 'disservices'.

Layers 2 to 4:

- Layer 1 can be further split in three more layers: its physical structures (Layer 2), governance structures (Layer 3), and its actors (Layer 4).
- We see Layers 2 to 4 as interacting with each other.

Water indicators are not a basic concept nor a layer in our framework. However, we see them as accompanying our framework. Borrowing from Pascual et al. (2023), water indicators are used to express the values of water (quantitatively or qualitatively). For instance, Ligtvoet et al. (2023) apply indicators to describe water-related challenges in clear and visually attractive ways.

These four layers and their interactions are partially based on the conceptualisations of water system organisations by Haileslassie et al. (2024) (which builds on the existing concept of socio-ecological systems) and the Value Landscapes Approach by Schulz et al. (2024 and 2019). A description of this conceptual framework is available in Chapter 3.1.

We use the framework to analyse strategy documents for foreign aid and trade

Focusing on strategy documents allows us to identify the values of water explicit in the direction that the Netherlands intends to give to its policy for foreign aid and trade. A focus on strategy documents alone also has its limitations. The implementation of national strategies is delineated

by policies, programmes, and specific instruments, which are then implemented on the ground. These layers of implementation were beyond the scope of our study. Moreover, current policy programmes and instruments might stem from strategies that precede the documents in our selection. This means that the picture that our study offers is not the full landscape of all possible values of water in Dutch foreign aid and trade. Our study does, however, examine a part of the formal context of subsequent policy programmes and instruments. Hence, it offers a picture of the values of water explicit in the overarching strategies.

We examine the documents and identify what elements from our framework they explicitly mention. We dedicate more attention to Layers 1 and 2 than to Layers 3 and 4. Although not a formal layer nor basic concept in our framework, we identify water indicators because they provide information on values. Likewise, we identify mentions of water as a source of peace or as contributing to conflict, as well as water in connection to the Sustainable Development Goals.

We selected the nine strategy documents for two reasons

First of all, we aimed to select strategy documents targeting a variety of topics, rather than focusing on strategy documents that only target water. The Dutch national government has dedicated attention to the values of water, for example, through the work of the Valuing Water Initiative, which was led by the Netherlands Enterprise Agency from 2019 to 2024. However, it remained the question whether other policy domains also dedicate attention to the values of water. Therefore, our selection included the general strategies for foreign aid and trade and the corresponding targeted (non-water) strategies. For reasons of scope, we excluded the Netherlands International Water Strategy (NIWA), which runs from its introduction in 2019 until 2030. With this selection, we aimed to produce a broader picture by studying strategy documents from other themes or clusters.

Secondly, we aimed to study the strategy documents of the current national government period. Because the Cabinet changed while we conducted our study, our selection stems from two different periods: the Cabinet Rutte IV (2022-2024) and the Cabinet Schoof (2024). Due to the difference in the number of documents from each national government period (seven and two, respectively), we treat the set of nine documents as a single sample.

Table 1
Dutch strategy documents for foreign aid and trade included in our study

Year	Month	Cabinet	Title of the document
2022	June	Rutte IV	Do What We Do Best
2022	October	Rutte IV	The Global Climate Strategy
2022	October	Rutte IV	The Dutch Global Health Strategy 2023-2030
2022	December	Rutte IV	The National Raw Materials Strategy
2023	May	Rutte IV	The Africa Strategy of the Netherlands 2023-2032
2023	June	Rutte IV	The policy framework Global Multilateralism
2023	November	Rutte IV	The policy document Human Rights – Democracy – the International Legal Order
2025	February	Schoof	The letter of the Minister for Foreign aid and trade of February 20
2025	May	Schoof	The letter of the Minister for Foreign aid and trade of May 28

Additional details on the selection of documents are available in the first paragraphs of Chapter 4. More details of our approach to the analysis are available in Chapter 4.2 and Appendix 4.

The values of water in nine Dutch strategy documents for foreign aid and trade

Layer 1: Functions and specific values of water

The functions and the specific values of water are mentioned unevenly

Drinking Water, Sanitation, and Hygiene is the most frequently mentioned function. Instrumental values (positive or negative) are dominant. There are only two passages that might indicate other specific values, but even in those passages, intrinsic or relational values would be implicit at best. When instrumental values of water are not combined with a function, those values are typically positive and often linked to governance or actors. For instance, the positive value of water (management) as a policy domain, theme, focus area, focal point, or sector.

Drinking Water, Sanitation, and Hygiene and (only) instrumental values of water

Drinking Water, Sanitation, and Hygiene is always (and only) accompanied by positive or negative instrumental values of water. Positive mentions include human needs and policy (targets), accomplishments, or contributions of the Netherlands to this function elsewhere. Negative mentions include drinking water scarcity, unequal access, contamination, or pressure on water systems. It is unclear whether one paragraph with instrumental values also articulates an indication of intrinsic values. The paragraph mentions that, according to the vision statement of the UN Water Conference of 2025, '*water is a fundamental part of all aspects of life*' and that '*the ongoing water and sanitation crisis is a threat to everyone, including in terms of health risks*'. Although water being mentioned as a fundamental part of all aspect of life, the text does not explicitly mention non-human life, which might have indicated intrinsic values. The passage is part of the Dutch Global Health Strategy 2023-2030 (p. 29).

Food and Agriculture and (only) instrumental values of water

Mentions of water in relation to Food and Agriculture are only instrumental and articulate both positive and negative values of water. These mentions do not indicate intrinsic or relational values. Positive mentions focus on the Netherlands contributing to agricultural water efficiency or water (management) as necessary for food systems. Negative mentions include water (scarcity) affecting food systems and pressures on water systems having the potential to promote conflict.

Energy, Industry, Business, and Employment often with positive instrumental values of water

Energy, Industry, Business, and Employment is mentioned in all documents but one. The exception is the policy document Human Rights – Democracy – the International Legal Order. The other documents always make an instrumental connection between water and this function, often positive. Those positive values typically refer to the contributions of water to the economy. The negative values most often refer to the risks that (changes in) water-related systems pose to the economy, and, less frequently, to the risks that the economy poses to water-related systems. Those mentions usually relate one of the following three topics:

1. In the National Raw Materials Strategy, there are multiple positive and negative links between the mining industry and water. They include the contributions of water to that industry and the tensions between the mining industry and water as part of nature.
2. Mentions of water as an input for sectors other than the mining industry or for the economy in general. Positive values are articulated in the use of water by humans for their benefit.

Negative values are articulated in the resulting risks or effects and the risks that water systems pose for the economy when those systems are under pressure.

3. Dutch water "know-how" or the Dutch water sector are both mentioned as having positive commercial or economic value. The focus lies on their expertise, position, the government support that they would receive, as well as on what their knowledge or skills allow for.

Water as Nature largely instrumental

When the text refers to water that exists in natural systems (which is Water as Nature), emphasis is usually placed on how such water affects or benefits humans. For example, water or water systems are mentioned as a resource or a supply. This implies the use of water (or its benefits) by humans, and therefore, positive instrumental values. There are other mentions of water shortages, water pollution, and their consequences for health, the economy, or development.

One mention without explicit instrumental values stems from the policy framework Global Multilateralism. The World Meteorological Organisation (WMO) is mentioned as specialising in weather, climate, and water. This does not immediately reflect specific values of water. The broader context of the paragraph might imply instrumental values because it relates to weather and climate risks for humans.

It is unclear whether two mentions of Water as Nature also indicate intrinsic or relational values of water. In a previous paragraph, we discussed a quote that might imply intrinsic values, which is part of the Dutch Global Health Strategy 2023-2030 (p. 29). It mentions water as a fundamental part of all aspects of life but does not specify if it includes non-human life. The quote that might reflect implicit relational values is part of the Africa Strategy of the Netherlands 2023-2032 (p. 29). It refers to a link between water and intergenerational and interethnic tensions but is not explicit about non-instrumental values.

Instrumental mentions of water might imply intrinsic values that are not specific to water

There are mentions of water as a useful tool or instrument for other purposes. For example, that the government will anchor the theme of biodiversity in development cooperation policy on water. Intrinsic values of water are therefore not the focus of those mentions. Instead, water is articulated from an instrumental perspective because it is used for other purposes. For instance, the Dutch Global Health Strategy 2023-2030 mentions water shortages enlarging human's ecological footprint (p. 25). Similarly, the National Raw Materials Strategy refers to 'particularly valuable biodiversity' (p. 11). These all suggest that non-human considerations might be present. However, those values would be implicit at best and more information would be needed to confirm this.

No explicit mentions of the relational values of water that are part of Dutch national identity

Dutch water 'know-how' and the Dutch water sector are often mentioned in the strategy documents. There are positive instrumental values in the use of water knowledge or the water sector for other purposes. In contrast, relational values of water are largely absent or left implicit. Throughout history, water has been a part of Dutch national identity in different ways, as documented by Mostert (2020) and Beugelsdijk et al. (2019). Although there are instrumental elements in that identity (such as the 'fight against water', floods, and land reclamation), there are also relational elements (such as water and sense of place). These relational values might (in part) explain why water has such prominent role in Dutch strategies for foreign aid and trade. However, in the strategy documents, we did not find explicit mentions of these relational values.

Layer 2: Physical structures

Instrumental values of water dominate the mentions of physical structures

Positive values are connected to the benefits that humans receive from physical water or infrastructure. Negative values, on the other hand, are connected to the potential harms derived from physical water, such as floods or illness due to contaminated water. Negative values often have positive counterparts. For example, floods are negative, and (management or techniques for) their prevention is positive; (infrastructure for) sanitation is positive, and a lack thereof is negative; wastewater is negative, and (techniques for) its surveillance is positive.

Mentions of water as a 'resource', and thereby instrumental

Overall, water is more often mentioned as a physical resource for the benefit of humans than as a component of natural systems, independently of humans. The documents mention parts of nature that include water such as the sea, international waters, wetlands, or river basins; however, those mentions do not explicitly refer to water. There are also various mentions of water infrastructure; physical water and Drinking Water, Sanitation, and Hygiene; other functions, and other physical aspects of water.

Layer 3 and 4: Governance structures and actors

Indications of water governance structures are often instrumental

Mentions of water that indicate governance structures often articulate instrumental values of water. They include water-related policy goals and water as a theme of focus area of the policy. Only a few of those paragraphs do not articulate specific values of water. There are also mentions of public funding (or cuts) for water (management) as an area of the policy.

Water-related actors providing input to the national government

There are mentions of actors who provide input to the national government. Examples include a stakeholder session held by the ministries of Infrastructure and Water Management, Economic Affairs and Climate Policy, and Foreign Affairs with companies, knowledge institutions, and civil society organisations, and information that was retrieved at a round table held by the Netherlands Water Partnership with the Dutch water sector.

Limited mentions of water-related actors, other than Dutch actors

Mentions of persons or organisations include the Netherlands, the Ministry of Infrastructure and Water Management, other Dutch ministries, the water sector, other countries, entrepreneurs, and the recipients of development aid. However, other than Dutch actors, the documents seldom mention them as acting or exerting influence on a decision (following the definition of actors by Enserink et al. 2022). Their action or influence is not explicit in the text.

Civil society as a water-related actor

There is a notable exception stemming from the Africa Strategy of the Netherlands 2023-2032. A passage in the document (p. 33) articulates civil society as able to act and exert influence. It mentions that civil society contributes to water and food-security, and that civil society organisations can highlight the negative side effects of (Dutch) businesses.

Instrumental values of Dutch water know-how and water sector

There are various instrumental mentions of Dutch water know-how, which is a non-physical aspect of water, and of government support for the Dutch water sector. Those mentions do not place

emphasis on water as a substance, its allocation, or as existing in a specific place and time. Instead, they place it on knowledge, skills, and what they might allow for.

Water indicators

Statistics with instrumental values of water

Quantitative water indicators are most often statistics of positive or negative instrumental values in connection to a function of water. Such indicators most often qualify Drinking Water, Sanitation, and Hygiene. They articulate positive values (such as the number of people receiving access to water and sanitation) and negative values (such as number of people that become ill or die due to pollution). Water statistics in connection to Food and Agriculture typically refer to agricultural water consumption or pressures on water that affect grain production. Quantitative water indicators of Energy, Industry, Business, and Employment include the monetary value of investments, global income affected by water-related pressures, and amount of water as an input for production. Water statistics in connection to Nature are found in paragraphs that mention water-related natural disasters, safe delta regions, and water scarcity. They typically articulate negative instrumental values in connection to nature (such as cities that are vulnerable to sea level rise, flooding and other water-related emergencies, and water as a resource that is scarce or under pressure) or positive counterparts to those values (such as the reduction of vulnerabilities, flood prevention, and alert or response systems).

Water footprints and other indicators

The documents mention other indicators that can be quantitative, such as water footprints, but do not provide numerical values for those indicators. Although sentences that mention water footprints do not explicitly articulate specific values of water, as a unit, the paragraphs that contain them do articulate instrumental values. Other examples include water demand outstripping supply, agricultural water efficiency and its improvement, and water per production unit in the mining industry. These mentions do not include numerical values for the indicators.

Qualitative indicators for physical and non-physical aspects of water

Qualitative indicators are predominantly used in combination with a function of water. They qualify physical aspects such as water stress, water scarcity, or water pollution. They also qualify non-physical aspects such as water management being (im-)proper, (un-)sustainable, or (not) inclusive, as well as water security. When qualitative indicators do not explicitly mention a function of water, they still articulate water's instrumental values.

Conflict (or peace)

Conflict (or peace) and instrumental values of water

Positive instrumental values are present in mentions of water (policy, management, and access) as a condition for stability, contributing to sustainability, boosting the economy, and helping to prevent conflict and reduce migration (the latter being implicitly mentioned as positive). Mentions of water-related conflict prevention or the importance of a conflict-sensitive approach to climate action contain positive and negative instrumental values. Water-related conflict is seen as something to be prevented (and therefore negative), while prevention and conflict-sensitive approaches are seen as desirable (and therefore positive). Such conflicts are mentioned in connection with water-related access, scarcity, or distribution.

Conflict (or peace) and relational values of water not explicit in the text

In addition to instrumental values of water, one paragraph that mentions conflict might imply relational values. The text stems from the Africa Strategy of the Netherlands 2023-2032 (p. 41) and mentions that pressure on natural resources (including water) is leading to long-term intergenerational and interethnic tensions. We see a potential indication of relational values in the link between water and intergenerational and interethnic tensions. However, those values are not explicit, and more information would be needed to confirm them.

The Sustainable Development Goals (SDGs)

The SDGs and Dutch policy goals, targets, and global action

In Do What We Do Best (2022), multiple Dutch policy goals are mentioned in connection to Sustainable Development Goal 6 on water. This and other SDGs are also mentioned in connection with water in other documents; namely, in the Global Climate Strategy, Dutch Global Health Strategy 2023-2030, the Africa Strategy of the Netherlands 2023-2032, and the policy document Human Rights – Democracy – the International Legal Order.

All mentions of the SDGs are instrumental

Instrumental values are embedded in the SDGs because these goals are meant for human development. All mentions of water and the SDGs in the documents are indeed instrumental. As described by Röckstrom and Sukhdev (Stockholm Resilience Center 2016), Goals 6, 13, 14, 15 represent the biosphere and thus nature. Therefore, the SDGs might include intrinsic values. However, we did not find explicit intrinsic values in the mentions of water and the SDGs.

Water-related threats to (and conditions for) the SDGs

The documents contain mentions of water-related threats to (and conditions for) the SDGs. Negative mentions include pressures on water and the water and sanitation crisis, negative side effects of international businesses, and policy to prevent trade-offs. The documents mention policy coherence and broad social engagement as necessary for the achievement of the SDGs. Civil society is mentioned twofold: as contributing to water and food security policy and as playing a significant role in highlighting any negative side effects of international businesses.

Sectoral policies are said to contribute to the SDGs

The Global Climate Strategy and the policy document Human Rights – Democracy – the International Legal Order argue that sectoral policies contribute to the SDGs. This last document also mentions the importance of a comprehensive approach to sustainable development through the SDGs. Likewise, it emphasises that the work in connection to foreign trade and development cooperation helps achieve human rights in relation to water.

FULL RESULTS

FULL RESULTS

1 The need to recognise water's multiple values

Water is under pressure

Globally, human-made and natural systems containing water, or water systems, face pollution, climate change, and ecosystem degradation (Ligtvoet et al. 2023). This situation results in water-related risks that include too little, too dirty, and too much water. In turn, those risks endanger the lives of hundreds of millions of people, their well-being, and the economy. They also increase the pressure on water systems, which, in turn, exacerbates the water-related risks.

Water is interrelated with the climate and biodiversity crises

The Global Commission on the Economics of Water explains that water, climate, and biodiversity are deeply intertwined (Mazzucato et al. 2024). Water regulates the climate system but can simultaneously be a driver of climate change. Similarly, water is connected to each of Earth's ecosystems and the loss of biodiversity contributes to destabilising the hydrological cycle. It follows that the degradation of water systems poses risks to biodiversity; likewise, climate change and biodiversity loss pose risks for water systems. For these and other reasons, the pressures on one system can affect the others.

As is the case with the climate and biodiversity crises, resolving the pressures that threaten water systems calls for transformative change

Many local, regional, and global water crises exist and persist (Ligtvoet et al. 2023). This indicates that the many efforts from civil society, governments, companies, and financial institutions have been insufficient to resolve the global pressures on water systems that lead to water-related risks. Resolving these pressures and crises calls for fundamental, system-wide shifts in views, structures, and practices, including their physical, technical, and institutional aspects (UN 2021, IPBES 2022 and 2024, Ligtvoet et al., 2024). These shifts are now known as transformative change (IPBES 2024).[1] Therefore, to address water-related risks, transformative change is needed to reshape the way in which societies value water (Mazzucato et al. 2024).

Transformative change requires the recognition of the multiple values of water

Over the last decade, the concepts of 'valuing water' and the values of nature (beyond an economic perspective alone) has received attention in global water and biodiversity research and policy. 'Valuing water' refers to the recognition of the full range of direct and indirect benefits and risks associated with water, be it cultural, spiritual, emotional, economic, environmental, or social (HPLW 2017). Such regained attention partially stems from the United Nations and World Bank Group High-Level Panel on Water (HLPW 2018), whose work argues that valuing water would provide foundations for a broader integrated water management agenda. It also proposed the five Bellagio Principles for Valuing Water (see text box 1.1). Then, in 2021, the United Nations World Water Development Report was dedicated to Valuing Water (UN 2021). The subsequent year, in

[1] Gurung et al. (2024) explain that transformative change can be incremental when small changes are deliberate and attention is paid to their type, quality, and directionality, as opposed to focusing only on the size, time, or location of the changes.

2022, the Intergovernmental Panel on Biodiversity and Ecosystem Services (IPBES) published its methodological assessment regarding the diverse conceptualisation of multiple values of nature and its benefits, including biodiversity and ecosystem functions and services. The concept of the values of nature thereby gained international attention. A common thread between the water and biodiversity publications is the need for transformative change, which calls for a recognition of the multiple ways in which water (or nature, which contains water) is important and therefore valuable.

1.1 Notable publications or events in connection with the values of water or nature

In 2017, a High-Level Panel on Water, which was convened by the United Nations and the World Bank Group, argued that valuing water would provide foundations for a broader integrated water management agenda. The High-Level Panel on Water proposed the following five principles, widely known as the Bellagio Principles for Valuing Water:

1. Recognise and embrace water's multiple values.
2. Reconcile values and build trust.
3. Protect the sources.
4. Educate to empower.
5. Invest and innovate.

The 2021 United Nations World Water Development Report was dedicated to 'valuing water'. The report highlighted the many perspectives that exist to determine the value(s) of water and synthesized a wide body of literature on this subject.

In 2022, the Global Commission on the Economics of Water (GCEW) was convened by the Government of the Netherlands. Its international publications have drawn attention to the need to change the way societies govern, use, and value water, and to the link between water and other parts of nature (Mazzucato et al. 2024).

In 2022, the Intergovernmental Panel on Biodiversity and Ecosystem Services (IPBES) proposed a conceptualisation of the multiple values of nature. Moreover, it emphasised that many valuation methods exist (that is, methods to understand, describe, and sometimes quantify values), but focusing on a too-narrow set of values.

In 2023, the first UN Water Conference in almost half a century was co-chaired by the Government of the Netherlands and the Government of Tajikistan.

The Government of the Netherlands has dedicated attention to the values of water

Over the years, the national government of the Netherlands has dedicated attention to valuing water in international initiatives and projects. In 2019, it launched its own Valuing Water Initiative to demonstrate how to practice the Bellagio Principles for valuing water. In 2022, it convened the Global Commission on the Economics of Water, whose efforts culminated in a 2024 publication on how to redefine the economics of water. Together with the Government of Tajikistan, it co-chaired the 2023 UN Water Conference.

PBL also dedicates attention to the values of water

In 2023, PBL published a report (Ligtvoet et al. 2023) commissioned by the Dutch Water Envoy. It presented an overview of global water challenges. It argued that to resolve global water challenges, water needs to be valued with a broader scope. This study gives follow-up to that recommendation. It was conducted by PBL as part of a covenant with the Directorate-General for International Cooperation (DGIS) of the Dutch Ministry of Foreign Affairs.

Anchored in the context of Dutch foreign aid and trade, this study makes three contributions to the recognition and understanding of the multiple values of water

First of all, this report offers an overview of definitions of the values of water in a selection of studies. Secondly, it offers a synthesis of those definitions into a conceptual framework that can be used for document analysis. Finally, it presents the application of the framework to identify what values of water are articulated in nine recent strategy documents for Dutch foreign aid and trade. Together, those three contributions allow for a broader and deeper understanding of the multiple values of water. They also offer building blocks that can be applied to examine how policy programmes and instruments consider the multiple values of water.

Reading ahead

Chapter 2 offers an overview of definitions of the value of water from a selection of relevant studies. Chapter 3 contains a description of our conceptual framework and its application. Chapter 4 offers an extensive description of the results of this study. Chapter 5 offers conclusions and reflections. The findings of this study are summarized in the chapter 'Findings', which precedes this introduction.

