METHODOLOGICAL DOCUMENT

Sustainable Management and Conservation of Water Resources

BWS0003

Managed Aquifer Recharge and Water Regulation Systems

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1 Introduction

Freshwater constitutes one of the most important resources for human well-being, the functioning of ecosystems, and economic development. However, in numerous regions of the world, water availability is subject to increasing pressure as a result of climate variability, rising demand, ecosystem degradation, and the overexploitation of surface and groundwater sources (Global Water Partnership, 2000).

These pressures manifest through the reduction of flows, the progressive depletion of aquifers, the loss of springs, the decline in the hydrological regulation capacity of ecosystems, and greater vulnerability to drought events. As a consequence, the water security of communities, productive systems, and natural ecosystems is increasingly compromised.

In this context, managed aquifer recharge and water regulation systems constitute relevant tools for increasing water availability, improving resilience to climate variability, and strengthening the sustainable management of water resources (Dillon et al., 2019).

Managed aquifer recharge comprises the set of activities aimed at deliberately increasing the infiltration, recharge, and underground storage of water through the implementation of infrastructure, management practices, nature-based solutions, or hybrid systems (Dillon et al., 2009). These activities may contribute to the recovery of aquifers, the maintenance of base flows, the restoration of springs, and the improvement of water availability during periods of lower precipitation.

Water regulation systems comprise interventions aimed at storing, delaying, redistributing, or regulating water flows over time within a basin or hydrological system, with the purpose of improving resource availability, reducing losses, and strengthening the resilience of territories to extreme events.

The activities covered by this category encompass a wide diversity of approaches, including traditional water management systems developed by local communities, infiltration structures, aquifer recharge systems, runoff regulation works, flow dispersion systems, small-scale water infrastructure, and other interventions aimed at increasing water availability through the strengthening of natural hydrological processes (Dillon et al., 2019).

This methodology has global scope and may be applied in any country or geographic region. Its design is independent of specific national contexts and enables the consistent quantification of water benefits derived from managed aquifer recharge and water regulation activities across different hydrological, climatic, and ecological systems (Zheng et al., 2021). The methodology is applicable both to traditional water management systems and to modern interventions based on infrastructure, nature-based solutions, or hybrid approaches.

Within the framework of the BioCarbon Water Standard (BWS), these activities may generate quantifiable water benefits when they produce a verifiable increase in water availability, aquifer recharge, or the regulation of hydrological flows compared to a baseline scenario (BioCarbon Cert, 2026).

This methodology establishes the technical guidelines for the quantification, monitoring, and reporting of the volumetric water benefits derived from managed aquifer recharge and water regulation systems (Reig et al., 2019).

The methodology enables the quantification of the net water benefit attributable to the activities implemented by the project through the application of direct measurement, water balance, hydrological modeling, or verifiable hydrogeological evidence approaches, as appropriate to the characteristics of each intervention.

The results are expressed in cubic meters of water per year (m^3/year) and constitute the basis for the quantification of net water benefits under the BioCarbon Water Standard.

The methodology seeks to facilitate the implementation of projects that contribute to water security, climate change adaptation, the sustainable management of aquifers, and the conservation of the hydrological processes that sustain human well-being and the integrity of ecosystems.

2 Objectives

The objective of this methodology is to establish the technical guidelines for the quantification, monitoring, and reporting of the volumetric water benefits derived from managed aquifer recharge and water regulation systems, within the framework of the BioCarbon Water Standard.

This methodology establishes:

(a) the criteria for the identification and characterization of managed aquifer recharge and water regulation activities implemented within the project boundaries;

(b) the eligibility and applicability conditions for managed aquifer recharge systems, water regulation systems, infiltration infrastructure, nature-based solutions, traditional water management systems, and other interventions aimed at increasing water availability;

(c) the procedures for establishing the baseline, including the hydrological, hydrogeological, climatic, and environmental characterization of the project areas;

(d) the requirements for the collection and use of monitoring data, hydrological modeling, water balance, and hydrogeological evidence necessary for the quantification of water benefits;

(e) the procedures for quantifying the volumetric water benefits associated with managed aquifer recharge and water regulation activities, expressed in cubic meters of water per year (m^3/year);

(f) the quantification approaches applicable to different types of systems and information conditions, including direct measurement, water balance, hydrological modeling, and verifiable hydrogeological evidence;

(g) the requirements for determining the net water benefit attributable to the project, considering the baseline, leakage, uncertainty, and other applicable adjustments established by the BioCarbon Water Standard;

(h) the guidelines for the monitoring, reporting, and management of the information used to demonstrate the water benefits generated by the project; and

(i) the requirements for the quantification of the net water benefits that may be recognized under the BioCarbon Water Standard.

3 Version

This document corresponds to the Draft for Public Consultation Version of the methodology BWS0003 – Managed Aquifer Recharge and Water Regulation Systems, issued by BioCarbon Cert on July 21, 2026.

This version has been developed to receive comments, observations, and technical inputs from stakeholders, project holders, conformity assessment bodies, water resources experts, communities, public entities, academic institutions, and other actors involved in sustainable water management.

During the public consultation period, BioCarbon Cert may receive, review, and consider comments on the scope, applicability conditions, eligible activities, baseline scenario, additionality, quantification, monitoring, uncertainty management, aquifer protection, leakage, permanence of the water benefit, and other requirements established in this methodology.

Once the public consultation period has concluded, BioCarbon Cert may adjust, supplement, or modify the content of this methodology before issuing the approved final version.

Unless expressly indicated otherwise by BioCarbon Cert, this public consultation version shall not be used as the final approved version for conformity assessment, project registration, or issuance of Verified Water Credits (VWC).

Project holders, conformity assessment bodies, and other users shall ensure that they apply the current version of this methodology published by BioCarbon Cert at the time of the relevant process.

BioCarbon Cert may periodically update this methodology to reflect scientific advances, technical developments, methodological improvements, regulatory changes, lessons learned from project implementation, or adjustments resulting from public consultation and conformity assessment processes.

4 Scope

This methodology establishes the technical requirements and procedures for the quantification, monitoring, and reporting of volumetric water benefits derived from managed aquifer recharge and water regulation systems, within the framework of the BioCarbon Water Standard (BioCarbon Cert, 2026).

The methodology is applicable to projects that implement, rehabilitate, recover, expand, optimize, or operate systems intended to increase aquifer recharge, the underground storage of water, or the temporal regulation of water flows within a defined hydrological or hydrogeological system.

The methodology has global scope and may be applied in any country or geographic region, provided that the project meets the applicability conditions established in this document and the applicable requirements of the BioCarbon Water Standard.

4.1 Technical scope

This methodology covers activities whose principal water benefit is associated with one or more of the following outcomes:

(a) increase in aquifer recharge;

(b) increase in the underground storage of water;

(c) improvement in the temporal regulation of water flows;

(d) increase in base flows attributable to recharge or regulation processes;

(e) recovery or increase in spring discharge;

(f) improvement of water availability during dry periods or periods of lower precipitation;

(g) delay, redistribution, or controlled release of water within a basin or hydrogeological system.

Water benefits shall be expressed in volumetric terms, in cubic meters of water per year (m^3/year) or in cubic meters during the corresponding monitoring period.

4.2 Scope boundaries

This methodology does not cover activities whose principal benefit corresponds to water quality improvement, the reduction of pollutant loads, wastewater treatment, the remediation of surface water bodies, the functional restoration of lakes, rivers, reservoirs, lagoons, bays, or coastal bodies, eutrophication control, oxygenation, bioremediation, pollutant removal, or sargassum management. Such benefits shall be quantified under the corresponding methodology of the BioCarbon Water Standard, where applicable.

Nor does it cover activities whose principal benefit is the harvesting and direct use of rainwater, the improvement of surface soil infiltration, or water retention in the soil profile, unless the project holder demonstrates that such activities generate managed recharge, underground storage, or water regulation benefits in accordance with this methodology. The methodology shall likewise not be applicable to activities that merely transfer water between users, basins, sub-basins, or ecosystems without generating a net water benefit.

4.3 Relationship with other methodologies

Where a project includes activities that may generate benefits under more than one methodology of the BioCarbon Water Standard, the project holder shall clearly separate the spatial, temporal, and volumetric boundaries of each activity.

The same volume of water shall not be accounted for simultaneously under this methodology and under another methodology of the BioCarbon Water Standard.

Where there is potential overlap between recharge, infiltration, water harvesting, water regulation, or water quality improvement benefits, the project holder shall apply a conservative approach and assign each volume to a single methodological category.

4.4 Scale of application

This methodology may be applied to projects of different scales, including local, community-based, farm-level, rural, peri-urban, urban, micro-basin, sub-basin, basin, or hydrogeological unit interventions, provided that the water benefits can be delimited, monitored, quantified, and robustly attributed to the project activities (Zheng et al., 2021).

The project holder shall define appropriate spatial and temporal boundaries for quantification, including the project area, the area of influence, and the recharge, conveyance, storage, and discharge zones, as well as the areas where associated benefits or impacts may occur.

5 Assumptions and limitations of the methodology

This methodology is based on technical and operational assumptions necessary to quantify the volumetric water benefits derived from managed aquifer recharge and water regulation activities.

These assumptions shall be assessed, documented, and justified by the project holder in accordance with the characteristics of the intervened hydrological or hydrogeological system, the project scale, the availability of information, and the quantification approach applied.

Where an assumption cannot be demonstrated with sufficient evidence, the project holder shall apply a conservative approach, limit the volume considered for quantification, or exclude the affected component from the calculation of water benefits.

5.1 General assumptions of application

The application of this methodology rests on the following assumptions:

(a) a reasonable hydrological or hydrogeological relationship exists between the activities implemented and the expected water benefit;

(b) the intervened system can be delimited spatially and temporally to a degree sufficient to enable the quantification of water benefits;

(c) the water benefits generated by the project can be expressed in volumetric terms, in cubic meters (m^3);

(d) the baseline scenario reasonably represents the conditions that would have occurred in the absence of the project;

(e) the with-project scenario represents the changes attributable to the activities implemented;

(f) the variables used for quantification are measurable, estimable, or verifiable through technically justified methods;

(g) the data used are representative of the project area, the area of influence, and the corresponding monitoring period;

(h) the deductions for losses, leakage, uncertainty, and other conservative adjustments prevent the overestimation of net water benefits.

The methodology recognizes that not all water captured, conveyed, retained, or infiltrated necessarily contributes to effective recharge, underground storage, or quantifiable water regulation. Therefore, where applicable, the project holder shall distinguish between captured volume, conveyed volume, infiltrated volume, volume effectively recharged, regulated volume, volume released as delayed flow, and non-eligible losses or outflows.

The methodology also recognizes that water benefits may manifest with a time lag (NRMMC, EPHC & NHMRC, 2009). Consequently, the project holder shall consider the travel time where relevant and shall not account for benefits before sufficient evidence exists that the volume has effectively contributed to recharge, underground storage, or water regulation, unless a duly justified conservative approach is applied.

