TECHNICAL GUIDANCE

STEP 3

MEASURE, SET & DISCLOSE

FRESHWATER

Version 1.1—July 2024

SCIENCE BASED TARGETS NETWORK
GLOBAL COMMONS ALLIANCE

Credits & Acknowledgments

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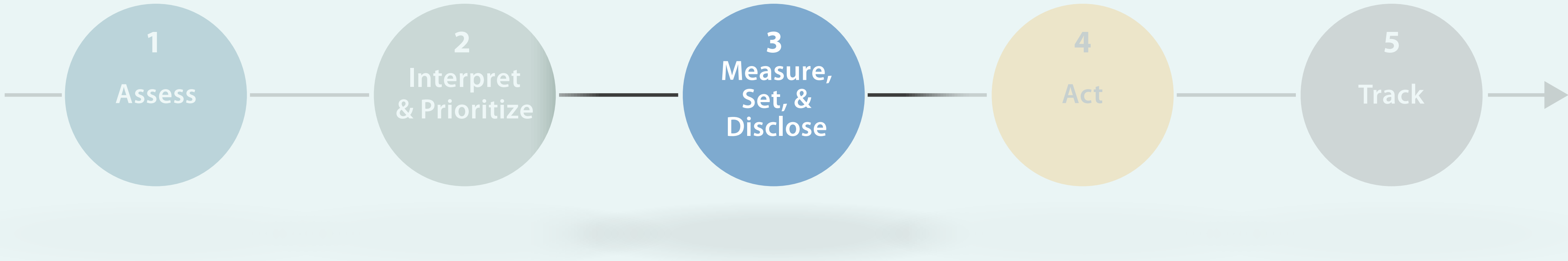

The five-step process for setting science-based targets for nature.

Letter from SBTN's Technical Director

> *By taking enough of the right actions, in the right places, and at the right time through science-based targets, companies can contribute towards an environmentally safe and socially just future.*

Dear Reader,

On behalf of the Science Based Targets Network (SBTN), I am pleased to share with you this new release of our methods for science-based targets for nature. These enhanced methods mark a critical step forward for corporate action on the mounting environmental and social crises associated with nature and biodiversity loss.

SBTN is a unique collaboration of over 80 leading global non-profits and mission-driven organizations. We are working together to co-develop scientifically rigorous and actionable methodologies for companies to set science-based targets for nature, complementing SBTi's science-based targets for climate.

SBTN's methods and guidance are intended to empower companies to deploy a clear, analytical approach, tested and vetted by scientific experts and end-users, for assessing and addressing their environmental impacts. Our work aims to align and build on related sustainability frameworks, data and tools to increase efficiency and drive action for nature through target setting.

Building on our methods first released in 2023, this updated and strengthened version reflects the learning from our validation pilot (conducted from fall 2023-spring 2024) and the insights of our non-profit partners and collaborators as well as the companies and consultancies that are part of the network.

The pilot process highlighted key benefits for target setting and reinforced that SBTN is closing a critical gap in corporate sustainability including:

- Increasing ambition and driving action on nature
- Leading to strategic discussions at a leadership level and generating value
- Providing credibility and a common language to advance engagement with stakeholders
- Acting as a trusted compass for company action

By definition science-based targets for nature are ambitious, focusing on place-based action where nature needs it most. As we turn toward the development of the next generation of targets, we will continue to respond and adapt to improve the feasibility and actionability of the methods while maintaining the scientific rigor at the heart of our work at SBTN.

These methods are ready for use by companies to set ambitious science-based targets for nature. As SBTN builds improvements in the target-setting methods, companies should be prepared to learn and incorporate updates as our science grows and environmental conditions change. In future versions, you will see a more comprehensive scope of coverage for freshwater and land methods, additional biodiversity integration, enhanced stakeholder engagement guidance, new methods for acting and tracking progress on targets (Steps 4 and 5), and new ocean and cities targets.

Thank you for your interest and support for our work.

Varsha Vijay, Ph.D.
Technical Director
Science Based Targets Network

By taking enough of the right actions, in the right places, and at the right time through science-based targets, companies can contribute towards an environmentally safe and socially just future.

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Additional resources

YOU CAN FIND THESE IN THE RESOURCES LIBRARY IN OUR WEBSITE:

RESOURCES TO ACCOMPANY STEP 3 FRESHWATER

- Step 1 Toolbox
- Stakeholder Consultation for Model Selection Recommendations
- Hogeboom's global water quantity app
- McDowell's global water quality model results

SUBSEQUENT METHODS

- Step 1: Assess
- Step 2: Interpret & Prioritize
- Step 3: Measure, Set & Disclose—Land

GENERAL RESOURCES

- Glossary
- SBTN FAQs

PLEASE NOTE THE FOLLOWING CONVENTIONS USED IN THIS DOCUMENT

Orange text signifies a link.

Numbers in superscript, for example,[1] indicate citations which can be retrieved in the bibliography.

Introduction
Step 3: Freshwater

Science-based targets **are defined as measurable, actionable, and time-bound objectives, based on the best available science, that allow actors to align with Earth's limits and societal sustainability goals.**

For freshwater, this refers to what the latest hydrological science says is necessary to meet local thresholds.

1.1 General approach

The approach to setting science-based targets for nature is based on the underlying DPSIR (Drivers, Pressures, States, Impacts, Responses) framework (please see the Step 1 for additional information), which can be used to understand the relationship between anthropogenic **pressures**, including those driven by company actions, and the **state of nature**.[2] For example, the pressure of freshwater pollution negatively impacts the state of nature corresponding to freshwater quality.

There is a five-step process to set science-based targets for nature:

- **Step 1: Assess**—screen and estimate impacts;
- **Step 2: Interpret & Prioritize**—set target boundary and prioritize;
- **Step 3: Measure, Set & Disclose**—set and validate targets;
- **(Step 4) Act**—develop action strategy;
- **(Step 5) Track**—Measurement, Reporting, and Verification (MRV).[3]

This process in terms of freshwater target setting is shown in Figure 1.

In Steps 1 and 2, companies will have screened their economic activities for materiality, completed an initial place-based assessment of pressures and states, defined the target boundary for each pressure with relevant SBTN methodology for target setting, and prioritized locations to set science-based targets for nature.

These steps are shown at the top of Figure 1. In locations where a company's **water use** and **nutrient pollution**[4] in freshwater systems indicate that they _must_ set the relevant Freshwater science-based targets (freshwater quantity and quality) for a given basin, companies must use the guidance within this Step 3 Freshwater method document. Data collected by companies during the Step 1b value chain assessment may facilitate the calculation of the target baseline but may only be used directly for the baseline when consistent with the guidance found in this document.

In the target-setting process, companies setting a Freshwater science-based target should utilize a model to predict, for a given water system and its users, the maximum allowable pressure to maintain a desired state of nature (the threshold), as shown in the bottom of Figure 1. Continuing to use pollution as an example, the target would define, for each basin, the maximum amount of pollutants that a company could discharge while maintaining acceptable freshwater quality for species or ecosystems.[5]

Companies _must_ *eventually* set Freshwater science-based targets throughout their direct operations and upstream target boundaries and should prioritize locations for target-setting consistent with Step 2: Interpret & Prioritize (refer to the guidance in Step 1: Assess[6] and Step 2: Interpret & Prioritize[7] for more information on how to determine which sites and activities must be included).

Looking ahead to Step 4, Appendix A provides a non-exhaustive list of potential response options companies may consider to meet the Freshwater science-based targets they have set. Targets set in Step 3 are presented as a reduction in withdrawal or pollution. However, response options include both direct and indirect actions in the basin. SBTN will provide further guidance in the first release of the Step 4: Act methods.

Calculating science-based targets for freshwater

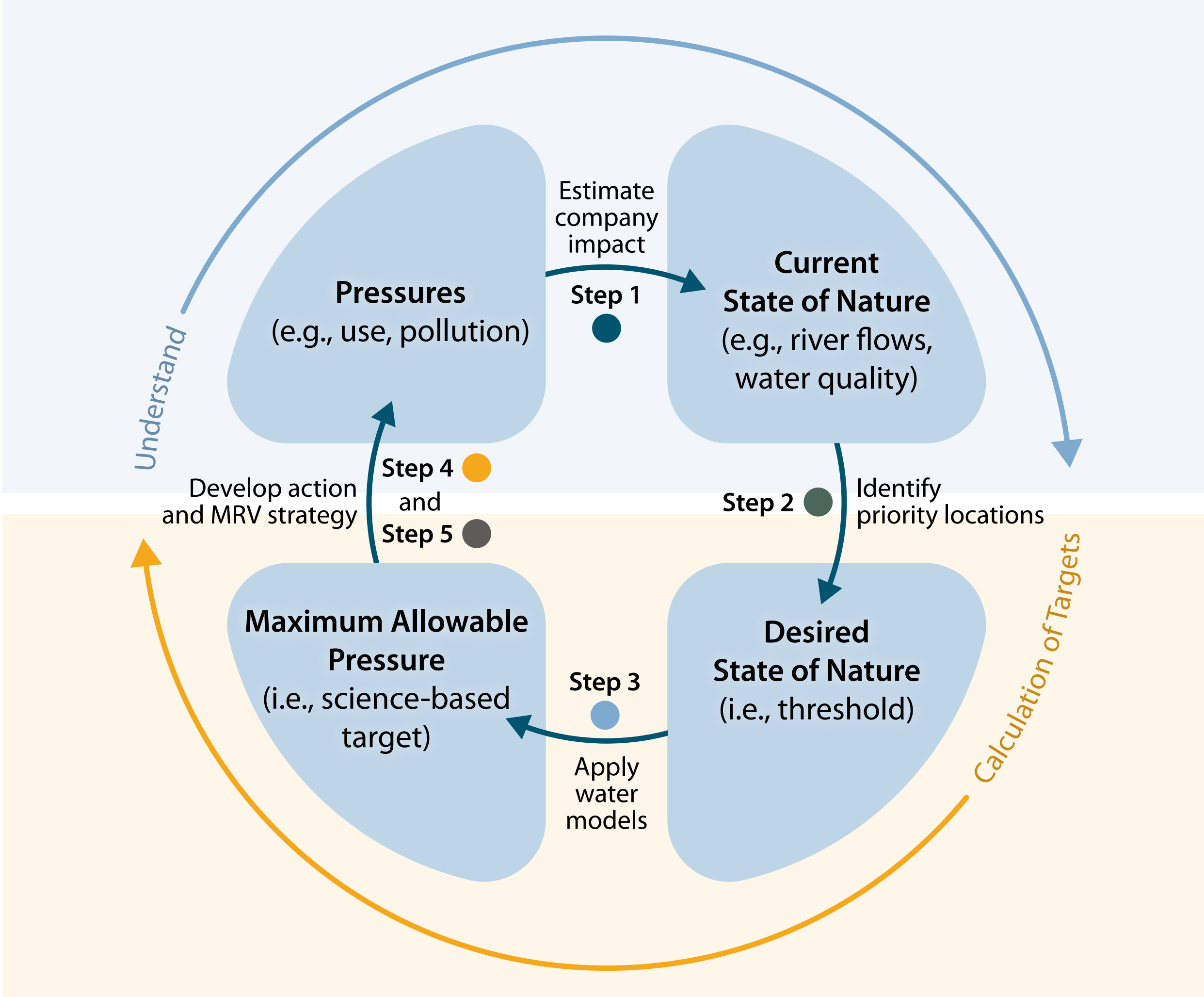


Figure 1: High-level overview of the five steps in the target setting process as applied to freshwater. This figure shows the relationships between different pressure and state of nature variables and how companies use them in the methods.

Setting targets for freshwater requires three components:

1. **Specific indicators to represent the pressure(s) and state of nature:** Following the example above, the rate at which phosphorus (P) is loaded into a water body is an indicator of pressure, while the P concentration in the body of water would be an indicator of the state of nature.

2. **A threshold value representing the desired state of nature:** Continuing with the example, this threshold corresponds to the maximum limit on P concentration below which a healthy aquatic ecosystem can be maintained (threshold P concentration).

3. **A method to relate the desired state of nature to the level of pressure:** Completing the example, this method would consist of using a model or tool (e.g., a freshwater quality model) capable of answering the question "What is the maximum P load (pressure) that will result in staying below the threshold P concentration (state of nature)?".

The process described in this method is designed to set targets for pressures at a level necessary to protect the state of nature. These target-setting methods do not explicitly consider the risk of these pressures impacting a company's business. Companies setting science-based targets for nature have the option of setting targets at a level more stringent than those required to protect nature if they find that the nature- based targets are not sufficiently stringent to protect business risk. When companies utilize this option, they *must* still submit the appropriate science-based target to SBTN but are *recommended* to provide additional detail on their reasoning for a more ambitious target value to inform further technical developments.

When setting targets for freshwater using Step 3: Measure, Set & Disclose of the five-step methodology, companies must complete four substeps (Figure 2). The same approach is followed for setting both Freshwater Quantity and Freshwater Quality targets.

The four substeps of the freshwater target-setting process are:

1. The company *must* consult with relevant stakeholders, including national and local (for top priority basins) organizations and institutions, and the SBTN basin threshold tool (when available[8]) to determine the availability (or absence) of models specific to a given basin (i.e., developed for that basin) paired with locally-based thresholds. Based upon this consultation, the company *must* determine the freshwater quantity and/or quality modeling approach (locally or globally developed modeling approach) consisting of the model and the respective threshold values representing the desired state of nature.

2. The company *must* aggregate the total pressures (i.e., water consumption and/or nutrient load) from all its activities across the given basin for the specified time period and *must* record the baseline values for these pressures.

3. The company then applies the models and thresholds defined in the first substep above to calculate the maximum allowable pressure that the basin can accept while still being protective of nature.

4. The last substep is target setting, where the company sets company-specific Freshwater Quantity and/or Quality targets for the given basin and submits them to SBTN for validation and disclosure.

The remainder of this chapter defines the specific indicators to be used, their threshold values representing the desired state of nature, and the predictive tool to be applied in calculating targets.

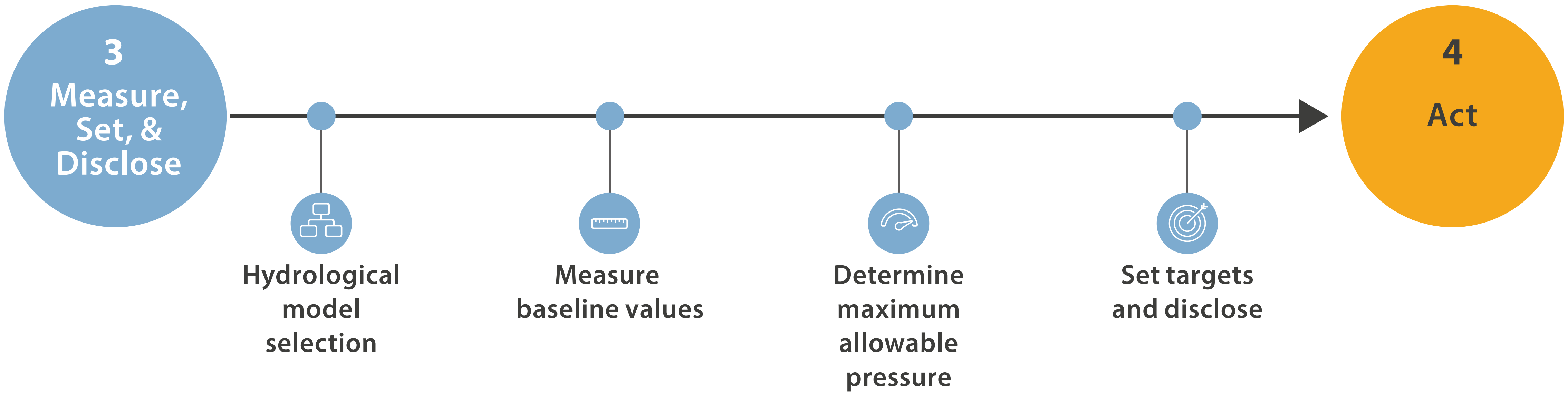


Figure 2: Within Step 3, there are four main substeps companies need to follow. This technical guidance describes each of these in detail.