2 The values of water in selected studies

An overview of the values of water in selected studies

This chapter presents a comprehensive overview of how selected studies define the ways in which water is valuable, to which we refer as values of water. Section 2.1 is dedicated to three reports relevant to international and Dutch policy discussions, including the United Nations flagship report on valuing water (UN 2021). The three reports synthesise bodies of literature (including academic articles) in their fields. Then, section 2.2 is dedicated to a selection of eleven scientific articles on the topic of valuing water, which we review to identify any major blind spots in our previous overview. Finally, section 2.3 contains an integration of the findings from those reviews, which later serve as input for the conceptual framework in Chapter 3.

Appendix 1 contains additional details of our approach in selecting and reviewing the studies.

We focus on existing syntheses of the literature

Note that studies beyond our selection have still contributed to the literature on the values of water. However, for reasons of scope, we focus on three reports that are in themselves syntheses. Examples of other notable works include the report by the Food and Agriculture Organisation (FAO 2006), which was dedicated to stakeholder-oriented valuation to support water resources management processes. Other studies have examined economic paradigms, piftfals, and options to value water, including Savenije and van der Zaag (2002), Hanemann (2006), or Grafton et al. (2023). There have also been recent publications by the Global Commission on the Economics of Water; however, due to the timeline of our study, those publications are out of our scope.

2.1 Three reports

A global overview

Our overview covers a global report on valuing water, a global report on the diverse values and valuation of nature, and a PBL report on global water challenges. We selected these three reports for their relevance and impact in policy-relevant discussions, their syntheses of other literatures, and the fact that they stem from different global research and policy fields:

1. The 2021 World Water Development Report on Valuing Water by the United Nations.
2. The 2022 Methodological Assessment of the Diverse Values and Valuation of Nature by the Intergovernmental Panel on Biodiversity and Ecosystem Services (IPBES).
3. The 2023 report The Geography of Future Water Challenges that was led by PBL (Ligtvoet et al. 2023), stemming from the interface between PBL and Dutch national decision-makers working with international water challenges (and a predecessor of our study).

Making explicit connections

We aim at more explicitly connecting two global reports - UN (2021) and IPBES (2022) - from different research and policy fields. The former stems from the international water field, and the latter, from the international biodiversity field. Their topics overlap because water is part of nature and other parts of nature contain or relate to water. Therefore, within our study, we explicitly connect those two bodies of knowledge by integrating them in our framework (Chapter 3) and analysis (Chapter 4).

2.1.1 About each report

The United Nations World Water Development Report 2021: Valuing Water

The World Water Development Report (WWDR) is an annual publication on water and sanitation issues that is authored by the United Nations (UN Water n.d.). It is published by UNESCO on behalf of UN-Water. The report has a different theme each year and offers analyses and policy recommendations. In 2021, the theme was 'Valuing water' and it discusses valuation of water from various interrelated perspectives. The report contains an overview of methodologies and approaches to valuation, as well as experiences from multiple regions, discussion of approaches to governance, financing, and methods to address needs regarding knowledge, research, and capacity (UN Water 2021).

The Methodological assessment of the diverse values and valuation of nature of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services

IPBES performs regular thematic, global, and regional assessments which concern knowledge on biodiversity, ecosystem services, and their connections. In 2022, they published a methodological assessment on the diverse values and valuation of nature which proposes a typology to describe and understand the multiple values of nature. It also offers guidelines for the design and implementation of valuation methods and processes and discusses how to embed the values of nature in decision-making and policymaking (IPBES n.d.).

The geography of future water challenges: Bending the trend

The report by Ligtvoet et al. (2023) was commissioned by the Netherlands Special Envoy of International Water Affairs and the Ministry of Infrastructure and Water Management. It was led by PBL and created in collaboration with various partners. In summary, the report explores pathways to reduce water and climate change risks. This exploration focuses on four clusters of water- and climate related challenges: river basins, deltas and coasts, drylands, and cities. It argues that addressing water- and climate-related challenges from a 'water perspective' can contribute to sustainable development. It offers nine critical and conditional steps to address such challenges, one of which is to value with a broader scope. The first copy of the report was offered to the minister of Infrastructure and Water Management of the Netherlands during a dedicated event and received national media coverage. It was also part of international policy-relevant discussions, for example, when it was presented at the UN Water Conference in 2023 during the meeting of the International Panel on Deltas and Coastal Zones.

2.1.2 The values of water according to UN (2021)

Different definitions and interpretations of 'value' and 'valuation'

The UN WWDR (2021) explains that the concepts of 'value' and 'valuation' are well defined; a dictionary search, explains the report, already provides clear definitions for those concepts. 'Valuation' is defined as '*the process by which a person or entity assigns value to something*' (UN WWDR 2021). Although there are various definitions for 'value', the report explains that, in the context of nature, 'value' is mainly used as (1) exchange value, (2) utility, or (3) importance. However, they do emphasise that 'value' and 'valuation' can have different interpretations (for example, by different actors or disciplines) despite their definitions being seemingly straight-forward.

Water is often valued from five interrelated perspectives

The following five perspectives are frequently adopted in the valuation of water:

1. Valuing the environment: water sources, in situ water resources, and ecosystems. This includes, for example, wetlands and ground water sources.
2. Valuing infrastructure for water storage, use, reuse, or supply augmentation.
3. Valuing Drinking Water, Sanitation, and Hygiene: water services, mainly drinking water, sanitation, and related human health aspects.
4. Valuing water as an input to production and socio-economic activity; notable examples include food and agriculture, energy, mining, other industry, business, and employment.
5. Other sociocultural values of water, including recreational, cultural, and spiritual attributes.
6. In valuation exercises, various indicators are used to express the value(s) of water from these different perspectives. Additional details on these perspectives are available in Appendix 2.

The values of water can be negative

The UN WWDR explains that the concept of value is often assumed to be positive, a benefit. However, water can have negative value. For example, drinking water and water availability are seen as positive. However, water pollution and floods have negative values. Similarly, while water can play a positive role in promoting peace, water can also contribute to conflict.

It is relevant to account for the negative values of water rather than only its positive ones. Because the values of water can be negative, reducing a negative value can be within the positive effects of a given intervention. For example, an investment in flood mitigation would reduce the negative value of floods. Likewise, when evaluating interventions such as investments, accounting for all inputs and costs (e.g. subsidies) might reveal negative economic returns or losses.

Economics is highly relevant but also faces challenges

Reports such as those of the Global Water Partnership (GWP 1998) and the Food and Agriculture Organisation (FAO 2004) provide overviews of economic approaches to value and valuation in the context of water. Economic valuation methods to estimate the value of water include residual value, mathematical optimisation models, replacement cost or value, contingent valuation, demand functions, and tradeable water rights. However, as explained in the UN WWDR, applying this discipline to assess the value of water has limitations. Traditional economic accounting often uses recorded prices or costs of economic transactions, but in the case of water, there is no clear relationship between its price and its value. Transactions related to water usually aim at recovering costs rather than reflecting the value that was delivered. Despite its challenges, economics remains a '*highly relevant, powerful and influential science*' (p. 21) and the UN WWDR report highlights the need to make it more comprehensive. Broad economic valuations already integrate methods from other

disciplines; for example, natural capital accounting uses input from the natural sciences on the physical aspects of water.

Varying understandings of the value of water also complicate its valuation

There can be significant differences between the values of water (as products of a valuation process) that are estimated through different methods. Moreover, the value or values of water can have different meanings for different stakeholders. The UN WWDR report refers to Chan et al. (2016), which explains that nature can be important for instrumental, intrinsic, and relational reasons. Instrumental values are linked to utility for humans, while intrinsic values are linked to nature having value independently from humans. The report also refers to Justus et al. (2009) to explain that these two types of values are already fundamental in moral theory and conservation biology. To return to Chan et al., relational values are a third category of values that derivate from relationships between people and nature. Their recognition might help foster pluralistic approaches to bridge differing worldviews (Parsons and Fisher 2019). However, in practice, balancing instrumental priorities with intrinsic and relational values is complex; Hellegers and Leflaive (2015) explain that no water allocation strategy encompasses all values of water and is thereby optimal, namely, because value systems intersect and overlap. Nonetheless, the essence of water governance is to resolve trade-offs and conflicts while maximising benefits and synergies (LeRoy Poff et al. 2015).

Values drive water governance

The UN WWDR explains that implicit and explicit values drive water governance. Although water governance and the values of water are intertwined, not all values of water are equally included in water governance. The UN report affirms that '*those who control how water is valued control how it is used*' (p.19). The value and valuation of water are therefore seen as connected to issues of power and equity in the governance of water resources. Neither the value of water nor its full suite of multiple values, explains the report, tend to be prominent in decision-making, however. It cites WWAP (2012) to argue that '*the failure to fully value water in all in its different uses is considered a root cause, or a symptom, of the political neglect of water and its mismanagement*' (p.19). It has been argued, states the UN WWDR, that the omission of a full representation of the value of water is a primary reason for the limited success of water-related goals and targets as well as failures in water governance.

Identifying and reconciling different values of water

The WWDR argues that it is important to identify and reconcile the different values of water. This recommendation goes beyond valuation exercises and applies to water governance. The WWDR refers to WWAP (2012) to state that polarised views on value can constrain (or be exacerbated by) poor governance. Amongst other effects, this can lead to lower priority being given to water policy and endanger the achievement of international socioeconomic goals. In line with that reasoning, the High-Level Panel on Water (HLPW 2018) encouraged countries to adopt a '*much broader stance on values than what was advocated under the Dublin principles*'; in other words, recognising and embracing the multiple values of water.

The need for more robust and multi-stakeholder methods

The WWDR explains that there is a call for more robust and multi-stakeholder methods to resolve trade-offs, to which the report refers to as multi-value approaches to water governance (Garrick et al. 2017). Such methods would require the valuation of water to go beyond what can be easily measured (Garrick et al. 2017). The UN report also highlights the works of Hellegers and Van Halsema (2019), which argues that decision-making would benefit from recognising, balancing, and addressing trade-offs between different types of values. Valuation exercises are needed that offer a

'*structured and transparent mechanism that supports a multi-stakeholder process*' (Hellegers and Van Halsema 2019). The UN report also mentions the work of Hermans et al. (2006) on mosaics of values for water resources management, in which water management is co-created.

The SDGs recognise that water is important

There are examples of global actors coming together around water. They include the rights to safe and clean drinking water and sanitation and the 2030 Agenda for Sustainable Development, from which the SDGs are derived. The SDGs are notable example of an international framework which recognises the importance of water. The sixth SDG states: '*Ensure availability and sustainable management of water and sanitation for all*'. The WWDR refers to a previous study by Ligtvoet et al. (2018) to illustrate that water has transversal value across all SDGs.

2.1.3 The values of water according to IPBES (2022)

Conceptualising the values of nature

The methodological assessment by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES 2022) does not define the value of water as a separate concept. Instead, Chapter 2 of that report proposes a conceptualisation of the diverse values of nature, which includes water as an implicit part of nature. It provides some water-related examples when describing the diverse values of nature, such as the example of water quality on page 61.

The values of nature through five overarching concepts

Chapter 2 explains that the concept of value has context-dependent meanings. To understand nature's diverse values, it presents a 'values typology' that uses and defines the concepts of 'life frames', 'worldviews', 'broad values', 'specific values', and 'indicators' (p. 49).

1. **Life frames** '*of nature's values illustrate the ways that people conceptualise, or frame, how nature matters. The four archetypes of living from, living in, living with and living as nature are not mutually exclusive. They offer a range of sources-of-concern for nature that can overlap or be emphasised in diverse contexts (*see 2.3.2 below*). Life frames are similar to value systems in that they inform the order and priority that an individual or group assigns to specific values in context*'.
2. **Worldviews** '*are like lenses through which individuals and social groups perceive, think about, interpret, inhabit and modify the world. Rooted in cultural traditions and languages, they help to shape people's broad and specific values*'.
3. **Broad values** '*are 'life goals' and 'guiding principles' informed by one's worldview and general beliefs, including what constitutes desirable human-nature relationships for a good quality of life (e.g. the desire for sustainability and justice)*'.
4. **Specific values** '*are 'opinions' or 'judgements' regarding the importance of things or situations expressed in particular contexts (e.g., components of nature, human-nature relationships, aspects of well-being). Specific values are justified as instrumental, intrinsic and relational*'.
5. **Indicators** '*are the 'quantitative measures' (e.g. money, hectares) and 'qualitative descriptors' (e.g. expressions, arguments, stories) of specific values. Value indicators are associated with valuation methods and can include preference based indicators (e.g. willingness-to-pay)*'.

Values and preferences are different concepts

The report differentiates between values and preferences. Values are defined through the values typology from the previous paragraph. Preferences are described as the stated or revealed ordering of options based on their desirability to people, which can be expressed in economic or sociocultural terms.

Values change over time at different rates

The layers of the diverse values of nature change at different rates. While broad values tend to change at inter-generational rates, specific values can change at quicker rates and overlap (Anderson et al. 2022, in section 2.6.1 of IPBES 2022). For example, modifying the context and prioritising different values in environmental regulation reflects a change in 'specific values'.

A wealth of valuation methods exists to determine the values of nature

IPBES groups over 50 valuation methods in four non-disciplinary families: nature-based, behaviour-based, statement-based, and integrated methods. Nature-based valuation is focused on the properties of nature and its contributions to people. Its applications include assessments of ecological integrity and quantification of nature's contributions to people. Statement-based valuation can be applied to deduce the importance of nature for people and their preferences. In contrast, behaviour-based valuation observes choices. Integrated valuation combines information sources, and it can be used to identify connections between types of values. The report includes a word of caution, however. In studies with Indigenous peoples and local communities, the rigid application of these method families can lead to omissions or misrepresentations.

Treating negative values more explicitly is a knowledge and capacity gap

Chapter 2 of the IPBES report mentions negative values as follows. Environmental research and policy communities, explains IPBES (2022), have worked for several decades on how to quantify the positive and negative ways in which nature affects humans (IPBES refers to Campagne et al. 2018, Gómez-Baggethun et al. 2010, TEEB 2010, Vaz et al., 2017). These ways are often known as ecosystem services and disservices (p. 44). Overemphasis on specific life frames in decisions can lead to the mismanagement of ecosystem disservices (p. 73). Chapter 2 (p. 98) lists a more explicit treatment of the role of negative values as a knowledge and capacity gap.

Other chapters seldom mention negative values

Chapter 3 presents a review that did not assess the concept of disservices or negative nature relations but did find value indicators of negative nature relations (p. 150). Examples include human-wildlife conflicts and the link between urban tree cover and wildlife and infrastructure damage, human health impacts, crime, and injustice. The chapter also mentions monetary valuation methods that include positive and negative effects, such as the negative impacts of floods or storms (p. 159) or the effect on human health and life (p. 164). Chapter 4 presents an example of coal mining in which the net revenue can become negative when external costs are included (p. 265). It also mentions the potential for nature's contributions to people to be negative (p. 285). Finally, Chapter 6 mentions alternative measures of human well-being that seek to indicate the disutility derived from negative externalities (p. 458). It also mentions that there is a lack of understanding of negative values of nature as a knowledge gap (p. 487), including their role in decisions (individual and collective).

There is variation in how valuation methods treat values and value-conflicts

Methods and metrics to estimate and express values often stem from different disciplinary traditions. They also integrate different values of nature and to varying extents. Some of those values may be anchored in incompatible understandings across cultures and contexts, which complicates valuation. Valuation methods deal with those and other value conflicts differently. It has been argued that valuation methods that are based on participation and deliberation may foster mediation of value conflicts (Rincón-Ruiz et al. 2019).

The multiple values of nature in decision making

A review of national biodiversity strategies and action plans, explains IPBES (2022), revealed that instrumental values tend to appear more frequently than relational or intrinsic ones. Even when references to the last two types appear, they tend to be part of aspirational or agenda-setting contexts. Nonetheless, assessing diverse values can help policymakers make intangible costs and benefits visible, which would otherwise be neglected; the report refers to Witt et al. (2019) to support this statement. Similarly, IPBES (2022) argues that the representation of diverse perspectives in decision-making supports inclusion, legitimacy, and allows for better understandings of the sources of environmental conflicts (p.97).

2.1.4 The values of water according to Ligtvoet et al. (2023)

The SDGs and the values of water

The report does not provide a separate definition of the value of water. However, throughout the report, the authors emphasise water's contributions to the SDGs, and, as a result, to sustainable development. Ligtvoet at al. argue that the goals might provide (part of) a framework to explore 'what constitutes value' and 'what counts in sustainable development'.

All SDGs are related to water, although to different extents

Ligtvoet et al. use hotspot landscapes to discuss water-related challenges: river basins, deltas and coasts, drylands, and cities. For each one, they describe qualitative and sometimes quantitative ways in which water supports the achievement of the Sustainable Development Goals. They also classify the SDGs in three groups, based on how much each SDG relates to water (see Table 2).

Table 2
SDGs classified by their connection to water, according to Ligtvoet et al. (2023)

Group	Sustainable Development Goal
Strongly related to water	3 Good health and well-being
	6 Clean water and sanitation
	11 Sustainable cities and communities
	13 Climate action
	14 Life below water
	15 Life on land
Related to water	1 No poverty
	2 Zero hunger
	5 Gender equality
	7 Affordable and clean energy
	10 Reduced inequalities
	12 Responsible consumption and production
	16 Peace, justice, and strong institutions
	17 Partnerships for the goals
Indirectly related to water	4 Quality education
	8 Decent work and economic growth
	9 Industry, innovation, and infrastructure

Indicators are used to describe water challenges

The report uses indicators to describe water challenges around the world in each hotspot landscape. To name a few examples: 'GDP per capita in river basins and large river cities', 'Upstream sediment trapped by dams in 2010 (in %)', and 'Global water withdrawal (in km3)'.

Valuing water with a broader scope

The report argues that tackling global water challenges requires valuing water with a broader scope. It offers nine final recommendations, one of which is dedicated to valuing water. They argue that water is undervalued and that a broader appreciation of the value of water for society and ecosystems is needed. Changes in how water is valued and in water governance are seen as necessary to tackle current and future water challenges.

2.2 Eleven scientific articles

A selection allows for a screening of academic literature

Our limited screening is a complement to our overview of the three reports discussed in the previous section (UN, IPBES, and PBL). It is not intended as an exhaustive overview of the academic literature on the values of water. Because the reports already synthyesise primary literature on their topics, we use this screening to identify any major blind spots in our own overview.

2.2.1 About the selection

Eleven articles

We specifically searched for articles that propose, use, or mention frameworks for the value of water and mention policy or decisions. We operationalised those selection criteria in a query using the engine Scopus. Additional details on this selection are available in Appendix 1. Results for individual articles (rather than results for the selection as a whole) are available in Appendix 3. Below, in the Table 3, we list all eleven articles we chose.

We classify the articles in five types of studies

Firstly, Haileslassie et al. (2024) and Schulz et al. (2019, 2024) propose a multi-disciplinary conceptual framework of the value of water and apply it to empirical work. Secondly, Hussain et al. (2007) and Pacetti et al. (2020) present empirical work, with the former using a mostly mono-disciplinary conceptual framework. Thirdly, Opperman et al. (2020) provide a topic overview and does not include a framework nor empirical work. Fourthly, various articles present techno-economic optimisation frameworks and their applications (Kounalakis & Theodorou 2019; Davidsen et al. 2015; Riegels et al. 2011; Alamanos et al. 2019). Finally, Villamayor-Tomas et al. (2015) integrates institutional analysis into a nexus approach, with case studies focusing on water allocation for food production, irrigation, (bio-) energy, and urban use.

2.2.2 The values of water according to the selection

Physical uses of water are important for humans

The value(s) of water is primarily defined by the (in)direct physical uses of water and their importance for humans. All articles we reviewed primarily refer to the physical dimension of water. About half of the articles focus on physical uses of water, functions, or benefits of water to people. Specifically, the four techno-economic articles discuss water uses and users (Kounalakis &

Theodorou 2019; Davidsen et al. 2015; Riegels et al. 2011; Alamanos et al. 2019); Hussain et al. (2007) discuss different aspects of water for agricultural production (including evapotranspiration, which is linked to non-consumptive aspects of the water cycle); and Villamayor-Tomas et al. (2015) focus on water allocation and institutional context in value-chains.

Table 3
Selection of 11 scientific articles

Citation	Title
Haileslassie et al. (2024)	Diversity and trade-offs of water values in the Akaki River system in Ethiopia: Context of urban–rural linkage
Schulz et al. (2024)	Valuing water: A global survey of the values that underpin water decisions
Pacetti et al. (2020)	Water Values: Participatory Water Ecosystem Services Assessment in the Arno River Basin, Italy
Opperman et al. (2020)	Achieving water security's full goals through better integration of rivers' diverse and distinct values
Alamanos et al. (2019)	Integrated hydro-economic modelling for sustainable water resources management in data-scarce areas: The case of Lake Karla Watershed in Greece
Schulz et al. (2019)	Understanding public views on a dam construction boom: The role of values
Kounalakis et al. (2019)	A hydrothermal coordination model for electricity markets: Theory and practice in the case of the Greek electricity market regulatory framework
Davidsen et al. (2015)	Hydroeconomic optimisation of reservoir management under downstream water quality constraints
Villamayor-Tomas et al. (2015)	The water-energy-food security nexus through the lenses of the value chain and the institutional analysis and development frameworks
Riegels et al. (2011)	Estimating resource costs of compliance with EU WFD ecological status requirements at the river basin scale
Hussain et al. (2007)	Measuring and enhancing the value of agricultural water in irrigated river basins

Studies seldom define the value of water or use mostly monetary indicators

The articles often determine the value of water in specific case studies. However, they regularly leave the concept of the value of water implicit or limit the concept to monetary indicators:

- Pacetti et al. (2020) conduct empirical work to identify values in a case study, but do not define a framework for what the value of water is.
- In a qualitative overview of water management as a topic, Opperman et al. (2020) do not define the concept of 'value'; however, they refer to valuation outputs or what people find important.
- The techno-economic optimisation studies (Alamanos et al. 2019, Kounalakis et al. 2019, Davidsen et al. 2015, Riegels et al. 2011) focus on the monetary value of water as an input for production, as the price of a unit of consumption, or as shadow prices.
- Villamayor-Tomas et al. (2015) also focus on water as an input for value-chains. Although they use two frameworks (Socio-Ecological Systems and Institutional Analysis and Development Framework), they do not specifically define the value of water.