5.2 Applicability limitations

This methodology shall not be applicable where:

(a) no reasonable hydrological or hydrogeological connection exists between the intervention and the expected water benefit;

(b) the principal benefit corresponds to water quality improvement, wastewater treatment, remediation, functional restoration of surface water bodies, or reduction of pollutant loads;

(c) the principal benefit corresponds solely to the harvesting and direct use of rainwater without associated recharge, underground storage, or water regulation;

(d) the activity corresponds solely to the improvement of surface infiltration or water retention in the soil without demonstrating managed recharge, underground storage, or water regulation;

(e) the project generates the transfer of water between users, sub-basins, aquifers, or ecosystems without a net water benefit;

(f) the project compromises ecological flows, existing water-use rights, or the water availability of downstream users;

(g) the project generates significant unmitigated risks of contamination or deterioration of aquifers, soils, water bodies, or ecosystems;

(h) the water benefits cannot be quantified, monitored, or verified in a robust and conservative manner.

The methodology does not quantify benefits associated with water quality improvement. Any quality improvement may be reported as a co-benefit, but shall not be used to increase the volume of water benefits quantified under this methodology.

5.3 Quantification limitations

The quantification of water benefits under this methodology may be limited by:

(a) the absence or low density of hydrological, hydrogeological, or meteorological data;

(b) short or incomplete historical series;

(c) uncertainty in the baseline;

(d) difficulty in separating the effects of the project from climate variability;

(e) difficulty in attributing changes in base flow, water-table levels, or springs exclusively to the project;

(f) spatial heterogeneity of the aquifer or hydrogeological system;

(g) uncertainty in parameters such as specific yield, transmissivity, hydraulic conductivity, effective porosity, or storage coefficient;

(h) the absence of piezometers, hydrometric stations, or representative monitoring points;

(i) limitations of hydrological or hydrogeological models not calibrated locally;

(j) uncertainty in travel times or in the temporal manifestation of the benefit;

(k) difficulty in quantifying leakage, losses, or downstream effects.

Where these limitations exist, the project holder shall apply conservative assumptions, uncertainty deductions, alternative measurement approaches, or the exclusion of non-demonstrable volumes.

Where hydrological or hydrogeological models are used, the results will be conditioned by the structure of the model, the input data, the parameters used, the calibration assumptions, and the simplified representation of the real system. Models shall be calibrated and validated with site-specific information wherever possible. Where this is not possible, the project holder shall technically justify their use and apply conservative uncertainty deductions.

In traditional water management systems, such as amunas, qochas, or other equivalent systems, the historical or cultural existence of the system does not in itself constitute sufficient evidence of the generation of additional water benefits. Quantification shall be based on the actual condition of the system prior to the intervention and on the verifiable increase generated by the project activities.

5.4 Permanence of the benefit and conservative approach

The methodology does not assume that the recharged or regulated water remains indefinitely stored in the hydrogeological system. In managed recharge and water regulation projects, the benefit may consist of temporary storage, delayed release, base-flow sustainment, or additional availability during dry periods.

Therefore, the permanence of the water benefit shall be assessed based on the functional continuity of the system and the demonstrable existence of the benefit during the corresponding monitoring period.

Where there is uncertainty, an absence of information, or technical limitations that may lead to the overestimation of the water benefit, the project holder shall apply conservative assumptions.

The use of conservative assumptions may include:

(a) selection of reasonable minimum values for effective recharge;

(b) selection of reasonable maximum values for losses, leakage, or non-eligible outflows;

(c) use of lower-bound estimates;

(d) uncertainty deductions;

(e) exclusion of periods or components with insufficient information;

(f) assignment of the benefit only to the volume that can be robustly demonstrated;

(g) use of the lowest result where multiple technically acceptable methods exist.

All conservative assumptions shall be documented, justified, and applied consistently throughout the corresponding monitoring period.

6 Terms and definitions

For the purposes of this methodology, the following definitions apply:

Aquifer

A geological formation or set of geological formations capable of storing and transmitting groundwater in quantities sufficient to feed springs, surface water bodies, groundwater-dependent ecosystems, or human and productive uses.

Aquifer recharge

The process by which water reaches and increases the storage of an aquifer or hydrogeological system, whether naturally or as a result of managed activities.

Area of influence

The spatial extent where the hydrological or hydrogeological effects associated with the project activities may occur or manifest. The area of influence may include capture, conveyance, recharge, underground storage, and discharge zones, springs, surface water bodies, beneficiary users, and downstream or upstream areas that may be affected by the project.

Base flow

The component of the flow of a river, stream, spring, or other water body that is sustained during periods without direct precipitation, generally associated with groundwater contributions or delayed water storage within the watershed.

Discharge

The process by which groundwater returns to the surface or feeds water bodies, springs, wetlands, rivers, streams, or other systems dependent on subsurface flow.

Discharge zone

An area or point where groundwater returns to the surface or contributes to the flow of rivers, streams, springs, wetlands, or other ecosystems or water uses.

Diverted volume

The volume of water captured or conveyed from a surface source, runoff, channel, streambed, infrastructure, or other origin into a recharge or water regulation system during a given period.

Effective recharge factor

A dimensionless factor used to estimate the proportion of the captured, conveyed, retained, or infiltrated volume that effectively contributes to aquifer recharge, underground storage, or quantifiable water regulation. This factor is based on site evidence, monitoring, modeling, applicable technical literature, or duly justified conservative assumptions (Dillon et al., 2009).

Hydrological or hydrogeological conceptual model

A simplified representation of the functioning of the intervened system, describing the water source, the capture, conveyance, infiltration, recharge, storage, and discharge pathways, as well as the relationship between the project activities and the expected water benefits.

Infiltration

The process by which water penetrates from the surface into the soil or subsoil. In this methodology, infiltration is considered relevant when it contributes to the recharge, underground storage, or water regulation of the system.

Managed aquifer recharge

The set of activities deliberately implemented to increase the recharge of water into aquifers or hydrogeological systems through infrastructure, management practices, nature-based solutions, traditional systems, or hybrid approaches (Dillon et al., 2009). These activities may include the capture, conveyance, infiltration, dispersion, or temporary storage of water for the purpose of improving water availability or the regulation of water flows.

Managed recharge system

A set of natural, artificial, or hybrid elements that make it possible to capture, convey, infiltrate, store, or regulate water in order to increase aquifer recharge or improve water availability. It may include channels, ditches, infiltration ponds, dissipation structures, modified streambeds, qochas, amunas, retention dikes, runoff dispersion areas, recharge wells, or other equivalent interventions (Dillon et al., 2009).

Net recharged or regulated volume

The volume of water that effectively contributes to aquifer recharge, underground storage, or water regulation attributable to the project, after deducting the baseline scenario, system losses, leakage, uncertainty, and other applicable conservative adjustments.

Net water benefit

The net, additional, and verifiable change in water availability, aquifer recharge, underground storage, or the regulation of water flows, attributable to the project activities compared to a baseline scenario, expressed in cubic meters (m^3) over a given monitoring period, after applying the corresponding deductions for leakage, uncertainty, or other applicable conservative adjustments.

Piezometer

An instrument used to measure the groundwater level or hydraulic pressure at a given point of the subsoil or of an aquifer. In this methodology, piezometers may be used as a source of evidence to assess changes in underground storage or the hydrogeological response of the system.

Recharge efficiency

The ratio between the volume of water conveyed or made available to the recharge system and the volume that effectively contributes to recharge, underground storage, or water regulation, after deducting losses from evaporation, unused runoff, non-attributable seepage, overflow, or other applicable factors (Dillon et al., 2009).

Recharge zone

An area where surface water, precipitation, runoff, or water conveyed by the project may infiltrate and contribute to aquifer recharge or underground storage.

Spring

A point or zone where groundwater naturally emerges at the surface, contributing to water bodies, human uses, productive activities, or ecosystem functions.

System losses

Volumes of water that enter the recharge or water regulation system but do not contribute to the quantifiable net water benefit, including evaporation, overflow, unused runoff, seepage not attributable to the system, operational losses, or other non-eligible flows.

Traditional water management system

A system developed, maintained, or used by local communities, Indigenous Peoples, or traditional communities to capture, convey, infiltrate, store, or regulate water, based on knowledge, practices, and infrastructure adapted to the local ecological, cultural, and hydrological context. These systems may be eligible under this methodology where they meet the applicability, monitoring, and quantification conditions established in this document.

Travel time

The estimated or measured period that elapses between the entry of water into the recharge or water regulation system and its manifestation as discharge, an increase in the water table, a contribution to base flow, spring recovery, or another verifiable hydrological or hydrogeological indicator.

Underground storage

The process by which water infiltrates, percolates, and remains temporarily stored in the subsoil or in an aquifer, contributing to water availability, flow regulation, spring recovery, or the resilience of the hydrological system.

Verifiable hydrogeological evidence

Technical, measurable, documented, and traceable information that supports the occurrence of recharge, underground storage, variations in water-table levels, spring recovery, changes in base flow, travel times, or other hydrogeological effects attributable to the project activities.

Water regulation

The capacity of a hydrological or hydrogeological system to store, delay, redistribute, or release water over time, contributing to resource availability, the maintenance of base flows, the reduction of extreme variability, and the resilience of ecosystems and communities.

Water regulation system

A set of interventions aimed at storing, delaying, redistributing, or releasing water in a controlled manner within a watershed or hydrological system, in order to improve the temporal availability of the resource, sustain base flows, feed springs, or reduce vulnerability to dry periods.

7 Applicability conditions

The applicability conditions establish the minimum requirements that shall be met for a project to apply this methodology. These conditions make it possible to determine whether the project is developed within an appropriate hydrological or hydrogeological context, whether there is a clearly identifiable recharge or regulation system, and whether the expected water benefits can be reasonably attributed to the activities implemented.

Project holders shall comply with the following conditions.

7.1 Water and hydrogeological context

The activities shall be implemented in territories where there is evidence of current, seasonal, or projected limitations in water availability, or where the natural water regulation of the system is degraded or insufficient to respond to the ecological, social, or productive needs of the territory.

The evidence may be based, among other things, on:

(a) regional hydrological, hydrogeological, or climatic analyses;

(b) historical records of flows, precipitation, water-table levels, or water availability;

(c) official diagnostics, basin studies, water management plans, or technical information from competent authorities;

(d) documented reduction of base flows, springs, or water availability during dry periods;

(e) evidence of seasonal or structural water stress;

(f) socioeconomic information on restricted access to water or the water vulnerability of communities and productive systems;

(g) studies that identify opportunities for recharge, underground storage, or water regulation.

The project holder shall demonstrate that the activities contribute to improving water availability, aquifer recharge, underground storage, or the temporal regulation of water flows, compared to the baseline scenario.

7.2 Defined hydrological or hydrogeological system

The project shall be developed within a clearly identifiable hydrological or hydrogeological system whose delimitation makes it possible to describe the relationship between the activities implemented and the expected water benefits.

The project holder shall identify, as appropriate:

(a) the relevant basin, sub-basin, micro-basin, or hydrographic unit;

(b) the aquifer, hydrogeological system, or underground storage unit related to the project;

(c) the capture, conveyance, recharge, storage, or discharge zones;

(d) the water bodies, springs, base flows, ecosystems, or users related to the expected water benefit;

(e) the area of influence where the hydrological or hydrogeological effects of the project may manifest.

7.3 Water source available for recharge or regulation

The project shall clearly identify the water source that will be used, conveyed, infiltrated, stored, or regulated by the project activities.

The water source shall be:

(a) identifiable;

(b) legally available, where applicable;

(c) compatible with the receiving system;

(d) sufficient to sustain the expected water benefit;

(e) consistent with the hydrological regime of the project area.

The use of the water source shall not compromise ecological flows, existing water-use rights, ecosystems dependent on the water resource, or downstream users (NRMMC, EPHC & NHMRC, 2009).