1.2 Freshwater method scope

This document focuses on technical guidance for Step 3: Measure, Set & Disclose for companies to measure baselines for specific indicators and set Freshwater science-based targets. These methods are not expected to be usable by all companies for managing their impacts on freshwater. Table 1 summarizes what is and is not included in this version (Version 1.1) of the methods for setting Freshwater science-based targets.

This version focuses on the following pressures on nature:

Water quantity: freshwater withdrawals from surface water bodies and groundwater.

Freshwater quality: the total amount of nitrogen and phosphorus entering a surface water body during a given time.

These pressures are selected because (1) they are the pressures most relevant to the impacts that a large percentage of corporations pose on freshwater, and (2) methods are available to define science-based targets that link these pressures to a healthy state of nature. Furthermore, this version considers only direct operations and upstream scope (not downstream scope), as methods to define quantitative target levels are currently available for these aspects of business scope.

While biodiversity does not appear explicitly as part of the Step 3 Freshwater methods, it is embedded implicitly within them. SBTN recognizes that the health of freshwater biodiversity and that of freshwater systems are interlinked and, in some contexts, may not even be distinguishable. Hence, all actions to maintain or improve the state of nature will effectively support biodiversity. In Steps 1 and 2, companies must incorporate biodiversity state of nature metrics to prioritize action on Freshwater targets in basins critical for mitigating biodiversity loss. Recommended freshwater biodiversity metrics can be found in the Step 1 methods.

Step 3 Freshwater methods consider biodiversity in the substep in which desired environmental conditions are set. The water quantity threshold accounts for the maintenance or enhancement of the freshwater ecosystems, including the needs of specific species, using environmental flow requirements. Similarly, water quality thresholds for nutrients used in this method are linked to eutrophication of freshwater ecosystems to avoid impacts on freshwater species and ecosystems. Further explanation on the inclusion of biodiversity is provided in a supplemental Biodiversity Report, to be followed by a more detailed gap analysis projected for release in 2024.

STAKEHOLDER CONSULTATION AND STAKEHOLDER ENGAGEMENT

National-level and local-level (stakeholder) consultation in Step 3 Freshwater guidance aims to support a company in its model selection. This process is distinct but related to the broader stakeholder engagement process that a company should undertake throughout its target-setting journey. More information regarding the broader stakeholder engagement process is provided in a separate SBTN ***Stakeholder Engagement Guidance document.***

1.3 Method applicability

The Sectoral Materiality Tool applied in Step 1: Assess defines which sectors are likely to have material impacts on freshwater quantity and quality. In general, business sectors that rely on agricultural products in parts of their value chain are likely to be subject to science-based targets for Freshwater Quantity and Quality. In addition, sectors where water is incorporated into a product (e.g., the food and beverage industry) and/or used for industrial processes or cooling purposes are likely to be subject to Freshwater science-based targets for at least Freshwater Quantity.

These methods are best suited to companies that know or can estimate the geographical location of their operations (direct operations and upstream value chain activities) so that pressures on freshwater quantity and quality can be located in specific water basins. Companies must move volumes in upstream boundary B to boundary A within five years of validating their initial Freshwater science-based targets. All upstream sourcing of agriculture on SBTN's **High Impact Commodities List (HICL)** in scope *must* be estimated at least to sub-national level. Water quality and quantity must be assessed using one of the available approaches. Future iterations of these methods will expand the set of issues and impacts that can be addressed.

Table 1: Summary of content included in this first version of methods to set SBTs for nature: Freshwater.

Content included	Content not included (i.e., to be included in subsequent versions)
Freshwater Quantity	
• Surface water flows • Groundwater levels (only basins where local model/thresholds exist)	• Groundwater levels (basins where local model/ thresholds do not exist)
Freshwater Quality	
• Nutrient pollution (nitrogen and phosphorus)	• Toxic chemicals • Other freshwater quality parameters
Scope	
• Upstream • Direct operations	• Downstream
Biodiversity and Ecosystems	
• Biodiversity is included in the Step 1 and Step 2 prioritization of basins for freshwater target setting and in the incorporation of environmental flow requirements and nutrient concentration thresholds, which protect freshwater species and ecosystems.	• Freshwater species and direct conversion of freshwater ecosystems
Future projections	
	• Consideration of forward-looking scenarios, including how future climate change will impact water availability and quality

Minimum data requirements

Setting Freshwater science-based targets requires data collection and management. Please see Step 1: Assess guidance for how companies can leverage existing work, capacity, and resources when setting science-based targets for nature.

Companies are required to collect data in order to define their **baseline** level of pressure for freshwater quantity and/or quality (also referred to in Step 1: Assess and Step 2: Interpret & Prioritize as freshwater use and pollution) for all basins in their direct operations and upstream scope for which targets will be set.[9] When gathering baseline data for target-setting, where possible, companies should use data from the last five full years of operation at a given site (direct operations) or purchases of a given commodity or service (upstream activity), unless this time period is not representative of their operations or typical environmental conditions.[10] The minimum data requirements for pressure baseline measurements are summarized in Table 2.

Table 2: Minimum data requirements for pressure baseline measurements.

STEP 3: MEASURE, SET & DISCLOSE	Data Requirement	Data Sources	Unit of Measurement
FRESHWATER QUANTITY			
Direct operations	Primary/direct measurements	Water meter	Volume per month, e.g., ML/month
Upstream	Primary/direct measurements (preferred, if available)	Water meter or water diversion	Volume per month, e.g., ML/month
	Secondary	Model results of water use or Blue-water footprint[11]	Volume per time, e.g., ML/month or ML/year or Volume per year, e.g., ML/year
FRESHWATER QUALITY			
Direct operations and Upstream	Primary/direct measurements (point sources)	Discharge flow and nutrient concentration	Volume per month, e.g., ML/month (for discharge flow) Mass of nutrient per volume, e.g., mg P/L (for nutrient concentration)
	Secondary (nonpoint sources)	Model results of nutrient load or Gray-water footprint	Mass of nutrient load per month or year, e.g. kg P/year (if based on model results of nutrient loads) or Volume per year, e.g., ML/year (if based on gray-water footprint)

2.1 Freshwater quantity pressure baseline

Water quantity pressures from direct operations *must* be calculated from **primary data**, i.e., direct site-specific measurements from water meters. The required units are the average withdrawal volumes over the course of each month. Sites that have nonconsumptive water use, such as cooling water, *may* report net withdrawals (i.e., gross withdrawals minus return flow), but only in cases where the nonconsumptive flow is returned at the same time and location[12] as the withdrawal and provided that the return does not significantly impact key freshwater quality parameters.

Water quantity pressures from upstream activities can be calculated either from primary data **(direct measurements)** or from **secondary data (modeled estimates)** using blue-water footprint(s)[11] or other models of water use.

The required units for primary data are average withdrawal volumes over the course of each month. The units for secondary data sources are either monthly or annual average water consumption, depending on the method used. Similar as for sites using primary data, sites using secondary data that have nonconsumptive water use may report net withdrawals, but only in cases where the nonconsumptive flow is returned at the same time and location as the withdrawal and provided that the return does not significantly impact key freshwater quality parameters.

Use the last five full years of operation to calculate baseline freshwater quantity pressures. If data from the last five full years of operation is not available, a duration of less than five years can be used.[13] If a single facility withdraws from several rivers or groundwater sources, expand the basin size to capture all sources.

2.2 Freshwater quality pressures

The data required to determine freshwater quality pressures for direct operations and upstream activities depends on the pollutant source.

Point sources (i.e., discharges from a single identifiable conduit, such as a discharge pipe from a wastewater treatment facility) require primary data consisting of monthly average discharge flow and nutrient concentration.

Pressures for **nonpoint sources** may be estimated from secondary data, either from the results of modeled estimates of nutrient load or from gray-water footprint(s). The required units for model estimates of nutrient load are average nutrient load over time (monthly or annually). The required units for gray-water footprint(s)are the annual average water volume required to assimilate the nutrient load. The specification of pressures in terms of nutrient loads is preferred to gray-water footprints, because gray-water footprints reflect a broader array of potential water quality impacts than nutrients.

Use the last five full years of operation to calculate baseline freshwater quality pressures. If data from the last five full years of operation are not available, a duration of less than five years is acceptable.[14]

Process for setting Freshwater science-based targets

Section 3 of this document details steps on the selection of a locally developed or globally developed modeling approach (section 3.1), establishing baseline values on relevant pressures (section 3.2), and setting Freshwater Quality and Quantity targets (sections 3.3 and 3.4).

Step 3a. Hydrological model selection

3.1 Model selection

3.1.1 Outline of locally and globally developed modeling approaches

Freshwater science-based targets rely on local information to indicate what a given ecosystem and its users need. The need for location-specific inputs to set Freshwater science-based targets can be demonstrated through the following examples:

- The environmental flow (e-flow) requirements representing the desired state of nature in a lowland river will be different from the e-flow requirements for a headwater stream.
- The level of nutrients resulting in acceptable algal growth in a clear lake with high levels of sunlight penetration will be different from the level in a turbid stream with little sunlight penetration.
- The relationship between nutrient load and the resulting state of nature will depend on the hydraulic characteristics of the receiving water body. Much of the phosphorus (P) load delivered to a slow-moving water body may settle out of the water column prior to being carried to downstream reaches, while the P load delivered to fast-moving streams may not settle out.

For Freshwater science-based targets to be effective, pressure mitigation and implementation actions must be applied in the local basin.[15] Referencing basin-specific conditions is therefore required to determine the threshold values representing the desired state of nature, to define the relationship between the pressures and the desired state of nature, and ultimately to set Freshwater science-based targets.[16]

The level of resources (i.e., data, time, and effort) required to accurately define Freshwater science-based targets can be substantial, depending on the science and data availability.[17]

Because models and thresholds for freshwater quantity and quality that have been locally endorsed and validated are not yet available in many parts of the world, SBTN accepts the use of two different modeling approaches. The selection of the modeling approach must correspond to local data availability.

These approaches can be summarized as follows:

- **Locally developed modeling approach:** Targets are based on hydrological and/or freshwater quality models specific to a given basin (i.e., developed for that basin), paired with locally based thresholds, emphasizing those which are recognized by the local basin management authority or water resources management agency. Stakeholder engagement is a critical part of ensuring that the model and threshold chosen are appropriate and compatible with corporate data.
- **Globally developed modeling approach:** Targets are based on global hydrological and/or freshwater quality models and paired with thresholds that are either globally defined (i.e., freshwater quality thresholds) or based on the results of global models (i.e., freshwater quantity thresholds). Local stakeholder engagement is used to ensure alignment on the application of a global model in a given basin. In cases where a local model and threshold are not available, global models represent the best available science to inform science-based targets.

Identifying and consulting with relevant stakeholders, including national and local organizations and institutions, is critical to the selection of the modeling approach. Section 3.1.2 provides more information on the model selection.

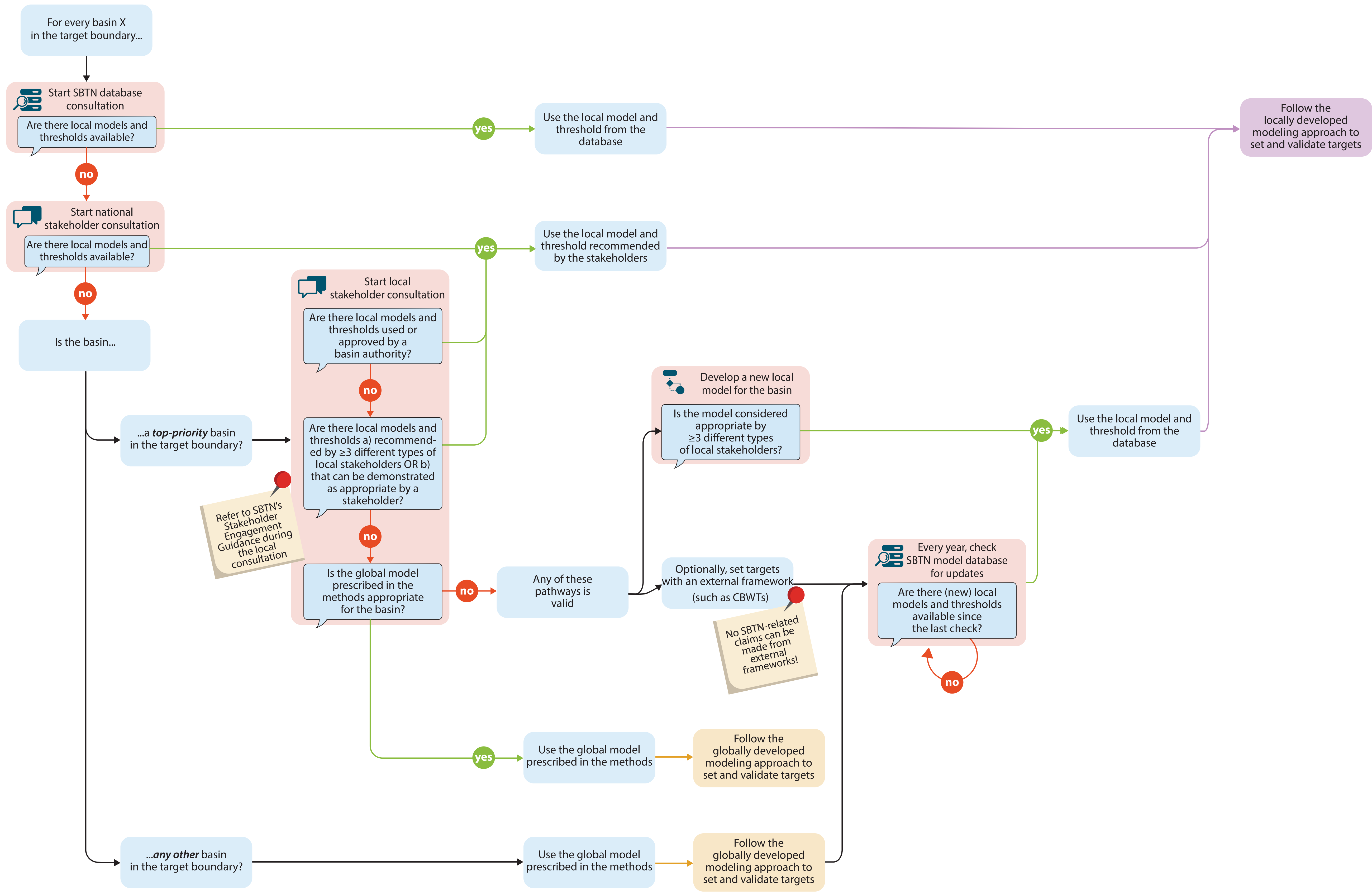


Figure 3: This decision-tree illustrates the process to select a modeling approach (either globally determined or locally determined) through a series of database and stakeholder consultations.

3.1.2 Model selection decision-tree

Figure 3 shows a decision-tree that companies can use to guide their selection of a locally or globally developed modeling approach. Companies are *required* to follow this decision-tree to determine which approach is to be applied for each basin in whichever priority sites have been identified under Step 2: Interpret & Prioritize.

The selection process has been designed to balance the need for scientific rigor and practicality. It prioritizes the use of local models in top-priority basins and aims to minimize the consultation burden for companies and all other stakeholders. Once the modeling approach has been selected, companies will be able to define the spatial scale for target setting (section 3.2.1) and record their baselines (sections 3.2.2 and 3.2.3). Even though the model selection process includes iterations on the model selection (e.g., if a better model is found during the initial validity period of the targets), the original baseline—and any progress made on it—will be recognized when companies recalculate their targets.