Conceptual frameworks include physical and non-physical aspects of water

The three studies that include (multi-disciplinary) conceptual frameworks to define the value of water include its physical and non-physical aspects (Haileslassie et al. 2024; Schulz et al. 2019 and 2024). Haileslassie et al. (2024) discuss knowledge that humans hold of the physical system as well as the associated values. Their conceptualisation builds on the existing notion of socio-ecological systems. Schulz et al. (2019, 2024) use their pre-existing framework in which they define 'assigned values' that are close to physical water allocation, are influenced by other values that people hold, and water governance.

Hussain et al. (2007) propose a framework that reflects an economic perspective to agricultural water. However, they do mention that values other than economic ones exist, such as cultural values.

Although Pacetti et al. (2020) do not propose a framework, they investigate the perceptions that humans have of a socio-ecological problem linked to water-related ecosystem services. Those perceptions are seen as anchored in the physical system.

Broad definitions of the values of water

Multi-disciplinary frameworks adopt broad definitions of the values of water. Haileslassie et al. (2024) describes water values as context-specific, interacting with, and created by, socio-ecological systems. Water systems are described as having three components that interact with the socio-cultural system: system structure (physical dimension), governance and power dynamics, and system functions. The physical dimension interacts with the non-physical parts of the system, which include governance in the form of formal and informal rules and regulations. Water values are seen as multiple, existing in all parts of societies, borne by different people, and being of different types (like scenic, heritage, cultural, or spiritual). The typology of specific values of nature from IPBES (2022) is used for their empirical research.

Similar elements are present in the work of Schulz et al. (2019, 2024). They conceptualise values with respect to water in three types: fundamental values, assigned values or water values, and governance-related values. Fundamental values (such as security) are guiding principles that inform individual decisions (professional and private); assigned values are assigned by people to water (such as irrigation, energy, cultural, spiritual); governance-related values (such as social justice) are input for water governance. In turn, water governance is seen as the combination of its polity, policy, and politics.

Multiple values, perspectives, and actors

Studies that use multi-disciplinary frameworks emphasise that there are multiple values, perspectives to value, and relevant actors. Haileslassie et al. (2024), Schulz et al. (2019; 2024), and Pacetti et al. (2020) include words of caution. In the case that they studied, Haileslassie et al. explain that water policy focuses on instrumental values, whereas there are also competing relational water values. They propose and apply an approach to identify those and more diverse values. Schulz et al. (2019) study values in conflicts around dams and, in the 2024 report, elaborate on the multiple types of values in decisions that affect water. Pacetti et al. (2020) focus on 'low priority' stakeholders, which, they explain, are often excluded from decisions. They propose and apply an analysis that focuses on those stakeholders and determines social perceptions regarding the value of water resources in a territory.

2.3 Looking ahead: input to design a framework for document analysis

Concepts, notions, and approaches

The literature from this chapter offers concepts, notions, and approaches to describe and understand the values of water, which can be used for document analysis. We retrieved the following concepts and notions:

- Water is often valued from **five interrelated perspectives** (UN 2021). They embody frequent functions of water: nature; drinking water, sanitation, and hygiene; food and agriculture; energy, industry, business, and employment; infrastructure; sociocultural.
- The diverse values of nature (IPBES 2022) can be conceptualised through **life frames**, **worldviews**, **broad values**, and **specific values**. There are three categories of specific values that are not mutually exclusive: **instrumental**, **intrinsic**, and **relational**.
- The values of water can be **positive** or **negative**. Examples of positive values include the contributions of water to the Sustainable Development Goals, while examples of negative values include floods due to too much water in a specific place or illness due to water pollution.
- **Indicators** (UN 2021, IPBES 2022) can be used to describe or categorise nature (including water) and to express its importance or value. IPBES defines them as quantitative measures or qualitative descriptors. For instance, Ligtvoet et al. (2023) apply indicators to describe water-related challenges in clear and visually attractive ways.
- The **Sustainable Development Goals** are highlighted by UN (2021) and Ligtvoet et al. (2023). Although not included in our selection of studies, other authors have championed the use of the SDGs as a framework. For example, Röckstrom and Sukhdev (Stockholm Resilience Center 2016) proposed the 'Wedding Cake' model. They argue that the economy and society are embedded in the biosphere and propose grouping the SDGs in three layers that represent this. The biosphere is represented by Goals 6, 13, 14, and 15, society by Goals 1, 2, 3, 4, 5, 7, 11, and 15, and the economy by Goals 8, 9, 10, and 12.
- Views and understandings of the values of water (or nature) vary, leading to value conflicts. Water has been found to contrite to peace but also conflict. Therefore, there are **positive and negative values of water in the context of conflict**.
- **Water** (or nature) **governance** is highlighted by all reports as well as by various articles.
- The reports overlap concerning natural and human-made systems, including water systems, which can be described as having **physical and non-physical aspects**. These systems deliver of **perform functions** and include **physical structures**, **governance structures**, and **actors**. Values influence and are influenced by governance and management. The works of Haileslassie et al. (2024) and Schulz et al. (2024; 2019) are examples of such descriptions.

These concepts serve as input for our framework and analysis, which we describe in Chapter 3.

3 A framework for document analysis

Constructing the framework

To construct a framework for document analysis, we use the concepts from section 2.3. The framework is thus intended as a synthesis of existing conceptualisations of the values of water, which can be used in future studies. In the case of this study, we use it in the analysis of Dutch strategy documents for foreign aid and trade. Note that the framework is not intended as an exhaustive nor final conceptualisation of the values of water. As shown in Chapter 2, the literature on that subject is wide and rich.

We present the conceptual framework in section 3.1. Then, in section 3.2, we discuss which parts of the framework we apply to the analysis of Dutch strategy documents and how we conduct the analysis (methods, scope, and additional elements). The results of our analysis are then discussed in Chapter 4.

3.1 The conceptual framework

We integrate five basic concepts into four layers that interact with each other

The five basic concepts, retrieved from section 2.3, are:

a. Functions of water. Adapted from the perspectives to the valuation of water in UN (2021) and the concept of water system functions of Haileslassie et al. (2024).
b. Specific values of water. The specific of values of nature from IPBES (2022) but applied to water.
c. Physical structures related to water. Adapted from the water system structure by Haileslassie et al. (2024).
d. Governance structures related to water. Although adapted from the water governance in Schulz et al. (2019 and 2024), water governance is mentioned by various other studies.
e. Actors related to water, which are mentioned across the literature.

We organise these five basic concepts into four layers that interact with each other:

1. Layer 1 is a matrix with the (a) functions of water in the vertical axis and the (b) specific values of water in the horizontal axis.

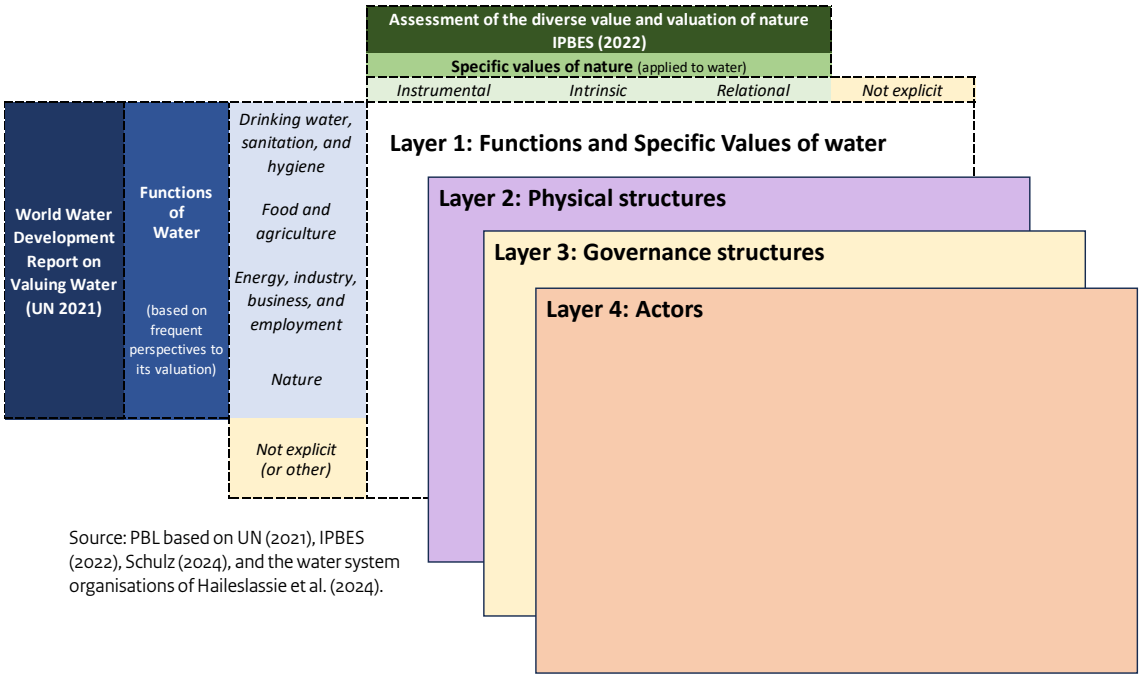
The remaining layers interact with each other. They are a decomposition of Layer 1 and can be visualised as adding a third dimension to Layer 1, as depicted in Figure 2.

2. Layer 2 are the physical structures.
3. Layer 3 are the governance structures.
4. Layer 4 are the actors.

The four layers and their interactions are partially based on the conceptualisations of water system organisations by Haileslassie et al. (2024)[2] and the Value Landscapes Approach by Schulz et al. (2024 and 2019). We further describe these layers in subsections 3.1.1 to 3.1.5.

[2] In turn, Haileslassie et al. (2024) builds on the existing concept of socio-ecological systems.

Figure 2
Our conceptual framework to identify the values of water in strategy documents



Source: PBL based on UN (2021), IPBES (2022), Schulz (2024), and the water system organisations of Haileslassie et al. (2024).

Interactions between layers

We conceptualise the values of water as influencing and being influenced by interactions between actors, physical structures, and governance structures. Figure 2 illustrates this. In its vertical axis, Layer 1 depicts the functions that water delivers or performs. In its horizontal axis, it depicts the specific values of water. Those values might be embedded in the functions of water, for example, in what those functions allow for or in the reasons why people might them important.

Layer 1 can be decomposed as follows. Water delivers or performs functions through physical structures (Layer 2) and governance structures (Layer 3). Actors (Layer 4) can interact with each other and with the other layers. Interactions and changes between and within these layers are influenced by specific values of water and can also influence those values. Note that values can be positive or negative. For example, water can perform functions and deliver 'services' but also 'disservices'.

Although not depicted in the figure, water indicators can be used to describe the values of water (a description of water indicators is available in section 3.1.6). We provide an example of the application of the framework in text box 3.1.

3.1 An example of our conceptual framework's application
Below, we exemplify how a mention of water would be characterised, according to the four layers of our conceptual framework.

The mention of water
Consider the following quote from the strategy document Do What We Do Best (2022):
'*Between 2016 and 2030 we will ensure that 30 million people have access to clean drinking water, and 50 million people to sanitation*'. (p. 34), in which 'we' refers to the Netherlands.

Layer 1: Functions and Specific Values of Water
In Layer 1, the quote refers to the function 'Drinking Water, Sanitation, and Hygiene' and does so from a positive instrumental value of water, in that it is humans who will have access.

Layer 2: Physical Structures
In Layer 2, the quote refers to physical structures in that it mentions physical water that people drink for water and sanitation.

Layer 3: Governance Structures
In Layer 3, governance structures are not explicitly mentioned but may be implicit in that the Netherlands will 'ensure' access, but it is not specified how.

Layer 4: Actors
In Layer 4, the quote refers to the Netherlands and the people who will have access to water and sanitation, without additional information on people's ability to act or influence decisions.

Conclusion
We characterise this quote as mentioning the positive contribution of the Netherlands to the physical provision of drinking water, sanitation, and hygiene for people, from an instrumental perspective, with governance structures and other actors remaining implicit.

3.1.1 Layer 1a: Functions of water

Four functions of water

The World Water Development Report (WWDR) on Valuing Water (UN 2021) mentions six perspectives from which water is often valued: water as nature; drinking water, sanitation, and hygiene; water for food and agriculture; water for energy, industry, business, and employment; water infrastructure; socio-cultural. These are not necessarily mutually exclusive. The same water body or water system can deliver or perform more than one of those functions; moreover, it can be valued in more than one way. At the same time, trade-offs may exist, amongst other reasons, because water is vital, finite, fugitive (in that human use usually requires it to be stored and replenished), part of indivisible natural systems, bulky, non-substitutable, and location bound (Savenije 2002).

Consumptive or physical uses of water

The first four perspectives are often consumptive or physical uses of water and are human-centred. We borrow those four perspectives and integrate them in Layer 1 of our conceptual framework as 'functions of water'. We borrow the concept of 'functions of water', as something that water systems deliver or perform, from Haileslassie et al. (2024). Table 4 describes the four functions of water in our framework.

Table 4
Functions of water, adapted from UN (2021)

System	Definition
Water as Nature	This system represents the water that exists in ecosystems. This water interacts with biotic and other abiotic factors in those ecosystems (including biodiversity and climate), shapes the water cycle, and enables and interacts with other physical and chemical processes in those ecosystems.
Drinking Water, Sanitation, and Hygiene	WASH is an abbreviation for water, sanitation and hygiene. It refers to services and access to drinking water, sanitation, and water in connection to human health. Access to water, sanitation and hygiene is institutionalized as a human right.
Water for Food and Agriculture	This system conceptualises water as an input for agriculture and food production.
Water for Energy, Industry, Business, and Employment	Water as input for production in sectors other than agriculture and food (as the name indicates: energy, industry, business, and employment). Examples include water used for producing green hydrogen, water for the extraction of critical raw materials, and water for river tourism.

Two other perspectives are not a function of water in our framework

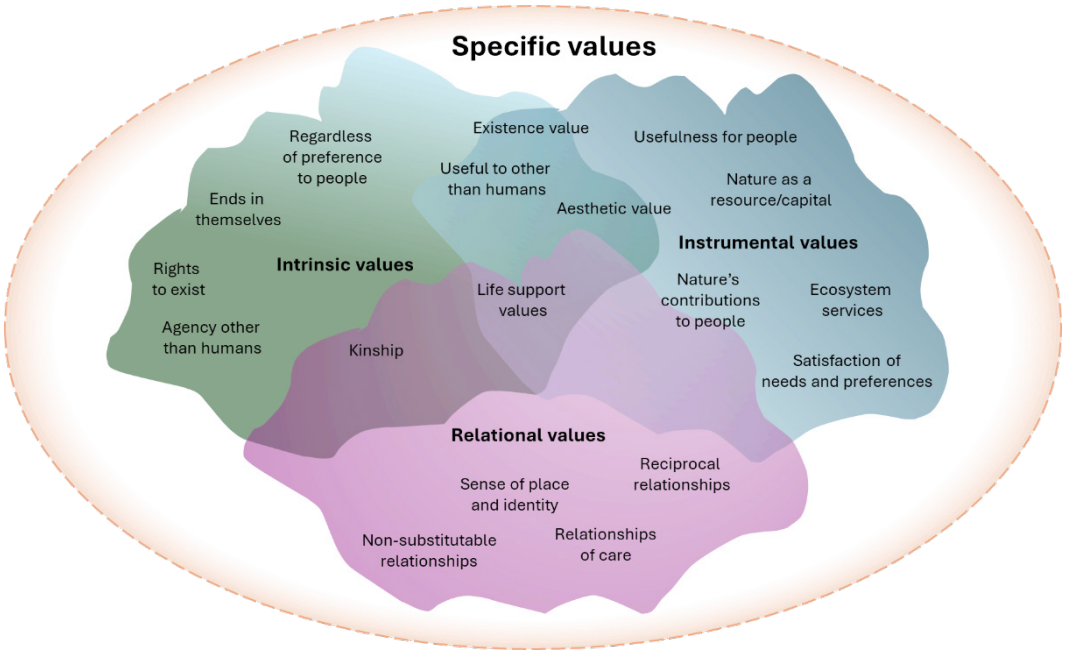
We do not include water infrastructure and socio-cultural valuation of water as separate functions of water from the WWDR. We consider water infrastructure to be part of the physical structures of the system (including natural and human-made) and therefore included in Layer 2 (see section 3.1.2). We consider socio-cultural aspects of water to permeate and overlap with all its functions, physical structures, governance structures, and actors. Each function can be valued because of socio-cultural reasons. Those socio-cultural reasons can be characterised with the specific values of water. Future studies can consider including a separate socio-cultural function of water, depending on the research goal. To account for what might not be covered with the four functions of water and their intersection with specific values of water, our framework does include a category for 'other' or 'no function of water'. Likewise, it includes a category for 'no specific values of water'.

3.1.2 Layer 1b: Specific values of water

Instrumental, intrinsic, and relational values

From the conceptualisation of the multiple values of nature by IPBES (2022), we limit our study to specific values, which can be instrumental, intrinsic, and relational. We do not examine life frames, worldviews, nor broad values. IPBES describes instrumental values as '*nature for people*', intrinsic values as '*nature for nature*', and relational values as '*nature as culture*' or '*one with nature*'. These values are not mutually exclusive and the boundaries between them are 'fuzzy' (IPBES 2022). Figure 3, adapted from an illustration in IPBES, illustrates those boundaries and provides examples of specific values.

Figure 3
General visualization of the fuzzy boundaries between the specific values of nature



Source: Adapted by PBL from an illustration in IPBES (2022, p. 61).

We focus on specific values because, according to IPBES, they contain information on '*the importance of things or situations expressed in particular contexts*' (p. 49); therefore, they might be relatively easier to identify in a text. PBL has used specific values for document analysis in a previous study (Dam et al. 2024), which examined which specific values are present in Dutch national policy for nature.

Nature for people (instrumental)

Instrumental values characterise nature as important because it is a means to achieve human ends or satisfy human preferences (Himes et al. 2024). They tend to be associated with nature (e.g. as asset, capital, resources, services) and its contributions to people (IPBES 2022), which include ecosystem services. Thus, they are also described as nature for people (IPBES 2023). One example is the consideration of wetlands as important ecosystems because they prevent floods and damages to humans. The idea that water holds economic value relates closely to the concept of instrumental value of water; in other words, the ways in which nature is important to people.

Nature for nature (intrinsic)

Intrinsic values are grounded on the belief that nature has a right to exist. Values or entities are expressed independently of any reference to people as those who value nature (Himes et al. 2024). This specific value is also described as nature for nature (IPBES 2023), for example when the conservation of biodiversity is regarded as a moral duty. Examples include specific conservation goals in the EU birds and habitats directives (European Commission: Directorate-General for Environment et al. 2015) of the European Union (Dam et al. 2024).

Nature as culture/one with nature (relational)

Relational values characterise the importance assigned to meaningful and often reciprocal relationships between humans and nature, and among people through nature (Himes et al., 2024; IPBES, 2022). From the perspective of relational values, humans regard nature as important beyond being a means to an end (Himes et al. 2024; IPBES 2022). Examples include a sense of place, sense of identity, spirituality, care, and reciprocity, and nature is often part of this relationship in the form

of a particular landscape, place, or species. This specific value is also described as nature as culture/one with nature (IPBES 2023) and is context-dependent, often place-based, non-tradable, and, in principle, not substitutable.

The three types of specific values are not mutually exclusive

Water (including its functions) can be valued from the perspective of more than one specific value. It may also be valued differently by different actors and from different perspectives, and by someone in multiple ways and at the same time. The specific values of water can be seen as existing in a space between the three types of specific values. For example, consider a physical water body. It may be important to the same person because it provides water for people to drink, to use in productive activities, and because it provides habitats for endangered species considered worth preserving. Moreover, the way in which the water body is managed may reflect instrumental, intrinsic, and relational values. Text box 3.2 illustrates that even the functions of water with clear instrumental values may reflect other specific values.

3.2 Multiple specific values of water and Dutch national identity

The connection between water and Dutch national identity exemplifies that the specific values of water are not mutually exclusive. Through historical research, Mostert (2020) described various links between water and Dutch national identity. That work does not use the typology of specific values from IPBES (2022). However, in this textbox, we organise examples provided by Mostert (2020) according to the categories of IPBES (2022) applied to water.

Instrumental values of water

Those links include, but are not limited to, the idea of a 'fight against water', floods as a setback in such fight, land reclamation as a success, and shipping and trade. These aspects reflect positive or negative instrumental values in that they are seen as benefitting or harming people.

Relational values of water

Mostert (2020) argues that a sense of place in connection to water is part of Dutch national identity. Cited examples include songs, poetry, paintings, or children's books with water-related elements, including landscapes. They further support that argument by citing a survey from the Social and Cultural Planning Agency (Beugelsdijk et al. 2019) in which 80-90% of the respondents considered water-related items (such as polder landscape, the Wadden Sea, polder mills, the Delta Works) to be characteristic of the Netherlands. In the same study, 44-55% of respondents reported feeling a connection to those items.

Multiple specific values of water can exist at the same time

We argue that these examples illustrate that even functions of water with clear instrumental values can have other specific values. In this case, polder mills that may be part of land reclamation (instrumental) are also part of water-related landscapes and sense of place associated to Dutch national identity. This suggests relational values. A similar argument can be made for the Wadden Sea, which is used for tourism and transport (instrumental) but is equally a protected area with vulnerable, endangered, or critically endangered species (intrinsic). The Wadden Sea is also recognized by UNESCO as World Heritage, and its existence is linked to Dutch national identity (relational).