7.4 Existence of an identifiable recharge or water regulation system

The project activities shall be associated with a clearly identifiable natural, artificial, traditional, or hybrid system, designed or managed to capture, convey, infiltrate, disperse, store, delay, or regulate water.

These systems may include, among others:

(a) amunas, qochas, or other traditional water management systems;

(b) conveyance channels toward infiltration zones;

(c) ditches, infiltration fields, or recharge areas;

(d) ponds, infiltration lagoons, or infiltration basins;

(e) runoff retention or dispersion structures;

(f) small-scale dikes, check dams, or equivalent structures;

(g) streambeds intervened to favor infiltration or temporary storage;

(h) recharge systems through wells, galleries, deep trenches, or other infiltration structures;

(i) hybrid systems that combine water infrastructure and nature-based solutions.

The project holder shall describe the components of the system, their location, operation, initial condition, operational capacity, and relationship with the expected water benefit.

7.5 Demonstrable hydrological or hydrogeological connection

The project holder shall demonstrate that a reasonable hydrological or hydrogeological connection exists between the activities implemented and the quantified water benefit.

To this end, the project holder shall develop a conceptual model of the system that describes, at a minimum:

(a) the water source used or regulated;

(b) the capture, conveyance, infiltration, recharge, storage, or discharge pathways;

(c) the relevant recharge and discharge zones;

(d) the relationship between the implemented system and the aquifers, springs, base flows, water bodies, or beneficiary users;

(e) the expected travel time or manifestation of the water benefit, where relevant;

(f) the main factors that may affect recharge, underground storage, or water regulation.

7.6 Environmental and hydrogeological compatibility

The project activities shall be compatible with the environmental, hydrological, and hydrogeological conditions of the area where they are implemented.

The project holder shall demonstrate that the activities do not generate significant risks of:

(a) deterioration of aquifers, soils, water bodies, or associated ecosystems;

(b) contamination of surface water or groundwater;

(c) negative alteration of ecological flows;

(d) significant reduction in water availability for downstream users;

(e) impact on groundwater-dependent ecosystems;

(f) material conflicts over water use.

Where potential risks exist, the project holder shall demonstrate that they can be adequately prevented, mitigated, monitored, and managed (NRMMC, EPHC & NHMRC, 2009).

8 Eligible activities

The eligible activities under this methodology correspond to interventions aimed at increasing aquifer recharge, the underground storage of water, or the temporal regulation of water flows within a defined hydrological or hydrogeological system.

The activities shall generate a measurable, additional water benefit attributable to the project, compared to the baseline scenario. Such a benefit may manifest through increased recharge, increased underground storage, improvement of base flow, spring recovery, the temporal regulation of water flows, or the improvement of water availability during dry periods.

The eligible activities may include new systems, the rehabilitation of existing systems, the recovery of traditional systems, the expansion of recharge or regulation infrastructure, and the optimization of systems already in operation, provided that they generate additional water benefits.

The activities may include, among others:

(a) traditional water management systems, such as amunas, qochas, or other equivalent systems;

(b) channels, ditches, structures, or systems for conveying water toward infiltration or recharge zones;

(c) ponds, infiltration lagoons, infiltration basins, infiltration fields, or infiltration areas;

(d) runoff retention, dispersion, or regulation structures;

(e) small-scale dikes, check dams, or other equivalent structures;

(f) streambeds or areas intervened to favor infiltration, temporary storage, or water regulation;

(g) recharge systems through wells, galleries, deep trenches, or other infiltration structures;

(h) hybrid systems that combine water infrastructure, nature-based solutions, and water management practices.

8.1 Implementation of new managed recharge or water regulation systems

This includes the implementation of new natural, artificial, traditional, or hybrid systems designed to capture, convey, infiltrate, store, delay, disperse, or regulate water in order to increase aquifer recharge, underground storage, or the availability of the water resource over time (Dillon et al., 2009).

These activities may include, among others:

(a) the construction of channels, ditches, irrigation canals, conveyance structures, or equivalent systems to direct water toward infiltration or recharge zones;

(b) the implementation of ponds, infiltration lagoons, infiltration basins, infiltration fields, or infiltration areas;

(c) the construction of runoff retention, dispersion, or regulation structures;

(d) the implementation of small-scale dikes, check dams, or other equivalent structures;

(e) the adaptation of streambeds, floodplains, or dispersion areas to favor infiltration, temporary storage, or water regulation;

(f) the implementation of recharge wells, infiltration galleries, deep trenches, or other recharge structures;

(g) the implementation of hybrid systems that combine water infrastructure, nature-based solutions, and water management practices.

8.2 Rehabilitation, recovery, or optimization of existing systems

This includes activities aimed at recovering, improving, or increasing the hydrological or hydrogeological performance of existing recharge or water regulation systems that are deteriorated, underused, partially operational, or functioning below their actual capacity.

These activities may include, among others:

(a) the rehabilitation of channels, ditches, conveyance, infiltration, retention, or dispersion structures;

(b) the removal of obstructions, sediment, or other materials that reduce the system's conveyance, infiltration, or regulation capacity;

(c) the repair or stabilization of deteriorated structures;

(d) the recovery of infiltration or recharge areas that have lost functionality;

(e) the expansion of conveyance, infiltration, temporary storage, or dispersion capacity;

(f) the improvement of system operation through the planned management of flows, opening times, diversion periods, or water distribution;

(g) the incorporation of control points, measurement systems, or regulation structures that make it possible to improve the performance and traceability of the system.

In such cases, only the verifiable increase relative to the system's performance in the baseline scenario may be considered an additional water benefit.

8.3 Traditional water management systems

Traditional water management systems developed, maintained, or used by local communities, Indigenous Peoples, or traditional communities shall be eligible, provided that they meet the applicability conditions established in this methodology (Zheng et al., 2021).

These systems may include, among others:

(a) amunas;

(b) qochas;

(c) traditional infiltration or recharge irrigation canals;

(d) ancestral channels conveying water toward infiltration zones;

(e) traditional systems for the temporary storage and delayed release of water;

(f) other equivalent community water management systems aimed at recharge, underground storage, or water regulation.

The historical or cultural existence of these systems shall not in itself be sufficient to generate water benefits under this methodology. The project holder shall demonstrate that the activities implemented generate a measurable increase attributable to the project relative to the baseline scenario, through rehabilitation, recovery, expansion, managed operation, structured maintenance, or verifiable improvement of the system's hydrological performance.

8.4 Nature-based solutions and hybrid interventions

Nature-based solutions and hybrid systems shall be eligible where their principal objective is to improve aquifer recharge, underground storage, or the temporal regulation of water flows.

These activities may include, among others:

(a) the restoration or recovery of recharge zones;

(b) the restoration of wetlands or temporary storage areas linked to recharge or water regulation processes;

(c) the functional reconnection of streambeds, floodplains, or infiltration zones;

(d) revegetation or restoration of strategic areas where their direct contribution to recharge, underground storage, or water regulation is demonstrated;

(e) the establishment of vegetative barriers, buffer strips, or other ecological interventions that favor the retention, infiltration, or regulation of flows;

(f) the integration of small-scale infrastructure with ecological restoration to improve the temporal availability of water.

Nature-based solutions shall be eligible under this methodology only where their principal water benefit is attributable to managed recharge, underground storage, or hydrological regulation processes. Other environmental benefits, such as biodiversity, carbon, or water quality, may be reported as co-benefits, but shall not be accounted for as water benefits under this methodology unless they are quantified in accordance with their specific requirements.

8.5 Eligible complementary activities

Activities may be considered complementary where they are necessary to implement, maintain, monitor, or improve the performance of recharge or water regulation systems.

These activities may include:

(a) the installation of sensors, hydrometric stations, rain gauges, piezometers, or other monitoring instruments;

(b) the construction or improvement of control points for measuring flows, levels, or volumes;

(c) the implementation of geographic information systems, databases, or hydrological monitoring tools;

(d) the periodic maintenance of conveyance, infiltration, retention, or regulation infrastructure;

(e) community activities for the operation, cleaning, surveillance, or maintenance of the system;

(f) training, governance, and operational strengthening actions directly linked to the continuity of the system.

These complementary activities shall not generate water benefits in themselves, except to the extent that they contribute to a verifiable increase in recharge, underground storage, or water regulation attributable to the project.

8.6 Activities not covered by this methodology

Activities whose principal objective is water quality improvement, the remediation of surface water bodies, wastewater treatment, the reduction of pollutant loads, eutrophication control, pollutant removal, oxygenation, bioremediation, sargassum management, or the functional restoration of lakes, rivers, reservoirs, lagoons, bays, or coastal bodies shall not be covered by this methodology, unless such activities form part of a managed recharge or water regulation system and the quantified water benefit corresponds exclusively to recharge, underground storage, or the temporal regulation of flows.

Benefits associated with water quality improvement or the functional restoration of surface water bodies shall be quantified through the corresponding methodology of the BioCarbon Water Standard, where one exists.

9 Baseline scenario and additionality

The project holder shall establish a baseline scenario that represents the hydrological, hydrogeological, and operational conditions that would have occurred in the absence of the project activities.

The demonstration of additionality shall be based on the comparison between:

(a) the baseline scenario, which represents the without-project condition; and

(b) the with-project scenario, which represents the condition resulting from the implementation, rehabilitation, recovery, expansion, optimization, or managed operation of the recharge or water regulation system.

Only the water benefits that are additional to the baseline scenario, attributable to the project activities, and supported by verifiable information may be considered for quantification under this methodology (Reig et al., 2019).

9.1 Identification of the baseline scenario

The baseline scenario shall describe the hydrological, hydrogeological, and operational condition of the project area and its area of influence before the implementation of the project activities, or in the absence of such activities.

The baseline shall make it possible to determine what would reasonably have occurred without the project with respect to:

(a) water availability;

(b) the natural or managed recharge of aquifers;

(c) underground storage;

(d) the behavior of base flows;

(e) spring discharge;

(f) the temporal regulation of water flows;

(g) the functioning of existing recharge or water regulation systems;

(h) water availability during dry periods.

The baseline shall be established in a conservative manner and on the basis of measurable, traceable, and documented information.

9.2 Baseline assessment and reference period

The baseline assessment shall include the collection and analysis of sufficient information to characterize the relevant hydrological or hydrogeological system and establish an appropriate reference scenario.

Depending on the type of project and the availability of information, the project holder shall collect, at a minimum, information on:

(a) the delimitation of the basin, sub-basin, micro-basin, aquifer, recharge zone, discharge zone, and area of influence;

(b) historical precipitation, climatic seasonality, occurrence of dry periods, and interannual variability;

(c) surface flows, base flows, water-table levels, spring discharge, or water availability, where such information exists or can be generated;

(d) the hydrogeological characteristics of the system, including the type of aquifer, permeability, probable flow direction, and recharge and discharge zones, where applicable;

(e) the initial condition of the natural, artificial, traditional, or hybrid systems associated with recharge or water regulation;

(f) the prior operational capacity of channels, ditches, infiltration structures, dispersion areas, qochas, amunas, dikes, infiltration ponds, recharge wells, or other relevant components;

(g) current water uses, existing users, ecological flows, and possible downstream dependencies;

(h) water quality, where there is a risk of impact on aquifers, soils, ecosystems, or users;

(i) current and customary water management practices in the project area;

(j) relevant socioeconomic information on water access, availability, or vulnerability.

The reference period used for establishing the baseline shall be sufficient to represent the hydrological and climatic variability of the project area.