Note that the national-level and local-level consultation in this section aims to support a company in its model selection. This guidance is distinct but related to the broader stakeholder engagement process that a company should undertake throughout its science-based target-setting journey (Steps 1-5). More information regarding the broader SBTN stakeholder engagement process is provided in a separate Stakeholder Engagement Guidance document.

Tasks 1 & 2. Identify the basin of activity or location and Consult SBTN basin threshold tool for local models

The first stage of the consultation process consists of checking the SBTN basin threshold tool (which is under development) for available local models and thresholds. This tool will contain **local models and thresholds** that have either been used by other companies that have set and have had externally validated science-based targets in the basin or have been identified and approved through research efforts by the SBTN Freshwater Hub. SBTN will populate this tool as companies set and validate targets using local models and thresholds, so that coverage will increase as time goes on. While the tool is in development, companies can skip this first node in the decision-tree and proceed to the national-level consultation.

Task 3. Consult national stakeholders

The second stage of the consultation process involves **national-level stakeholders**. Companies are *required* to consult either of the following actors on the existence of any appropriate local model and threshold for the basin of interest:

i. National water authorities or ministries involved in water resource allocation; or

ii. Country offices of SBTN Freshwater Hub partner organizations (the World Wide Fund for Nature (WWF), The Nature Conservancy (TNC), the Pacific Institute, and the World Resources Institute). Other environmental nonprofits with freshwater expertise may also be consulted.

Companies should identify all basins that fall within the same national jurisdiction to expedite this process.

An **appropriate local model** is one that, in the opinion of the consulted stakeholders, meets most of these criteria:

- safeguards aquatic ecosystems and their ecological services by including environmental flows and natural flow regime alterations;
- accounts for major anthropogenic disturbances to surface flows, for example from dams or canals (cross-basin transfers);
- accounts for (allocated) water resource use rights and for acceptable water access for the population;
- accounts for major anthropogenic fluctuations in groundwater levels (for water quantity only);
- accounts for local, national, or international water quality standards for nutrient pollutants (for water quality only);
- accounts for major anthropogenic sources of nutrient pollutants in the basin (for water quality only);
- has been ground-tested in the basin or its predictions have been corroborated by observed data.

In addition, either the local model must allow for the calculation of thresholds for the basin or a locally based threshold for the basin must be already known and in use by local stakeholders. Target setting using a combination of a local threshold and global model results is only allowed when the resulting target can be demonstrated to be more restrictive than the target obtained by using the global model and threshold. Future versions may allow for additional combinations of models and thresholds.

Companies may include additional criteria for stakeholders to use when assessing the appropriateness of a local model. Companies must record the assessments of stakeholders on these criteria and be ready to submit these records as part of the documentation for the validation process. Stakeholder consensus on each of the criteria for assessing the appropriateness of a model is not a target validation requirement. Stakeholders must give their consent to be quoted; otherwise, companies must anonymize their comments and report which type of stakeholder provided which comments.

If the national-level consultation leads to an appropriate local model and threshold, the company must use it for target setting. In cases where multiple local models and/or thresholds are found, companies should follow the recommendation from the stakeholders regarding which one is preferred. As part of the validation process, companies must submit a brief assessment of the local modeling approach's appropriateness by national stakeholders (based on the above criteria and/or others deemed relevant by the consulted stakeholders).

Task 4. Consult local stakeholders

If the national-level consultation fails to deliver any appropriate local modeling approach, companies must refer to the results of Step 2: Interpret & Prioritize process, where the basins have been ranked according to the company's pressures and state of nature (including biodiversity), to understand how to proceed with each basin. Top-priority basins will require companies to invest more effort in finding local modeling approaches, while other basins in the target boundary will allow companies to directly use global modeling approaches.

From the ranking of sites completed in Step 2, companies *must* consider the following categories:

- **Top-priority basins:** Based on the Step 2 prioritization exercise, companies should consider the highest 10% of basins, or 10 basins if there are more than 100 basins in the target boundary, as top-priority basins.
- **Other basins in the target boundary:** All other basins in the target boundary are considered part of this category.

Companies should be aware that the ranking of basins, determined by Step 2: Interpret & Prioritize, may be different for water quantity than for water quality, depending on the company's pressures and the state of nature at each site. In other words, the same basin might be considered a top-priority basin for water quality but not for quantity. Companies are required to keep these lists and rankings separate for validation, but are recommended to proceed with the consultation process simultaneously to expedite it and reduce stakeholder burden. As part of the prioritization approach, companies are encouraged to develop targets in basins that are considered top priority for both freshwater quantity and quality as well as those that are priorities for Land science-based targets.

For all basins considered top-priority basins, companies must identify **relevant local-level stakeholders** and approach them to consult on the existence of appropriate local models and thresholds. Refer to section 3.1.3 for further guidance on the stakeholder identification process.

The consultation with local-level stakeholders consists of the following three questions:

1. ***Are there local modeling approaches used by the local water authority(-ies) to manage water quantity or water quality in the basin?***

   If there are, the company is required to use the same models and thresholds for its target-setting and can end the local-level consultation. Otherwise, the company proceeds to the second question.

2. ***(A) Are there appropriate local water models and thresholds that, in the opinion of at least three different types of stakeholders, meet most of model criteria?***

   or

   (B) Does one stakeholder point to appropriate local water models and thresholds, along with supporting evidence that they are protective of nature? Consulting with more than one stakeholder is recommended.

   (Refer to the description above to understand the criteria for considering a local water modeling approach appropriate for target setting, and to the stakeholder identification in section 3.1.3 for the list of stakeholder types that can be consulted.)

   If there are appropriate local models, the company is required to use those models and thresholds for its target setting and can end the local-level consultation. If multiple local modeling approaches are supported, the company should use the modeling approach with the most stakeholder support. Stakeholder consensus on each of the criteria for assessing appropriateness of a model is not a target validation requirement. If none of the modeling approaches is supported by at least three types of stakeholders or by one stakeholder with supporting evidence that they are protective of nature, the company proceeds to the third question.

3. ***Are the global water modeling approaches—those provided by SBTN in sections 3.3.1 (water quantity) and 3.4.1 (water quality)—appropriate to use in this particular basin?***

   If the global modeling approaches are appropriate for the basin, the company is required to use those modeling approaches to set its target. Otherwise, the company can conclude that no appropriate modeling approach, neither local nor global, is available for the basin. Further guidance is included below on how to proceed.

Global modeling approaches are considered appropriate to be used in a given basin if, in the opinion of local stakeholders:

- the basin does not have major inter-basin water transfers, dams, or other diversions that are not accounted for by the model;
- the basin does not have major disputes as to water rights or water access that are not accounted for by the model;
- the basin does not have major anthropogenic disturbances to nutrient flows that are not accounted for by the model;
- the basin does not have threatened (terrestrial or freshwater) species or ecosystems that are highly dependent on water flows beyond the global model's considerations for e-flows;
- the basin does not have threatened (terrestrial or freshwater) species or ecosystems that are highly sensitive to freshwater nutrient concentrations or dissolved oxygen (DO) concentrations;
- the global model has not been challenged by local stakeholders in the past for being inaccurate to the water regime in the basin.

Companies may include additional criteria for stakeholders to assess the appropriateness of global modeling approaches to local basin conditions. Companies must record the assessment of stakeholders on these criteria and be ready to submit these records as part of the documentation for the validation process. Stakeholders must give their consent to be quoted, otherwise, companies must anonymize their comments and report which type of stakeholder provided which comments.

If it is determined through stakeholder consultation that the basin-wide threshold has been met, the company must demonstrate that the existing threshold is protective of nature as part of the target validation submission. The company would then either 1) set a target at the site's current baseline levels (i.e., a maintenance target) or 2) adopt a reduction target greater than 0% (irrespective of methodology). In either case, they would follow SBTN's mitigation hierarchy for response options (Avoid, Reduce, Regenerate and Restore, Transform) at Step 4.

If the company is unable to identify an appropriate local modeling approach and cannot engage with local stakeholders to confirm the appropriateness of the global modeling approach for target setting, companies can still proceed with using the global modeling approach for the purpose of target setting. Companies must submit evidence for validation demonstrating that they have attempted to find a local modeling approach and contacted national and local stakeholders (providing the specifics on the basin, organization, and title of those contacted).

For top-priority basins where no appropriate local or global modeling approach is available, companies _can_ proceed with either of the following two options. Both options are equally valid for target setting, and the company can choose its preference depending on the resource availability and interest in the basin.

1. Companies _may_ fund the development of local modeling approaches for the basin. Due to noted risks associated with company-funded research,[18] companies engaging in this option will be required to establish an independent advisory body (composed of at least five independent stakeholders with no financial or other relationship to the company) to verify that the local model and threshold are appropriate and open access, and that the science underlying the model is being used without regard for financial implications for the company and in best service of the science underlying the science-based targets.

   For use in the SBTN methods, companies must ensure that a majority (at least three of the five stakeholders) agree that the model and threshold are appropriate to use and the research has been conducted with the aim of representing the best available science. Companies may then use the model to set science-based targets once the safeguards are met. As part of the validation process for these targets, companies will submit the model (including verification of open access), supporting methodological documentation, and stakeholder evaluation.

2. Companies _may_ wait until a local modeling approach is developed and, in the meantime, pursue target setting using external frameworks or standards, such as contextual water targets or the Alliance for Water Stewardship (AWS). However, companies will not be able to make any claims with SBTN about having science-based targets for these basins. When presenting information related to their target coverage, companies will indicate that this basin does not have science-based targets due to the lack of adequate models.

- Once the SBTN basin threshold tool is published, the company will consult the tool annually to see if a local water modeling approach has been included. Where a global model and threshold are used, if a new local model and threshold are found, the company will be required to use it to set targets and will be able to submit them for validation. Once these targets are validated, the company will be able to make standard claims associated with setting science-based targets.

"

The model selection process has been designed to balance the need for scientific rigor and practicality.

Task 5. Select global model (as appropriate)

For "all other basins in the target boundary," companies *may* use global modeling approaches to set and have validated targets. Companies may, optionally, search for appropriate local water modeling approaches, but this is not required. SBTN encourages companies to prioritize action through target-setting, and subsequent actions to achieve these targets, by setting and having validated targets with the global modeling approach, since it represents the current best available science.

For this reason, companies are encouraged to use global models and thresholds to set **directionally correct targets**[19] where no other options are readily available, noting that in these cases (where the global model is used) the target value will be subject to revision on an annual basis as coverage in the SBTN basin threshold tool expands.

3.1.3 Relevant local-level stakeholders

Relevant local-level stakeholders are those with specialized knowledge and insights relevant to the basin or hydrological science. Companies *should* start with an internal consultation within their company and/or supply chain to identify the stakeholders that may have relevant information to inform the modeling approach selection (refer to section 3.1.1).[20]

Based on the Organisation for Economic Co-operation and Development (OECD) and AWS guidance on stakeholders in the water sector,[21] SBTN derived a list of five key basin stakeholder groups that are likely to have relevant information to inform the modeling approach selection. For the local-level stakeholder consultation, companies *may* consult any combination of the following:

- water management agencies/basin authorities. Authorized basin agencies are governmental agencies that have the authority to make decisions on the allocation of water resources. Examples include basin management authorities, water resource management agencies, and catchment councils;
- governmental regulators (water quantity/quality);
- scientists and academics involved in the basin;
- local water-related NGOs or local chapters of international NGOs (WWF, TNC, etc.);
- local communities and/or indigenous groups or their representatives;
- relevant local departments involved in water supply to the facility.

Through this consultation, companies are required to document whether stakeholders were able to do the following:

- identify existing local thresholds or targets (at the outset of the process);
- identify the scientific model/approach (locally developed modeling approach);
- provide/share local models, thresholds, and/or data (locally developed modeling approach).

Companies will be required to provide this documentation as part of their validation submission (see section 3.1.4 for more information).

For a hypothetical example of the stakeholder consultation process please see the Ursus Nourishment case study.

> *Note: If a company is planning to set a Landscape Engagement target following the Step 3 Land methods in the same basin as a Freshwater Quantity/Quality target using a local model, it should follow the above steps for setting a Freshwater target first before setting a Landscape Engagement target.*

3.1.4 VALIDATION CRITERIA FOR CONSULTATION[22]

Companies *must* document the following:

A. A stakeholder mapping exercise within the basin of interest (refer to section 3.1.3 for identifying relevant local stakeholders), prioritizing stakeholders who are knowledgeable about existing models and thresholds in the given basin.

B. (If relevant local stakeholders are identified) Documentation summarizing whether relevant local stakeholders are able to support: (i) the identification of any existing local thresholds/targets, (ii) the identification of a scientific model/approach, and (iii) the provision/sharing of local models, thresholds, and/or data (see section 3.1.3).

C. A record of the person(s) contacted at the basin management authority (or water resources agency) for the given basin, and their response, regarding the existence of local models/thresholds for freshwater quantity and/or quality. This information is required for the justification of the modeling approach selection.

Step 3b.
Baseline pressure calculation

3.2 Baseline values on relevant pressures

3.2.1 Spatial scale

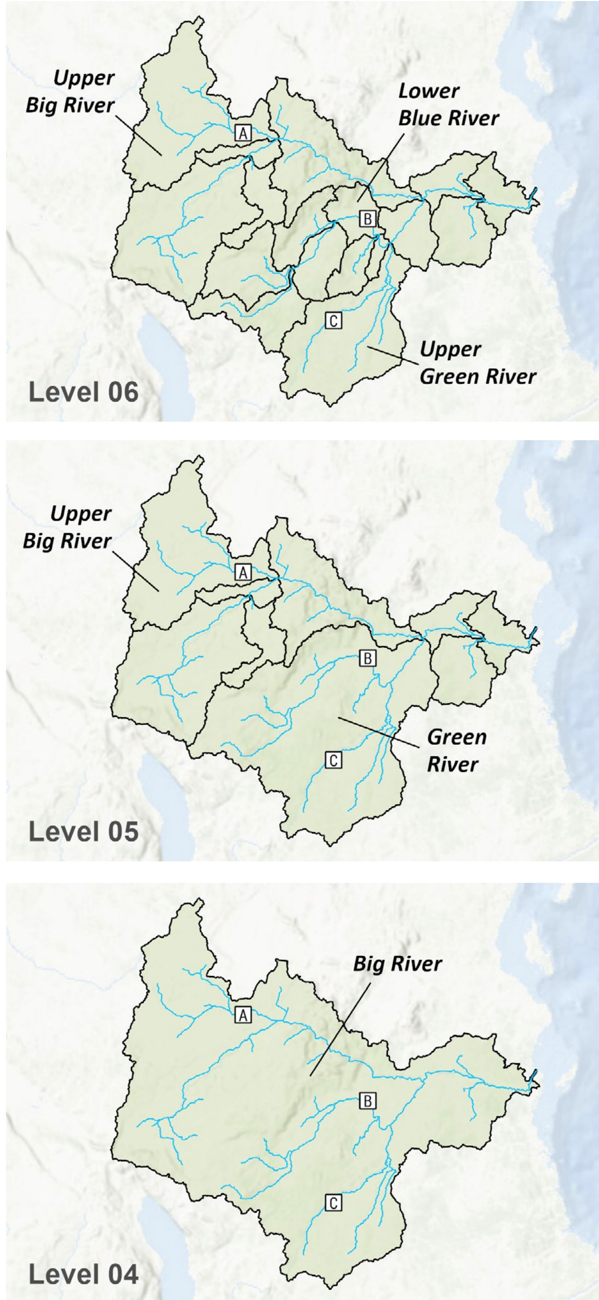
Freshwater science-based targets are to be set for priority sites at the basin level. Basins are defined at different degrees of spatial aggregation depending on the number of tributaries feeding into the downstream water body (e.g., by using the Pfafstetter Coding System, a hierarchical method of coding river basins—see Glossary for further definition). Before taking baseline measurements, companies must define the spatial scale (i.e., basin and level of aggregation) for which targets will be set.