Layer 1 from our conceptual framework

Because multiple specific values of water can exist at the same time, we depict Layer 1 of our conceptual framework as a space (or matrix) in which the functions of water and the specific values of water can intersect with each other. In other words, one function of water can have various specific values. Likewise, each type of specific value can cover multiple functions of water.

3.1.3 Layer 2: Physical structures

Physical structures deliver or perform functions of water

Layer 2 is partially based on the water system structure by Haileslassie et al. (2024). According to that research, water systems have three key components: water system structure, functions, and governance. A water system structure includes '*organisms and physical features of the system (biotic and abiotic). More generally, the structure of the water system refers to the explanation of living beings and the physical features of the environment in which the organisms sustain*' (pp. 100-101).

Natural and human-made

We define Layer 2 as physical structures, which can be natural, human-made, or a combination of both. The layer includes, but is not limited to, water as a substance, water bodies, and hydraulic infrastructure. It is different than the definition of 'water infrastructure' from the WWDR UN report (2021), which emphasises human-made structures.[3] Unlike the water system structures in Haileslassie et al. (2024), we exclude people from this layer and instead include them in Layer 4, as actors.

3.1.4 Layer 3: Governance structures

Policy, politics, and polity

We based Layer 3 on the water governance concept as defined by (Schulz et al. 2024), which reads '*the combination of water policy (the content of decision-making), water politics (the power play between different actors), and water polity (the institutions within which decisions are being taken)*'. Water policy includes policy instruments and the material dimension of water governance, including how water is allocated. Water politics includes the power relations between such actors within water governance. Water polity can also be understood as the institutional setting in which water governance takes place, with which we understand institutions as rules and regulations, formal and informal (North 1991). The role of water governance in water systems is also emphasised by other studies named in Chapter 2.

3.1.5 Layer 4: Actors

Persons or organisations able to act or exert influence on decisions

Definitions of actors in the studies vary or remain implicit. Therefore, we borrow the textbook definition by Enserink et al. (2022, p. 78). They define an actor as '*a social entity, a person or an organization, able to act on or exert influence on a decision*'. In line with the selection of literature that this study covered, we see actors as holding values and interacting with or through the other layers of the system.

[3] The UN (2021) defines hydraulic infrastructure as storing or moving water (such as dams and pipes); using or reusing water (such as rainwater collection systems or water treatment plants); supplying water (such as urban distribution networks), or augmenting water supply (such as desalination of seawater). The definition explicitly excludes 'soft infrastructure', which refers to organisations, institutions, or social networks.

3.1.6 Water indicators

Water indicators offer information on the values of water

Water indicators are not a layer in our framework nor one of its basic concepts. However, they are connected to the framework because they can offer information on the values of water. They are 'quantitative measures' or 'qualitative descriptors' that characterise nature (Pascual et al. 2023), and, in the case of this framework, water.[4]

Indicators can be biophysical, socio-cultural, or monetary

Anderson et al. (2002) classify value indicators into three large types. Biophysical indicators include stocks and flows in ecosystems, while socio-cultural indicators include quantitative descriptors such as photo rankings or relational values identified in an area, as well as qualitative measures like ethnographic accounts or themes in a text. Finally, monetary indicators are preference-based and may assess subjective preferences, as well as benefits and costs related to natural capital.

Water indicators across various disciplines

Authors have developed water indicators across various disciplines. Examples from an economic perspective include the efforts by the World Bank to better include water in natural capital accounting (World Bank 2024). Other examples are the development of methodologies that enable local stakeholders to express values of water beyond the focus on economic values, such as the works of the Hermans et al. (2006), Haileslassie et al. (2024), and Pacetti et al. (2020). The UN WWDR (2021) also presents water indicators such as water footprints, monetary metrics, environmental flows, water stress index, gross domestic product, and the proportion of a population exposed to pollution.

3.2 The framework's application

In subsection 3.2.1 below, we discuss the method and scope of our document analysis, with additional details available in Appendix 4. In subsection 3.2.3, we discuss two additional elements included in our analysis.

3.2.1 Methods and scope

Document analysis as a qualitative research method

This study examines a selection of recent strategy documents that outline Dutch policy for foreign aid and trade (issued from 2022 to 2025). The primary data extracted from these sources consists of the paragraphs and sentences that explicitly mention the word 'water'. We analyse the contents extracted by identifying what layers from our framework they articulate. As such, the layers in our framework serve as predefined codes to identify the different themes to which the term 'water' is associated in the documents. While conducting the study, some adjustments were made to the framework, making it an iterative process.

[4] Pascual et al. (2023) builds on Díaz et al. (2018) and Anderson et al. (2022) to define value indicators (often abbreviated simply as indicators) as '*quantitative measures and qualitative descriptors used to denote nature and people–nature relationships and nature's contributions to people (NCP)* (Díaz et al. 2018), *typically in biophysical, monetary or socio-cultural terms* (Anderson et al. 2022)'.

Accordingly, our study relies on a variant of 'content analysis' and 'thematic analysis', following Bowen (2009), who, in turn, refers to Corbin & Strauss (2008), Strauss & Corbin (1998), and Fereday & Muir-Cochrane (2006). A similar approach was followed by Dam et al. (2024), who also worked with the specific values of nature defined by IPBES (2022), although that study used more varied keywords.

Framework layers

We use the following framework layers, dedicating more attention to the Layers 1 and 2 than to Layers 3 and 4:

- From Layer 1, we identify functions and specific values that are explicitly mentioned in relation with 'water' and are included in our framework.
- From Layer 2, we identify whether the text refers to physical aspects of water systems, including natural and human made structures.
- From Layers 3 and Layer 4, we identify mentions of non-physical aspects of water systems and we pinpoint the word 'water' mentioned in a name. This identification roughly points at elements of water governance and / or actors in the respective parts of the documents. For example, 'water' being mentioned as a policy focus theme suggests an element of water governance.

Although not a formal layer nor basic concept in our framework, we identify water indicators because they provide information on values.

Content rather than discourse

Our analysis focuses on *contents* rather than *discourse*. In other words, we focus on the explicit contents and themes in each text rather than on how the language is articulated to present them. That is because the identification of more implicit elements in the text – such as the power relations or social dynamics involved in water governance – is not the primary focus of our study. Identifying such elements would likely require a different approach (e.g. discourse analysis)[5]. Our analysis privileges the identification of explicit associations between the word 'water' and the different themes and semantic layers identified in our framework. Such identification remains sufficiently sensitive to some language choices: for example, referring to water as a resource (rather than a 'substance' or a 'water source') might suggest an instrumental perspective on water as means to an end.

[5] Discourse analysis is a research method that is used to interpret and analyse spoken and/or written language with the intention of understanding the underlying meanings, ideologies, and power dynamics within a specific context (Fairclough 1992, 2003). Its application departs from the idea that language is deployed to maintain and exercise power (Jacobs 2021), and that analysing the way language is used in each context can therefore serve to highlight associated values, assumptions, and ideologies. In the context of policymaking, this means that language (and other communicative acts) can be viewed as simultaneously part of the policy process and producers of policy (Wash 2020).

3.2.2 Additional elements

Water for peace or conflict

We search the data for mentions of water in connection to conflict or peace. Conflicts around water or trade-offs between stakeholders around water are frequently mentioned in the literature we named in Chapter 2. The connection between water and peace has also received wider attention. For example, the 2024 World Water Development Report (UN 2024a) was dedicated to water for prosperity and peace. That report explains that water can be a source of peace and prosperity when it promotes community stability, peacebuilding, migration management, and disaster risk reduction. Water as a contributor to conflict includes water pollution, water scarcity, and problems with water accessibility as factors that endanger food security and contribute to loss of livelihood, after which, conflict can follow.

Water and the Sustainable Development Goals

We search the data for mentions of water in connection to the SDGs. Ligtvoet et al. (2023) suggests that these goals are a possible avenue to explore the value of water. UN (2021) mentions them as a notable example of global actors coming together to recognize the importance of water. Other authors and organisations have used them at the interface between science and policy, such as the Stockholm Resilience Center (2016). In both cases, for reasons of scope, we limit our analysis to an identification of the paragraphs that mention water and connect it to conflict (or peace) or to the Sustainable Development Goals.

4 The values of water in Dutch strategy documents

Analysing nine Dutch strategy documents

This analysis covers the nine strategy documents from Table 5. Focusing on strategy documents allows us to identify the values of water that are explicitly included in the direction that the National Government of the Netherlands intends to give to its policy for foreign aid and trade. Such direction is part of the formal context in which policy programmes and instruments would be embedded.

Table 5
Dutch strategy documents for foreign aid and trade included in our study

Year	Month	Cabinet	Title of the document
2022	June	Rutte IV	Do What We Do Best
2022	October	Rutte IV	The Global Climate Strategy
2022	October	Rutte IV	The Dutch Global Health Strategy 2023-2030
2022	December	Rutte IV	The National Raw Materials Strategy
2023	May	Rutte IV	The Africa Strategy of the Netherlands 2023-2032
2023	June	Rutte IV	The policy framework Global Multilateralism
2023	November	Rutte IV	The policy document Human Rights – Democracy – the International Legal Order
2025	February	Schoof	The letter of the Minister for Foreign aid and trade of February 20
2025	May	Schoof	The letter of the Minister for Foreign aid and trade of May 28

Two reasons that motivate our selection

Firstly, we aimed to select strategy documents targeting a variety of topics, rather than focusing on strategy documents that target water. The national government of the Netherlands has dedicated attention to the values of water, for example through the work of the Valuing Water Initiative, which was led by the Netherlands Enterprise Agency from 2019 to 2024. However, it remained the question whether other policy domains also dedicate attention to the values of water. Therefore, our selection included the general strategies for foreign aid and trade and the corresponding targeted (non-water) strategies. For reasons of scope, we excluded the Netherlands International Water Strategy (NIWA), which runs from its introduction in 2019 until 2030. With this selection, we aimed to produce a broader picture by studying strategy documents from other themes or clusters.

Secondly, we aimed to study strategy documents from the current national government period. Because the Dutch Cabinet changed while we conducted our study, our selection stems from two different national government periods: the Cabinet Rutte IV (2022-2024) and the Cabinet Schoof (2024). Due to the difference in the number of documents from each national government period (7 and 2, respectively), we treat the set of nine documents as a single sample. The first seven documents stem from the national government period of the Cabinet Rutte IV (2022-2024). The first one, Do What We Do Best (2022), was the overarching strategy for foreign aid and trade of that cabinet. That document announced that it would be supplemented by targeted strategies;

specifically, an international climate strategy, an Africa strategy, a global health strategy, a raw materials strategy, and a policy document on multilateralism and human rights. Published between 2022 and 2023, these strategies are the next six documents in our selection.

The last two documents stem from the subsequent national government period of the Cabinet Schoof (2024). Those two documents are the Cabinet's first policy letters on development aid (February 2025) and foreign trade (May 2025). Although they stem from a different government period, they mention that they continue work in the lines of the Dutch Global Health Strategy 2023-2030 and the National Raw Materials Strategy, and that they complement the Africa Strategy of the Netherlands 2023-2032 by emphasising mutual interests.

The full landscape of water values in Dutch foreign aid and trade

Including only strategy documents in our selection has two main limitations. Firstly, the study does not examine policies, programmes, and specific instruments that stem from those strategies, nor their implementation on the ground. The values of water present in that implementation may vary from those in the strategy documents alone. Secondly, current policies, programmes, and specific instruments may stem from strategy documents that precede those in our selection. This means that the picture that our study offers is not the full landscape of possible values of water in Dutch foreign aid and trade. Our study does, however, examine a part of the formal context of subsequent policy programmes and instruments and offers a picture of the values of water explicit in the overarching strategies.

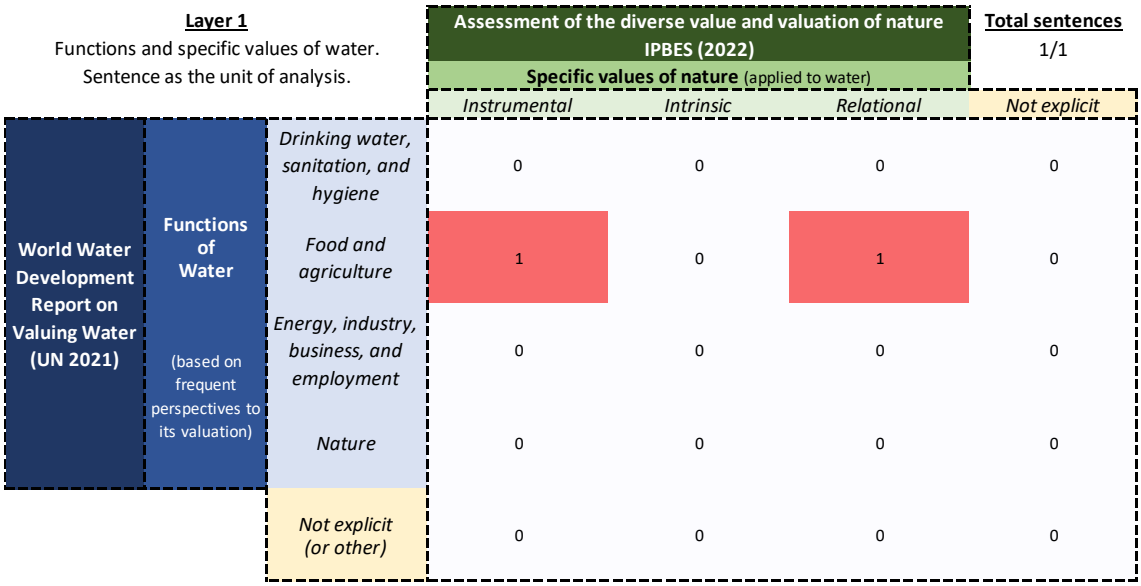
The layers of our framework as organising principle

Section 4.1 is dedicated to Layer 1 of our framework, section 4.2 to Layer 2, and section 4.3 to Layers 3 and 4. Although not a formal layer, section 4.4 discusses water indicators. Likewise, sections 4.5 and 4.6 are dedicated to water in connection to conflict (or peace) and the Sustainable Development Goals.

Each section summarises the results with heatmaps of the values of water, which follow Layer 1 from our framework. They have two axes: specific values of water (horizontal axis) and the functions of water (vertical axis). At each intersection, the heatmap shows the number of data points that mention a combination of specific values and functions. Therefore, each heatmap illustrates the frequency of those values in the dataset of sentences or paragraphs.

Note that one sentence or paragraph can be counted in more than one cell of the heatmap, as neither the specific values nor the functions are mutually exclusive. Figure 4 offers the following example. Assume that we study one single sentence, and that such sentence mentions water in connection to food and agriculture from an instrumental and relational perspective. The heatmap for that sentence would have two frequencies of '1': firstly, in the intersection of 'Food and Agriculture' and 'Instrumental'; secondly, in the intersection of 'Food and Agriculture' and 'Relational'.

Figure 4
Example of a heatmap for one sentence if that sentence mentioned Water for Food and Agriculture and articulated instrumental and relational values



4.1 Layer 1: Functions and specific values of water

Uneven mentions of functions and specific values of water

In the mentions of water, positive instrumental values dominate, often in combination with drinking water, sanitation, and hygiene. Figure 5 and Figure 6 summarise the frequencies in the sentences and paragraphs. Over half of the paragraphs (about 60%) articulate at least one of the four functions of water. Drinking Water, Sanitation, and Hygiene has the highest frequency for paragraphs and sentences. In contrast, most paragraphs (about 90%) articulate specific values of water, even when they do not specify any of the four functions of water. Those paragraphs always contain instrumental values. We identified that two paragraphs might also contain intrinsic or relational values, respectively; however, those values would be, at best, implicit. Moreover, the values of water in the documents are more often positive than negative: there are over twice as many paragraphs with positive than with negative values. This is also evident when comparing the typically higher frequencies of Figure 7 (positive values) with the lower frequencies of Figure 8 (negative values). In the only passage that might indicate intrinsic values, those values are positive. In the only passage that might indicate relational values, those values are negative. In the following paragraphs, we elaborate further on these observations.

Figure 5
Results (per sentence) in Layer 1 of our framework: functions and specific values of water

Layer 1 Functions and specific values of water. Sentence as the unit of analysis.			Assessment of the diverse value and valuation of nature IPBES (2022) Specific values of nature (applied to water)			Total sentences 166/166
			Instrumental	*Intrinsic*	*Relational*	*Not explicit*
World Water Development Report on Valuing Water (UN 2021)	Functions of Water (based on frequent perspectives to its valuation)	*Drinking water, sanitation, and hygiene*	42	0	0	0
		Food and agriculture	13	0	0	0
		Energy, industry, business, and employment	18	0	0	0
		Nature	19	0	0	2
		Not explicit (or other)	76	1	0	16

Figure 6
Results (per paragraph) in Layer 1 of our framework: functions and specific values of water

Layer 1 Functions and specific values of water. Paragraph as the unit of analysis.			Assessment of the diverse value and valuation of nature IPBES (2022) Specific values of nature (applied to water)			Total paragraphs 106/106
			Instrumental	*Intrinsic*	*Relational*	*Not explicit*
World Water Development Report on Valuing Water (UN 2021)	Functions of Water (based on frequent perspectives to its valuation)	*Drinking water, sanitation, and hygiene*	33	1	0	0
		Food and agriculture	16	0	0	0
		Energy, industry, business, and employment	26	0	0	0
		Nature	24	1	1	1
		Not explicit (or other)	35	0	0	8

Figure 7
Results (per paragraph) in Layer 1 of our framework: positive values

Layer 1: Positive values Paragraph as the unit of analysis.			Assessment of the diverse value and valuation of nature IPBES (2022) Specific values of nature (applied to water)			Total paragraphs 77/106
			Instrumental	*Intrinsic*	*Relational*	*Not explicit*
World Water Development Report on Valuing Water (UN 2021)	Functions of Water (based on frequent perspectives to its valuation)	*Drinking water, sanitation, and hygiene*	23	1	0	0
		Food and agriculture	13	0	0	0
		Energy, industry, business, and employment	22	0	0	0
		Nature	17	1	0	0
		Not explicit (or other)	28	0	0	0

Figure 8
Results (per paragraph) in Layer 1 of our framework: negative values

Layer 1: Negative values Paragraph as the unit of analysis.			Assessment of the diverse value and valuation of nature IPBES (2022) Specific values of nature (applied to water)			Total paragraphs 31/106
			Instrumental	*Intrinsic*	*Relational*	*Not explicit*
World Water Development Report on Valuing Water (UN 2021)	Functions of Water (based on frequent perspectives to its valuation)	*Drinking water, sanitation, and hygiene*	15	1	0	0
		Food and agriculture	12	0	0	0
		Energy, industry, business, and employment	12	0	0	0
		Nature	17	1	1	0
		Not explicit (or other)	2	0	0	0

4.1.1 Functions: Drinking Water, Sanitation, and Hygiene

Frequent mentions of Drinking Water, Sanitation and Hygiene

Drinking Water, Sanitation and Hygiene is mentioned more often than the other functions. All documents but two articulate it, with the two exceptions being the National Raw Materials Strategy and the letter of the Minister for Foreign aid and trade of May 28. This function is always (and only) accompanied by positive or negative instrumental values.

Efforts to meet human needs and targets

Positive mentions of Drinking Water, Sanitation, and Hygiene include human needs and policy (targets), accomplishments, or contributions by the Netherlands. For example, the Global Climate Strategy connects climate resilience and water for human consumption ('*By scaling up our efforts, we will ensure that an extra seven million people have access to a climate-resilient drinking water supply and sanitation facilities*' (p. 29)). In turn, the Africa Strategy of the Netherlands 2023-2032 mentions that the country will work on water infrastructure for drinking water and sanitation (*'The Netherlands will enhance water infrastructure in collaboration with nine countries in Africa, thereby supplying 3.5 million people with drinking water and sanitation by 2026*' (p. 49)).

Pressures on water systems and human health

The negative mentions, on the other hand, include drinking water becoming scarcer, unequal access to drinking water and sanitation, contaminated water as a cause of illness or death, and pressure on water systems (including climate change) having consequences on health or fresh water supplies. For example, the Global Health Strategy mentions water as a matter of life and death (*'Every day, almost a thousand children die as a result of avoidable diarrhoeal diseases associated with water supplies and sanitation. Access to safe drinking water and good sanitation is thus literally a matter of life and death*' (p. 37)).

Connections with other functions

Around half of the paragraphs for Drinking Water, Sanitation, and Hygiene also mention other functions of water. For example, Do What We Do Best connects it with Food and Agriculture. That document mentions drinking water scarcity as the reason for Dutch efforts in connection to agricultural water (*'Because drinking water is becoming scarcer, the Netherlands will also introduce digital information systems to contribute to optimising use of water in farming'* (p. 34)).

4.1.2 Functions: Food and Agriculture

Food and Agriculture only instrumental (as positive or negative)

Water in connection to Food and Agriculture is mentioned in six documents. The three documents that do not articulate this function are the National Raw Materials Strategy, the policy document Human Rights – Democracy – the International Legal Order, and the letter of the Minister for Foreign aid and trade of May 28. Those mentions articulate instrumental values, positive or negative, without an indication of intrinsic nor relational values.

Dutch contributions to water for Food and Agriculture

The documents mention that the Netherlands contributes to agricultural water efficiency or to water (management) as necessary for food systems. Mentions of agricultural water efficiency are found in Do What We Do Best, the Global Climate Strategy, and the Dutch Global Health Strategy 2023-2030. Various mentions of water (management) as a component of (or as necessary for, or as contributing to) food systems are found in the Global Climate Strategy, the Dutch Global Health Strategy 2023-2030, the Africa Strategy of the Netherlands 2023-2032, the policy framework Global Multilateralism, and the letter of the Minister for Foreign aid and trade of February 20 (2025). For example, the Global Climate Strategy (2022, p .30) mentions that the Netherlands "*advocates a coherent approach to the various components of these systems (food, water, soil, biodiversity, land rights, poverty, economic growth, safety, etc.), thus encompassing the entire context.*". Similarly, the Africa Strategy of the Netherlands 2023-2032 (p. 41) mentions water as a basis for food systems (*'The Netherlands supports African efforts to promote sustainable management and protection of, for example, water, land, forests, wetlands*

and oceans, which form an important basis for sustainable food systems and inclusive socioeconomic development').