For climatic and hydrological variables, the project holder shall preferably use historical series of at least ten (10) years prior to the start of the project, where such information is available.

Where sufficient local series do not exist, data from meteorological or hydrometric stations located in comparable areas, recognized satellite products, technical or academic studies, official data, documented community information, or field measurements generated specifically for the project may be used.

Where data with shorter periods are used, the project holder shall justify their representativeness and apply conservative assumptions to avoid the overestimation of water benefits.

9.3 Baseline by type of intervention

The baseline shall be defined in accordance with the type of intervention implemented.

9.3.1 New systems

Where the project implements a new managed aquifer recharge or water regulation system in an area where such a system did not previously exist, the baseline shall correspond to the hydrological and hydrogeological condition without the system implemented by the project.

The prior absence of the recharge or regulation system does not imply that the natural recharge of the area is equal to zero. The project holder shall distinguish between the natural recharge or the hydrological flows that would occur in the absence of the project and the additional benefit attributable to the activities implemented.

In this case, the additional water benefit shall correspond to the net increase in recharge, underground storage, base flow, spring discharge, or water regulation attributable to the implemented system, relative to the without-project condition.

9.3.2 Rehabilitation, recovery, or optimization of existing systems

Where the project consists of the rehabilitation, recovery, expansion, optimization, or managed operation of an existing system, the baseline shall correspond to the actual functioning of the system before the project intervention.

In such cases, the original, historical, potential, or theoretical capacity of the system shall not be used as the baseline, unless that capacity verifiably reflects the actual functioning expected in the absence of the project.

The baseline shall take into account the physical and operational condition of the system before the intervention, the volume of water effectively captured, conveyed, infiltrated, recharged, or regulated before the project, the actual frequency of operation or maintenance, the failures or limitations that affected its performance, and the expected trend of the system without intervention.

The additional water benefit shall correspond solely to the difference between the system's performance with the project and the performance that would reasonably have occurred without the project.

9.3.3 Traditional water management systems

Where the project involves traditional water management systems, such as amunas, qochas, or other equivalent systems, the historical or cultural existence of the system shall not in itself preclude the applicability of this methodology.

Nevertheless, the baseline shall represent the actual condition of the system before the project intervention, including its state of conservation, level of operation, functional capacity, and effective hydrological contribution.

The project holder shall document, as appropriate, the historical or traditional use of the system, the condition prior to the intervention, the level of functioning before the project, the rehabilitation, recovery, maintenance, or managed operation activities implemented, the hydrological contribution expected or measured before and after the intervention, and the community or institutional agreements necessary for its operation and maintenance.

The additional water benefit shall be limited to the verifiable increase generated by the project activities and shall not be based solely on the historical existence of the system or on its undemonstrated potential capacity.

9.4 Demonstration of additionality

The project holder shall demonstrate that the quantified water benefits are additional, attributable to the project, and would not have occurred in the absence of the activities implemented.

The demonstration of additionality shall include, at a minimum:

(a) a comparison between the baseline scenario and the with-project scenario;

(b) evidence that the activities generate a verifiable increase in recharge, underground storage, water availability, base flow, spring discharge, or water regulation;

(c) a demonstration that the activities do not correspond exclusively to mandatory measures required by law, regulation, license, permit, administrative order, or other binding instrument;

(d) an analysis of whether the activities constitute common practice in the project area or in equivalent systems;

(e) a justification that the quantified water benefit is a direct consequence of the project activities and not of ordinary climatic variations, external interventions, or changes not attributable to the project.

Where legal, regulatory, administrative, contractual, or licensing obligations exist, the project holder shall demonstrate that the activities exceed the mandatory minimum requirements and that only the water benefit generated above those requirements will be considered additional (BioCarbon Cert, 2026).

Where an activity is widely adopted or represents the customary practice of the territory, the project holder shall demonstrate that the project introduces additional improvements, such as a verifiable increase in recharge or water regulation capacity, the rehabilitation of deteriorated or inoperative systems, the expansion of the spatial or functional reach of the system, the incorporation of monitoring, managed operation, or structured maintenance, or a demonstrable improvement in water availability during dry periods.

9.5 Confirmation of additionality

Only water benefits that simultaneously meet the following conditions may be considered for quantification under this methodology:

(a) they are measurable or estimable through technically justified methods;

(b) they are additional to the baseline scenario;

(c) they are attributable to the project activities;

(d) they do not correspond to the mere transfer of water between users, zones, sub-basins, or ecosystems;

(e) they do not generate significant negative impacts on third parties, ecosystems, or ecological flows;

(f) they are duly documented and verifiable.

Where there is uncertainty regarding the additionality or attribution of the water benefit, the project holder shall apply conservative assumptions and limit quantification to the volume that can be reasonably demonstrated.

10 Quantification of volumetric water benefits

The quantification of volumetric water benefits under this methodology is based on the estimation of the additional water benefit generated by managed aquifer recharge and water regulation activities, compared to the baseline scenario.

The benefits shall be expressed in cubic meters of water per year (m^3/year) or in cubic meters of water during the corresponding monitoring period, according to the duration of the period assessed.

Quantification shall be carried out in a conservative, transparent, traceable manner consistent with the type of system implemented, the availability of data, and the hydrological and hydrogeological conditions of the project area.

10.1 General quantification principle

The water benefit under this methodology corresponds to the net additional volume of water attributable to the project activities, associated with one or more of the following effects:

(a) an increase in aquifer recharge;

(b) an increase in underground storage;

(c) an improvement in the temporal regulation of water flows;

(d) an increase in base flow or in spring discharge during periods of lower water availability;

(e) a verifiable increase in water availability attributable to the operation of the recharge or water regulation system.

The net water benefit shall be calculated using the following general expression:

$$NWB = GWB - BL - D_{l,k,u} \quad \text{Equation 1}$$

Where:

NWB	=	Net water benefit attributable to the project; m^3
GWB	=	Gross water benefit measured or estimated in the with-project scenario; m^3
BL	=	Water benefit that would occur in the baseline scenario; m^3
$D_{l,k,u}$	=	Applicable deductions for non-eligible losses, leakage, uncertainty, or other conservative adjustments; m^3

Only the net water benefit may be considered for the issuance of Verified Water Credits (VWC), in accordance with the requirements of the BioCarbon Water Standard.

10.2 Selection of the water benefit metric

The project holder shall select and justify the principal water benefit metric that will be used for quantification.

The selected metric shall be consistent with the type of system, the objective of the intervention, the way the water benefit manifests, and the availability of monitoring data.

The metrics applicable under this methodology include:

(a) Volume of water recharged: the additional volume of water that contributes to aquifer recharge or underground storage as a result of the project.

(b) Volume of additional underground storage: the additional volume of water stored in the aquifer or hydrogeological system attributable to the project.

(c) Volume of water effectively regulated: the additional volume of water available during periods of lower precipitation or greater scarcity, attributable to the temporal regulation generated by the project.

(d) Additional volume discharged as base flow or spring flow: the additional volume of water that manifests as an increase in base flow, spring discharge, or other delayed flows attributable to recharge or water regulation.

The project holder shall avoid double counting among these metrics. The same volume of water shall not be accounted for simultaneously as recharged water, stored water, regulated water, and discharged water. Where a project generates several related hydrological effects, the project holder shall select a principal metric or clearly demonstrate that the quantified volumes do not overlap.

10.3 Quantification approaches

Quantification under this methodology shall take into account the with-project scenario, the baseline scenario, and the deductions for non-eligible losses, leakage, uncertainty, and other applicable conservative adjustments.

The quantification of water benefits may be carried out through one or more of the following approaches:

(a) direct measurement;

(b) system water balance;

(c) hydrological or hydrogeological modeling;

(d) verifiable hydrogeological evidence.

The selected approach shall be appropriate for the type of project, the scale of the intervention, the availability of data, and the hydrological or hydrogeological conditions of the area (Reig et al., 2019).

10.3.1 Quantification through direct measurement

Direct measurement shall be prioritized where it is technically feasible and where adequate instruments exist to record the volumes of water captured, conveyed, infiltrated, recharged, discharged, or regulated by the system.

Direct measurement may be carried out through:

(a) flow sensors;

(b) hydrometric stations;

(c) calibrated flow measurement structures;

(d) level gauges;

(e) piezometers;

(f) weirs, Parshall flumes, or other calibrated hydraulic devices;

(g) storage or level sensors in regulation structures;

(h) equivalent instrumental records.

Where the flow diverted or conveyed into the system is measured, the volume of water entering during the monitoring period shall be calculated as:

$$V_{in,t} = \sum (Q_t \times \Delta t) \quad \text{Equation 2}$$

Where:

$V_{in,t}$	=	Volume of water entering or conveyed into the system during period t; m^3
Q_t	=	Flow measured during the time interval t; m^3/s
Δt	=	Duration of the measurement interval; seconds

Where the system receives water from multiple entry points, the total volume entering shall be calculated as the sum of the volumes measured at all relevant entry points.

The gross volume recharged or regulated shall be calculated by deducting the volumes that do not contribute to the eligible water benefit:

$$V_{gr,t} = V_{in,t} + P_{s,t} - V_{out,t} - V_{evap,t} - V_{ov,t} - V_{use,t} - V_{l,t} - \Delta S_{sup,t} \quad \text{Equation 3}$$

Where:

$V_{gr,t}$	=	Gross volume potentially recharged or regulated during period t; m^3
$V_{in,t}$	=	Volume of water entering or conveyed into the system during period t; m^3
$P_{s,t}$	=	Direct precipitation over the surface of the system during period t, where applicable; m^3
$V_{out,t}$	=	Volume of surface outflow not attributable to recharge or water regulation during period t; m^3
$V_{evap,t}$	=	Volume lost to evaporation during period t; m^3
$V_{ov,t}$	=	Volume lost to overflow or system exceedance during period t; m^3
$V_{use,t}$	=	Volume used directly for uses not associated with the recharge or regulation benefit during period t; m^3
$V_{l,t}$	=	Other operational or non-eligible losses during period t; m^3
$\Delta S_{sup,t}$	=	Change in the surface storage of the system during period t; m^3

Where the change in surface storage is positive, it shall be deducted from the gross volume, since the water remains stored and has not yet generated the quantified water benefit. Where the change is negative, it may be added to the balance if it is demonstrated that the released volume effectively contributed to recharge, discharge, or water regulation during the period assessed.

Where not all the infiltrated or conveyed volume contributes to effective recharge, underground storage, or water regulation, an effective recharge factor shall be applied:

$$V_{R,t} = V_{gr,t} \times F_{RE,t} \qquad \text{Equation 4}$$

Where:

$V_{R,t}$	=	Volume of effective recharge or water regulation attributable to the system during period t; m^3
$V_{gr,t}$	=	Gross volume potentially recharged or regulated during period t; m^3
$F_{RE,t}$	=	Effective recharge factor or contribution to water regulation; dimensionless, between 0 and 1

The effective recharge factor shall be based on site-specific information, field measurements, hydrogeological studies, modeling, tracers, applicable technical literature, or duly justified conservative assumptions.

10.3.2 Quantification through system water balance

Where it is not possible to directly measure all relevant flows, the project holder may quantify the water benefits through a water balance of the recharge or regulation system.

The water balance shall represent the inflows, outflows, losses, and storage changes during the monitoring period (Dunne & Leopold, 1978).