The basin level used by companies will be determined by the modeling approach they select (see section 3.1) and the pressure targeted (i.e., withdrawals and/or pollution), and may be a finer scale than used for the Step 1 and 2 methods. For example, in the globally developed approach for freshwater quantity that applies Hogeboom's water quantity global model,[23] Pfafstetter Level 5 basins would be used; whereas in the globally developed approach for freshwater quality that applies McDowell et al. (2020),[24] results in the SBTN State of Nature Water Layers app, Pfafstetter Level 6 basins would be selected. The basin level for the locally developed approaches will depend upon the specific local model.

Task 6. Compile company activities in the basin

Companies will need to compile their sites by the basin level used in the model to ensure that targets consider all sites at the selected spatial scale. The concept of compiling sites by basin level is illustrated in Figure 4 for a company with three priority sites (sites are shown as lettered squares in Figure 4). At Level 6, each of these sites is located in a different basin. At Level 5, sites B and C are located in the same basin, while site A is located in a separate basin. At Level 4, all three sites are located in the same basin.

The table in Figure 4 shows the compilation of sites and the basins they reside in at the different Pfafstetter levels. Once the appropriate basin level is determined, this compilation can be used to identify the specific basins within which to set targets. For example, the globally developed modeling approach to freshwater quantity using Hogeboom's water quantity global model requires the use of Pfafstetter Level 5, dictating that targets will be set specifically for the Upper Big River and Green River basins. The globally developed modeling approach to freshwater quality requires the use of Pfafstetter Level 4, dictating that targets for all three priority sites will be set as part of a single basin.[25] It is acceptable for a company to use the globally developed modeling approach at a larger spatial resolution than the aggregated pressure data. However, the company should clearly state in the target-setting language the model's scale in comparison to the target-setting basin boundary.



	Basin by Pfafstetter Level		
Operation	6	5	4
Site A	Upper Big River	Upper Big River	Big River
Site B	Lower Blue River	Green River	Big River
Site C	Upper Green River	Green River	Big River

Figure 4: Compiling priority sites by basins at different Pfafstetter levels. Hydrological basins should be aggregated to the correct level, depending on the target-setting process described in this guidance document. The figure shows the relationship between different levels, where the larger basins (e.g., level 4) contain the smaller basins (e.g., level 5 or 6).

Locally developed modeling approach
The size of the basin selected in Step 2 will often be the same as used for Step 3, as companies were encouraged to select basin sizes in Step 2 that were consistent with the basin sizes used by the global models in Step 3. Basin sizes may not match between Steps 2 and 3 when a locally developed model is available. There is no fixed requirement regarding the basin level for setting Freshwater science-based targets using the locally developed modeling approach because the spatial domain for this approach will typically be dictated by the available model(s). The AWS Standard[26] recommends that the scope of the analysis be large enough to do all of the following:

- Contain the upstream land area or aquifer contributing to your sites' water source(s).
- Contain the downstream areas affected by your sites' nutrient loads.
- Contain the upstream and downstream areas of impacts for other actors that are contributing to the water challenge.

When determining the scope of analysis, the maximum allowable distance from a pressure in the basin of interest can be defined as the distance at which a site's actions can still be distinguished from background conditions, in terms of either freshwater quantity or freshwater quality. As noted in "Setting Site Water Targets Informed By Catchment Context: A Guide For Companies,"[27] consideration *may* also be given to (1) using the same catchment boundaries as the appropriate water governing body, and (2) soliciting stakeholders' input on an appropriate spatial scope. If a large basin (i.e., Pfafstetter Level 4) is selected, companies must demonstrate that targets protect thresholds at each of the Pfafstetter Level 5 sub-basins.

The possibility exists that the identified local model may have finer spatial resolution than the basin size selected in Step 2, e.g. Step 2 defined the basin size at Pfafstetter Level 4 hydrobasins while the local model is based on Pfafstetter Level 5. In this situation, the required reduction percentages (discussed below in Sections 3.3 and 3.4) should be calculated separately for each of the higher resolution basins. In the case where the local model has higher spatial resolution than the basin size selected in Step 2, but the local model only covers a portion of Step 2 area, companies should: 1) Use local model results for the portion of the Step 2 basin where local model results exist, and 2) Use global model results for the remainder of the basin.

Globally developed modeling approach
The basin levels for setting Freshwater science-based targets using a globally developed modeling approach are directly specified and vary depending on the pressure targeted and chosen model.

- For Freshwater Quantity targets, companies must use Level 5 basins for setting targets, consistent with the scale of data provided by Hogeboom's water quantity global model.
- Companies must use Level 6 basins for setting Freshwater Quality targets, consistent with McDowell et al. (2020) results in the SBTN State of Nature Water Layers app.

Task 7. Calculate baselines

3.2.2 Freshwater quantity baseline value

Once the spatial scale for each baseline is selected, the company can calculate its baseline value. The aggregation of total water withdrawals from all the company's activities within a specified basin level and time period is recorded as its "water quantity baseline value" in this basin. The company may be able to leverage data and information collected in the value chain assessment in Step 1: Assess to calculate its Step 3 baseline.

The output of this step in the target-setting process is a measurement of a company's baseline withdrawals as an indication of its overall water use, for each basin. This baseline value of present-day withdrawal will be used to calculate the company's target withdrawal for each basin based on the basin's environmental flow requirement. In cases where secondary data are used, a supply shed approach will be accepted for acting on this target. A supply shed approach is a group of suppliers in a given market (e.g., national or sub-national) that provide functionally identical goods or services (commodities) and are part of the company's supply chain. Supply sheds allow companies to report pressure reductions from sourcing regions rather than farms—see Glossary for further definition. Step 5 will include guidance for estimating or directly measuring the volumetric benefits of Step 4 actions.

Data disaggregation requirements
Primary (direct measurement) and secondary (modeled estimates) data *must* be separated for baselining and target-setting. Direct operations and upstream data *must* also be disaggregated by primary or secondary data for target-setting in a given basin. Note that upstream sites will often be more reliant on secondary data. Primary and secondary data *may* be combined only for high-level communication purposes.

Direct operations
For a company's direct operations, the freshwater quantity baseline value *must* be defined based on primary data (i.e., metering of water use) for all priority sites (refer to Table 2 in section 2).

Upstream
For a company's upstream value chain, the baseline value *may* be calculated using either primary or secondary data sources. For companies using secondary data sources (particularly the case for companies sourcing from agricultural suppliers), companies can use the information they collected in Step 1: Assess and Step 2: Interpret & Prioritize, such as the number of products/commodities produced, to estimate water consumption using tools such as blue-water footprint(s) to convert product/commodity production into units of volume of blue water used per time (see Table 2 in section 2).[28] Data from representative sites can also be utilized as a secondary data source for estimating pressure if the company can show that those sites are representative. Climate, geography, soil type, land use, and water-related technologies and practices should all be considered representativeness criteria when submitting targets for validation. Upstream data should be recorded on a monthly basis whenever possible, recognizing that secondary data sources may only provide data on an annual basis.[29]

Companies *must* use the average aggregate withdrawals[30] over the last five full years of operation to represent the baseline, unless this time period is not representative of their operations or typical environmental conditions. Operations that have been in existence for less than five years (or have collected data for less than five years) *should* use the average aggregate withdrawals over the length of their existence (or period of data collection). This period accounts for both interannual variations and ongoing investment in water reductions that companies have achieved prior to setting science-based targets.

3.2.3 FRESHWATER QUALITY BASELINE VALUE

Following the process for calculating the freshwater quantity baseline value (see section 3.2.2), once the spatial scale is selected, companies can calculate the freshwater quality baseline value. The aggregation of the total present-day load of nutrients from all the company's facilities (direct operations) and/or sourcing (upstream activities) locations within a specified basin and time period is recorded as its "freshwater quality baseline value." As with the freshwater quantity baseline, companies can leverage data and information from their Step 1 value chain assessment in completing the baselining requirements.

The output of this section is a measurement of a company's baseline nutrient loads or gray-water footprint as an indication of its overall freshwater pollution (for nitrogen (N) and phosphorus (P)). This baseline value of present-day load will be used to calculate the company target load for each basin based on the basin's threshold values for acceptable algal growth. In cases where secondary data is used, a supply shed approach will be acceptable for acting on this target. Step 5 will include guidance for estimating or directly measuring water quality benefits of Step 4 actions.

Data disaggregation requirements

Primary (direct measurement) and secondary (modeled estimates) data *must* be separated for baselining and target setting. Direct operations and upstream data *must* also be disaggregated by primary or secondary data for target setting in a given basin. Pressures quantified as nutrient loading and pressures defined as gray-water footprint *must* be separated for baselining and target setting. Note that upstream sites will often be more reliant on secondary data. Primary and secondary data may be combined only for high-level communication purposes.

Point sources

The data requirements for defining freshwater quality baseline values depend on how pollutants are delivered to the water body. Pollutants discharged from a facility via a confined discharge pipe (i.e., a point source) *must* be calculated from primary data. In such a case, loads are calculated by multiplying primary data on discharge flow (i.e., volume per time at the point source) by primary data on discharge concentration (mass per volume), resulting in units of mass per time (e.g., kg P/month).

For direct operations or upstream, the freshwater quality baseline value *must* be based on primary data for all point source discharges (see Table 2 in section 2) and calculated separately for both N and P. In particular, a company *must* aggregate the nutrient loads, mass of N, or mass of P[31] per time unit (such as kg P/month) from all its facilities/sourcing locations within a specified basin level and time period. For example, a company with three facilities/sourcing locations in a given basin will be *required* to sum the P loads across these three facilities/sourcing locations and report the cumulative P load in units of mass of nutrient per time (e.g., kg P/month). The same procedure is to be repeated for the N loads across these three facilities/sourcing locations to calculate the cumulative N load (e.g., kg N/month).[32]

Nonpoint sources

It may be difficult to obtain primary data on nutrient loads from nonpoint sources,[33] so secondary data sources *may* be used to calculate baseline freshwater quality values for nonpoint sources (refer to Table 2 in section 2). If a locally developed model exists describing nutrient loading from the different land use activities in the basin, this will serve as one potential secondary data source for calculating baseline freshwater quality values. These locally developed modeling approaches *may* be used for priority sites within a company's direct operations or upstream activities (i.e., upstream agricultural suppliers) when the company cannot otherwise get primary data.

Companies may also use the secondary data sources Used in Step 1: Assess and Step 2: Interpret & Prioritize, such as life cycle impact assessment approaches. SBTN recommends that, where possible, companies utilize models that produce estimates representative of the actual activities undertaken at each operational site and are consistent with SBTN tool and data criteria. Relevant resources for companies include environmentally extended input-output (EEIO) models and databases (e.g., EXIOBASE or Eora), life cycle impact assessment methods (e.g., IMPACT World+) and life cycle inventory databases. While these are commonly used approaches for modeling pressures, there is no one solution and companies should combine these with other approaches like spatial modeling and remote sensing to address method needs. Additional tools to support the baseline pressure assessment are available in the SBTN Step 1 Toolbox.[34]

Data from representative sites can also be utilized as a secondary data source for estimating pressure if the company can show that those sites are representative. Climate, geography, soil type, land use, and water-related technologies and practices should all be considered representativeness criteria when submitting targets for validation. If companies measure pressure as nutrient loading (via direct measurements or modeled estimates), the pressures will be in loads of N or P (mass N or P/time) into the water bodies. If companies measure pressures as gray-water footprint, these will be tracked in terms of water volume/time required to assimilate the nutrient loads. This data should be recorded on a monthly basis whenever possible, recognizing that secondary data sources may only provide data on an annual basis.[35]

Whether companies use the average aggregate nutrient load (N and P) or the average gray-water footprint, companies must use the average aggregate nutrient load or average gray-water footprint over the last five full years of operations to represent the baseline, unless this time period is not representative of their operations or typical environmental conditions. Operations that have been in existence for less than five years (or have collected data for less than five years) should use the average aggregate nutrient loads over the length of their existence (or period of data collection). This period accounts for both interannual variations and ongoing investment in nutrient loads that companies have achieved prior to setting science-based targets.

Indirect point sources

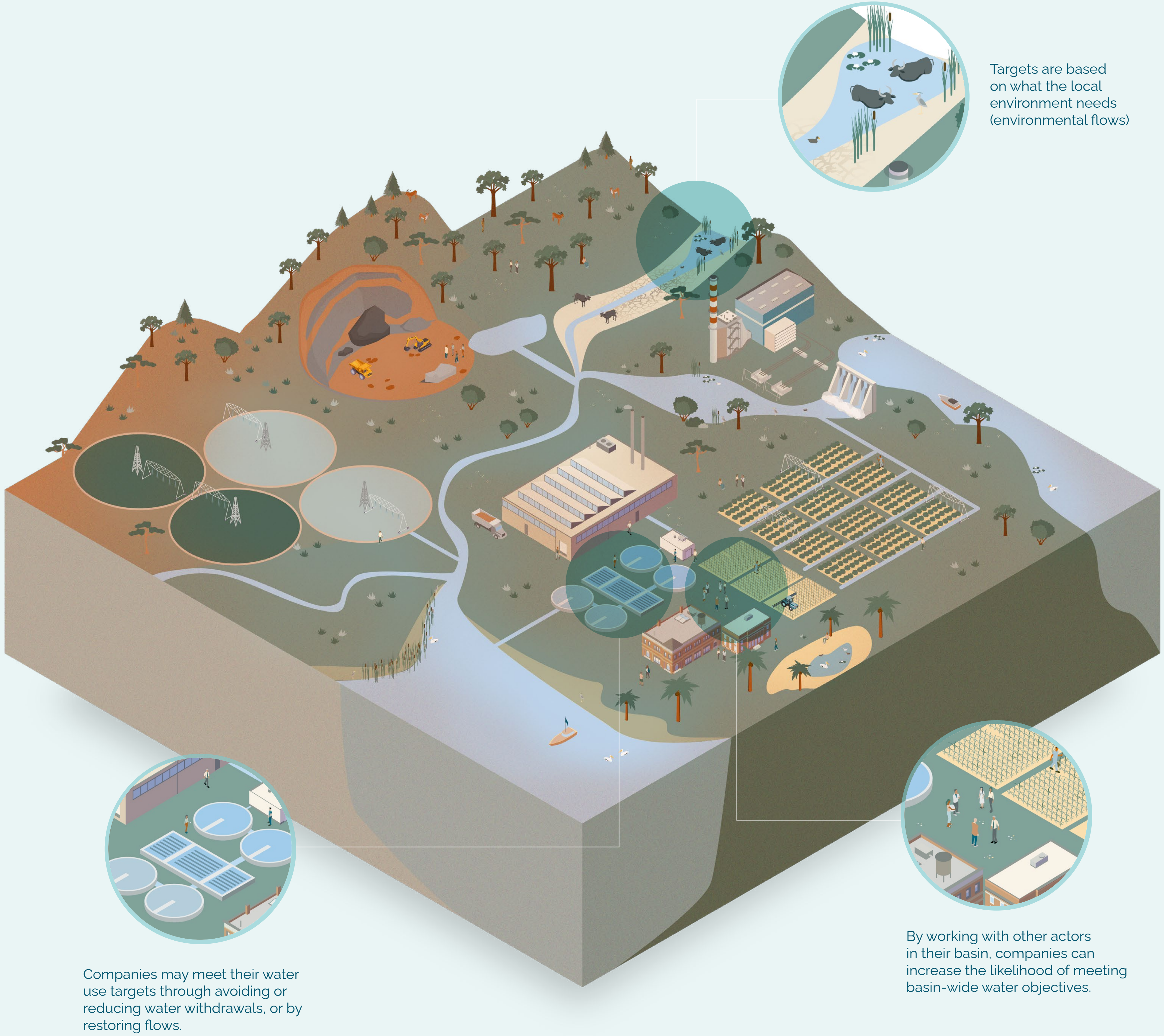
Indirect point source nutrient loads (i.e., situations in which a company's nutrient load is routed to a non-company wastewater treatment plant prior to discharge to the water body) are out of scope for this version of SBTN's Freshwater methods.