Water scarcity and conflict

Negative mentions of Water in connection to Food and Agriculture include water (scarcity) affecting food systems and pressures on water systems having the potential to promote conflict. Those mentions are part of the Global Climate Strategy, the Dutch Global Health Strategy 2023-2030, and the policy framework Global Multilateralism. For example, the policy framework Global Multilateralism connects water and water scarcity to harvests and food security ('*Water – or the lack thereof – not only has a major impact on harvests and food security but can also play a key role in promoting conflict*' (p.15)).

Frequent connections to other functions

Food and Agriculture is usually mentioned with other functions of water. Those paragraphs typically articulate Drinking Water, Sanitation, and Hygiene or Water as Nature. For instance, the Global Climate Strategy connects these three functions in the following statement: '*Pressure on water resources is increasing due to climate change, population growth, pollution, industrial production, agriculture and urbanisation. Estimates suggest that if the current trends continue, 45% of global GDP, 52% of the world's population and 40% of global grain production will be at risk by 2050*' (p.28). In the quote, we see Water as Nature implied in the mention of 'water resources' from an instrumental perspective. We elaborate on the articulation of water as a 'resource' in section 4.1.4.

4.1.3 Functions: Energy, Industry, Business, and Employment

Energy, Industry, Business, and Employment in most documents

All documents but one articulate Energy, Industry, Business, and Employment. The policy document Human Rights – Democracy – the International Legal Order does not mention water in connection to Energy, Industry, and Business. The other documents always make an instrumental connection between water and this function, often positive. Those positive values typically refer to the contributions of water to the economy. The negative values most often refer to the risks that (changes in) water-related systems pose to the economy, and less frequently, to the risks that the economy poses to water-related systems. Those positive and negative values are usually mentioned with one of the following three themes.

Positive and negative links between water and the mining industry

Firstly, the National Raw Materials Strategy mentions multiple positive and negative links between the mining industry and water. Those links include the contributions of water to the mining industry and the tensions between the mining industry and water as part of nature. For example:

- Water as a physical input for the extraction of raw materials: '*Extraction of critical raw materials also requires large volumes of water*' (p. 11).
- Tensions between water extraction for mining and water stress: '*Copper and lithium extraction, for example, have particularly high water requirements, yet more than half of this production is concentrated in areas with high levels of water stress*' (p. 11).
- Risk of pollution: '*Water sources and soil can become polluted because of the chemicals used in ore processing, for example, and mine tailings, which are often toxic*' (p. 11).
- International waters and their jurisdiction: '*Many of the potentially important deposits are located in waters outside state jurisdiction, i.e. to which, in principle, any sovereign state can lay claim under international law*' (p. 18)

- Linking policy domains in international settings: '*More actively link mining to policy objectives on deforestation, biodiversity and water, for example by raising the matter of water use in the mining industry at the UN 2023 Water Conference*' (p. 20).
- The development of technology to decrease the demand of raw materials: '*Innovation is also driving the development of new battery types that do not contain these raw materials at all, such as LFP, sodium-ion, redox flow and seawater batteries*' (p. 30).

Water as an input to other sectors

Secondly, water is mentioned as an input for sectors other than the mining industry or for the economy in general, with both positive and negative instrumental values. Often, these mentions articulate water as part of nature because they either mention water as a (re-)source or the effects that human activities have on water. Therefore, positive values are articulated in the use of water by humans for their benefit, and negative ones, in the resulting risks or effects. Negative values are also articulated as risks that water systems pose for the economy when those systems are under pressure. All the mentions include instrumental values and no explicit intrinsic and relational values. For example:

- The letter of the Minister for Foreign aid and trade of February 20th (2025) mentions water supply as necessary for stability, resilience, economic growth, and as contributing to food security and health: *'Voldoende, veilig en betrouwbaar water is een voorwaarde voor stabiele samenlevingen, veerkrachtige gemeenschappen en economische groei. Ook draagt het bij aan wereldwijde voedselzekerheid en gezondheid'* (p. 8).[6]
- The policy framework Global Multilateralism mentions water as necessary for food and energy: '*Many current crises are linked to water: food becomes more expensive when harvests fail, sustainable forms of energy are reliant on water, and climate change and conflicts both call for a better distribution of water*' (p. 32).
- The Dutch Global Health Strategy 2023-2030 mentions negative effects of economic activities on water systems, and the resulting risks for the global economy: *'Climate change, population growth, growing consumption, harmful production structures, increasing pollution and urbanisation are all putting increasing pressure on water and food supplies. It is estimated that if current trends continue, by 2050 45% of global income, 52% of the global population and 40% of grain production will be at risk*' (p. 27).

Positive values of Dutch water 'know-how' and the Dutch water sector

Thirdly, Dutch water 'know-how' and the Dutch water sector are mentioned as having positive commercial and economic value. The documents mention their expertise, position, or the government support that they would receive. The focus of those mentions lies on knowledge or skills, the activities that they allow for, and their economic value. Hence, the mentions articulate positive instrumental values. For instance:

- Do What We Do Best (2022) refers to Dutch excellence in the field of water: '*There are many opportunities for the Dutch business community in areas such as sustainability and digital transformation. The Netherlands excels in fields including water, energy, sustainable mobility, food security, the agriculture sector and life sciences and health*' (p. 21).

[6] '*Sufficient, safe, and reliable water is a prerequisite for stable societies, resilient communities, and economic growth. It also contributes to global food security and health.*'

- Afterwards, the same document commits government support for water entrepreneurs abroad (‘*The government is therefore fully committed to supporting Dutch entrepreneurs operating abroad in these and other fields*’ (p. 21)).
- The letter of the Minister for Foreign aid and trade of February 20th (2025) mentions the Dutch global position in water management and that this offers opportunities for Dutch businesses: *‘Nederland is een wereldspeler op gebieden als voedselzekerheid, watermanagement en gezondheid. Deze thema’s zijn niet alleen van groot belang voor lage- en middeninkomenslanden, maar ook voor Nederland zelf. Veel landen willen op deze gebieden met ons samenwerken. Hier liggen ook grote kansen voor ons bedrijfsleven’* (p. 8).
- Afterwards, the same document commits to engage the Dutch water sector in acquisition opportunities: *‘We zetten de brede Nederlandse watersector in bij projecten en aanbestedingen’* (p. 9).[7]
- The letter of the Minister for Foreign aid and trade of May 28 (2025) also mentions opportunities for entrepreneurs and knowledge institutes: *‘Daarnaast zet het kabinet in op die thema’s waar Nederland goed in is: voedselzekerheid, watermanagement en gezondheid. Deze thema’s zijn niet alleen van groot belang voor lage- en middeninkomenslanden, maar ook voor Nederland zelf. Veel landen willen op deze gebieden met ons samenwerken. Dit willen wij stimuleren, want hier liggen kansen voor ondernemers en kennisinstellingen’* (p. 23).[8]

Energy, Industry, Business, and Employment sometimes often without other connections

Less than half of the paragraphs that do mention Energy, Industry, Business, and Employment, also articulate other functions of water. When they do, the paragraphs typically articulate Water as Nature. The other two functions of water (Drinking Water, Sanitation, and Hygiene; and Food and Agriculture) are mentioned in similar ways. Some paragraphs mention water as necessary for the economy, food, and health (including drinking water). Other paragraphs mention the negative consequences of human activities on water, which in turn, poses risks for economic activities, food, and health. For instance:

- The Africa Strategy of the Netherlands 2023-2032 mentions water as a basis for food systems and socioeconomic development: ‘*The Netherlands supports African efforts to promote sustainable management and protection of, for example, water, land, forests, wetlands and oceans, which form an important basis for sustainable food systems and inclusive socioeconomic development*’ (p. 41).
- The Global Climate Strategy (2022) mentions that water systems under pressure threaten food security and rural livelihoods: *‘Around the world, food and water systems are coming under increasing pressure, with direct consequences for health, food security, rural livelihoods, the habitability of cities, and achievement of the SDGs’* (p. 15).

4.1.4 Functions: Nature

Water as Nature in all but two documents

Most documents articulate Water as Nature, except for Do What We Do Best and the policy document Human Rights – Democracy – the International Legal Order. The remaining documents

[7] ‘*We engage the broad Dutch water sector in projects and tenders.*’

[8] ‘*In addition, the government focuses on the themes where the Netherlands excels: food security, water management, and health. These themes are not only of great importance to low- and middle-income countries but also to the Netherlands itself. Many countries want to collaborate with us in these areas. We want to encourage this, as there are opportunities here for entrepreneurs and knowledge institutions.*’

articulate this function from an instrumental perspective, even when mentioning water-related systems that are part of nature, apart from one sentence that does not show specific values of water. For example, Do What We Do Best mentions the contributions of the Netherlands to improve river basin management and safer deltas (which contain water): '*In the period up to 2030, the Netherlands will help a total of 20 million people with improvements to river basin management and action to ensure safer deltas*' (p. 34). Likewise, the policy document Human Rights – Democracy – the International Legal Order mentions the Sustainable Development Goals and '*the right to access to clean, safe drinking water and sanitation and the right to a clean, healthy and sustainable physical environment*' (p .15). This last quote might imply water as part of the physical environment. In those mentions, the importance of water as part of nature is human-centered, and, therefore, instrumental.

Instrumental values dominate Water as Nature

All but one mention of Water as Nature articulate instrumental values. When the text refers to water that exists in natural systems, emphasis is usually placed on how such water affects or benefits humans. For example, water or water systems are mentioned as a resource or a supply. This implies the use of water (or its benefits) by humans, and, therefore, positive instrumental values. There are other mentions of water shortages, water pollution, and their consequences for health, the economy, or development. Thus, those mentions imply negative instrumental values.

The following examples stem from the Africa Strategy of the Netherlands 2023-2032:

- Water is listed along with other natural 'resources' or parts of nature:
    - '*The Netherlands supports African efforts to promote sustainable management and protection of, for example, water, land, forests, wetlands and oceans, which form an important basis for sustainable food systems and inclusive socioeconomic development*' (p. 41).
    - '*The substantial impact of climate change in Africa is putting increasing pressure on natural resources such as land and water, forests and biodiversity, as well as mineral resources*' (p. 41).

Another example stems from the policy framework Global Multilateralism:

- *Water pollution and human health are connected: 'The conservation and sustainable use of biodiversity and healthy ecosystems are basic prerequisites for a healthy economy, public health and an effective climate change strategy. They also form the basis of our planet's resilience to the effects of climate change. Soil, water and air pollution pose a direct threat to human health' (p. 55).*

Only one paragraph mentions Water as Nature without explicit instrumental values of water

In the policy framework Global Multilateralism, one quote does not articulate instrumental values of water explicitly. The document mentions the World Meteorological Organisation (WMO), which specialises in weather, climate, and water. It also mentions institutes that are members of the WMO, which allows them access to data for weather forecasting, extreme weather warnings, and climate diagnosis. Although this might imply instrumental values because it relates to weather and climate risks for humans, those risks are not explicitly mentioned in connection to water. The quote is as follows:

- '*Thanks to their membership of the World Meteorological Organization (WMO), the UN's specialised agency for weather, climate and water, the Royal Netherlands Meteorological Institute (KNMI) and the meteorological services of Curaçao and St Maarten have fast and free access to observations from the rest of the world for the purpose of weather forecasting, extreme weather warnings and climate diagnostics*' (p. 14).

Intrinsic or relational values remain implicit at best

There are two mentions of Water as Nature that could indicate intrinsic or relational values, but those values remain implicit at best. Those mentions stem from the Dutch Global Health Strategy

2023-2030 and the Africa Strategy of the Netherlands 2023-2032, respectively. Because those are the only to mentions that might indicate intrinsic or relational values, we reserve their discussion for the following section, dedicated to the specific values of water.

4.1.5 Specific values of water

Instrumental values of water dominate the documents

Instrumental values are dominant, with only two possible indications of other specific values. About 90% of the sentences that mention water articulate at least instrumental values of water. In each document, the percentage ranges from 80-100%. The instrumental values of water are positive, negative, or both. Two sentences (discussed further on in this section) might also imply positive intrinsic values or negative relational values, but those values are not explicit in the text.

Half or less than half of the instrumental mentions have at least one function of water

The four functions of water we apply – Drinking Water, Sanitation, and Hygiene; Food and Agriculture; Energy, Industry, Business, and Employment; and Nature – capture half or less than half of the instrumental mentions. In the documents, about half of the sentences and two thirds of the paragraphs that articulate instrumental values of water also articulate one or more functions from our framework. Drinking Water, Sanitation, and Hygiene is the most frequent function, on its own or in combination with others. Chapter 4.1.1 to 4.1.4 provide more details on those specific mentions.

When instrumental values of water are not combined with one or more functions, those values are typically positive and often linked to governance or other actors. Water (management) is often mentioned as policy domain, theme, focus area, focal point, or sector. Those mentions of water can be classified into Layer 3 of our framework, which describes governance structures. For instance:

- The letter of the Minister for Foreign aid and trade of February 20 mentions water management as a field in which the government will promote three Dutch interests that the letter names (trade and economy, security and stability, and migration): '*Onze inzet gaat zich richten op drie Nederlandse belangen: handel en economie, veiligheid en stabiliteit, en migratie. Deze belangen behartigen we met programma's en diplomatieke inzet op gebieden waar Nederland in uitblinkt: watermanagement, voedselzekerheid en gezondheid*' (p. 1).

In this example, water governance structures are implied in the mention of water management. Other governance structures are also implied in the use of water management as an area to promote the three Dutch interests of trade and economy, security and stability, and migration.

In other instances, the mentions of water may indicate the presence of certain actors. Such actors can be classified in Layer 4 of our framework. For example:

- The National Raw Materials Strategy mentions a water-related actor that coordinates a programme: '*The Secretary of State for Infrastructure and Water Management is coordinating the government-wide Circular Economy Programme. This programme and the raw materials strategy are complementary and can reinforce each other in terms of increasing security of supply in the medium term and reducing the adverse effects of extraction and processing of critical raw materials on people and the environment*' (p. 15).

Water as a fundamental part of life

It is unclear whether one paragraph with instrumental values in connection to Drinking Water, Sanitation, and Hygiene also implies intrinsic values. The paragraph in question is part of the Global Health Strategy (p. 28). It mentions that, according to the vision statement of the UN Water Conference of 2025, '*water is a fundamental part of all aspects of life, inextricably linked to the three pillars of*

sustainable development. It is crosscutting and has close linkages with climate and health, amongst others. The ongoing water and sanitation crisis is a threat to everyone, including in terms of health risks'. There might be an indication of intrinsic values in water being mentioned as a fundamental part of all aspect of life; however, the text does not specifically refer to non-human life. Therefore, intrinsic values would be, at best, implicit.

Instrumental mentions of water might sometimes imply intrinsic values of nature

There are mentions of water as a useful tool or instrument for other purposes. For example, that the government will anchor the theme of biodiversity in development cooperation policy on water. Intrinsic values of water are therefore not the focus of those mentions. Instead, water is articulated from an instrumental perspective because it is used for other purposes. For instance:

- The Dutch Global Health Strategy 2023-2030 mentions water shortages enlarge our ecological footprint: '*Global warming, loss of biodiversity, environmental pollution (including carbon emissions), substantial land use changes, deforestation, water shortages and imbalances in mineral cycles (e.g. nitrogen) are enlarging humankind's ecological footprint, and the Netherlands is no exception*' (p. 25).
- When discussing the risks of mining, the National Raw Materials Strategy lists both water and biodiversity: '*The collapse of tailings dams have caused major disasters in the past, and leakage can release waste into the environment. It is worth noting that mines are often located in areas that have protected forests, high water stress levels, and particularly valuable biodiversity*' (p. 11).

The mentions of 'loss of biodiversity' and 'particularly valuable biodiversity' can imply non-human considerations, potentially suggesting intrinsic values of nature. However, those values are not explicit in the text, and more information would be needed to confirm them.

One mention of water, conflict, and interethnic tensions might indicate relational values

This indication directly articulates Water as Nature. The paragraph in question, which stems from the Africa Strategy of the Netherlands 2023-2032, mentions that pressure on natural resources (including water) is leading to long-term intergenerational and interethnic tensions. There are instrumental values in the mention of water as a resource, implying its use by (or benefits for) humans. There might be an indication of relational values in the link between water and intergenerational and interethnic tensions. However, more information would be needed to confirm those values. The mention reads: *'The substantial impact of climate change in Africa is putting increasing pressure on natural resources such as land and water, forests and biodiversity, as well as mineral resources. This is leading to long-term intergenerational and interethnic tensions. Further tensions are arising between countries over access to transboundary water sources, grasslands and agricultural land and other ecological resources'* (p. 41).

Relational values of water as part of Dutch national identity are not explicit

As described in Chapter 4.1.3, Dutch water 'know-how' and the Dutch water sector are often mentioned. There are positive instrumental values in the use of water knowledge or the water sector for other purposes. In contrast, relational values of water are largely absent or left implicit. Throughout history, as discussed in text box 3.1 from section 3.1.1, water has been a part of Dutch national identity in different ways. Although there are instrumental elements in that identity (such as the 'fight against water', floods, and land reclamation), there are also relational elements, such as water and sense of place. In the strategy documents, we did not find explicit mentions of relational values in connection to Dutch national identity.

4.2 Layer 2: Physical structures

Physical structures are articulated less often than water's non-physical aspects

Less than half of the sentences or paragraphs articulate water's physical aspects. In contrast, around 60% of the sentences and 70% of the paragraphs articulate its non-physical aspects. In the following paragraphs, we discuss the functions and specific values that are mentioned with those physical structures. We summarise those results in Figure 9 and 10 below.

Figure 9
Results (per sentence) in Layer 2 of our framework: physical structures

Layer 2 Physical structures. Sentence as the unit of analysis.			**Assessment of the diverse value and valuation of nature IPBES (2022)** **Specific values of nature** (applied to water)			**Total sentences** 73/166
			Instrumental	*Intrinsic*	*Relational*	*Not explicit*
World Water Development Report on Valuing Water (UN 2021)	**Functions of Water** (based on frequent perspectives to its valuation)	*Drinking water, sanitation, and hygiene*	34	0	0	0
		Food and agriculture	12	0	0	0
		Energy, industry, business, and employment	12	0	0	0
		Nature	14	0	0	2
		Not explicit (or other)	12	0	0	3

Figure 10
Results (per paragraph) in Layer 2 of our framework: physical structures

Layer 2 Physical structures. Paragraph as the unit of analysis.			**Assessment of the diverse value and valuation of nature IPBES (2022)** **Specific values of nature** (applied to water)			**Total paragraphs** 48/106
			Instrumental	*Intrinsic*	*Relational*	*Not explicit*
World Water Development Report on Valuing Water (UN 2021)	**Functions of Water** (based on frequent perspectives to its valuation)	*Drinking water, sanitation, and hygiene*	26	1	0	0
		Food and agriculture	15	0	0	0
		Energy, industry, business, and employment	15	0	0	0
		Nature	19	1	1	1
		Not explicit (or other)	4	0	0	0

Physical structures are typically mentioned with a function of water

Even when physical structures are not explicitly mentioned with a function of water, one of those functions is implied in the text. For instance, there are mentions of water footprints, the Sustainable Development Goals, and environmental quality. The mentions of water footprints imply water for Energy, Industry, Business, and Employment (see p. 46 of Do What We Do Best (2022)). Depending on the context, they could also refer to Water as Nature, Food and Agriculture, or Drinking, Water, Sanitation, and Hygiene. Similarly, on page 11 of the Global Climate Strategy (2022), the sixth Sustainable Development Goal is mentioned as 'sustainable water supply'. The text articulates instrumental values because it implies that water is used by (or benefits) humans. Because SDG6 contains various targets and indicators, the text could implicitly refer to any function of water.

Physical structures may refer to water infrastructure

Mentions of physical structures sometimes refer to water infrastructure. The letter of the Minister for Foreign aid and trade of February 20 (2025) contains an example; it refers to water provision as critical infrastructure ('*Nederland draagt bij aan herstel van kritieke infrastructuur, zoals de gezondheidszorg en de energie- en watervoorziening*', p. 6).[9] More general physical aspects of water are also mentioned, without explicitly referring to water infrastructure. The policy framework Global Multilateralism offers an example, as it mentions that: '*Soil, water and air pollution pose a direct threat to human health*' (p. 55).

In mentions of other physical structures, water is sometimes left implicit

Water infrastructure (other than for drinking water and sanitation) is implicit in other mentions of water. For example, Do What We Do Best mentions digital systems and water in farming, which might imply digital infrastructure and irrigation: '*Because drinking water is becoming scarcer, the Netherlands will also introduce digital information systems to contribute to optimising use of water in farming*' (p. 34). Irrigation and energy infrastructure might be implicit in the policy framework Global Multilateralism: '*Many current crises are linked to water: food becomes more expensive when harvests fail, sustainable forms of energy are reliant on water, and climate change and conflicts both call for a better distribution of water*' (p. 32). Mentions of hydrogen are an example of water being left implicit. The documents state that hydrogen is the focus of trade missions or refer to the use of hydrogen as a fuel. Although the production of hydrogen requires water as an input (see Dagnachew et al. (2023) for further discussion), this is not mentioned in the documents.

In mentions of natural systems, water is also sometimes left implicit

Water is part of (physical) natural systems mentioned in the text, such as the sea, wetlands, and river basins. However, in those cases, the text does not explicitly mention water as part of nature. An exhaustive identification of those mentions was outside the scope of our analysis. However, we found some examples in paragraphs from our dataset. For instance, the Global Climate Strategy mentions: '*The Netherlands also helps developing countries draw up and implement their NAPs, specifically focusing on increasing climate resilience by making improvements in river basin management and taking action to ensure safer deltas*' (p. 29)[10].