The general equation shall be:

$$R_t = (I_t - O_t - L_t - \Delta A_t) \times F_{RE,t} \quad \text{Equation 5}$$

Where:

R_t	=	Volume of effective recharge or water regulation during period t; m^3
I_t	=	Total water inflows to the system during period t; m^3
O_t	=	Non-eligible outflows from the system during period t; m^3
L_t	=	System losses during period t; m^3
ΔA_t	=	Change in the surface or temporary storage of the system during period t; m^3
$F_{RE,t}$	=	Effective recharge factor or contribution to water regulation; dimensionless, between 0 and 1

The inflows may include direct precipitation, captured runoff, diverted flows, seasonal surpluses, conveyed flows, or temporarily stored volumes.

The outflows and losses may include evaporation, overflow, unused discharges, surface outflows not associated with recharge, non-eligible direct uses, operational losses, and other flows that do not contribute to the quantified water benefit.

The water balance shall be applied with a temporal resolution appropriate to the functioning of the system. Where possible, a daily or monthly resolution shall be used. An annual resolution shall only be acceptable where the system has low temporal variability or where the project holder justifies that a finer resolution is not reasonably feasible and that the approach applied is conservative.

10.3.3 Quantification through hydrological or hydrogeological modeling

Where the system is complex, operates at the basin or sub-basin scale, or where the water benefits manifest through multiple flow pathways, the project holder may use hydrological or hydrogeological models to quantify the project benefits (U.S. Army Corps of Engineers, n.d.).

Modeling may be used to estimate, among others:

(a) additional aquifer recharge;

(b) changes in underground storage;

(c) variations in base flow;

(d) additional spring discharge;

(e) travel times;

(f) the spatial and temporal distribution of water benefits;

(g) the interaction between surface water and groundwater.

The models used shall be appropriate for the system assessed and shall document, at a minimum:

(a) the objective of the model;

(b) the spatial and temporal boundaries;

(c) the input data;

(d) the assumptions and parameters used;

(e) the sources of information;

(f) calibration and validation, where possible;

(g) sensitivity analysis;

(h) the associated uncertainty;

(i) the results of the baseline scenario;

(j) the results of the with-project scenario.

Where modeling is used, the additional water benefit shall be calculated as the difference between the modeled result of the with-project scenario and the modeled result of the baseline scenario:

$$WB_{add,t} = M_{WP,t} - M_{BL,t} \quad \text{Equation 6}$$

Where:

$WB_{add,t}$	=	Additional water benefit during period t; m^3
$M_{WP,t}$	=	Modeled result of the with-project scenario during period t; m^3
$M_{BL,t}$	=	Modeled result of the baseline scenario during period t; m^3

Models shall be calibrated with site-specific data wherever it is reasonably feasible. Where it is not possible to calibrate the model with local data, the project holder shall justify the use of regional parameters or technical literature and apply conservative uncertainty deductions.

10.3.4 Quantification through verifiable hydrogeological evidence

Where the water benefit manifests principally as an observed hydrogeological response, the project holder may quantify the benefit through verifiable hydrogeological evidence.

This approach may be applied where sufficient data exist to demonstrate changes attributable to the project in variables such as:

(a) water-table levels;

(b) underground storage;

(c) base flow;

(d) spring discharge;

(e) moisture or storage in the subsurface profile, where relevant;

(f) water travel time;

(g) water availability during dry periods.

Where water-table levels are used to estimate changes in underground storage, the following equation may be applied for unconfined aquifers:

$$\Delta V_{gw,t} = A_{aq} \times S_y \times \Delta h_t \qquad \text{Equation 7}$$

Where:

$\Delta V_{gw,t}$	=	Change in underground storage during period t; m^3
A_{aq}	=	Area of the aquifer or zone of influence considered; m^2
S_y	=	Specific yield of the aquifer; dimensionless
Δh_t	=	Change in the water-table level attributable to the project during period t; m

For confined or semi-confined aquifers, the project holder shall use the appropriate storage coefficient and technically justify the equation applied.

Where the increase in base flow or spring discharge is used, the additional volume shall be calculated as the difference between the flow observed with the project and the flow expected in the baseline scenario:

$$V_{Qadd,t} = \sum \left(Q_{WP,t} - Q_{BL,t}\right) \times \Delta t \qquad \text{Equation 8}$$

Where:

$V_{Qadd,t}$	=	Additional volume associated with base flow or spring discharge during period t; m^3
$Q_{WP,t}$	=	Flow observed or estimated in the with-project scenario during interval t; m^3/s
$Q_{BL,t}$	=	Flow expected in the baseline scenario during interval t; m^3/s
Δt	=	Duration of the measurement interval; seconds

The flow expected in the baseline scenario shall be estimated through historical data, control sites, rainfall–runoff relationships, hydrological modeling, comparison with non-intervened micro-basins, or other technically justified methods.

Where comparisons with control sites or non-intervened micro-basins are used, it shall be demonstrated that such areas are hydrologically and climatically comparable to the project area.

10.4 Adjustment for climate variability

The quantification of the water benefit shall distinguish between the effects attributable to the project and those derived from ordinary climatic variations or extreme events.

The project holder shall adjust the quantification, where relevant, taking into account variables such as:

(a) annual and seasonal precipitation;

(b) the temporal distribution of precipitation;

(c) evapotranspiration;

(d) droughts or anomalously wet years;

(e) significant changes in temperature or other climatic variables;

(f) antecedent hydrological conditions.

Where the data show that an increase in recharge, base flow, spring discharge, or water availability can be explained wholly or partly by favorable climatic conditions, the project holder shall deduct such an effect or apply a conservative assumption.

10.5 Determination of the additional water benefit

The additional water benefit shall be calculated as the difference between the result of the with-project scenario and the baseline scenario.

$$WB_{add,t} = WB_{WP,t} - WB_{BL,t} \quad \text{Equation 9}$$

Where:

$WB_{add,t}$ = Additional water benefit during period t; m³

$WB_{WP,t}$	=	Water benefit estimated or measured in the with-project scenario during period t; m³
$WB_{BL,t}$	=	Water benefit expected in the baseline scenario during period t; m³

Where the result is negative or cannot be demonstrated with sufficient evidence, the additional water benefit for the corresponding period shall be considered equal to zero.

Non-demonstrated benefits shall not be carried over from one monitoring period to another.

10.6 Deductions to determine the net water benefit

Once the additional water benefit has been determined, the corresponding deductions shall be applied to obtain the net water benefit.

$$NWB_t = WB_{add,t} - LK_t - UN_t - AD_t \qquad \text{Equation 10}$$

Where:

NWB_t	=	Net water benefit during period t; m³
$WB_{add,t}$	=	Additional water benefit during period t; m³
LK_t	=	Leakage deduction during period t; m³
UN_t	=	Uncertainty deduction during period t; m³
AD_t	=	Other applicable conservative adjustments during period t, including adjustments for performance, non-eligible losses, or other factors; m³

The deductions shall be applied before determining the volume eligible for the issuance of VWC.

Where it is not possible to quantify a deduction precisely, the project holder shall apply a conservative approach that avoids the overestimation of the net water benefit.

10.7 Conversion into Verified Water Credits

Verified Water Credits (VWC) shall be determined on the basis of the net water benefit quantified, monitored, audited, and declared in conformity for the corresponding monitoring period.

$$VWC_t = NWB_t \qquad \text{Equation 11}$$

Where:

VWC_t	=	Verified Water Credits corresponding to period t; m^3
NWB_t	=	Net water benefit during period t; m^3

One (1) VWC represents one (1) cubic meter of net water benefit (BioCarbon Cert, 2026).

No VWC shall be issued for projected benefits, unmonitored benefits, benefits not attributable to the project, or benefits that have not been audited and declared in conformity in accordance with the requirements of the BioCarbon Water Standard.

10.8 Prevention of double counting

The project holder shall demonstrate that the water benefits quantified under this methodology have not been accounted for, recognized, or issued under another methodology, program, recognition mechanism, financial instrument, or offsetting initiative (BioCarbon Cert, 2026).

The same volume of water shall not be accounted for simultaneously as:

(a) water infiltrated under an infiltration methodology;

(b) water captured, stored, or used under a rainwater harvesting methodology;

(c) water recharged, stored underground, or regulated under this methodology;

(d) water restored or improved in quality under a water quality improvement methodology.

Where there is potential overlap between activities, metrics, or methodologies, the project holder shall clearly separate the spatial, temporal, and volumetric boundaries of each benefit. In cases of uncertainty, the most conservative approach shall be applied and the volume shall be assigned to a single methodological category (Reig et al., 2019).

10.9 Quantification traceability requirements

The project holder shall retain and make available for audit all the information used in the quantification, including:

(a) field measurement data;

(b) climatic, hydrological, and hydrogeological series;

(c) records of system operation;

(d) the assumptions and parameters used;

(e) intermediate calculations;

(f) models, input and output files, where applicable;

(g) maps, geospatial files, and delimitations used;

(h) evidence of instrument calibration or validation;

(i) the justification of deductions, adjustment factors, and conservative assumptions;

(j) documentation of data quality control.

The information shall be sufficient to enable the independent reproduction of the calculations and the conformity assessment by the Conformity Assessment Body.

11 Aquifer protection and water quality

Managed aquifer recharge and water regulation activities shall be implemented in such a way that they do not cause the deterioration of the quality of surface water, groundwater, soils, associated ecosystems, or the current or potential uses of the water resource (NRMMC, EPHC & NHMRC, 2009).

Water quality is considered in this methodology as a condition of environmental protection and risk management. This methodology does not quantify benefits associated with water quality improvement, the reduction of pollutant loads, wastewater treatment, the remediation of water bodies, or the functional restoration of lakes, rivers, reservoirs, lagoons, bays, or other surface water bodies (EPA Victoria, 2009).

11.1 Water quality risk assessment

The project holder shall assess whether the water source used, conveyed, infiltrated, recharged, or regulated may pose risks to the aquifer, the soils, the connected water bodies, the ecosystems, or the water users.

The assessment shall take into account (NRMMC, EPHC & NHMRC, 2009), as appropriate:

(a) the origin of the water used for recharge or regulation;

(b) possible upstream sources of contamination;

(c) land uses in the capture, conveyance, infiltration, or recharge areas;

(d) the characteristics of the aquifer or receiving system;

(e) the vulnerability of the aquifer to contamination;

(f) the current or potential uses of groundwater or surface water;

(g) the applicable regulations on water quality, aquifer recharge, or the protection of water sources (International Association of Hydrogeologists, n.d.).

11.2 Compatibility with the receiving system

Where the activities involve infiltration or recharge into an aquifer or hydrogeological system, the project holder shall demonstrate that the quality of the water is compatible with the receiving system and does not pose a significant risk of deterioration (NRMMC, EPHC & NHMRC, 2009).

Where there is a risk of contamination, the project holder shall implement prevention, control, or treatment measures before considering the associated volume as eligible for the quantification of water benefits.

These measures may include, among others:

(a) the exclusion of contaminated sources;

(b) sedimentation or the removal of solids;

(c) sediment traps, filters, or pretreatment structures;

(d) the protection of capture, conveyance, and infiltration zones;

(e) erosion control;

(f) preventive water quality monitoring;

(g) the temporary suspension of operation where the water quality is not compatible with the intended recharge or regulation.

11.3 Water quality monitoring

Where the risk analysis identifies material risks of water quality deterioration, the project holder shall include quality parameters in the monitoring plan.