Figure 5: Freshwater quantity targets

COMPANIES FROM ALL SECTORS CAN SET A FRESHWATER SCIENCE-BASED TARGETS

These targets address corporate pressures on nature through freshwater withdrawals from surface water bodies and groundwater.*

When calculating Freshwater Quantity science-based targets, information needed includes both direct operations water use and upstream activities water use.



* Targets for the explicit protection of groundwater are only set in basins where a local model and groundwater thresholds exist.

Steps 3c & 3d. Environmental thresholds identification and Freshwater Quantity target setting

3.3 Setting Freshwater Quantity targets

After companies have calculated freshwater quantity baseline values for all priority sites in a given basin, they can begin to define targets for freshwater quantity for direct operations and upstream activities (the Freshwater Quantity targets are shown as a conceptual diagram in Figure 5). To set targets, they must next calculate the maximum allowable level of basin-wide withdrawals (water withdrawals corresponding to all water users in a given basin), specified in terms of the required percentage reduction in the present-day rate of withdrawal. Target setting concludes by allocating a portion of this amount to the company's operations and suppliers. Targets are to be set for each basin in which priority sites have been identified in Step 2.

Note that this section is designed to produce results that are at the upper limit of what would be acceptable, such that there is no buffer built in as a margin of error. Ideally, a company would be more ambitious than these targets (i.e., set a Freshwater Quantity target that aims at reducing freshwater withdrawals more drastically than what is to be required through the targets). In that case, companies *must* submit the target value as determined using the SBTN methods but are *recommended* to also provide information on their more ambitious target value and its rationale.

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Tasks 8 & 9. Apply modeling approach for the basin and Calculate required, basin-wide pressure reductions

3.3.1 Maximum allowable level of basin-wide withdrawals

The process for calculating the maximum allowable level of basin-wide withdrawals depends on the modeling approach selected.

Locally developed modeling approach
If a locally developed model and a locally based threshold value exist, they *must* be applied to determine the required percentage reduction in basin-wide rate of withdrawal that is in compliance with the **threshold**[36] stream flow (or groundwater recharge) regime.

The threshold values used for this approach must be endorsed by the authorized basin agency and protective of nature (see sections 3.1 and 3.1.3)—not independently determined by the company. If there are no threshold values that are endorsed by the authorized basin agency, then a company can use values that are supported by at least three different types of stakeholders or can be demonstrated to be protective on nature (see sections 3.1.1 and 3.1.3). Two options exist for determining the maximum allowable level of basin-wide withdrawals for a locally developed modeling approach:

- *Direct application of model:* This option provides more flexibility in terms of consideration of groundwater and dam operations. However, it requires that a company be able to apply the locally developed model to explicitly demonstrate that the proposed target will result in the attainment of environmental flow requirements and/or thresholds for groundwater depletion, if they exist. This approach will require a company to gain access to the locally developed model and have the in-house technical expertise to independently conduct model simulations.

  It is most suited for situations where it is possible and feasible to apply the locally developed model and where factors such as groundwater depletion or dam operations are relevant.

- *Back-calculation from existing results:* This option uses specific equations for calculating the required percentage reduction in the level of basin-wide withdrawals, using information on e-flow requirements and modeled (or historically observed) stream flow regimes. It allows Freshwater Quantity targets to be set without rerunning the locally developed model. However, it assumes that freshwater withdrawals are the dominant cause of non-attainment of desired flow conditions and lacks flexibility for considering factors such as groundwater depletion or dam operations.

  It is most suited for situations where it is not possible and/or feasible to apply the locally developed model and/or where factors such as groundwater depletion or dam operations are not relevant.

Direct application of model
The first option for determining the maximum allowable level of basin-wide withdrawals within the locally developed modeling approach can be used in cases where the local model is available for purposes of evaluating specific basin-wide withdrawal reduction scenarios. For this option, the company defines the maximum allowable level of withdrawal by demonstrating that the desired stream flows (and/or aquifer level, if targets are being set for the protection of groundwater) will be attained for the targeted level of basin-wide withdrawal over the entire period of simulation. Similar to the back-calculation from existing results option, allowable withdrawals should be set at a level where e-flow requirements are attained for at least 75% of each of the months over the simulation period.

In contrast with the back-calculation from existing results option, the *Direct application of model* option does not require the assumption that the rate of withdrawal at any given time is directly reflected as a reduction in stream flow. This makes the *Direct application of model* option suitable for situations where the protection of groundwater levels is an important consideration. Furthermore, this option is better suited for situations where pressures other than withdrawals (e.g., dams) are responsible for the non-attainment of e-flow requirements, as it allows the effect of alternative dam operations to be considered.

Back-calculation from existing results
This option provides a specific equation for calculating the maximum allowable level of basin-wide rate of withdrawals (volume per time, e.g., ML/month) that will attain the desired e-flow conditions (refer to Equation 1 below). This option is reliant on e-flow information and is based on the assumption[37] that the rate of withdrawal at any given time is directly reflected as a reduction in stream flow (or e-flow gap); therefore, the necessary reduction in withdrawals is the same percentage as the desired increase in stream flow (to meet the e-flow gap).

This assumption allows the present required basin-wide withdrawal reduction to be directly calculated from:

- Present-day stream flows (representing current withdrawals)
- Natural stream flows (representing the absence of withdrawals)
- Locally derived e-flow requirements.

The specification of the required basin-wide withdrawal reduction is based on the concept of "excess withdrawals," i.e., the amount by which present-day withdrawals exceed the level necessary to attain e-flow requirements. The percentage reduction required to attain e-flow requirements is calculated as *the ratio of excess withdrawal (environmental flow requirement minus present day stream flow) to present-day withdrawal (natural flow minus present day stream flow)*—see the following equation:

$$\text{\% Reduction in basin-wide withdrawal required} = \frac{\text{Excess withdrawal}}{\text{Present-day withdrawal}} \times 100$$

Equation 1

This concept is illustrated in Figure 6 using hypothetical hydrographs. The upper line in the bottom half of Figure 6 (natural flow) represents the natural stream flow regime, the middle-dashed line (environmental flow requirement) represents the e-flow requirements, and the lower line (present-day flow) represents present-day stream flows.

For this example, present-day stream flows are consistently less than the respective e-flow requirements, indicating that the present level of withdrawal exceeds what is desired. The excess withdrawal for any given month is defined as the difference between the e-flow requirement and the present-day flow (for this example, $30\text{x}10^6$ ML/month). The present-day withdrawal for any given month is defined as the difference between the natural stream flow and the present-day stream flow (for this example, $50\text{x}10^6$ ML/month). The application of Equation 1 to this example shows that the "ratio of excess withdrawal to present-day withdrawals" is 0.6 (i.e., $30\text{x}10^6 \div 50\text{x}10^6$), which means that the basin-wide withdrawals need to be reduced by 60% to attain e-flow requirements.

Equation 1 *must* be applied for each basin within the target boundary, over the entire period for which flows are available,[38] with results tracked for each month of each year. This will generate a matrix of required reduction percentages for each month and year. The 75^{th} percentile reduction percentage[39] calculated independently for each month (i.e., the value for each month that is exceeded in 25% of all years simulated) and the present-day level of a company's rate of withdrawal are used in section 3.3.2 to define company-specific Freshwater Quantity targets. The Ursus Nourishment case study for provides a hypothetical example demonstrating how a company would use results from Equation 1 to calculate a 75^{th} percentile reduction percentage and Freshwater Quantity targets.

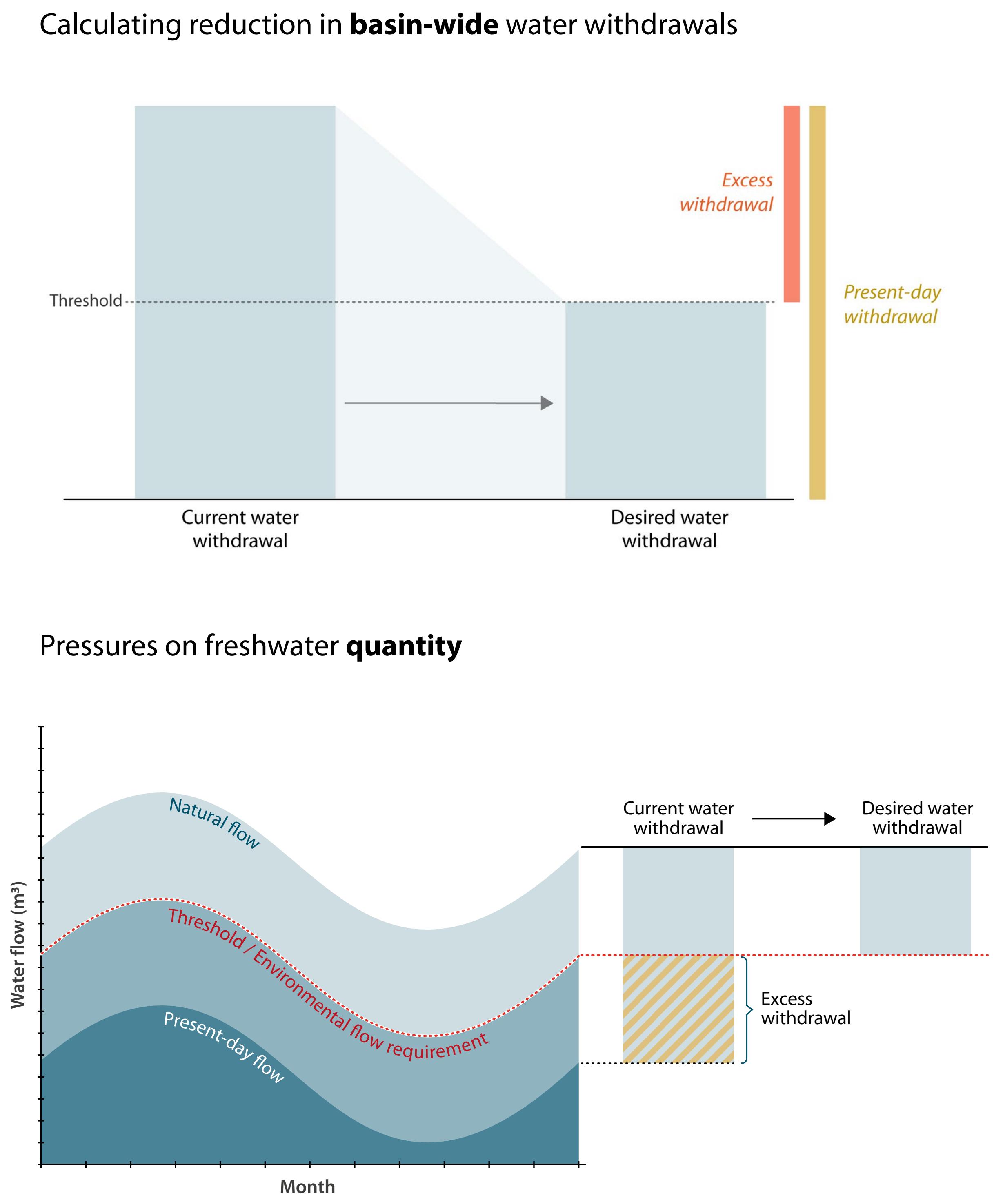


Figure 6: These graphs show the relationship between current and desired levels of water withdrawals. The first image shows how these variables are used to calculate the required reduction for the targets. The second image in the figure, where the desired water withdrawals are identified as the environmental flow requirements, includes a third variable: natural flows in the basin. This shows their seasonal variability over the course of a year.

Globally developed modeling approach
Globally developed Freshwater Quantity targets *must* be defined using the results from Hogeboom's water quantity global model to define the required reduction percentage in basin-wide withdrawals that will attain the desired stream flows.[40]

The approach is similar to that described for the locally developed approach, where the required reduction percentage is based on the ratio of excess withdrawals to present-day withdrawals (i.e., Equation 1). The difference is that the globally developed approach uses the results of global hydrologic models to calculate excess and present-day withdrawals rather than locally developed data and therefore may reflect an over- or under-estimation of actual water scarcity/availability conditions. As discussed below, all technical steps are being automatically conducted within the model framework such that a company only needs to specify the basin(s) of interest, and the required basin-wide reduction will be provided.

Hogeboom et al. (2020) estimated natural stream flow by extracting results from three global hydrologic models[41] to define ensemble mean monthly flow regimes for streams worldwide in the absence of any withdrawals. They determined e-flow requirements based on the ensemble mean results of three widely accepted methods[42] for establishing e-flow requirements to be set aside in each basin to ensure proper aquatic ecosystem functioning on a monthly basis. They then calculated the amount of water available for human use by subtracting e-flow requirements from natural flow regimes, for each basin in the world and for each month in the period 1970–2005.

Hogeboom's water quantity global model is updating the above analysis to calculate the required reduction percentage at the basin level for each month of the period 1971–2010 using Equation 1, and subsequently to define the percentage reduction required for each month such that e-flow requirements would be attained approximately 75% of the time.[43] These results are provided for each Pfafstetter Level 5 basin worldwide in an easy-to-use format. These reduction percentages are to be used as the basis for target setting if the globally developed approach is taken using the Hogeboom model.

Task 10. Set company water quantity and quality targets

3.3.2 Determine company-specific Freshwater Quantity target

Section 3.3.1 explains how a company calculates the basin-wide reductions in water withdrawals needed in order to meet environmental and social requirements. Once the company has determined this value (on both a yearly and a monthly basis for each site targeted), it then defines a target level for its individual withdrawals, consistent with the maximum allowable level of basin-wide withdrawals defined above.

The conversion of allowable basin-wide withdrawals into individual company-specific targets requires a decision on how the water pressure reduction burden will be shared among water users. For methods developed by SBTN, the determination of individual contributions[44] within the context of a societal goal (e.g., water flows that meet environmental needs) is referred to as **allocation**. Many different approaches are available for determining a company's share of an allocated resource or allocated responsibility for action. For this target-setting method, the allocation approach called "equal contraction of efforts" is used.[45] This approach assumes that all water users in the basin will reduce their withdrawals by the same percentage.

Companies can take the results from Equation 1 (for the locally developed back-calculation from existing results approach) or from Hogeboom (for the globally developed approach) and convert these into the individual company's maximum amount of withdrawals (in terms of volume per time, such as ML/month) that will (through equal contraction of withdrawals, by all actors within the basin) attain the desired state of nature (Equation 2). To convert basin-wide allowable withdrawals to company-specific allowable withdrawals, companies can multiply the required basin-wide percentage reduction with the company's present-day level of withdrawal (in the same units of volume per time). It is important to note that, in cases where the model indicates a negative reduction is indicated, the percent reduction used in Equation 2 must be set to zero, i.e. target withdrawals cannot be greater than present-day baseline withdrawals.

$$\text{Company target withdrawal} = \frac{100 - \text{\% reduction in basin-wide withdrawal}}{100} \times \text{Present-day company withdrawal}$$

Equation 2

Box 1: Freshwater Quantity targets and the AWS Standard

Criteria 2.3.2 of the AWS Standard requires sites to develop a water stewardship plan that addresses water risks, opportunities, and shared challenges at the basin level. The plan must include specific targets for each of the water stewardship outcome areas, including water quantity. This method for setting science-based targets for freshwater quantity offers a robust way of developing water quantity targets for sites implementing the AWS Standard.