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[9] '*The Netherlands contributes to the restoration of critical infrastructure, such as healthcare, energy, and water supply.*'

[10] NAP is the abbreviation of National Adaptation Plans.

A few mentions articulate water ambiguously; they do not explicitly mention its physical nor non-physical aspects

A few mentions ambiguously articulate water; as in, they do not explicitly mention either its physical or non-physical aspects. Yet it can often be inferred whether the mention refers to physical or non-physical aspects of water. One example of such physical aspects stems of the Global Climate Strategy, which mentions water as necessary for health, food, livelihoods, cities, and the Sustainable Development Goals (p. 15). One example of non-physical aspects stems from the Dutch Global Health Strategy 2023-2030, which mentions water as a focus area of policy (pp. 5, 16, and 27).

In terms of physical structures, instrumental values of water dominate

Positive values are connected to the benefits that humans receive from physical water or infrastructure. Negative values, on the other hand, are connected to the potential harms derived from physical water, such as floods or illness due to contaminated water. Negative values often have positive counterparts. For example, floods are negative, and (management or techniques for) their prevention is positive; (infrastructure for) sanitation is positive, and a lack thereof is negative; wastewater is negative, and (techniques for) its surveillance is positive. Those examples stem from the following two quotes:

- The letter of the Minister for Foreign aid and trade of February 20 (2025) refers to the Dutch position in water management and technology for drinking water, coastal protection, and water purification: '*Nederland is een wereldleider in watermanagement en -technologie. Denk aan drinkwater, kustbescherming en waterzuivering*' (p. 8).
- The Dutch Global Health Strategy 2023-2030 mentions wastewater surveillance ('*The Netherlands can also contribute expertise developed by Dutch knowledge institutions such as RIVM to help improve surveillance techniques, and early warning and health information systems. One such technique is wastewater surveillance*' p. 18).

4.3 Layers 3 and 4: Governance structures and actors

The strategy documents themselves are part of governance structures

In the nine strategy documents, included in this study, the national government of the Netherlands outlines the direction that it intends to give to Dutch policy for foreign trade and development aid, its goals, and some instruments. Therefore, the documents themselves, as well as their content, are part of governance structures and are authored by actors. However, the documents also contain explicit mentions of governance structures and actors, as described below.

Mentions of non-physical aspects of water indicate governance structures or actors

Non-physical aspects of water are part of about 60% of the sentences and 70% of the paragraphs in the dataset. They indicate the presence of governance structures or actors (Layer 3 and Layer 4 of our framework, respectively). Most of those mentions include instrumental values. Less than a third of the sentences and about half of the paragraphs also mention a function of water. Figure 11 and 12 summarise these results, which we then discuss in the following paragraphs.

Figure 11
Results (per sentence) with non-physical aspects of water

Proxy for Layer 3 and 4 Non-physical aspects. Sentence as the unit of analysis.			Assessment of the diverse value and valuation of nature IPBES (2022) Specific values of nature (applied to water)			Total sentences 105/166
			Instrumental	*Intrinsic*	*Relational*	*Not explicit*
World Water Development Report on Valuing Water (UN 2021)	Functions of Water (based on frequent perspectives to its valuation)	*Drinking water, sanitation, and hygiene*	18	0	0	0
		Food and agriculture	5	0	0	0
		Energy, industry, business, and employment	9	0	0	0
		Nature	9	0	0	1
		Not explicit (or other)	65	0	0	8

Figure 12
Results (per paragraph) with non-physical aspects of water

Proxy for Layer 3 and 4 Non-physical aspects. Paragraph as the unit of analysis.			Assessment of the diverse value and valuation of nature IPBES (2022) Specific values of nature (applied to water)			Total paragraphs 76/106
			Instrumental	*Intrinsic*	*Relational*	*Not explicit*
World Water Development Report on Valuing Water (UN 2021)	Functions of Water (based on frequent perspectives to its valuation)	*Drinking water, sanitation, and hygiene*	17	1	0	0
		Food and agriculture	10	0	0	0
		Energy, industry, business, and employment	18	0	0	0
		Nature	14	1	0	1
		Not explicit (or other)	34	0	0	2

Indications of water governance structures are often instrumental

The mentions of water governance include water-related policy goals and water as a theme or focus area of the policy. Only a few of those paragraphs do not articulate specific values of water. For example, Human Rights – Democracy – the International Legal Order says that Dutch efforts in foreign trade and development aid '*help achieve human rights goals in relation to the economy, society, sexual and reproductive health and rights (SRHR), water, raw materials and the environment*' (p. 13). The documents also refer to water governance in the form of public funding (or cuts) for water

(management) as an area of the policy. Such mentions stem from the letter of the Minister for Foreign aid and trade of February 20th (2025): '*Binnen het beschikbare budget wordt extra geld vrijgemaakt voor veiligheid en stabiliteit, migratie, voedselzekerheid, en watermanagement*' (p. 15) and '*Vanuit het beleidskader geen geld meer voor klimaat, voedselzekerheid en water*' (p. 16).[11]

There are mentions of actors who provide input to the national government

The National Raw Materials Strategy (2022) mentions a stakeholder session, which was held by the ministries of Infrastructure and Water Management, Economic Affairs and Climate Policy, and Foreign Affairs with companies, knowledge institutions, and civil society organisations (p. 5). Another example stems from the letter of the Minister for Foreign aid and trade of February 20th (2025). It refers to information retrieved at a round table held by the Netherlands Water Partnership with the Dutch water sector: '*Door samenwerking en innovatie te stimuleren, vergroten we ons verdienvermogen én dragen we bij aan stabiliteit en perspectief voor lage- en middeninkomenslanden*'; '*Dit kwam ook aan bod tijdens de ronde tafel met de Nederlandse watersector van het Netherlands Water Partnership*' (p. 9).

Other than the Netherlands itself and Dutch actors, the documents seldom articulate water-related persons and (governmental) organisations as actors

Mentions of persons or organisations include the Netherlands, the Ministry of Infrastructure and Water Management, the water sector, other countries, entrepreneurs, and the recipients of development aid. Often, other than the Netherlands and Dutch actors, it is not explicitly mentioned that they can '*act on or exert influence on a decision*, which is how Enserink et al. (2022) define actors (see section 3.1.4). For example, the Dutch Global Health Strategy 2023-2030 characterises the Dutch approach to water management as '*preventive, comprehensive, adaptive and focused on the long term, and this would be a valuable thing to share with other countries*' (p. 27). While 'other countries' are mentioned, their action or influence is not explicit.

An exception articulates civil society as an actor that can exert influence

A notable exception stems from the Africa Strategy of the Netherlands 2023-2032, which articulates civil society as an actor that can exert influence. The document mentions that civil society contributes to water and food-security, and that civil society organisations can highlight the negative side effects of (Dutch) businesses: '*A diverse and powerful civil society contributes to good governance and security, the observance of human rights, balanced climate, water and food-security policy and sustainable and social entrepreneurship. The UN's SDGs and the AU's Agenda 2063 cannot be achieved without broad social engagement. Civil society organisations play a significant role in highlighting the negative side effects of activities by international – including Dutch – businesses*', p. 33).

Instrumental mentions of Dutch water know-how and water sector

There are various instrumental mentions of Dutch water 'know-how' as a non-physical aspect of water, as well as mentions of government support for the Dutch water sector. The latter is often mentioned in connection with its expertise, position, or government support. We discussed these mentions in section 4.1.3, as they often refer to water-related knowledge or skills that have positive commercial or economic value. Emphasis is not placed on water as a substance, its allocation, or as

[11] '*Within the available budget, extra funds are allocated for security and stability, migration, food security, and water management*' and '*No more funds from the policy framework for climate, food security, and water*'.

existing in a specific place and time. Instead, emphasis lies on the knowledge or skills and what they might allow for.

4.4 Water indicators

Indicators typically show instrumental values of water linked to one of its functions

Most often, the water indicators in the documents characterise Drinking Water, Sanitation, and Hygiene. Although some sentences seem to use water indicators without specifying a function of water, often, the paragraph provides additional context on the function of water that is being articulated. This is visible in the different distributions of the frequencies of Figure 13 (sentences) and Figure 14 (paragraphs). We elaborate on quantitative and qualitative indicators in the following sub-sections.

Figure 13
Results (per sentence) with water indicators

Layer 1: Water indicators Sentence as the unit of analysis.			**Assessment of the diverse value and valuation of nature IPBES (2022)** **Specific values of nature** (applied to water)			**Total sentences** 64/166
			Instrumental	*Intrinsic*	*Relational*	*Not explicit*
World Water Development Report on Valuing Water (UN 2021)	**Functions of Water** (based on frequent perspectives to its valuation)	*Drinking water, sanitation, and hygiene*	26	0	0	0
		Food and agriculture	10	0	0	0
		Energy, industry, business, and employment	10	0	0	0
		Nature	11	0	0	0
		Not explicit (or other)	19	0	0	3

Figure 14
Results (per paragraph) with water indicators

Layer 1: Water indicators Paragraph as the unit of analysis.			Assessment of the diverse value and valuation of nature IPBES (2022) Specific values of nature (applied to water)			Total paragraphs 34/106
			Instrumental	*Intrinsic*	*Relational*	*Not explicit*
World Water Development Report on Valuing Water (UN 2021)	Functions of Water (based on frequent perspectives to its valuation)	*Drinking water, sanitation, and hygiene*	18	0	0	0
		Food and agriculture	14	0	0	0
		Energy, industry, business, and employment	12	0	0	0
		Nature	13	0	0	0
		Not explicit (or other)	4	0	0	0

4.4.1 Quantitative water indicators

Positive and negative values of Drinking Water, Sanitation, and Hygiene

Various quantitative water indicators are statistics that show positive or negative values of Drinking Water, Sanitation, and Hygiene. Positive indicators include the number of people having (or receiving) access to water and sanitation. For example, Do What We Do Best mentions the former: '*Between 2016 and 2030 we will ensure that 30 million people have access to clean drinking water, and 50 million people to sanitation.*', p. 34). Negative indicators are often number of people that become ill or die due to pollution. For example, the policy framework Global Multilateralism mentions that: '*Tens of millions of people die every year from the effects of air pollution, and water pollution – like climate change and biodiversity loss – contributes to the decreasing availability of drinking water, especially for the world's poorest people*' (p.55). Quantitative indicators are also used with other functions, as depicted in Figure 15 and 18 and discussed in the following paragraphs.

Figure 15
Results (per sentence) with quantitative water indicators

Layer 1: Water indicators (Quantitative) Sentence as the unit of analysis.			Assessment of the diverse value and valuation of nature IPBES (2022) Specific values of nature (applied to water)			Total sentences 15/166
			Instrumental	*Intrinsic*	*Relational*	*Not explicit*
World Water Development Report on Valuing Water (UN 2021)	Functions of Water (based on frequent perspectives to its valuation)	*Drinking water, sanitation, and hygiene*	4	0	0	0
		Food and agriculture	2	0	0	0
		Energy, industry, business, and employment	1	0	0	0
		Nature	2	0	0	0
		Not explicit (or other)	4	0	0	3

Figure 16
Results (per paragraph) with quantitative water indicators

Layer 1: Water indicators (Quantitative) Paragraph as the unit of analysis.			Assessment of the diverse value and valuation of nature IPBES (2022) Specific values of nature (applied to water)			Total paragraphs 10/106
			Instrumental	*Intrinsic*	*Relational*	*Not explicit*
World Water Development Report on Valuing Water (UN 2021)	Functions of Water (based on frequent perspectives to its valuation)	*Drinking water, sanitation, and hygiene*	7	0	0	0
		Food and agriculture	7	0	0	0
		Energy, industry, business, and employment	4	0	0	0
		Nature	5	0	0	0
		Not explicit (or other)	0	0	0	0

Agricultural water consumption and pressures that affect grain production

Water statistics in connection to Food and Agriculture typically refer to agricultural water consumption or pressures on water that affect grain production. For example, the Dutch Global Health Strategy 2023-2030 mentions: '*In response to growing water shortages, we will also help countries optimise water use in agriculture, which accounts for 70% of annual water consumption* (p. 28). The Global Climate Strategy mentions: '*Pressure on water resources is increasing due to climate change, population*

growth, pollution, industrial production, agriculture and urbanisation. Estimates suggest that if the current trends continue, 45% of global GDP, 52% of the world's population and 40% of global grain production will be at risk by 2050' (p. 28).

Water and investments, global income, and production

Quantitative water indicators of Energy, Industry, Business, and Employment include the monetary value of investments, global income affected by water-related pressures, and amount of water as an input for production. The Global Climate Strategy mentions water-related investments: '*The Fund's Water Facility, for example, has attracted $675 million in public and private capital for investments in water and ecosystems*' (p. 32). The Dutch Global Health Strategy 2023-2030 mentions the risks that result from water being under pressure: '*Climate change, population growth, growing consumption, harmful production structures, increasing pollution and urbanisation are all putting increasing pressure on water and food supplies. It is estimated that if current trends continue, by 2050 45% of global income, 52% of the global population and 40% of grain production will be at risk*' (p. 27). Finally, the National Raw Materials Strategy mentions the amount of water required for production without mentioning a specific number: '*Extracting metal content from lower-grade ores requires more energy and water per production unit and generates more mining waste*' (p. 11).

Water-related natural disasters, safe delta regions, and water scarcity

Water statistics in connection to Nature are found in paragraphs that mention water-related natural disasters, safe delta regions, and water scarcity. Most of those paragraphs articulate negative instrumental values in connection to nature, in the form of cities that are vulnerable to sea level rise, flooding and other water-related emergencies, and water as a resource that is scarce or under pressure. The positive aspects of those values include the reduction of vulnerabilities, flood prevention, and alert or response systems. For example, one mention articulates positive instrumental values in the form of safe delta regions. Examples include:[12] the Global Climate Strategy mentions that '*Two-thirds of the global population is expected to live in cities by 2050, including 800 million people in coastal cities vulnerable to rising sea levels*' (p. 28). The Dutch Global Health Strategy 2023-2030 mentions the percentage of the deaths caused by natural disasters caused by water-related emergencies: '*Moreover, flooding and other water-related emergencies are responsible for 70% of all deaths caused by natural disasters*' (p. 27). It also mentions safe delta regions and that they benefit people ('*We are also working to improve river basin management and create safe delta regions by 2030, benefiting a total of 20 million people*', p. 27).

Water footprints

Water footprints are mentioned in three documents in total. The sentences that mention them do not make specific values of water explicit. However, when the scope is expanded to the paragraph, instrumental values are visible. The quotes are as follows:

- The policy target of reducing the water footprints of the Netherlands is mentioned in Do What We Do Best: '*The government is currently working on an international climate strategy which, among other things, will aim to reduce the Netherlands climate, land and water footprints*' (p. 46).

[12] In some of these mentions, water is implicit in words such as the sea, floods, or deltas. Identifying water-related concepts was outside the scope of our analysis; however, these sentences are part of our dataset because they stem from paragraphs with explicit mentions of 'water'.

- The Global Climate Strategy mentions the measurement of water footprints: '*Besides striving to achieve climate neutrality for this country,*[20] *we are therefore committed to substantially reducing our international footprint in several areas*[21] *and are working on reaching an agreement with foreign partners on how this will be measured*[22]' (p. 12); footnote 22 reads: '*Climate footprint, water footprint, land footprint and material footprint*').[13]
- The National Raw Materials Strategy mentions water footprints in connection with the impacts of the supply chains of raw materials: '*Reducing our footprint in raw material supply chains starts with quantifying its impact and putting the issue on the agenda. Many battles still have to be won here, in terms of research and raising both awareness and the profile of the issue. This is because the term footprint has multiple facets: potentially, it may concern deforestation, water consumption, biodiversity loss and poor working conditions*' (p. 20).
- The Dutch Global Health Strategy 2023-2030 mentions the ecological footprint of the Netherlands in connection to water shortages but does not articulate water footprints separately: '*Global warming, loss of biodiversity, environmental pollution (including carbon emissions), substantial land use changes, deforestation, water shortages and imbalances in mineral cycles (e.g. nitrogen) are enlarging humankind's ecological footprint, and the Netherlands is no exception*' (p. 25).

Other quantitative indicators

The strategy documents do mention other indicators that can be quantitative but do not provide any statistics. The Global Climate Strategy mentions water demand outstripping supply by 2030: '*At present, more than two billion people live in countries experiencing high water stress and it is likely that demand for fresh water will outstrip supply by 2030*' (p. 28). It also mentions agricultural water efficiency: '*Digital information systems and nature-based solutions should help improve agricultural water efficiency*', p. 29). The National Raw Materials Strategy has various mentions of water (volumes) for mining. For instance: '*Extracting metal content from lower-grade ores requires more energy and water per production unit and generates more mining waste*' (p. 11).

4.4.2 Qualitative water indicators

Physical and non-physical aspects of water

Qualitative water indicators are predominantly used in combination with a function of water. Physical aspects include water being (un-)safe and non-physical aspects include water management. Figure 17 and 20 below show the frequencies of sentences and paragraphs in our dataset with qualitative water indicators. We will then describe these results in the following paragraphs.

[13] The other two footnotes in the quote do not mention footprints.

Figure 17
Results (per sentence) with qualitative water indicators

Layer 1: Water indicators (Qualitative) Sentence as the unit of analysis.			Assessment of the diverse value and valuation of nature IPBES (2022) Specific values of nature (applied to water)			Total sentences 55/166
			Instrumental	*Intrinsic*	*Relational*	*Not explicit*
World Water Development Report on Valuing Water (UN 2021)	Functions of Water (based on frequent perspectives to its valuation)	*Drinking water, sanitation, and hygiene*	23	0	0	0
		Food and agriculture	10	0	0	0
		Energy, industry, business, and employment	9	0	0	0
		Nature	11	0	0	0
		Not explicit (or other)	17	0	0	0

Figure 18
Results (per paragraph) with qualitative water indicators

Layer 1: Water indicators (Qualitative) Paragraph as the unit of analysis.			Assessment of the diverse value and valuation of nature IPBES (2022) Specific values of nature (applied to water)			Total paragraphs 30/106
			Instrumental	*Intrinsic*	*Relational*	*Not explicit*
World Water Development Report on Valuing Water (UN 2021)	Functions of Water (based on frequent perspectives to its valuation)	*Drinking water, sanitation, and hygiene*	17	0	0	0
		Food and agriculture	14	0	0	0
		Energy, industry, business, and employment	9	0	0	0
		Nature	13	0	0	0
		Not explicit (or other)	4	0	0	0

Safety, scarcity, or pollution

The physical aspects of water that are qualified include its safety, scarcity, and pollution. For example, the National Raw Materials Strategy mentions a cleaner environment benefiting society (‘*Circularity benefits society in four ways: (1) mitigation of climate change (preventing greenhouse gas emissions), (2) a cleaner environment (better air, water and soil quality), (3) restoration of biodiversity and (4) increasing security of supply of raw materials*’, p. 14). Another example stems from the Dutch Global Health

Strategy 2023-2030, which mentions water shortages in connection to the circumstances that enlarge ecological footprints (*'These circumstances also have direct and indirect consequences for both global health and the public health situation in the Netherlands, such as heatwaves, water shortages, spread of infectious disease, including zoonoses, more drug-resistant pathogens and declining food security and food safety'*, p. 25).

Water management and water security

Non-physical aspects that are qualified include water management being (im)proper, (un)sustainable, or (not) inclusive. Another aspect is water scarcity. For instance, The Dutch Global Health Strategy 2023-2030 mentions unequal access to safe drinking water during the COVID-19 pandemic: *'Unequal distribution of COVID-19 vaccines, personal protective equipment (such as face masks) and respirators, and unequal access to safe drinking water and sanitation and to health information all show that global solidarity takes a backseat during a crisis'*, (p. 13). It also mentions the need for sustainable and inclusive water management: *'Sustainable and inclusive water management is needed to guarantee access to water, sanitation, healthy food and sustainable food systems'*, (p. 27). The letter of the Minister for Foreign aid and trade of February 20th (2025) refers to water management that is futureproof: '*We ondersteunen landen met hun nationale waterstrategieën en het toekomstbestendig maken van hun watermanagement*', (p. 9).[14]

Instrumental values also without explicit functions of water

When qualitative indicators do not explicitly mention a function of water, they still articulate water's instrumental values. Even when they are not explicitly mentioned, functions of water are typically implicit. They may, however, still be ambiguous. For example, the Global Climate Strategy mentions people living in countries with water stress as well as demand for fresh water. This implies the use of water by humans and therefore articulates instrumental values. However, it might also refer to water for Energy, Industry, Business, and Employment or one of the other two functions. The quote is as follows: *'At present, more than two billion people live in countries experiencing high water stress and it is likely that demand for fresh water will outstrip supply by 2030'* (p. 28).

4.5 Conflict (or peace)

Positive and negative instrumental values of water

All but two of the documents articulate water and conflict (as well as peace), showing both positive and negative instrumental values. The two documents are: the policy document Human Rights – Democracy – the International Legal Order (2023) and the letter of the Minister for Foreign aid and trade of May 28th (2025). However, the former does mention '*the right to access to clean, safe, drinking water and sanitation*' (p. 15) and '*human rights goals*' (p. 13) in relation to water. The remaining documents mention positive or negative instrumental values of water in connection to conflict (or peace). Figure 19 summarises these results, which we then describe in the following paragraphs.

[14] '*We support countries with their national water strategies and in making their water management future-proof.*'

Figure 19
Results (per paragraph) with water in connection to conflict (or peace).