The parameters shall be selected in accordance with the water source, the receiving system, the risks identified, the water uses, and the applicable regulations.

Where monitoring evidences a quality deterioration attributable to the project, the project holder shall exclude from the quantification the volumes associated with the affected component or period, until it is demonstrated that the risk has been corrected or mitigated.

11.4 Relationship with water quality improvement benefits

Water quality improvements that may be generated as a co-benefit of the project may be reported qualitatively or through complementary indicators, but shall not be used to increase the volume of water benefits quantified under this methodology.

Benefits associated with water quality improvement shall be quantified through the corresponding methodology of the BioCarbon Water Standard, where applicable.

12 Permanence of the water benefit and performance adjustments

The water benefits generated by managed aquifer recharge and water regulation activities depend on the adequate functioning of the system during the corresponding monitoring period. Therefore, the project holder shall demonstrate that the activities implemented operated to a degree sufficient to generate the reported water benefits.

For the purposes of this methodology, the permanence of the water benefit does not imply that the water must remain indefinitely stored in the subsoil or within the hydrological system. In managed recharge and water regulation systems, the benefit may manifest as recharge, temporal storage, delayed release, an increase in base flow, spring recovery, or greater water availability during dry periods.

Consequently, permanence shall be understood as the functional continuity of the system and the demonstrable existence of the water benefit during the monitoring period for which the benefits are quantified.

The natural or managed release of water toward base flows, springs, water bodies, users, or ecosystems shall not be understood as a loss of the water benefit, where such a release corresponds to the intended function of the recharge or water regulation system.

Where, during a monitoring period, operational failures, infrastructure deterioration, sedimentation, obstruction, abandonment of maintenance, reduction of the water source, extreme climate events, or other factors that diminish the performance of the system occur, the project holder shall adjust the quantification of the water benefit to reflect only the volumes effectively generated and demonstrated.

No VWC shall be issued for water benefits that have not been generated, monitored, or demonstrated during the corresponding monitoring period.

12.1 Demonstration of water benefit permanence

The project holder shall demonstrate that the system maintained its functionality during the monitoring period.

The permanence of the water benefit may be demonstrated through:

(a) records of system operation;

(b) records of maintenance, cleaning, or repair;

(c) evidence of the functioning of channels, ditches, amunas, qochas, retention structures, infiltration areas, recharge wells, or other relevant components;

(d) measurements of flow, conveyed volume, water-table level, spring discharge, base flow, or other relevant indicators;

(e) field inspections;

(f) community or institutional records, where applicable;

(g) evidence that the system maintains its capacity to capture, convey, infiltrate, store, recharge, or regulate water in accordance with its intended function.

12.2 Operation and maintenance plan

The project holder shall have an operation and maintenance plan proportionate to the type, scale, and complexity of the recharge or water regulation system (EPA Victoria, 2009).

The plan shall include, at a minimum:

(a) the identification of the critical components of the system;

(b) those responsible for operation, inspection, maintenance, and repair;

(c) the frequency of inspections and maintenance activities;

(d) procedures for cleaning, sediment removal, unclogging, and repair;

(e) measures to maintain the capacity for capture, conveyance, infiltration, recharge, or regulation;

(f) procedures to control erosion, sedimentation, clogging, or structural deterioration;

(g) rules for the operation of the system, including periods of capture, diversion, closure, opening, or water distribution;

(h) response protocols in the event of failures, extreme events, or reduced performance;

(i) mechanisms for community or institutional participation, where applicable;

(j) documentary records of the activities carried out.

Where the project involves traditional water management systems, such as amunas, qochas, or other equivalent systems, the operation and maintenance plan shall recognize the community arrangements, local practices, traditional knowledge, and responsibilities associated with the operation of the system.

12.3 Failures, deterioration, or interruptions

Where failures, deterioration, or interruptions occur that reduce the capacity of the system for capture, conveyance, infiltration, recharge, or regulation, the project holder shall exclude from the quantification the volumes not generated or not demonstrated.

These failures may include, among others:

(a) the collapse or deterioration of infrastructure;

(b) the sedimentation, clogging, or obstruction of channels, ditches, qochas, amunas, ponds, wells, galleries, or equivalent structures;

(c) the loss of infiltration or recharge capacity;

(d) abandonment or lack of maintenance;

(e) damage from extreme events;

(f) interruptions in the operation of the system;

(g) the loss of critical instruments or monitoring points;

(h) access restrictions that prevent verification of the system's performance.

If the failure is corrected during the same monitoring period, only the benefits effectively generated before and after the correction may be quantified, provided that they are supported by verifiable information.

12.4 Extreme climate events

Where droughts, floods, landslides, or other extreme events occur that affect the generation of the water benefit, the project holder shall reflect such effects in the quantification of the corresponding period.

The occurrence of an extreme event does not automatically generate an additional deduction. The adjustment shall be based on the actual performance observed or conservatively estimated during the monitoring period.

The project holder shall distinguish between:

(a) ordinary climate variability, which shall be incorporated into the baseline, the quantification, and the management of uncertainty;

(b) extreme events that reduce the generation of benefits during a monitoring period;

(c) failures or losses of system functionality attributable to extreme events.

12.5 Post-issuance adjustments

Since VWCs are issued ex post, performance reductions occurring in subsequent periods shall not affect the water benefits previously issued, unless a material error, double counting, false information, or subsequent evidence is identified demonstrating that the benefit reported for the issued period was not effectively generated.

In such cases, the project holder shall report the situation and apply the adjustments that correspond in accordance with the procedures of the BioCarbon Water Standard (BioCarbon Cert, 2026).

12.6 Documentation

The project holder shall document the information used to demonstrate the permanence of the water benefit and the performance of the system during each monitoring period.

The documentation shall include, as appropriate:

(a) operation records;

(b) records of maintenance, cleaning, or repair;

(c) field inspections;

(d) photographic or georeferenced evidence;

(e) community or institutional records;

(f) hydrological or hydrogeological measurements;

(g) failures, interruptions, or extreme events identified;

(h) corrective actions implemented;

(i) adjustments applied to the quantification;

(j) the technical justification of the volumes considered for the issuance of VWC.

13 Leakage, downstream effects, and adjustment for indirect impacts

The project holder shall identify, assess, and, where applicable, quantify the leakage and indirect impacts associated with managed aquifer recharge and water regulation activities.

For the purposes of this methodology, leakage corresponds to negative hydrological or hydrogeological impacts occurring outside the project's quantification boundaries as a consequence of the activities implemented, and which may reduce, displace, or nullify part of the reported water benefits.

The purpose of the leakage assessment is to ensure that the quantified water benefits represent a real net increase in water availability, aquifer recharge, underground storage, or the temporal regulation of water flows, and not a mere transfer of water between users, ecosystems, sub-basins, or hydrogeological units.

The leakage identified shall be deducted from the additional water benefit in order to determine the project's net water benefit.

13.1 Difference between system losses and leakage

The project holder shall clearly differentiate between system losses and leakage.

System losses correspond to volumes of water that enter the recharge or regulation system but do not contribute to the eligible water benefit within the quantification boundaries. These losses may include evaporation, overflow, unused surface outflows, operational losses, surface storage not converted into a water benefit, or non-eligible direct uses. These losses shall be deducted during the calculation of the gross or effective volume of the system.

Leakage, in contrast, corresponds to indirect or displaced negative impacts occurring outside the project's quantification boundaries as a consequence of the activities implemented. These may include, among others, a reduction in water availability for downstream users, an impact on ecological flows, the displacement of withdrawals toward other sources, or the transfer of water pressure toward other hydrological or hydrogeological units.

13.2 Identification of potential leakage sources

The project holder shall carry out a systematic assessment to identify possible leakage sources associated with the project activities.

The potential leakage sources may include, among others:

(a) a reduction in water availability for users, ecosystems, or water bodies located downstream;

(b) an impact on ecological flows, environmental flows, or flows necessary to maintain ecological functions;

(c) the displacement of withdrawal, consumption, or water pressure toward other sources, zones, or periods;

(d) the transfer of water pressure between basins, sub-basins, micro-basins, aquifers, or hydrogeological units;

(e) the negative alteration of discharge zones, springs, wetlands, or groundwater-dependent ecosystems;

(f) a reduction in temporal availability during critical periods for users or ecosystems;

(g) indirect operational changes, including induced increases in consumption or the expansion of high water-demand activities;

(h) the deterioration of water quality that affects the functional suitability of the water resource in aquifers, water bodies, soils, or connected ecosystems.

13.3 Spatial boundary for leakage assessment

The project holder shall define a spatial boundary for the leakage assessment, which may extend beyond the project area and the quantification boundaries where necessary to capture relevant hydrological or hydrogeological impacts.

The spatial boundary shall take into account, as appropriate:

(a) reaches downstream of the capture, diversion, retention, or regulation points;

(b) potentially affected water users;

(c) applicable ecological flows or environmental requirements;

(d) surface water bodies connected to the intervened system;

(e) the recharge and discharge zones of the relevant aquifer or hydrogeological system;

(f) springs, wetlands, or groundwater-dependent ecosystems;

(g) possible connections with adjacent sub-basins, micro-basins, aquifers, or hydrogeological units;

(h) areas where activities, withdrawals, consumption, or pressures on the water resource may be displaced as a result of the project.

The delimitation shall be justified in the Project Document and shall be consistent with the hydrological or hydrogeological conceptual model of the system.

13.4 Materiality assessment

The project holder shall assess the materiality of each potential leakage source identified, taking into account:

(a) the probable magnitude of the impact;

(b) the duration of the impact;

(c) the spatial location;

(d) the hydrological, ecological, or social sensitivity of the affected area;

(e) the existence of users, water-use rights, or ecosystems dependent on the water resource;

(f) the probability of occurrence;

(g) the capacity for monitoring or verification;

(h) the degree of attribution of the impact to the project activities.

Leakage may be considered non-material where the project holder demonstrates, with sufficient evidence, that its magnitude is negligible and that it does not compromise users, ecological flows, water-dependent ecosystems, or existing rights.

Leakage below five percent (5%) of the additional water benefit of the monitoring period may be considered negligible, provided that this determination is technically justified, transparently documented, and does not entail negative impacts on ecological flows, sensitive ecosystems, vulnerable users, or existing use rights.

13.5 Quantification and deduction of leakage

Where leakage is material, the project holder shall quantify it in volumetric terms, expressed in cubic meters (m^3), for the corresponding monitoring period.

The total leakage deduction shall correspond to the sum of the material leakage volumes identified during the monitoring period:

$$LK_t = \sum LK_{i,t} \qquad \text{Equation 12}$$

Where:

LK_t	=	Total leakage deduction during period t; m^3
$LK_{i,t}$	=	Material leakage i identified during period t; m^3

Where the same leakage may be classified under more than one category, the project holder shall avoid the double deduction of the same volume.

The quantification of leakage may be based on direct measurements, water balances, comparison with the baseline, control sites, user information, withdrawal data, downstream flows, modeling, or technically justified proxy values.

Where it is not possible to quantify a material leakage precisely, the project holder shall apply a conservative approach, which may include:

(a) the use of technically justified proxy values;

(b) the application of conservative deduction factors;

(c) the exclusion of the affected volume;

(d) the reduction of the eligible water benefit;

(e) the suspension of benefit accounting for the affected activity or component until sufficient information is available.

No VWC shall be issued for water benefits affected by material leakage that has not been quantified or adequately managed.