Calculating reduction in **company-specific** water withdrawals

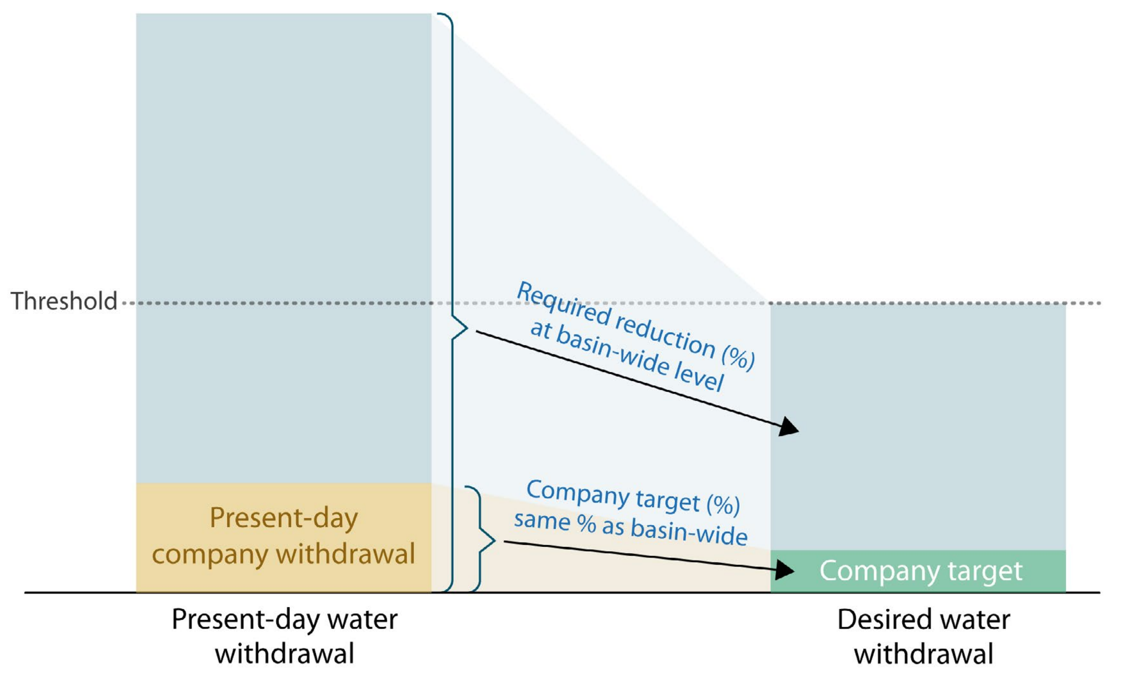


Figure 7: This figure shows the relationship between a company's individual shares of current and desired withdrawals relative to the total withdrawals in the basin. The same percentage required in the total withdrawals is applied to the company's individual withdrawals, to calculate their targets.

The allocation approach of "equal contraction of efforts" effectively gives every stakeholder the same level of reduction ambition, defined as a percentage, relative to its starting position (i.e., the moment when the stakeholder calculates its baseline). This allocation approach was chosen for its simplicity, as the only input data required is the baseline level of an individual company's impacts. For practical reasons, this version of the methodology does not address potential allocation factors such as social, economic, technological, or political aspects.

The equal contraction of efforts approach has the potential to penalize companies that are leading on water withdrawal reduction ambitions *before* calculating the baseline. To help mitigate this problem, companies should define their baseline, taking the last five years of impacts into account. Future iterations of this methodology will consider other allocation approaches to deal with the known limitations of equal contraction of efforts (e.g., locking in an unfair share for users that have been using a greater proportion of the resource).

Finally, defining individual targets using the SBTN approach does not preclude collective action. The upcoming methods for Step 4: Act and Step 5: Track will include guidance on how to implement collective action to meet freshwater targets and track progress in these circumstances. With regard to penalizing early adopters, the Step 4 guidance may take into account past activities that advance progress toward targets.

3.3.3 Timestep for Freshwater Quantity targets

Companies *may* use annual or monthly time periods for their **surface** Freshwater Quantity targets, dependent on their baselining methodology:

- When baselines were calculated with annual values, the targets *must* be expressed as annual reductions.
- When baselines were calculated with monthly values, the targets may be expressed as monthly or annual reductions. If companies set their targets on an annual basis, the required reduction *must* be equal to the largest reduction required across all individual months. For example, if the required reductions are 50% for certain months of the year and zero for other months, a company *could* set targets on an annual basis requiring a blanket 50% reduction across the entire year.

  The decision to use monthly vs. annual targets will likely depend on the type of company setting targets. For example, agricultural irrigation withdrawals that vary widely on a seasonal basis may be better suited to monthly targets than some types of direct operations whose water withdrawals are relatively constant over the course of the year.

Freshwater Quantity targets based on protection of **groundwater** levels *should* be specified on an annual basis.

3.3.4 Template statement for Freshwater Quantity targets

For **a pressure reduction target of 25% or less**:

- Companies *must* submit their targets with a target year of five years from the date that the target is submitted,

  or

  With adequate justification, companies *may* choose a target date of up to ten years. Adequate justification must be submitted for validation and must demonstrate that the extended target date 1) aligns with the timeframe of global societal or policy goals (e.g., GBF or UN SDGs), 2) aligns with the timeframe of local or regional policy or voluntary goals, or 3) is associated with documentation on stakeholder engagement or other tangible actions that they deem critical for implementing actions to achieve their target in that basin.

For **a pressure reduction target above 25%**, companies can submit their targets with a target year of up to ten years from the date that the target is submitted.

These target lengths balance the urgent need for progress on freshwater quantity in line with global goals and provide companies sufficient time to implement actions to reduce their pressures.

When setting annual targets, the target will be stated as "Company X will reduce its water withdrawal in the ______ basin to ______ ML/year by the year ______."

When setting monthly targets, the target will be stated as "Company X will reduce its water withdrawal in the ______ basin to ______ ML/month for each of the following months. The reductions will occur by the year ______."

3.3.5 Validation criteria for Freshwater Quantity targets

<u>Model selection process</u>

- **R1—Stakeholder endorsement of models:** Models and thresholds are *required* to be developed by an authorized basin agency or otherwise, following the criteria in the model selection process laid out in section 3.1.1:
  - (A) Are there appropriate local water models and thresholds that, in the opinion of at least three different types of stakeholders, meet most of model criteria?, or
  - (B) Does one stakeholder point to appropriate local water models and thresholds, along with supporting evidence that they are protective of nature? Consulting with more than one stakeholder is recommended.
- An authorized basin agency is a national, regional, state, or local government agency that has the authority to make decisions on the allocation of water resources. Examples include basin management authorities, water resource management agencies, and catchment councils.
- **R2—Clearly document stakeholder mapping and engagement:** Documentation is *required* to be provided to demonstrate that, in the opinion of the stakeholders consulted in the model selection process, the model used to set targets meets most of the appropriateness criteria laid out in section 3.1.1.

<u>Locally developed modeling approach</u>

- **R3—Spatial domain for baseline pressure:** The spatial domain (i.e., basin) for taking a baseline pressure measurement and for setting targets is *required* to be consistent/compatible with the spatial scale defined in the model following the criteria in Section 3.2.1.
- **R4—Baseline target boundaries:** For the baseline pressure measurement at each basin, companies are *required* to identify all of their operations (direct and upstream) that materially affect water availability, as defined in Step 1: Assess.
- **R5—Five year average aggregate baseline:** For the baseline pressure measurement at each basin, baseline water withdrawals *must* be aggregated across all company operations, using the last five years (or period of existence, if less than five years) of data.
- **R6—Data disaggregation requirements:** Baseline values *must* be calculated and recorded separately for direct operations and upstream activities, following the criteria in Section 3.2.2.
- **R7—Primary and secondary data disaggregation:** Baseline values based on primary data *must* be calculated and recorded separately from those based on secondary data, following the criteria in Section 3.2.2.
- **R8—Application of the local model:** The specified percentage reduction in basin-wide withdrawals *must* be calculated in one of the following ways (see section 3.3.1 for details on when to apply each approach):
  - Using basin-wide percentage reductions as calculated using Equation 1 (if using the back-calculation approach).
  - Using a hydrologic model and allocation scheme approved by an authorized basin agency to demonstrate that the level of withdrawal used to set the company's targets complies with local e-flow requirements (if using the direct application of model approach).
- **R9—Target calculation methodology:** Targets for company-specific withdrawals *must* be calculated using Equation 2 and specified in terms of maximum water extraction in terms of volume of water per time, to be achieved within a specified time frame.

<u>Globally developed modeling approach</u>

- **R10—Spatial resolution of target:** The spatial domain (i.e., basin) of the target is *required* to be consistent/compatible with Pfafstetter Level 5—the spatial scheme provided by Hogeboom's water quantity global model.
- **R11—Coverage:** All company activities in direct operations or upstream that materially affect freshwater quantity in the spatial domain *must* be identified.
- **R12—Five year average aggregate:** Baseline water withdrawals *must* be defined for each activity, using the last five years (or period of existence, if less than five years) of data, separating primary and secondary data.
- **R13—Application of the global model:** The specified percentage reduction in basin-wide withdrawals *must* be calculated using results for the basin provided by Hogeboom's water quantity global model.
- **R14—Target calculation methodology:** Targets for company-specific withdrawals *must* be calculated using Equation 2 and specified according to maximum water extraction in terms of volume of water per time, within a specified time frame.

<u>Target timeframe</u>

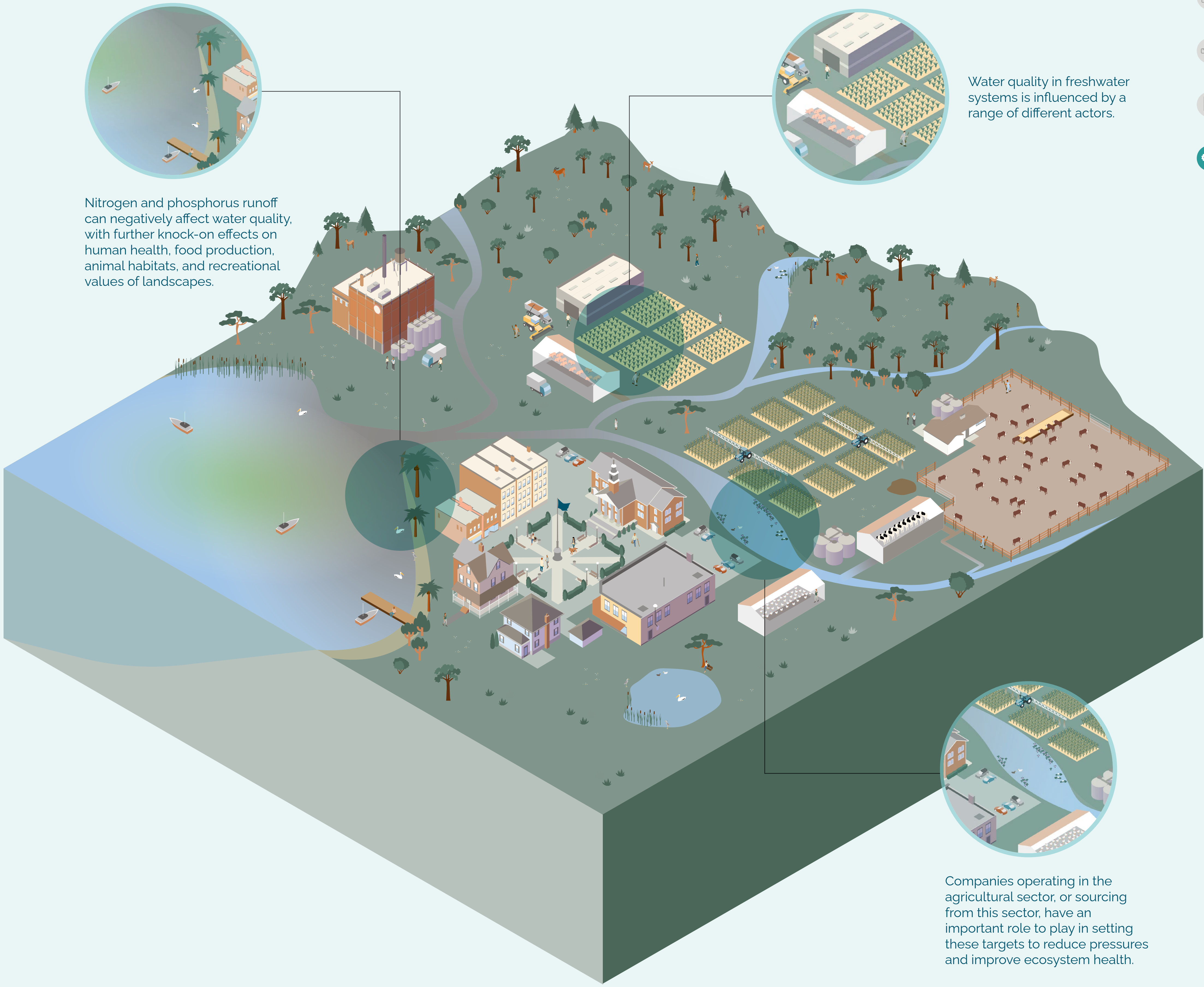
- **R15—Target timeframe:** Companies with a reduction percentage target <25% must submit adequate evidence to support their selection of a target timeframe (up to 10 years) based on:
  - 1) alignment with the timeframe of global societal or policy goals (e.g., GBF or UN SDGs),
  - 2) timeframe of local or regional policy or voluntary goals, or
  - 3) documentation on stakeholder engagement or other tangible actions critical for implementing actions to achieve their target in that basin.

Figure 8: Freshwater quality targets

Science-based targets for Freshwater Quality focus on pressures associated with loads of nitrogen (N) and phosphorus (P) to surface water bodies. Targets for toxic chemicals and other freshwater quality parameters will be developed in future iterations.

Companies that can influence N and P concentration levels within a basin are key actors that should consider setting a water quality target.

V1.1 Freshwater Quality targets will address point source and nonpoint source pollution. Different types of data will be needed depending on whether the target is managing a company's direct operations or upstream impacts.



Steps 3c & 3d.
Environmental thresholds identification and Freshwater Quality target setting

3.4 Setting Freshwater Quality targets

Target setting for freshwater quality follows a similar process to the process described for freshwater quantity (section 3.3). After companies have calculated freshwater quality baseline values for all priority sites in a given basin, they can begin to define targets for freshwater quality for direct operations and upstream activities. To set targets, companies *must* next calculate the required percent reduction in existing load for all nutrient sources in a basin and then define the portion of that amount of reduction (at the basin level) to be allocated to the company's operations. Target setting concludes by allocating a portion of this amount to the company's operations. Targets are to be set for each basin in which priority sites have been identified in Step 2: Interpret & Prioritize.

Note that this section is designed to produce results that are at the upper limit of what would be acceptable, such that there is no buffer built in as a margin of error. Ideally, a company would be more ambitious than these targets (i.e., set a Freshwater Quality target that aims at reducing nutrient loads more drastically than what is to be required through the targets). In that case, companies *must* submit the target value as determined using the SBTN methods but are *recommended* to also provide information on their more ambitious target value and its rationale.

Tasks 8 & 9. Apply modeling approach for the basin and Calculate required, basin-wide pressure reductions

3.4.1 Maximum allowable level of basin-wide nutrient load

Locally developed modeling approach

Under this step, the company applies a method to relate the magnitude of nutrient loads within a basin to the resulting freshwater quality within that spatial domain in order to then determine the maximum amount of basin-wide nutrient load that will be within the specified freshwater quality threshold. Two options exist for calculating the maximum allowable level of nutrient loads for the locally developed modeling approach:

- ***Direct application of model:*** This option provides more flexibility in terms of the use of freshwater quality indicators other than nutrient concentration, but it requires the application of the locally developed model to explicitly demonstrate that the proposed nutrient load target will result in attainment of freshwater quality consistent with the threshold concentration representing the desired freshwater quality.