Layer 1: Water & Conflict (or Peace) Paragraph as the unit of analysis.			Assessment of the diverse value and valuation of nature IPBES (2022) Specific values of nature (applied to water)			Total paragraphs 13/106
			Instrumental	*Intrinsic*	*Relational*	*Not explicit*
World Water Development Report on Valuing Water (UN 2021)	**Functions of Water** (based on frequent perspectives to its valuation)	*Drinking water, sanitation, and hygiene*	6	0	0	0
		Food and agriculture	5	0	0	0
		Energy, industry, business, and employment	5	0	0	0
		Nature	3	0	1	0
		Not explicit (or other)	1	0	0	0

Water for stability and sustainability

There are positive instrumental values in mentions of water as a condition for stability, or as contributing to sustainability instead of promoting conflict. These values stem from the policy framework Global Multilateralism and letter of the Minister for Foreign aid and trade of February 20th (2025). The former mentions water as having the potential of boosting the economy and contributing to sustainability: *'Water – or the lack thereof – not only has a major impact on harvests and food security but can also play a key role in promoting conflict. In addition, poor water management is a major threat to sustainable economic development. This also applies to developed countries, where the burden is sometimes passed on to future generations. When properly managed, however, water can boost the economy and thus contribute to a sustainable future'* (p. 15). The letter of the Minister for Foreign aid and trade of February 20th (2025) articulates water as a condition for stability, resilience, and economic growth: *'Voldoende, veilig en betrouwbaar water is een voorwaarde voor stabiele samenlevingen, veerkrachtige gemeenschappen en economische groei'* (p.8). It then mentions water (management) as having the potential to prevent conflict and reduce migration: *'Goed waterbeleid, slim watermanagement en toegang tot water en sanitaire voorzieningen kunnen bovendien helpen om conflicten te voorkomen en migratie te verminderen'* (p.8).[15]

Water-related conflict prevention

There are positive instrumental values in water-related conflict prevention or the importance of a conflict-sensitive approach to climate action. Those mentions have positive and negative values. Water-related conflict is seen as something to be prevented (and therefore negative). Prevention and conflict-sensitive approaches are seen as desirable (and therefore positive).

Government efforts to prevent water-related conflict are mentioned in two documents, in the form of support for the developers of big data systems:

[15] *'Good water policy, smart water management, and access to water and sanitation can also help prevent conflicts and reduce migration.'*

- Do What We Do Best (2022) mentions that *'the Netherlands will try to help prevent conflict by supporting organisations that are working on systems that will use big data to gain an insight into potential water-related conflicts and solutions for them'* (p. 34).
- The Global Climate Strategy mentions that the country *'will endeavour to prevent conflict by providing additional support for organisations developing systems that will use big data to gain insight into potential water-related conflicts and solutions for them'* (p. 29).

The importance of a conflict-sensitive approach to climate action or adaptation is mentioned in two documents:

- The Global Climate Strategy mentions the importance of a conflict-sensitive approach to climate action: '*The Netherlands contributes its expertise in specific areas like water, land use and food security to strengthen climate vulnerability analyses and risk assessment. We endeavour to persuade multilateral and international partners and partner organisations of the importance of adopting a conflict-sensitive approach to their climate action*' (p. 19).
- The Africa Strategy of the Netherlands 2023-2032 makes an indirect connection between conflict and water. In the same paragraph, it first mentions that climate change in Africa is increasing the pressure on water. Then, it mentions that '*the Netherlands is working to develop a conflict-sensitive and inclusive approach to climate adaptation efforts. This is essential in order to prevent climate maladaptation, a phenomenon in which adaptation efforts actually exacerbate tensions and conflict*' (p. 41).

Water-related access, scarcity, or distribution

There are negative instrumental values in mentions of conflicts in connection with water-related access, scarcity, or distribution. Negative instrumental values are implicit in most mentions of conflict prevention or the need for solutions. In addition, four documents articulate negative instrumental values more explicitly:

- The Africa Strategy of the Netherlands 2023-2032 refers to access to transboundary water sources ('*Further tensions are arising between countries over access to transboundary water sources, grasslands and agricultural land and other ecological resources*', p. 41).
- The policy framework Global Multilateralism mentions the impacts of water scarcity ('*Water – or the lack thereof – not only has a major impact on harvests and food security but can also play a key role in promoting conflict*', and: '*Many current crises are linked to water: food becomes more expensive when harvests fail, sustainable forms of energy are reliant on water, and climate change and conflicts both call for a better distribution of water*', p. 15).
- The National Raw Materials Strategy mentions deposits in international waters[16] that any sovereign state may claim ('*Many of the potentially important deposits are located in waters outside state jurisdiction, i.e. to which, in principle, any sovereign state can lay claim under international law*', p. 18).
- The Dutch Global Health Strategy 2023-2030 mentions water distribution during conflict ('*Unequal distribution of COVID-19 vaccines, personal protective equipment (such as face masks) and respirators, and unequal access to safe drinking water and sanitation and to health information all show that global solidarity takes a backseat during a crisis*', p. 13). A similar connection is also present in the policy framework Global Multilateralism, in the sentences that mentions conflict calling for a

[16] Although this last mention refers to seas and oceans, this passage was already part of our dataset because it mentions the word 'water' elsewhere.

better distribution of water (see the second quote earlier in this paragraph, stemming from page 19 of that document).

Water and interethnic tensions

One paragraph mentions conflict and might indicate relational values in connection to interethnic tensions, but such values are not explicit in the text. This indication is also discussed in sub-section 4.1.5, because it might indicate relational values of water. The paragraph itself stems from the Africa Strategy of the Netherlands 2023-2032 (p.41) and, as discussed in sub-section 4.1.5, mentions that pressure on natural resources (including water) is leading to long-term intergenerational and interethnic tensions. There might be an indication of relational values in the link between water and intergenerational and interethnic tensions; however, the text is not explicit about those values, and more information would be needed to confirm them.

4.6 The Sustainable Development Goals

Water in connection to the SDGs is mentioned instrumentally

Only four documents do not explicitly mention water in connection to the Sustainable Development Goals: the National Raw Materials Strategy, the policy framework Global Multilateralism, the letter of the Minister for Foreign aid and trade of February 20th, and the letter of the Minister for Foreign aid and trade of May 28th. The remaining five documents make an instrumental connection between water and the SDGs. Figure 20 summarises the results by function and specific value of water, which we describe in the following paragraphs.

Figure 20
Results (per paragraph) with water in connection to the Sustainable Development Goals

Layer 1: Water & the SDGs Paragraph as the unit of analysis.			**Assessment of the diverse value and valuation of nature IPBES (2022)** **Specific values of nature** (applied to water)				**Total paragraphs** 14/106
			Instrumental	*Intrinsic*	*Relational*	*Not explicit*	
World Water Development Report on Valuing Water (UN 2021)	**Functions of Water** (based on frequent perspectives to its valuation)	*Drinking water, sanitation, and hygiene*	6	1	0	0	
		Food and agriculture	3	0	0	0	
		Energy, industry, business, and employment	2	0	0	0	
		Nature	5	1	0	0	
		Not explicit (or other)	8	0	0	0	

Policy goals, targets, and global action

The SDGs are mentioned in relation to Dutch policy goals, policy targets, and global action. These mentions stem from all nine documents. For instance, Do What We Do Best names water as one of the focus themes of Dutch development cooperation policy, which was selected because of the '*specific expertise*' of the Netherlands. The document also dedicates a paragraph (on p. 34) to multiple

policy goals in connection to SDG6 on water. The Global Climate Strategy advocates to connect water and climate action as well as SDG6. The Dutch Global Health Strategy 2023-2030 mentions the UN 2023 Water Conference as an opportunity to ensure action for the achievement of the SDGs. The Africa Strategy of the Netherlands 2023-2032 and the policy document Human Rights – Democracy – the International Legal Order mention them as necessary or important when pursuing other goals of the policy. Some examples are as follows:

From Do What We Do Best:

- *'The main goals of Dutch development cooperation policy are to tackle the root causes of poverty, terrorism, irregular migration and climate change, and to achieve the United Nations' Sustainable Development Goals'*, (p. 4).

From the Global Climate Strategy:

- *'The Netherlands will make every effort to ensure that Water for Climate and Environment is one of the themes proposed for the interactive dialogues at the UN 2023 Water Conference in March next year, which it will be co-hosting. Our efforts at the COP27 climate summit will focus on the preparations for this Conference and on lobbying the global climate community to accelerate and scale up SDG 6 actions'* (p. 36).

Threats to the achievement of the SDGs

There are mentions of pressures on water as well as the water and sanitation crisis as threats to achieving the SDGs. These stem from two documents. Firstly, the Global Climate Strategy mentions that pressure on water systems endangers the achievement of the Sustainable Development Goals. Secondly, the Dutch Global Health Strategy 2023-2030 makes an indirect link between Drinking Water, Sanitation, and Hygiene and the Sustainable Development Goals. See the following quotes:

From the Global Climate Strategy:

- *"Around the world, food and water systems are coming under increasing pressure, with direct consequences for health, food security, rural livelihoods, the habitability of cities, and achievement of the SDGs'* (p. 15).

From the Dutch Global Health Strategy 2023-2030:

- *'The ongoing water and sanitation crisis is a threat to everyone, including in terms of health risks. The COVID-19 pandemic has exposed our shared vulnerabilities. The co-hosts will seek to ensure that the conference commits to concerted action to achieve internationally agreed water-related goals and targets, including those contained in the 2030 Agenda for Sustainable Development'*, (p.28).

Policy coherence, trade-offs, and civil society

Policy coherence is mentioned as a condition for achieving the SDGs. Potential trade-offs and any negative side effects for international businesses are also mentioned, which stems from two documents. Do What We Do Best articulates policy coherence as necessary for the achievement of the SDGs and mentions the review of an action plan for policy coherence. The action plan is then mentioned in the Africa Strategy of the Netherlands 2023-2032. Moreover, the Africa Strategy of the Netherlands 2023-2032 emphasises that civil society and broad social engagement are conditions for the achievement of the SDGs, for example, by highlighting negative side effects of international business, including Dutch business. Some examples are as follows:

From Do What We Do Best:

- '*Policy coherence is needed to achieve the SDGs'* (p. 46).

- *'The government is currently working on an international climate strategy which, among other things, will aim to reduce the Netherlands climate, land and water footprints. The government is also pursuing an active policy focusing on achieving synergy between the SDGs and climate policy and preventing trade-offs'* (p. 46).

From the Africa Strategy of the Netherlands 2023-2032:

- *'The Revised Action Plan for Policy Coherence for Development issued at the end of 2022 prioritises topics that are directly related to the achievement of the UN SDGs. By implementing coherent policy, both bilaterally and through the EU, the Netherlands can help to make the difference on issues such as climate, food and water, illicit financial flows and tax avoidance, and global health and vaccine inequalities'* (p. 20).
- *'A diverse and powerful civil society contributes to good governance and security, the observance of human rights, balanced climate, water and food-security policy and sustainable and social entrepreneurship. The UN's SDGs and the AU's Agenda 2063 cannot be achieved without broad social engagement. Civil society organisations play a significant role in highlighting the negative side effects of activities by international – including Dutch – businesses'* (p. 33).

Sectoral policies are said to contribute to the SDGs beyond such sector

The Global Climate Strategy and the policy document Human Rights – Democracy – the International Legal Order make the argument that sectoral policies can contribute to the SDGs beyond the borders of a given sector. The latter also mentions the importance of *'a comprehensive approach to sustainable development and human rights, via Agenda 2030 (SDGs)'* (p. 13) and emphasises that the work in connection to foreign trade and development cooperation helps achieve human rights in relation to water. Some examples include:

From the Global Climate Strategy:

- *'The actions described in this strategy also contribute to, for example, SDG2 (sustainable agriculture and food systems), SDG5 (gender equality), SDG6 (sustainable water supply), SDG7 (access to sustainable energy), SDG8 (sustainable, inclusive economic growth and decent work), SDG9 (industry, innovation and infrastructure), SDG10 (reduced inequalities), SDG12 (responsible consumption and production) and SDG15 (life on land)'* (p. 11).

From the policy document Human Rights – Democracy – the International Legal Order:

- *'Our efforts within the realm of foreign trade and development cooperation help achieve human rights goals in relation to the economy, society, sexual and reproductive health and rights (SRHR), water, raw materials and the environment'* (p. 13).

A majority of instrumental values

All mentions of the SDGs articulate instrumental values of water and one mention might indicate intrinsic values. Instrumental values are embedded in the Sustainable Development Goals, since these goals are designed for human development. As described by Röckstrom and Sukhdev (Stockholm Resilience Center 2016), SDGs 6, 13, 14, 15 represent the biosphere and, therefore, they represent nature. While these and other goals may include intrinsic elements, we did not find those elements in the mentions of water contained in the documents. The paragraph that might contain an indication of intrinsic values also mentions the Sustainable Development Goals. We discussed this paragraph in previous sections (4.1.1, 4.1.4, 4.1.5, and 4.5). The mention results in the two '1' frequencies for intrinsic values in Figure 20, but more information would be needed to confirm those intrinsic values.

The mention stems from the Global Health Strategy:

- '*The UN Water Conference will take place in New York from 22 to 24 March 2023. According to the conference vision statement, water is a fundamental part of all aspects of life, inextricably linked to the three pillars of sustainable development.* [...] *The co-hosts will seek to ensure that the conference commits to concerted action to achieve internationally agreed water-related goals and targets, including those contained in the 2030 Agenda for Sustainable Development*' (p. 28).

5 Conclusions and reflections

An uneven articulation of the values of water

Our study found that a selection of nine recent Dutch strategy documents for foreign aid and trade (from 2022-2025) unevenly articulate the various values of water. The documents are Do What We Do Best (2022), The Global Climate Strategy (2022), The Dutch Global Health Strategy 2023-2030 (2022), The National Raw Materials Strategy (2022), The Africa Strategy of the Netherlands 2023-2032 (2023), The policy framework Global Multilateralism (2023), The policy document Human Rights – Democracy – the International Legal Order (2023), The letter of the Minister for Foreign aid and trade of February 20 (2025), and The letter of the Minister for Foreign aid and trade of May 28 (2025). Those strategy documents predominantly mention water as an instrument to achieve other goals, including human necessities. Therefore, they emphasise the instrumental values of water. Most frequently, the documents mention access to (or lack of) drinking water, sanitation, and hygiene. They also mention other (dis)services of water to people, development, or the economy.

Values of water linked to non-human purposes, sense of place, and reciprocal relationships between humans and water receive less attention. Although there are mentions of water as benefiting non-human entities, in those mentions, water itself is typically a means rather than an end. Likewise, although existing literature (Mostert 2020, Beugelsdijk et al. 2019) indicates that values of water such as sense of place are part of Dutch national identity, we did not find any explicit references to those values. Finally, there are two passages in total that might indicate non-instrumental values: the passages stem from the Africa Strategy of the Netherlands and the Global Health Strategy. However, also in those passages, non-instrumental values remain at best implicit.

Limited mentions of water-related actors

Actors are (groups of) persons and organisations that can act or exert influence on decisions. Other than the Netherlands as a country and the Dutch water sector, the documents seldom mention water-related actors as acting or exerting influence, despite various mentions of water-related conflicts. This is notable, since these water-related conflicts play out on an international level.

For example, the nine documents mention positive values such as conflict prevention, conflict-sensitive approaches to climate action, and water as contributing to stability and sustainability. Likewise, they mention negative values such as water playing a role in conflict through water access, scarcity, or distribution. Such conflicts would typically involve various persons or organisations and their values, but the documents seldom elaborate on this.

The focus on instrumental values aligns with existing literature

The strategy documents largely include water because of its potential or perceived contributions or connections to foreign aid and trade. Therefore, water is included from an instrumental perspective. Those findings coincide with existing studies indicating that instrumental values are (more) present in policy (such as the review of national biodiversity strategies and action plans in IPBES (2022) and the case described by Haileslassie et al. (2024)), in contrast to other values.

Attention to multiple values can contribute to decision-making

The climate and biodiversity crises are expected to increase the urgency of water-related challenges, as argued by Mazzucato et al. (2024), and thereby the relevance of broad approaches to the values of water. IPBES (2022) indicates that identifying and recognising multiple values can

contribute to decision-making. It can make intangible costs and benefits of environmental policy visible and allow for better understandings of the sources of environmental conflicts. Other international literature conveys similar messages, such as UN 2021, Haileslassie et al. 2024, Schulz et al. 2019 and 2024, Pacetti et al. 2020. In Dutch foreign aid and trade, initiatives such as the Valuing Water Initiative seem to adopt broad approaches to the values of water.

This study offers building blocks for future research

This study built on the first Bellagio Principle for Valuing Water, which states that it is necessary to '*identify and take into account the multiple and diverse values of water to different groups and interests in all decisions affecting water*' (HLPW 2018). We identified what values of water are articulated in a selection of strategy documents and found those values to often be instrumental. It was beyond our scope to examine and evaluate whether the documents and the corresponding programs and instruments are effective, efficient, or in line with the first (or any other) Bellagio Principle. However, the study offers building blocks that future research could apply to the identification of the values of water that are included in initiatives, programmes, and instruments for Dutch foreign aid and trade, whether they address the first (or any other) Bellagio Principle, and whether they are effective and efficient.

Our framework can be adjusted to best fit the goals of follow-up studies

We make the following suggestions for follow-up studies. While our framework focuses on specific values, the conceptualisation by IPBES (2022) also includes other values and concepts (such as broad values and world views). Other sources offer additional definitions of values as well as other concepts. For example, future studies could include the broad values as described by IPBES (2022), values as described by Schulz (2019 and 2024) or socio-cultural systems as described by Haileselassie (2024). Similarly, our framework includes only four functions of water – Drinking Water, Sanitation, and Hygiene; Food and Agriculture; Energy, Industry, Business, and Employment; and Nature – and does not include socio-cultural functions of water. Future studies could consider more explicit socio-cultural functions of water. Likewise, if the level of detail of the study requires it, water-related ecosystem services or other categories could be used instead of our functions of water. Regarding our approach, future studies could examine the documents in more detail rather than focusing on the explicit mentions of the word 'water'. Other possible expansions would be a more deliberate focus on discourse rather than content analysis and a more detailed analysis of governance structures and actors. Finally, future studies could focus on the policy programmes and instruments in Dutch foreign aid, rather than strategy documents. The focus would then lie closer to implementation than strategy.

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Appendices

Appendix 1: Approach to review the studies

We reviewed two selections of studies to answer our main review question: How is the value of water and water systems characterised in primary and secondary literature? In the first review, we answered the question for a selection of three reports. In the second review, we answered the question for a selection of eleven scientific articles. In the first two sections of this appendix, we describe our approach to these reviews. Then, in the third section, we describe a comparison between our results and the output of a generative artificial intelligence (AI) tool, used to verify and reflect on our own findings.

Selection and review of three reports

We selected three reports for their international relevance and impact in policy-relevant discussions, their syntheses of other literatures, and the fact that they stem from different research and policy fields (water and biodiversity).

Relevance and impact of the reports

The first report is the 2021 edition of the United Nations World Water Development Report, dedicated to valuing water (UN 2021). It is the flagship report of the coordinated mechanisms of the United Nations on water and sanitation issues, also known as UN-Water. The 2021 edition is an account of the state of knowledge on the valuation of water from different perspectives.

The second report is the 2022 Methodological Assessment of the Diverse Values and Valuation of Nature from the Intergovernmental Panel on Biodiversity and Ecosystem Services (IPBES 2022). More specifically, we review Chapter 2 of that report, which presents a conceptualisation of the multiple values of nature. IPBES publishes comprehensive evaluations of the state of knowledge on biodiversity and ecosystem services, which inform international policy-relevant discussions such as those of the Convention on Biological Diversity (CBD).

The third report is the PBL-led report The Geography of Future Water Challenges by Ligtvoet et al. (2023), a predecessor of our study at PBL. That report presents water challenges in a clear and visually attractive way. It recommends broadening the scope when valuing water if water challenges are to be tackled. The first copy of that report was offered to the minister of Infrastructure and Water Management of the Netherlands during a dedicated event and received national media coverage. It was also part of international policy-relevant discussions, as when it was presented at the UN Water Conference in 2023, during the meeting of the International Panel on Deltas and Coastal Zones.

All three reports (UN 2021; IPBES 2022; Ligtvoet et al. 2023) were produced as collaborations between various agencies.

Research and policy fields of the reports

By selecting these reports, within our study, we aim to connect bodies of knowledge stemming from different (yet overlapping) research and policy fields. UN (2021) stems from the international water field. IPBES (2022) stems from the international biodiversity field (IPBES 2022). Ligtvoet et al. (2023) stems from the interface between PBL and Dutch national decision-makers working with international water-related challenges (Ligtvoet et al. 2023).

Our selection of reports is not exhaustive. Due to the timing of this study, our selection does not incorporate the latest publication of the Global Commission on the Economics of Water (Mazzucato et al. 2024). That report was published while this study was already in progress. Nonetheless, we see common elements with the studies that we reviewed. For example:

- The need to better value water, from various perspectives, and to enrich economic approaches by making use of other disciplines (which is also suggested by the United Nations report).
- The emphasis on green water and atmospheric moisture flows, which constitute water as part of ecosystems and nature, which are in turn the focus of the work of IPBES.
- A call to value water better due to its essential role of human well-being and welfare (which was also pointed out by Ligtvoet et al. (2023)).

Future work could indeed expand our overview of the literature to include this and other studies relevant to the subject of this report.

Our approach to review the reports

The review was conducted by two researchers, supported by a team of three other researchers that provided input, suggestions, and parts of the text for this report. The first researcher reviewed all three reports. The second researcher focused on Chapter 2 of the IPBES (2022). Those two researchers identified key concepts from the reports, that were discussed in iterations of workshops with the other researchers in the team. The first researcher prepared answers to the research question and drew conclusions.

Selection and review of eleven articles

About the scope of the selection of articles

Our selection is not intented as exhaustive nor intended for a full overview of the literature in this topic. It is intended as a limited academic screening to complement the findings from the selection of the three reports that we also reviewed (UN 2021; IPBES 2022; Ligtvoet 2023). Future work could provide a more extensive overview of the academic literature, as needed.