13.6 Leakage prevention and mitigation measures

The project holder shall identify and implement measures to prevent or mitigate material leakage.

These measures may include, as appropriate:

(a) operating rules that avoid downstream impacts;

(b) the maintenance of ecological flows or minimum flows;

(c) maximum limits for capture, diversion, or retention;

(d) the seasonal scheduling of recharge or regulation activities;

(e) coordination mechanisms with downstream users;

(f) the monitoring of flows at critical points;

(g) the monitoring of springs, wetlands, or dependent ecosystems;

(h) measures to avoid the displacement of withdrawals toward other sources;

(i) community or institutional agreements for water management;

(j) operational adjustments where negative impacts are detected.

The prevention and mitigation measures shall be documented in the Project Document and verified during the monitoring periods.

13.7 Leakage monitoring and reassessment

The project holder shall monitor the potential leakage sources throughout the monitoring period.

The monitoring shall be proportionate to the risk, scale, and complexity of the project, and may include:

(a) downstream flows;

(b) water-table levels;

(c) spring discharge;

(d) water availability for relevant users;

(e) compliance with ecological flows;

(f) changes in water withdrawal or consumption in related areas;

(g) indicators of water-dependent ecosystems;

(h) complaints, conflicts, or reports from stakeholders related to water availability.

The leakage assessment shall be updated at each monitoring period and where significant changes occur in the system, in water use, in climatic conditions, in the operation of the project, or in the conditions of the related users and ecosystems.

13.8 Non-permissible conditions

Activities that generate leakage or indirect impacts that meet any of the following conditions shall not be eligible under this methodology:

(a) they produce a net reduction in water availability in the relevant hydrological or hydrogeological system;

(b) they compromise ecological flows or applicable environmental requirements;

(c) they significantly affect existing water-use rights;

(d) they generate material negative impacts on downstream users;

(e) they deteriorate ecosystems dependent on surface water or groundwater;

(f) they transfer water pressure toward other basins, sub-basins, aquifers, or sources without a conservative deduction;

(g) they cannot be reasonably assessed or conservatively quantified;

(h) they generate material conflicts over water use that are not adequately managed.

Where any of these conditions occurs during a monitoring period, the project holder shall exclude the affected volume from the quantification of water benefits and apply the corresponding corrective measures.

14 Uncertainty management

The project holder shall identify, assess, document, and manage the uncertainty associated with the quantification of the water benefits generated by managed aquifer recharge and water regulation activities.

The purpose of uncertainty management is to ensure that net water benefits are not overestimated and that the volumes considered for the issuance of VWC reflect conservative, traceable, and technically justified estimates.

Where material uncertainty exists regarding the magnitude, attribution, timing, or permanence of the water benefit, the project holder shall apply conservative deductions or limit quantification to the volume that can be demonstrated with sufficient evidence.

14.1 Sources of uncertainty

The project holder shall identify the sources of uncertainty relevant to the quantification of the water benefit.

The sources of uncertainty may include, among others:

(a) measurement errors associated with sensors, flow meters, piezometers, hydrometric stations, rain gauges, or other instruments;

(b) uncertainty in calibration curves, stage–discharge curves, hydraulic structures, or relationships used to estimate flows and volumes;

(c) gaps, discontinuities, or errors in climatic, hydrological, or hydrogeological data series;

(d) uncertainty in precipitation, evapotranspiration, evaporation, runoff, infiltration, storage, or discharge data;

(e) uncertainty associated with the delimitation of the area of influence, recharge zone, discharge zone, or relevant hydrogeological unit;

(f) uncertainty in hydrogeological parameters, such as specific yield, storage coefficient, transmissivity, hydraulic conductivity, effective porosity, or flow direction;

(g) uncertainty in effective recharge factors or recharge efficiency;

(h) uncertainty associated with hydrological or hydrogeological models, including model structure, parameterization, calibration, validation, and sensitivity;

(i) uncertainty in the estimation of the baseline scenario;

(j) uncertainty in the attribution of the water benefit to the project relative to climate variability, land-use changes, external interventions, or other factors not attributable to the project;

(k) uncertainty in the estimation of leakage, losses, or other conservative adjustments;

(l) uncertainty derived from the use of proxy data, technical literature, regional values, or default assumptions;

(m) uncertainty associated with the timing of the benefit, including travel time, discharge delay, underground storage, or the manifestation of the benefit in base flows or springs.

14.2 Uncertainty assessment

The uncertainty assessment shall be consistent with the quantification approach used.

Where direct measurement is used, the project holder shall assess the precision of the instruments, the frequency of measurement, the calibration and maintenance of equipment, the spatial representativeness of the measurement points, and the existence of missing data, outliers, or discontinuities.

Where a water balance is used, the project holder shall assess the uncertainty associated with each component of the balance, including inflows, outflows, losses, storage changes, and effective recharge factors.

Where hydrological or hydrogeological modeling is used, the project holder shall assess the uncertainty in the input data, parameters, model structure, calibration, validation, sensitivity analysis, and attribution of the benefit to the project.

Where quantification is based on verifiable hydrogeological evidence, the project holder shall assess the representativeness of piezometers, springs, control points, or monitoring sites; the estimation of changes in water-table levels; the delimitation of the hydrogeological area of influence; the separation between project effects and climatic effects; and the estimation of travel time.

Where it cannot be sufficiently demonstrated that the observed benefit is attributable to the project, the corresponding volume shall be excluded or conservatively adjusted.

14.3 Quantification and deduction for uncertainty

The project holder shall quantify the uncertainty where sufficient data exist to do so, through statistical or analytical methods, error propagation, confidence intervals, sensitivity analysis, or estimation ranges.

The uncertainty may be expressed as absolute error, relative error, confidence interval, standard deviation, sensitivity range, conservative lower bound, or percentage of uncertainty applicable to the calculated water benefit.

Where the uncertainty is material, the project holder shall apply an uncertainty deduction to the additional water benefit.

The uncertainty deduction may be calculated as:

$$UN_t = WB_{add,t} \times DF_{UN,t} \qquad \text{Equation 13}$$

Where:

UN_t	=	Uncertainty deduction during period t; m³
$WB_{add,t}$	=	Additional water benefit during period t; m³
$DF_{UN,t}$	=	Uncertainty deduction factor during period t; dimensionless, between 0 and 1

The uncertainty deduction factor shall be technically justified and shall reflect the quality of the data, the robustness of the quantification method, the representativeness of the monitoring, the uncertainty of the baseline scenario, and the capacity to attribute the benefit to the project.

Alternatively, where confidence intervals or estimation ranges are available, the project holder may directly determine the conservative water benefit using the technically justified lower bound of the quantified result.

Uncertainties below five percent (5%) of the additional water benefit of the monitoring period may be considered non-material, provided that the estimate is technically justified, the sources of uncertainty are documented, the quality of the data is sufficient, and the determination does not lead to the overestimation of the water benefit.

14.4 Conservative approach and data treatment

The project holder shall apply a conservative approach in all cases where the uncertainty may lead to the overestimation of the water benefit.

The conservative approach may include:

(a) the use of the lower bound of a confidence interval;

(b) the exclusion of non-representative or non-verifiable data;

(c) the application of deduction factors;

(d) the use of reasonable minimum values for effective recharge parameters;

(e) the use of reasonable maximum values for losses, leakage, or non-eligible outflows;

(f) the exclusion of periods with insufficient data;

(g) the reduction of the eligible volume where attribution to the project is partial or uncertain;

(h) the application of the lowest result where several technically valid quantification approaches exist.

The project holder shall have procedures to identify, review, and treat missing data, outliers, measurement errors, and monitoring gaps.

Missing data may be completed through interpolation, data from nearby stations, hydrological relationships, models, or proxy values only where the method is technically justified and does not lead to overestimation.

Missing data shall not be completed through assumptions that increase the water benefit, unless sufficient evidence exists to support such an estimate.

Outliers shall not be automatically excluded. The project holder shall assess whether such values represent measurement errors or real hydrological conditions. Any exclusion of data shall be documented and technically justified.

14.5 Documentation and updating of uncertainty

The project holder shall transparently document all the sources of uncertainty identified and the methods used to assess and manage them.

The documentation shall include, at a minimum:

(a) a description of the sources of uncertainty;

(b) the affected variables;

(c) the estimated magnitude of the uncertainty, where possible;

(d) the method used to quantify it or assess it qualitatively;

(e) the justification of conservative assumptions;

(f) the deductions applied;

(g) the treatment of missing data or outliers;

(h) sensitivity analysis, where applicable;

(i) the limitations of the approach used;

(j) evidence of calibration, validation, or data quality control;

(k) the justification of the selection of the uncertainty deduction factor.

The uncertainty assessment shall be reviewed at each monitoring period and updated where relevant changes occur in the monitoring system, measurement instruments, availability or quality of data, quantification approach, hydrological or hydrogeological model, baseline scenario, climatic or hydrological conditions, system operation, or leakage risks.

Where the updating of information reduces the uncertainty, the project holder may adjust the uncertainty deduction factor for future periods. Reductions in uncertainty deductions shall not be applied retroactively to periods already audited and declared in conformity, unless the BioCarbon Water Standard or its applicable procedures expressly permit it.

15 Monitoring of project activities

The monitoring of project activities is aimed at verifying the effective implementation of managed aquifer recharge and water regulation systems, collecting the information necessary for the periodic quantification of water benefits, and demonstrating the permanence of the benefit during each monitoring period.

Monitoring shall make it possible to:

(a) verify that the eligible activities were implemented and operated in accordance with the project design;

(b) record the data necessary for the quantification of the gross, additional, and net water benefit;

(c) assess the performance of the recharge or water regulation system;

(d) verify the functionality of the capture, conveyance, infiltration, recharge, storage, or regulation components;

(e) identify system losses, leakage, uncertainty, operational failures, or required adjustments;

(f) support the quantification of the VWC corresponding to the monitoring period.

15.1 Monitoring plan

The project holder shall structure the monitoring plan in accordance with the type of system implemented, the quantification approach selected, and the hydrological and hydrogeological conditions of the project area.

The monitoring plan shall be consistent with:

(a) the conceptual model of the system;

(b) the spatial boundaries of the project;

(c) the area of influence;

(d) the baseline scenario;

(e) the quantification approach applied;

(f) the potential leakage sources;

(g) the risks of performance loss;

(h) the data quality and traceability requirements.

The monitoring shall be designed in such a way that it makes it possible to compare the with-project scenario against the baseline scenario and to demonstrate that the quantified water benefits are additional, attributable, and verifiable.

15.2 Monitoring variables

The monitoring plan shall include the variables necessary to support the quantification of the water benefit and the applicable adjustments.

As appropriate to the type of project, variables of the following categories shall be monitored:

(a) Hydrological variables: flow or volume captured, conveyed, entering the system, infiltrated, discharged, released, overflowed, or lost; base flow; spring discharge; water levels in temporary storage structures; the duration of capture, conveyance, infiltration, or regulation events.

(b) Hydrogeological variables: water-table levels, hydraulic pressure, changes in underground storage, spring discharge, probable flow direction, travel time, the interaction between surface water and groundwater, and the hydrogeological response following recharge or regulation events.

(c) Meteorological variables: precipitation, temperature, evapotranspiration or evaporation, relative humidity, solar radiation, wind speed, and the occurrence of droughts, extreme rainfall, floods, or other relevant climatic events (Allen et al., 1998).