  It is most suited for situations where it is feasible to conduct new applications of the local model and where thresholds for parameters other than nutrients are relevant.

- ***Back-calculation from existing results:*** This option provides specific equations for calculating allowable loads using the information on existing recognized nutrient thresholds and model results for present-day nutrient concentration. It allows targets to be set without requiring a new application of the locally developed model but lacks flexibility for considering factors such as nutrient-related freshwater quality thresholds specified in terms other than nutrient concentration (e.g., chlorophyll a, dissolved oxygen).

  It is most suited for situations where it is not feasible to conduct new applications of the local model and/or where thresholds for parameters other than nutrients are not relevant.

Direct application of model

The direct application of model option for defining the maximum allowable nutrient load applies in cases where a locally developed model and freshwater quality thresholds are available to be applied for purposes of evaluating specific reduction scenarios. For this option, the company defines its maximum allowable level of nutrient load by demonstrating with model results that the desired instream concentration will be attained for the targeted level of nutrient load over the entire period of simulation. This option avoids the simplifying assumption of the back-calculation from existing results approach that nutrient concentrations are proportional to nutrient loads. It also allows for targets to be set considering freshwater quality endpoints (e.g., chlorophyll a, dissolved oxygen), which reflect the impact of nutrient pollution rather than the instream nutrient concentration.

Back-calculation from existing results

The back-calculation from existing results method provides specific equations for calculating the maximum amount of nutrient load (in terms of mass per time, such as kg/year) that will attain the desired instream nutrient concentration. It is based on the assumption that instream nutrient concentrations at any given time are directly proportional to the rate of nutrient loading (e.g., Preston et al., (2011)). This assumption allows the required basin-wide reduction in load to be directly calculated from the output of the freshwater quality model representing present-day nutrient concentrations (which will be provided by essentially all locally developed models) and the threshold nutrient concentration, thus representing the maximum concentration consistent with the desired state of nature.

The extent to which basin-wide nutrient loads must be reduced to meet the desired nutrient concentration is based on the same concept of comparing the ratio of excess pressure to present-day pressure described above for Freshwater Quantity science-based targets. For quality, pressures are expressed as instream nutrient concentration (by assuming a proportional relationship between loads and concentrations), as illustrated by the following equation:

$$\text{\% Required reduction in basin-wide nutrient load} = \frac{\text{Current nutrient concentration} - \text{Threshold nutrient concentration}}{\text{Current nutrient concentration}}$$

Equation 3

Equation 3 is applied over the entire time period of existing locally developed model results to determine the 75th percentile largest individual required reduction percentage. Note that the temporal resolution of the threshold nutrient concentration may vary by basin (e.g., specified as an instantaneous never-to-be-exceeded value, as a seasonal average, or as an annual average) and that the temporal resolution required for this assessment should be consistent with the temporal resolution considered by the threshold. The percentage reduction provided by Equation 3 is used in the next step in conjunction with the present-day level of nutrient loads to define company-specific Freshwater science-based targets.

Globally developed modeling approach
For globally developed Freshwater Quality targets, the company uses results from a global freshwater quality model to define the maximum amount of nutrient load that will attain the desired instream nutrient concentration. The required percentage reduction in nutrient loads for globally developed targets is based on results from the modeling work described in McDowell et al. (2020).[46]

Based on global models of N and P concentrations using data from thousands of sites sampled worldwide between 1990 and 2016, their work defined:

- Present-day median growing season total N and total P concentrations for basins worldwide.
- Which nutrient (N or P) is the **limiting factor** (i.e., in the lowest supply relative to needs) for algal growth in each basin. They determined the limiting nutrient by comparing the predicted N:P ratio with the Redfield ratio (Redfield et al., 1963) of seven (as specified on a mass basis; predicted N:P ratios greater than seven were taken as an indicator of P limitation, whereas N:P ratios less than seven were taken as an indication of N limitation).
- That global concentration threshold values for total N (0.80 mg-N/L) and total P (0.046 mg-P/L) represent acceptable levels of algal growth. These concentrations were based on a literature review of studies defining local N and P thresholds related to periphyton growth.

The extent to which basin-wide loads must be reduced in order to meet the desired state of nature is based on Equation 3, described above for the locally developed approach. The current nutrient concentration to apply Equation 3 can be obtained from McDowell et al. (2020)[47] results in the SBTN State of Nature Water Layers app. Note that Equation 3 is applied only to the basin-specific limiting nutrient as identified by McDowell et al. (2020) and in the SBTN app.

Task 10. Set company water quantity and quality targets

3.4.2 Allocation approach

At this point in the process, the company defines a target level for its nutrient loads, consistent with the maximum allowable basin-wide load defined above. This is accomplished by multiplying the required percentage reduction (as calculated either via Equation 3 or via a direct application of model approach) with the present-day nutrient load:

$$\text{Company target load} = \frac{100 - \text{\% Reduction in basin-wide load required}}{100} \times \text{Present-day company load}$$

Equation 4a

$$\text{Company target grey water footprint} = \frac{100 - \text{\% Reduction in basin-wide load required}}{100} \times \text{Present-day grey water footprint}$$

Equation 4b

The targets set using Equation 4a or 4b, depending on the units used, assume the same “equal contraction of efforts” allocation approach as described earlier for freshwater quantity in section 3.3.2. It is important to note that, in cases where the model indicates a negative reduction is indicated, the percent reduction used in Equation 4a or 4b must be set to zero, i.e. target loads cannot be greater than present-day baseline loads.

3.4.3 Timestep for Freshwater Quality targets

Companies *can* use annual or finer (e.g., seasonal) time periods for their targets, but the selected percentage reduction reflected in the target *must* be consistent with the most stringent required reduction. For example, if the threshold nutrient concentration applies only to the summer growing season and the required reductions are 25%, companies *can* set targets on an annual basis, but they will be *required* to achieve a blanket 25% reduction across the entire year. Companies *may* also set targets on a seasonal basis, when the local basin authority specifies a growing season (e.g., May–September in the Northern Hemisphere), and require reductions only for those months where the threshold concentration is applicable.

When using the globally developed modeling approach companies can choose to use the average annual reduction or monthly reduction targets. Company must mirror the approach taken in the baseline data collection i.e. if a company measured their baseline monthly, they must use the monthly target reductions and if they had an annual baseline, they must set an annual target. If they do follow the monthly approach a company can either 1) set individual targets per month or 2) take the most ambitious monthly reduction percentage and apply it annually.

3.4.4 Template statement for Freshwater Quality targets

For **a pressure reduction target of 25% or less**:

- Companies *must* submit their targets with a target year of five years from the date that the target is submitted,

  or

  With adequate justification, companies *may* choose a target date of up to ten years. Adequate justification must be submitted for validation and must demonstrate that the extended target date 1) aligns with the timeframe of global societal or policy goals (e.g., GBF or UN SDGs), 2) aligns with the timeframe of local or regional policy or voluntary goals, or 3) is associated with documentation on stakeholder engagement or other tangible actions that they deem critical for implementing actions to achieve their target in that basin.

For **a pressure reduction target above 25%**, companies can submit their targets with a target year of up to ten years from the date that the target is submitted.

- When setting targets on an annual basis, using direct or secondary measurement (with units of nutrient load), targets will be stated as "Company X will reduce its nutrient load in the ____ basin to ____ kg P (or N)/year by the year ____."
- When setting targets on a seasonal basis, using direct or secondary measurements (with units of nutrient load), targets will be stated as "Company X will reduce its nutrient load in the ____ basin to ____ kg P (or N)/month for each of the following months. The reductions will occur by the year ____."
- When setting targets on an annual basis, using gray-water footprint(s), targets will be stated as "Company X will reduce its gray-water footprint in the ______ basin to ____ ML/year by the year ____."

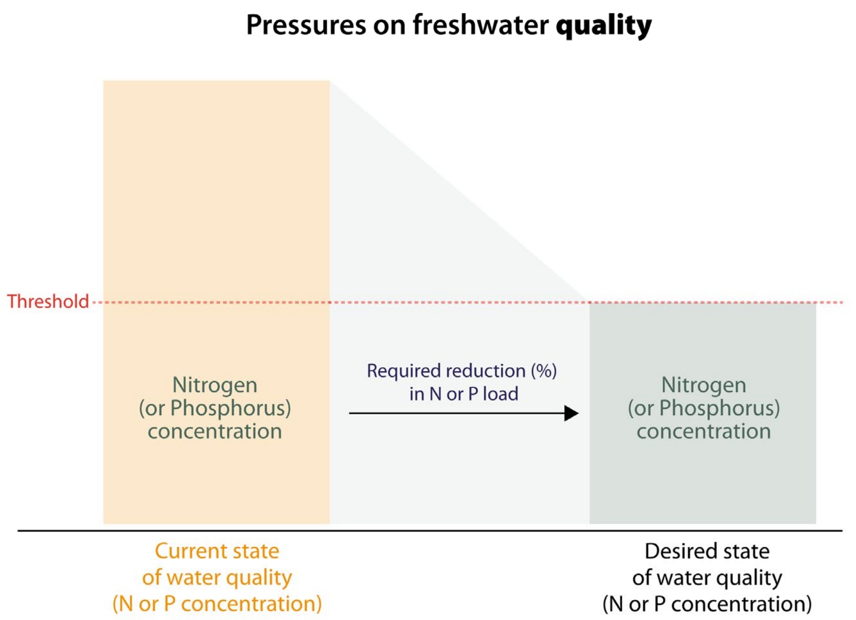
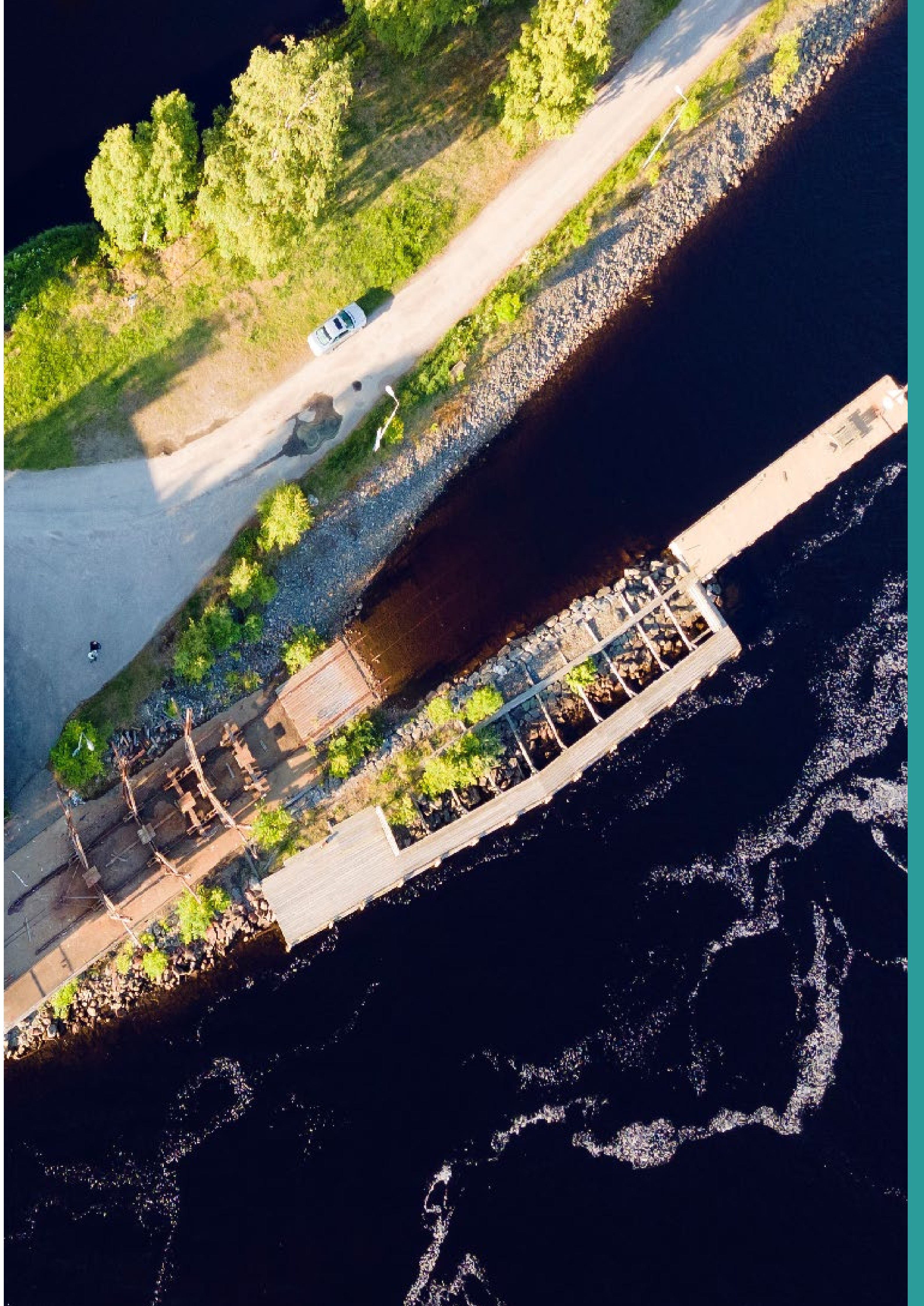


Figure 9: Pressures on freshwater quality. This illustration shows the relationship between current and desired levels for water quality pressures in the basin (either Nitrogen or Phosphorus).

Box 2: Freshwater Quality targets and the AWS Standard.

Criteria 2.3.2 of the AWS Standard requires sites to develop a water stewardship plan that addresses water risks, opportunities, and shared challenges at the basin level. The plan must include specific targets for each of the water stewardship outcome areas, including water quality. This method for setting science-based targets for freshwater quality offers a robust way of developing water quality targets for sites implementing the AWS Standard.



3.4.5 Validation criteria for Freshwater Quality targets

Model selection process

- **R16—Model approval:** Models and thresholds are *required* to be developed by an authorized basin agency or otherwise, following the criteria in the model selection process laid out in section 3.1.1:
  - (A) Are there appropriate local water models and thresholds that, in the opinion of at least three different types of stakeholders, meet most of model criteria?, or
  - (B) Does one stakeholder point to appropriate local water models and thresholds, along with supporting evidence that they are protective of nature? Consulting with more than one stakeholder is recommended.
- **R17—Evidence of model approval:** Documentation is *required* to be provided demonstrating that, in the opinion of the stakeholders consulted in the model selection process, the model used to set targets meets most of the appropriateness criteria laid out in section 3.1.1.

Locally developed modeling approach

- **R18—Spatial resolution of target:** The spatial domain (i.e., basin) of the target is *required* to be consistent/compatible with the spatial scale used in the model following the criteria in Section 3.2.1.
- **R19—Coverage:** For the baseline pressure measurement at each basin, companies are *required* to identify all of their operations (direct and upstream) that materially affect water quality, as defined in Step 1: Assess.
- **R20—Five year average aggregate:** Baseline nutrient loads *must* be defined for each operation, using the last five years (or period of existence, if less than five years) of data.
- **R21—Data disaggregation requirements:** Baseline values *must* be calculated and recorded separately for direct operations and upstream activities, following the criteria in section 3.2.2.
- **R22—Primary & secondary data disaggregation:** Baseline values based on primary data *must* be calculated and recorded separately from those based on secondary data, following the criteria in section 3.2.2.
- **R23—Application of the local model:** The specified required percentage reduction in basin-wide pollution loads *must* be calculated in one of the following ways:
  - Taken from the model application, if available;
  - Using Equation 3 or the direct application of model approach as described in section 3.4.1

- **R24—Target calculation methodology:** Targets for company-specific pollution load reduction *must* be calculated using Equation 4 and specified in terms of maximum nutrient load in terms of mass of nutrient per time, within a specified time frame.