How we selected the articles

We selected the sample of academic articles through a search in the engine Scopus. We searched for articles on the topic of the values of water and narrowed down the search to those that mentioned frameworks and their application to policy and decisions. We operationalized these criteria with the following keywords: (TITLE-ABS-KEY ('*water values*' OR '*valuing water*') AND TITLE-ABS-KEY (*framework*) AND TITLE-ABS-KEY (*policy* AND *decision*)) AND (LIMIT-TO (DOCTYPE , 'ar')). The resulting list of 11 articles is available in Table 6.

Our approach to review the articles

Two researchers reviewed the articles. We divided the sample in two groups, and each researcher was the main reviewer of one group. The main researcher read each article of their group and extracted relevant text. Where relevant, the researcher wrote their own interpretation of the

material, as input to answer the review question. When applicable, each researcher marked an articule as highly relevant for the review. Afterwards, each researcher read the articles that their colleague marked as highly relevant. They also read their colleague's text and interpretation from all articles. Then, the first researcher prepared answers to the review question for each article, which the second researcher reviewed and adjusted where necessary. All steps in this process were accompannied by iterative discussions between the two researchers.

Table 6
Sample of 11 articles for the primary literature review

Article	Authors	Title	Source title	DOI
Haileslassie et al. (2024)	Haileslassie A.; Tesema E.; Mersha M.; Bekele T.W.; Desalegne M.; Haile A.T.	Diversity and trade-offs of water values in the Akaki River system in Ethiopia: context of urban–rural linkage	Sustainable Water Resources Management	https://doi.org/10.1007/s40899-024-01068-5
Schulz et al. (2024)	Schulz C.; Wolf L.J.; Martin-Ortega J.; Glenk K.; Gischler M.	Valuing water: A global survey of the values that underpin water decisions	Environmental Science and Policy	https://doi.org/10.1016/j.envsci.2024.103685
Pacetti et al. (2020)	Pacetti T.; Castelli G.; Bresci E.; Caporali E.	Water values: Participatory water ecosystem services assessment in the Arno River Basin, Italy	Water Resources Management	https://doi.org/10.1007/s11269-020-02684-4
Opperman et al. (2020)	Opperman J.J.; Orr S.; Baleta H.; Garrick D.; Goichot M.; McCoy A.; Morgan A.; Schmitt R.; Turley L.; Vermeulen A.	Achieving water security's full goals through better integration of rivers' diverse and distinct values	Water Security	https://doi.org/10.1016/j.wasec.2020.100063
Alamanos et al. (2019)	Alamanos A.; Latinopoulos D.; Papaioannou G.; Mylopoulos N.	Integrated hydro-economic Modelling for sustainable water resources management in data-scarce areas: The case of Lake Karla Watershed in Greece	Water Resources Management	https://doi.org/10.1007/s11269-019-02241-8
Schulz et al. (2019)	Schulz C.; Martin-Ortega J.; Glenk K.	Understanding public views on a dam construction boom: The role of values	Water Resources Management	https://doi.org/10.1007/s11269-019-02383-9

Kounalakis et al. (2019)	Kounalakis M.E.; Theodorou P.	A hydrothermal coordination model for electricity markets: Theory and practice in the case of the Greek electricity market regulatory framework	Sustainable Energy Technologies and Assessments	https://doi.org/10.1016/j.seta.2019.04.012
Davidsen et al. (2015)	Davidsen C.; Liu S.; Mo X.; Holm P.E.; Trapp S.; Rosbjerg D.; Bauer-Gottwein P.	Hydroeconomic optimization of reservoir management under downstream water quality constraints	Journal of Hydrology	https://doi.org/10.1016/j.jhydrol.2015.08.018
Villamayor-Tomas et al. (2015)	Villamayor-Tomas S.; Grundmann P.; Epstein G.; Evans T.; Kimmich C.	The water-energy-food security nexus through the lenses of the value chain and the institutional analysis and development frameworks	Water Alternatives	
Riegels et al. (2011)	Riegels N.; Jensen R.; Bensasson L.; Banou S.; Møller F.; Bauer-Gottwein P.	Estimating resource costs of compliance with EU WFD ecological status requirements at the river basin scale	Journal of Hydrology	https://doi.org/10.1016/j.jhydrol.2010.11.005
Hussain et al. (2007)	Hussain I.; Turral H.; Molden D.; Ahmad M.-U.-D.	Measuring and enhancing the value of agricultural water in irrigated river basins	Irrigation Science	https://doi.org/10.1007/s00271-007-0061-4

Comparison of the results with the results of a generative AI tool

After human researchers conducted the two reviews of the reports and articles, we verified the conclusions with help of a generative AI tool.[17] A researcher outside of the team interacted with the AI tool to produce answers to our review questions. That colleague received a list of questions. As needed, the colleague edited the queries to be able to produce useful output from the AI tool. The first researcher then compared the output of the AI tool with the conclusions of the human review.

Below, we list any differences between the review by humans and by the AI tool that led to changes in the material that we present in this report.

[17] We used a paid subscription version of ChatGPT available at PBL, where the tool is not trained on prompts and responses.

Review of three reports

Description of Ligtvoet et. (2023):

- Difference: The AI tool mentions that the report calls for transformative approaches to '*rebalance ecosystem functioning and human land use, ensuring water systems sustain socio-economic development while preserving ecosystem values*.' In the draft of our report, we did not refer to this report as recommending transformative change.
- Change in our report after reading the review of the AI tool: After inspecting the report by Ligtvoet et al. (2023) again, we decided to cite this report as a source calling for transformative change. The reports by UN (2021) and IPBES (2022) were also inspected; after confirming that they also call for transformative change, these sources were also cited.

Review of scientific articles

Clusters of articles

- Difference: The researchers classified the eleven articles in five clusters, while the AI tool classified them in three clusters. Moreover, it did not classify Schulz et al. (2019) in any of the clusters (but the query did not request it to include all articles, either).
    - Two of those clusters contain the same papers:
        - The cluster with techno-economic approaches (Kounalakis & Theodorou 2019; Davidsen et al. 2015; Riegels et al. 2011; Alamanos et al. 2019).
        - The cluster with Hussain et al. (2007) and Pacetti et al. (2020), although the latter were clustered for different reasons. Namely, the researchers described the cluster as presenting empirical work, with one of the articles using a mono-disciplinary conceptual framework (Hussain et al. 2007). In contrast, the generative AI tool described the cluster as characterising the value of water '*through the lens of ecosystem services and use dimensions*' and as considering the benefits that humans derive from water.
    - The last cluster produced by the AI tool contains five papers that the researchers had classified differently: Haileslassie et al. (2024), Schulz et al. (2024), Opperman et al. (2020), Villamayor-Tomas et al. (2015).
        - The researchers had clustered Haileslassie et al. (2024) and Schulz et al. (2019, 2024) as articles that propose and apply a multi-disciplinary conceptual framework of the value of water and apply it to empirical work.
        - The researchers had left Opperman et al. (2020) as a separate cluster with no other articles, as it provides a topic overview and does not include a framework nor empirical work.
        - The researchers had excluded Villamallor-Tomas (2015) as they considered it less relevant because it does not have an explicit focus on the value(s) of water. Instead, it presents an application to evaluate the costs-and benefits in value-chains in which water can be consiered part of the resources, and the associated water actors and governance, part of the institutional background.
- Change in our report after reading the review of the AI tool: after inspecting the article by Villamayor-Tomas (2015) again, we decided to include it in the review and the clusters instead of leaving it out of scope. The reason is that, even though the values of water are not the explicit focus of this article, the article considers water to be valuable as part of value-chains for production.

Appendix 2: Additional details on five perspectives to value water from UN (2021)

Table 7
Frequent perspectives to the valuation of water

Perspective	Details regarding the way in which the value of water is appreciated
Environment	• The concept of ecosystem services is sometimes used to describe the value of water. • The size of ecosystem services is sometimes expressed with a monetary unit to enable comparison, but some values cannot (or '*should not*') be monetized (p. 2). • Water-related ecosystem services are rarely treated as a separate category but derived from underlying results. • Ecosystem services related to resilience (or risk reduction) are substantial but often not recognised or inadequately included in economic planning. • Different value systems exist, which makes the development of a unified system problematic. However, a common approach might be feasible ('*under which different environmental values or value systems can be compared, contrasted and used*') (p.2).
Infrastructure	• The valuation of the costs and benefits of water-related infrastructure often not well developed, standardised, or widely applied, and adequate data is not always available. • Challenges exist in connection to non-consumptive uses and indirect and non-use values. • Valuations tend to focus on the target beneficiaries of infrastructure and tend to overlook other groups, including those affected by the infrastructure. • Indirect costs, such as social and environmental are often treated as externalities. • '*Good governance*' is at the core of valuation of infrastructure.
Drinking Water, Sanitation, and Hygiene	• Drinking Water, Sanitation, and Hygiene is often overlooked or not assigned a value that can be compared with other uses of water. • There are direct and indirect benefits of Drinking Water, Sanitation, and Hygiene. • Estimates indicate that achieving universal access to Drinking Water, Sanitation, and Hygiene would have a positive return on investment in most regions. • Drinking Water, Sanitation, and Hygiene is often subsidised because it is fundamental to life and public health, yet this does not ensure access to basic services for lower and all income groups. • The report recommends examining affordability from the perspective of disadvantaged groups.

Socio-economic	• Agriculture uses most global freshwater resources, but the monetary value assigned to water in food production is low. • Such estimates do not usually consider the direct and indirect benefits of water to users other than food production. This includes the high food security value of water. • As competition for water and water scarcity increases, agricultural use of water is being questioned. • In the energy, industry, and business (EIB) sector, the focus is often on operational savings and short-term revenue impacts rather than the value of water in administrative costs, natural capital, financial risk, the future of businesses, or innovation. • Water risks are related to higher costs, lower earnings, and financial losses. Such risks include flooding, scarcity, and climate change. • The EIB sector focuses on monetisation and can sometimes be indifferent to other aspects of value to other actors. • The EIB often uses volumetric indicators. • Co-benefits of water are not easy to quantify, especially when water is only one of the factors that influences them (e.g. job creation).
Socio-cultural	• Cultures might hold values that are difficult to quantify, articulate, and compare with other values. • Such values are often excluded from value assessments that focus on other values. • Water can have positive and negative values with respect to peace and conflict. • '*The values of water to human well-being extend well beyond its role in supporting direct physical life-sustaining functions, and include mental health, spiritual well-being, emotional balance and happiness*' (p. 105).

Appendix 3: The values of water in 11 scientific articles

Table 8
The value of water in 11 scientific articles

Article	How is the value of water and water systems characterised?
Haileslassie et al. (2024) Two readers; high relevance.	Value is mentioned throughout the paper, and it is emphasised that '*values and valuation can be defined in a context-specific manner*'. To clarify this, they present definitions from the literature: '*For example, Jackson (2006) defined value as something that has merit or importance, is of worth or is cared about, whereas valuation refers to the process of estimating the value of an object, often in monetary terms*'. Conceptually, the article proposes a framework in which water values are incorporated: '*Integrated socio-ecological system composed of water system organization and the socio-cultural system characteristics which together respond to and drive community perception of water values (Polaine et al. 2022b; Haileslassie et al. 2020; Geleta et al. 2023)*'. Water values are seen as interacting with, and created by, a socio-ecological system. They discuss that understanding and identifying multiple water values and their interactions requires knowledge of the '*structure, processes, governance, and the interaction of their components which function to provide WESS*'. WESS is an acronym for 'water ecosystem services'. In the framework, water values are seen as multiple, existing in all parts of societies, born by different people (water value bearers), being of different types (like scenic, heritage, cultural or spiritual). To capture this width, they mention that 'this underlines that water valuing exercises need to consider not just relevant formal governance systems but also informal ones'. In addition to water governance and water function, this article also mentions water system structures as a key component of a water system: "*…the water system structures are the organisms and physical features of the system (…) includes natural and man-made systems such as different land use land covers, water infrastructure (e.g., rivers, lakes; wetlands), livestock, people, etc.*" One of their examples is reservoirs. They conclude in their abstract "*…that water system structures (e.g. reservoirs) are the mnemonic value for past events and sustain scenic values of local, national, and global importance.*" In the empirical part of the study, values are mentioned as follows: the number that is calculated for the 'Cumulative Pollution Index' (CPI) is referred to as CPI values water quality. Types of values closer to water uses, such as 'water value for energy', 'domestic water value', 'agricultural water value'. The categories of values 'instrumental', 'relational', and 'intrinsic' are incorporated into the study.
Schulz et al. (2024) Two readers; high relevance	They applied the Value Landscapes Approach (VLA), building on previous works of the authors. They conceptualise values with respect to water in three types: fundamental values, assigned values or water values, and governance-related values. Fundamental values '*include guiding principles that inform decisions across all arenas of life, personal and professional*'. Assigned values or water values are '*the values that people assign to water, for example, for irrigation, hydroelectric energy, fish, cultural, or spiritual purposes, etc.*'. Fundamental values form value landscapes that are input to

	governance-related values, assigned values or water values, and to water governance. Water governance is the combination of water polity, water policy, and water politics. Governance-related values are input to water governance and the assigned values or water values.
Pacetti et al. (2020) One reader.	Value is mentioned but not explicitly defined. It seems to be used to refer to related but different meanings. Namely: (1) From the three objectives of the study, the first one is to '*carry out an analysis of the society perception (with a specific focus on low priority stakeholders) regarding the value of water resources in the territory by utilising the WES concept*'. WES stands for water-related ecosystem services, (2) '*touristic values*', (3) '*different values that water can have within a catchment*', (4) in a participatory evaluation: '*participants were asked to determine WES actual value*' by ranking the WES with an ordinal scale. A WES with a low 'value' is one for which a severe 'socio-ecological issue' is perceived, and a WES with a high 'value' is one without such issue.
Opperman et al. (2020) One reader.	Value is mentioned but not explicitly defined. Seems to be used, implicitly, as (1) the output of a valuation, economic or otherwise; (2) what people find useful or important.
Alamanos et al. (2019) One reader.	The concept of 'irrigation water value' is introduced. It is defined as the amount of euros of profit that are added by each cubic metre that is used to produce a crop.
Schulz et al. (2019) Two readers; high relevance.	They applied the Value Landscapes Approach (VLA), building on previous works of the authors. It integrates three types of values: (i) assigned (water) values, (ii) governance-related values, and (iii) fundamental values. Assigned values are about the 'what', '*assigned to external objects and natural resources, for example the multiple uses and benefits from water, such as fish or drinking water, which may be place-specific*'. Governance-related values are about the 'how' and cover '*idealised characteristics of governance, such as sustainability, social justice, or economic efficiency*', and concern for example governance principles or what people regard as good water governance. Fundamental values are about the 'why' and refer to '*people's abstract goals, which they seek to realise across decision-making situations*'. These values are seen as connected to each other, existing at different levels of abstraction, and as plural. What is worth noting is that the VLA is more extensively described in a paper from Schulz and others in 2017, which did not come up in our search. Regarding it as a snowballing result from this search, we may refer to this paper in the policy brief itself or in other documents of this project.
Kounalakis et al. (2019)	Value is mentioned but not explicitly defined. Seems to be used, implicitly, as a synonym of price: '*Moreover, as fossil fuel price variation does not correlate to water's value a significant trade-off is created*'.

One reader.	
Davidsen et al. (2015) One reader.	The 'water value method' is introduced, a variant of a stochastic dynamic programming optimisation method with a hydro-economic application for reservoir management under downstream water quantity and quality constraints. 'Value' is used in different yet related senses. Overall, it is used as a synonym of cost, sometimes immediate and sometime marginal, of complying with water quality and quantity constraints. (1) To refer to the quantity that a variable adopts. (2) The cost arising from water allocation (CYN). (3) The marginal value per m3 of water demand supplied or curtailed (CYN/m3). (3) Water values as the '*value of storing a marginal volume of water in the reservoir for later use*'. (4) '*The shadow prices are the values of storing water and represent the trade-off with the future and represent the additional costs, which should be targeted in e.g. taxation in an opportunity cost pricing scheme*.'
Villamayor-Tomas et al. (2015) One reader.	The value or values of water are not explicitly addressed. The article studies value-chains and discusses water allocation in the context of value chains in a catchment.
Riegels et al. (2011) One reader.	The value of water for different uses is determined in this study from an economic perspective. The study interprets the cost of resources as opportunity costs but does not attempt valuation of the environmental costs of water use, for which an environmental constraint is implemented. It is seen as '*the difference between average annual net benefits to all water users at an existing baseline and average annual net benefits to all water users after WFD ecological status objectives have been achieved*'. The concepts of '*water use values*' and '*net value of water use*' are introduced and are different concepts than '*water prices*' or '*water costs*'. For urban/domestic water use, the marginal value of water use '*is estimated by assuming that the retail price of water is equal to the marginal value of water use at existing water use levels*'. For agriculture, industry, livestock, and tourism, the residual method is used to estimate water use values by '*subtracting total input costs from total production value and dividing the difference by the amount of water input*', followed by adjustments to reflect water scarcity and the learning of users under water scarcity, manifested by the development of new supplies for uses other than irrigation. For all users, the net value of water use is obtained by subtracting estimated costs of water supply from water use values. Costs include annualised investment costs of investment in water supply for specific users and their water quality requirements (such as domestic).
Hussain et al. (2007) One reader.	The article is limited to water that is used in the agricultural sector. The 'value of water' is seen as a concept to assess the net benefits of agricultural water. The article elaborates further on the dimensions of such value.

	According to the article, economic values of water exist, but also values such as '*sustainability, social values (i.e. employment generation, improvements in food security and poverty alleviation) and cultural values.*' The dimensions of the value of water are classified in four basic categories: use, time, space, and impact. The factors that affect those dimensions can be classified according to special scales: micro or local level, meso or intermediate level, macro level, and other factors (i.e. the cost of water supplies, externalities, and intrinsic factors).

Appendix 4: Approach to the document analysis

The general method (document analysis) and scope of this study are described in Chapter 3.2. This appendix contains details of its implementation, which had four steps (selection of documents, extraction of the data, identification of the concepts, interpretation of the results). The first four sections are dedicated to those steps, and the last one, to practical considerations.

Step 1: Selection of the strategy documents

We selected the nine strategy documents from Table 6. We explain the reasons for their selection in the first paragraphs of Chapter 4. We retrieved the documents from the website of the Dutch National Government. The first seven documents were retrieved in the English language and the last two documents in the Dutch language. In previous chapters, where we use quotes of those two documents, we provide a footnote with a translation in English. Although the documents in our selection stem from two different government periods (Cabinet Rutte IV 2022-2024 and Cabinet Schoof 2024), due to the difference in the number of documents from each period, we treat all documents as the same sample.

Table 9
Dutch strategy documents for foreign aid and trade included in our study.

Year	Month	Cabinet	Title of the document
2022	June	Rutte IV	Do What We Do Best
2022	October	Rutte IV	The Global Climate Strategy
2022	October	Rutte IV	The Dutch Global Health Strategy 2023-2030
2022	December	Rutte IV	The National Raw Materials Strategy
2023	May	Rutte IV	The Africa Strategy of the Netherlands 2023-2032
2023	June	Rutte IV	The policy framework Global Multilateralism
2023	November	Rutte IV	The policy document Human Rights – Democracy – the International Legal Order
2025	February	Schoof	The letter of the Minister for Foreign aid and trade of February 20th
2025	May	Schoof	The letter of the Minister for Foreign aid and trade of May 28th

Step 2: Extraction of the data

For each document, a lead researcher extracted the sentences containing the word 'water' and compiled them in an Excel workbook. Each sentence was saved in one row, along with the paragraph that contained it. The columns of the Excel workbook mirror the concepts from our framework (described in chapter 3.3). They were designed to allow the researcher to later identify, for each row with an sentence containing the word 'water', whether the sentence articulated each of the concepts. The same identification was conducted for paragraphs.

Step 3: Identification of the concepts

The lead researcher identified, per row, whether the sentence articulated the concept from each of the columns. We name this process as 'scoring'. The columns in each of the rows were scored for that particular sentence with a binomial '1' or '0', indicating that the sentence articulated the concept (value of 1) or not (value of 0). Table 10 is an example of the structure of the Excel

workbooks. The workbook also contained columns and a tab that allowed the researcher to add notes or reflections. The process was repeated for the paragraphs that contained the sentences.

Table 10
Example of the structure of the Excel files used for the analysis

Paragraph	Sentence	Water as Nature	Drinking Water, Sanitation, and Hygiene	Intrinsic values	Instrumental values	Relational values
[string]	*[string]*	*[binary]*	*[binary]*	*[binary]*	*[binary]*	*[binary]*
Paragraph	Quote 1					
Paragraph	Quote 2					
[...]	[...]					

Consistency of the analysis

We conducted the identification of the concepts in two rounds. In the first round, the first seven documents were analysed by two researchers (a lead researcher and a co-researcher), as described in the following paragraphs. The analysis of the eighth document was conducted by only one researcher. To increase consistency, the first author of this study acted as either the lead researcher or the co-researcher for all the documents examined. Because of the timing of its publication, the ninth document was only included in the second round. In that second round, the first author conducted the analysis of all nine documents.

First round of analysis

The analysis of the first two documents served as a pilot for testing and refining the method described. Therefore, during the analysis of these two documents, two researchers shared lead and co-researcher tasks. For the remaining documents, the lead researcher of each document extracted and scored the data and notified their findings to the co-researcher. Then, the co-researcher examined the extracted data and findings to identify differences of opinion regarding the scoring. A joint reflection was then held. Differences of opinion were discussed until consensus was reached.

Second round of analysis

Before this round, the first author processed the feedback from the internal and external reviews. The framework was organised in Layers instead of only separate concepts. The author then analysed all nine documents and made the results and datasets available to the team.

Step 4: Interpreting the results

To interpret the scores, the concepts and layers from the framework were interpreted for the set of documents as a unit. The binary scores were used as an input to those descriptions. They were used to locate the quotes pertaining to a concept or a layer. Their frequencies indicated how often these concepts or layers were mentioned in the documents. Those indications were then confirmed by re-reading the quotes, iteratively, during the writing of the results and findings.