(d) Operational variables: dates and periods of operation, diverted volumes, the opening or closing of gates or diversion points, the physical condition of the system, sedimentation, clogging, obstructions, erosion, structural damage, maintenance, repairs, interruptions, and corrective measures.

(e) Geospatial variables: the boundaries of the project area, area of influence, and the capture, conveyance, infiltration, recharge, temporary storage, and discharge zones; water bodies, springs, wetlands, infrastructure, monitoring points, and zones potentially associated with leakage or downstream impacts.

(f) Water quality variables: parameters defined in accordance with the water quality risk analysis and aquifer protection, where applicable.

(g) Leakage and indirect impact variables: downstream flows, water availability for relevant users, compliance with ecological flows, changes in water withdrawal or consumption, indicators of dependent ecosystems, and reports from stakeholders.

The selected variables shall be sufficient to reproduce the net water benefit calculations and to verify the consistency of the quantification approach applied.

15.3 Monitoring points, frequency, and methods

The project holder shall define monitoring points sufficient to adequately represent the functioning of the system and the quantified water benefits.

The monitoring points shall be georeferenced and documented. As appropriate, they may include capture, diversion, system-entry, outflow or overflow, infiltration or recharge, and temporary storage points, as well as wells, piezometers, springs, base-flow measurement points, downstream points, control sites, and water quality sampling points (ISO 19111, 2019).

The monitoring frequency shall be sufficient to capture the temporal dynamics of the system and to support the quantification of the water benefit. The project holder shall define the measurement frequency in accordance with:

(a) the precipitation regime;

(b) the seasonality of the system;

(c) the periods of capture, conveyance, infiltration, or recharge;

(d) the expected travel time;

(e) the variability of flows or levels;

(f) the quantification approach applied;

(g) the sensitivity of the water benefit to failures or extreme events.

Where possible, continuous or high-frequency monitoring is recommended for critical variables such as flow, water level, precipitation, and water-table level.

At a minimum, the monitoring plan shall contemplate:

(a) monitoring during the periods of system operation;

(b) monitoring during the rainy season or period of greatest capture;

(c) monitoring during the dry season or period of manifestation of the water benefit;

(d) operational inspections at least once per year;

(e) the recording of extreme events or relevant failures when they occur.

The monitoring methods may include direct measurements, automatic sensors, hydrometric stations, meteorological stations, piezometers, spring measurements, field observations, operational records, satellite imagery, geographic information systems, calibrated modeling, control sites, or documented community records.

15.4 Monitoring of traditional water management systems

Where the project involves traditional water management systems, such as amunas, qochas, or other equivalent systems, the monitoring plan shall be adapted to their technical, cultural, community, and operational characteristics.

The monitoring shall consider, as appropriate:

(a) the length, location, and condition of the traditional channels or structures;

(b) the capture, diversion, infiltration, and discharge points;

(c) the traditional periods of operation;

(d) community activities for cleaning, maintenance, or rehabilitation;

(e) operation records maintained by communities or local authorities;

(f) community observers or local persons responsible for monitoring;

(g) the associated springs, base flows, or discharge points;

(h) the travel time or manifestation of the water benefit;

(i) changes in water availability during dry periods.

Community records may be used as complementary evidence, provided that they are documented, traceable, and consistent with other sources of technical information (Zheng et al., 2021).

15.5 Monitoring report and records

The project holder shall prepare a monitoring report for each monitoring period.

The report shall include, at a minimum:

(a) a description of the activities implemented during the period;

(b) the operational condition of the system;

(c) the variables monitored;

(d) the data sources used;

(e) the location of the monitoring points;

(f) the results of the hydrological, hydrogeological, meteorological, operational, geospatial, and water quality monitoring, where applicable;

(g) the assessment of leakage and downstream impacts;

(h) the uncertainty assessment;

(i) the extreme events, failures, or interruptions that occurred;

(j) the maintenance activities and corrective actions;

(k) the calculations of the gross, additional, and net water benefit;

(l) the deductions applied;

(m) the justification of the assumptions used;

(n) updated geospatial information;

(o) relevant documentary, photographic, or technical evidence.

The project holder shall retain all monitoring records, databases, calculations, reports, geospatial files, operation records, maintenance evidence, and other information used for the quantification of the water benefit.

The information shall be organized in such a way that it makes it possible to verify the traceability between the field data, the processed data, the calculations performed, the deductions applied, the net water benefit reported, and the VWC requested for issuance.

16 Document management, quality control, and information assurance

The project holder shall implement and maintain a document management, quality control, and information assurance system that makes it possible to organize, retain, verify, and make available the information used for the design, implementation, monitoring, quantification, and reporting of the project's water benefits.

This system shall ensure the traceability between the activities implemented, the data monitored, the calculations performed, the deductions applied, and the net water benefits reported under this methodology.

The document management, quality control, and information assurance procedures shall be proportionate to the type, scale, complexity, level of risk, and quantification approach applied by the project.

16.1 Document management system

The project holder shall have a document management system that makes it possible to retain and organize, at a minimum, the following information:

(a) the Project Document;

(b) a description of the project holder and the actors involved;

(c) the location of the project area and the area of influence;

(d) a description of the managed aquifer recharge or water regulation system;

(e) documentation on the rights, permits, authorizations, or agreements necessary to implement the activities;

(f) the information used to establish the baseline scenario;

(g) information on the hydrological, hydrogeological, climatic, environmental, and operational conditions of the project;

(h) monitoring records;

(i) operation and maintenance records;

(j) geospatial information;

(k) calculation files;

(l) hydrological or hydrogeological models, where applicable;

(m) monitoring reports;

(n) quality control evidence;

(o) information used to assess leakage, uncertainty, water quality, and conservative adjustments;

(p) audit reports and relevant communications from the conformity assessment process.

The information shall be retained in formats that allow its review, reproduction, and traceability during the period required by the BioCarbon Water Standard and its applicable procedures.

16.2 Minimum technical information

The project holder shall retain technical information sufficient to enable the independent assessment of the reported water benefits.

This information shall include, as appropriate:

(a) the delimitation of basins, sub-basins, micro-basins, aquifers, recharge zones, discharge zones, and the area of influence;

(b) the climatic, hydrological, and hydrogeological series used;

(c) records of precipitation, flows, water-table levels, spring discharge, storage, infiltration, overflows, or system outflows;

(d) water quality data, where applicable;

(e) the raw data and processed data used in the quantification;

(f) the location and description of the monitoring points;

(g) records from sensors, flow meters, piezometers, rain gauges, hydrometric stations, or other instruments;

(h) evidence of the calibration, maintenance, or verification of critical instruments;

(i) community or institutional records of operation and maintenance, where applicable;

(j) photographs, videos, field records, or georeferenced evidence;

(k) the justification of assumptions, parameters, effective recharge factors, deduction factors, and conservative adjustments;

(l) documentation of missing data, outliers, corrections, or data exclusions.

Where community records or local knowledge are used in traditional water management systems, such as amunas, qochas, or other equivalent systems, these shall be documented, dated, traceable, and consistent with the available technical information.

16.3 Geospatial information

The project holder shall maintain up-to-date geospatial information that makes it possible to represent and verify the location of the relevant elements of the project.

The geospatial information shall include, as appropriate:

(a) the boundaries of the project area;

(b) the area of influence;

(c) the capture zones;

(d) the conveyance zones;

(e) the infiltration or recharge zones;

(f) the temporary storage zones;

(g) the discharge zones;

(h) water bodies, springs, wetlands, or related ecosystems;

(i) the location of infrastructure implemented, rehabilitated, or optimized;

(j) the monitoring points;

(k) relevant users, communities, or beneficiary areas;

(l) zones potentially associated with leakage or downstream impacts.

The geospatial files shall be retained in formats that allow their independent review, including, where applicable, vector files, raster files, geographic databases, metadata, and the coordinate reference systems used (ISO 19111, 2019).

16.4 Quality control of data, calculations, and models

The project holder shall implement quality control procedures to ensure that the data, calculations, and models used in the quantification are complete, consistent, traceable, and technically reliable.

The quality control shall include, at a minimum:

(a) verification of the temporal and spatial consistency of the data;

(b) the identification and review of missing data, outliers, measurement errors, or inconsistencies;

(c) verification of units, conversions, formulas, and links in the calculation files;

(d) review of the input data used in the quantification;

(e) review of the deductions for leakage, uncertainty, non-eligible losses, and other conservative adjustments;

(f) verification that there is no double counting of volumes;

(g) verification of the calibration, maintenance, or proper functioning of critical instruments;

(h) review of the consistency between field data, databases, calculation files, maps, and reports;

(i) documentation of corrections, exclusions, or adjustments made;

(j) the internal review of the results before their inclusion in the monitoring report.

Where hydrological or hydrogeological models are used, the project holder shall retain and review the information necessary to assess the consistency of the model, including input data, parameters, assumptions, scenarios, output files, calibration, validation, sensitivity analysis, and uncertainty, where applicable (EPA Victoria, 2009).

Where sufficient evidence does not exist regarding the quality, calibration, origin, or traceability of critical data, the project holder shall exclude such data or apply a conservative approach.

16.5 Traceability, version control, and backup

The document management system shall make it possible to trace each reported result back to its original sources.

The traceability shall cover, at a minimum:

(a) the origin of the data;

(b) the date of collection;

(c) the method of measurement or estimation;

(d) the instruments used;

(e) the person responsible for collection or processing;

(f) the quality controls applied;

(g) the use of the data in the calculations;

(h) the relationship between data, calculations, deductions, and the reported net water benefit.

The project holder shall implement version control for documents, databases, calculation files, models, maps, and reports. Such control shall make it possible to identify the current version, modification dates, those responsible, and a description of the changes made.

The project holder shall implement information backup and security mechanisms proportionate to the volume, sensitivity, and relevance of the data managed, including backup copies, secure storage, access control, and protection against loss or unauthorized alteration.

16.6 Personnel competence and internal review

The project holder shall ensure that the personnel responsible for the collection, processing, analysis, modeling, quantification, and reporting of data have the competence appropriate to the tasks assigned.

Competence may be demonstrated through technical or professional education, relevant experience, specific training, instruction in the use of instruments, or experience in traditional, community, or local water management systems, where applicable.

Before submitting a monitoring report or a request for the issuance of VWC, the project holder shall carry out an internal review of the reported information. This review shall verify, at a minimum:

(a) compliance with the applicability conditions;

(b) consistency between the activities implemented and the eligible activities;

(c) the completeness of the baseline information;

(d) the consistency of the quantification approach applied;

(e) the quality and traceability of the data;

(f) the correct application of deductions;

(g) the absence of double counting;

(h) consistency between the monitoring report, the calculation files, the databases, and the geospatial information;

(i) the availability of documentary support.

The findings of the internal review and the corrective actions applied shall be documented.

16.7 Confidentiality and availability for conformity assessment

The project holder may classify as confidential commercial, contractual, financial, or sensitive information, in accordance with the applicable procedures of the BioCarbon Water Standard (BioCarbon Cert, 2026).

Nevertheless, the information necessary to assess the conformity of the project, demonstrate additionality, reproduce the quantification of water benefits, assess leakage, uncertainty, data quality, and methodological compliance shall be available to the Conformity Assessment Body and to BioCarbon, as appropriate.

The classification of information as confidential shall not prevent the technical review necessary to determine the conformity of the project with this methodology.

Where the information is not sufficient to reproduce, verify, or assess the reported water benefits, the corresponding volume shall not be considered for the issuance of VWC.

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