Globally developed modeling approach

The validation criteria for globally developed Freshwater Quality science-based targets consist of ensuring the following:

- **R25—Spatial resolution of target & coverage:** The spatial domain (i.e., basin) of the target was explicitly identified at Pfafstetter Level 6 - the spatial scheme provided by McDowell et al. (2020) in the SBTN State of Nature Water Layers app.
- **R26—Coverage:** All company operations (direct and upstream) that materially affect freshwater quality in the spatial domain were identified.
- **R27—Five year average aggregate:** Baseline nutrient loads were defined for each operation, using the last five years (or period of existence, if less than five years) of data, separating primary and secondary data..
- **R28—Application of the global model:** The specified required percentage reduction in basin-wide loads was calculated using Equation 3.
- **R29—Target calculation methodology:** Targets were calculated using Equation 4 and specified according to maximum nutrient load in terms of mass of nutrient per year, within a specified time frame.

Target timeframe

- **R30—Target timeframe:** Companies with a reduction percentage target <25% must submit adequate evidence to support their selection of a target timeframe (up to 10 years) based on:
  - 1) alignment with the timeframe of global societal or policy goals (e.g., GBF or UN SDGs),
  - 2) timeframe of local or regional policy or voluntary goals, or
  - 3) documentation on stakeholder engagement or other tangible actions critical for implementing actions to achieve their target in that basin.

3.4.6 Next steps for companies with validated freshwater targets

After setting their Freshwater science-based targets, companies should start implementation actions and track progress on their pressures, relative to their baselines. Further guidance on Step 4: Act and Step 5: Track is forthcoming,[48] and a preliminary list of response options for Step 4: Act is provided in Appendix A and in the SBTN Initial Guidance. The AWS Standard Version 2.0 is also a useful resource to support companies in creating and implementing water stewardship plans with associated response options that can help sites meet their Freshwater science-based targets.

After setting their Freshwater science-based targets, companies should start implementation actions and track progress.

Endnotes

1 See https://sciencebasedtargets.org/resources/files/SBTi-criteria.pdf.

2 See SBTN Glossary: https://sciencebasedtargetsnetwork.org/resources/.

3 Refer to "Science-Based Targets for Nature, Initial Guidance for Business (September 2020)" for a detailed description of the five-step process. For technical guidance, please see the methods for Step 1: Assess and Step 2: Interpret & Prioritize. Guidance for Steps 4 and 5 is anticipated to be published in science-based targets for nature V2.

4 A form of water pollution driven by excess levels of nutrients, primarily nitrogen (N) and phosphorus (P).

5 The concept of setting quantitative pressure targets at a level necessary to protect water is not new. It is based on existing accepted approaches to target setting (e.g., the United States' Total Maximum Daily Loads program).

6 Step 1: Assess (Version 1.1). Science Based Targets Network (SBTN). 2024.

7 Step 2: Interpret & Prioritize (Version 1.1). Science Based Targets Network (SBTN). 2024.

8 This tool is under development and will be made available to target-setting companies with new technical developments slated for 2024.

9 Freshwater quantity and/or freshwater quality data collection depends on the water aspects that were prioritized in Step 2: Interpret & Prioritize for a specific basin.

10 If operations or the purchase of a given commodity/reliance on upstream activity have been in existence for less than five years (or have collected data for less than five years), then the time frame should be over the length of existence (or the period of data collection for less than five years). If sourcing locations for commodities have varied over the last five years, then refer to Step 1: Assess and Step 2: Interpret & Prioritize for guidance. However, if the shifts in sourcing locations occurred within the same basin, then the pressure data from each of these locations should be averaged.

11 Water Footprint Network: Water footprints of crops, derived crop products, biofuels, livestock products, and industrial products. All data are available at national and sub-national level. Select "Report" as the entry category. The datasets are attached to "Value of Water Report" 47 and 48 (2010). https://waterfootprint.org/en/resources/waterstat/product-water-footprint-statistics/.

12 Or upstream of the location of withdrawal.

13 Sites that have implemented the AWS Standard should have gathered this data for AWS Indicator 1.3.3.

14 Sites that have implemented the AWS Standard should have gathered this data for AWS Indicator 1.3.4.

15 Further information and reasoning for the importance of taking a local approach when setting Freshwater science-based targets can be found here.

16 Sites that have implemented the AWS Standard should have already gathered data on basin specific conditions for Criteria 1.5. Basin water quantity and quality data, respectively, should have been collected for AWS Indicators 1.5.3 and 1.5.4.

17 It is expected that end-user resources required for target-setting will decrease in the future as a result of (a) additional SBTN tools to make models more accessible to end users and (b) companies becoming more familiar with both the impacts of their operations and the target-setting methods.

18 Legg T, Hatchard J, Gilmore AB. The science for profit model—how and why corporations influence science and the use of science in policy and practice. PLoS One. 2021 Jun 23;16(6):e0253272.

19 This describes a target that is incentivizing the correct direction of action from baseline to achieve the target, although when more precise and accurate models are used, the target value may be changed.

20 Sites that have implemented the AWS Standard should have identified relevant stakeholders for AWS Indicator 1.2.1. Companies may also choose to conduct an initial literature review of freshwater quantity and freshwater quality modeling in the basin to facilitate the local stakeholder identification process.

21 OECD. 2015. "Stakeholder engagement for inclusive water governance," OECD Studies on Water, OECD Publishing, Paris.

22 For sites that have implemented, or are implementing the AWS Standard, this requirement can be integrated with documentation of the stakeholder identification and engagement process for AWS Indicator 1.2.1.

23 The Water Footprint Network developed a global database of model results based on the work of Hogeboom et al. (2020). The database is available here: https://www.acc.waterfootprintassessmenttool.org/?b=sbtn.

24 McDowell, R. W., A. Noble, P. Pletnyakov, B. E. Haggard and L. M. Mosley, 2020. Global Mapping of Freshwater Nutrient Enrichment and Periphyton Growth Potential. Scientific Reports. https://doi.org/10.1038/s41598-020-60279-w.

25 Sites that have implemented the AWS Standard should have defined their basin level as part of AWS Criteria 1.1.

26 Alliance for Water Stewardship, 2019. AWS Standard Version 2.0 Guidance. https://a4ws.org/the-aws-standard-2-0/download-the-aws-standard-2-0/.

27 UN Global Compact CEO Water Mandate, Pacific Institute, CDP, The Nature Conservancy, World Resources Institute, WWF, UNEPDHI Partnership Centre for Water and Environment. 2019. Setting Site Water Targets Informed by Catchment Context: A Guide for Companies. www.ceowater-mandate.org/site-water-targets.

28 Water use for agricultural commodities' production considers only blue-water footprint (see Glossary for definition) and not the green-water footprint (consumption of water sourced from precipitation and stored in soil as soil moisture).

29 Sites that have implemented the AWS Standard may have gathered this data for AWS Criteria 1.4.

30 Either by month or annually, depending on the spatial resolution selected to set targets.

31 Note that this load represents the mass of a nutrient (N or P) and not the mass of a nutrient-containing compound such as ammonia or bulk fertilizer.

32 Sites that have implemented the AWS Standard may have already gathered the data necessary for these calculations as part of AWS Indicator 1.3.4.

33 Nonpoint sources are sources of pollution that are delivered to the receiving water body in a diffuse manner (e.g., runoff from agricultural operations).

34 SBTN Step 1 Toolbox (2023). https://sciencebasedtargetsnetwork.org/wp-content/uploads/2023/05/SBTN-Step-1-Toolbox-v1-2023.xlsx

35 For sites that have implemented the AWS Standard, some of this data may have already been gathered for AWS Indicators 1.4.1 or 1.4.3.

36 This is the threshold value that represents the desired state of nature (see Section 1.1).

37 This assumption is best made when factors such as groundwater depletion or dam operations are not dominant in affecting the flow regime, as has been documented in some cases (e.g., Döll et al., 2009).

38 A period of record of at least 20 years is required to capture interannual variability in precipitation.

39 This percentile was suggested by Hogeboom's water quantity global model as a level that balances ambitious reduction goals with the realization that a certain amount of freshwater must be made available for use.[23]

40 While this version of the methodology mandates the use of Hogeboom as the only acceptable tool for the globally developed modeling approach to freshwater quantity, additional sources of models will be considered (and might be added) in future versions.

41 The global hydrologic models currently being used are H08 (Hanasaki et al., 2008); PCR-GLOBWB 2 (Sutanudjaja et al., 2018); and WaterGAP-2C (Müller Schmied et al., 2016).

42 The methods used to define environmental flow requirements are described in Pastor et al. (2014), Richter et al. (2012), and Smakhtin et al. (2004).

43 The same 75th percentile value is used as for the locally developed approach, with no additional safety factor, consistent with the previously stated objective of balancing ambitious reduction goals with the realization that a certain amount of water must be made available for use.

44 'Contributions' can be reductions in 'negative' actions leading toward undesirable outcomes, like pollution, or 'positive' actions leading toward desirable outcomes like improved ecosystem integrity.

45 Alternative allocation approaches will be considered in future versions of this method.

46 While this version of the methodology mandates the use of McDowell as the only acceptable tool for the globally developed approach to freshwater quality, additional sources of models may be added in the future.

47 McDowell (in preparation) is updating the above analysis to provide improved model predictions.

48 Note that progress on a Freshwater Quantity science-based target set with a locally developed modeling approach (guidance will be found in Step 5: Track) will be based on changes to gross withdrawals, unless an explicit demonstration is provided that any credited return flows are present in the stream at the location, time, and quality that they are being applied. The application of V1 methods will also guide the development of MRV on secondary modeled estimates of nonpoint source pollution using the gray-water footprint and other models of water assimilation used in Freshwater Quality science-based targets.

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Appendix A: Freshwater Response Options

This is a non-exhaustive list of possible response options companies may consider in their attempt to meet the Freshwater science-based targets they have set. Further guidance will be provided in the first release of the methods for Step 4: Act. Many response options have co-benefits not only in terms of water quality and quantity but for land too, for example in terms of quality and quantity as well as for biodiversity, and other realms (e.g., terrestrial). It is important to note that collective action for water stewardship is strongly advised as a means to engage proactively in partnerships and landscape-level initiatives. This is because there are likely to be freshwater-related challenges that cannot be effectively tackled on a company-by-company basis.

The Alliance for Water Stewardship (AWS) Standard is a useful resource to support companies in organizing their water stewardship plans that take into account response options that will help achieve science-based targets.

Table A.1: Freshwater response options.

Avoid, Reduce, Regenerate, Restore, Transform (AR³T) classification	Freshwater Response Option	Freshwater Quantity (Target Benefit)	Freshwater Quality (Target Benefit)	No Conversion of Natural Ecosystems (Target Benefit)	Land Footprint Reduction (Target Benefit)	Landscape Engagement (Target Benefit)	SBTi Climate FLAG (Target Benefit)
Avoid	Use of recycled water such that a facility does not need to withdraw water and has no net water consumption	Direct	Indirect	Unknown	Indirect	Indirect	Unknown
Avoid	Use of treatment effluent and other non-potable water supplies such that a facility does not need to use potable water for production and operations	Direct	Indirect	Unknown	Indirect	Indirect	Unknown
Avoid	Avoid further water use through efficient use of water through behavior and technology	Direct	Indirect	Unknown	Unknown	Indirect	Indirect
Avoid	Avoid withdrawals from sensitive ecosystems and limited sources (incl. groundwater)	Direct	Direct	Unknown	Indirect	Direct	Unknown
Avoid	Avoid runoff and erosion by building green (vegetation) or gray (barrier) infrastructure along waterways and in the watershed to avoid, reduce, or slow down overland flow and erosion	Direct	Direct	Unknown	Unknown	Indirect	Unknown
Avoid	Avoid habitat conversion to reduce erosion, to preserve the watershed's ability to store, treat, and deliver water, and to reduce impact to terrestrial and aquatic ecosystems	Direct	Direct	Direct	Unknown	Direct	Indirect
Avoid	Eliminate the use of hazardous chemicals	Unknown	Direct	Unknown	Unknown	Direct	Indirect
Avoid	Zero liquid discharge of wastewater to the environment	Indirect	Direct	Unknown	Unknown	Indirect	Unknown
Reduce	Installation of (or upgrade to existing) wastewater treatment facilities to reduce pollutant loading	Indirect	Direct	Unknown	Unknown	Indirect	Unknown
Reduce	Reduce water use (existing or future) through efficient use of water via behavior and technology changes	Direct	Indirect	Unknown	Unknown	Indirect	Indirect
Reduce	Reduce water-intensive production components	Direct	Indirect	Unknown	Unknown	Indirect	Unknown
Reduce	Reduce hard surfaces and/or create pervious surfaces to limit surface runoff and associated erosion within the watershed	Direct	Direct	Unknown	Unknown	Direct	Unknown
Reduce	Reduce point source pollution affecting surface and groundwater sources	Indirect	Direct	Unknown	Unknown	Direct	Unknown
Reduce	Reduce nutrient runoff by promoting/adopting agricultural best management practices such as regenerative agriculture	Direct	Direct	Unknown	Indirect	Direct	Indirect
Restore/Regenerate	Rehabilitation of degraded land cover in catchments, to increase infiltration (quantity) and reduce pollutant runoff (quality)	Direct	Direct	Unknown	Unknown	Direct	Unknown

Key: Direct Indirect Unknown

Avoid, Reduce, Regenerate, Restore, Transform (AR³T) classification	Freshwater Response Option	Freshwater Quantity (Target Benefit)	Freshwater Quality (Target Benefit)	No Conversion of Natural Ecosystems (Target Benefit)	Land Footprint Reduction (Target Benefit)	Landscape Engagement (Target Benefit)	SBTi Climate FLAG (Target Benefit)
Restore/Regenerate	Restoring and managing wetlands and other aquatic habitats to improve water quality and quantity	Direct	Direct			Direct	Indirect
Restore/Regenerate	Remediate contaminated land/water in order to restore ecosystem function		Direct			Direct	
Restore/Regenerate	Plant/restore native vegetation to improve water quality and quantity in watersheds or along riparian/wetland buffers	Direct	Direct			Direct	Indirect
Restore/Regenerate	Remove alien vegetation and aggressive indigenous plant species	Direct	Indirect		Indirect	Direct	
Restore/Regenerate	Restore soil health across different degraded habitats	Direct	Direct		Indirect	Direct	Direct
Restore/Regenerate	Recharge aquifers and groundwater sources through solutions such as managed aquifer recharge	Direct	Indirect		Indirect	Indirect	
Restore/Regenerate	Restore flow regime/re-establish hydrologic connection (e.g., removing hard structures and barriers such as dams and levees, re-operation of existing dams to better align with natural flow regime, rewetting wetlands and floodplains)	Direct	Direct			Indirect	
Restore/Regenerate	Implement regenerative agriculture to regenerate degraded agricultural landscapes	Direct	Direct		Indirect	Direct	Indirect
Restore/Regenerate	Construct treatment wetlands or algal filters to meet water quality and quantity objectives	Direct	Direct			Direct	Indirect
Transform	Transform urban landscapes to include created waterscapes (e.g., ponds, rivers, wetlands)	Direct	Direct			Direct	
Transform	Creating policies and guidance that bring about a positive change in water quantity or quality in a company and its impact on the watershed	Direct	Indirect			Indirect	
Transform	Transform/replace unsustainable products and practices and expand sustainable product lines	Indirect	Indirect			Indirect	
Transform	Influence designer behavior e.g., reduce water use or reduce nonpoint source pollution when consuming your products	Indirect	Indirect			Indirect	

Key: Direct | Indirect | Unknown

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