



METHODOLOGICAL DOCUMENT

**Sustainable Management and
Conservation of Water Resources**

BWS0005

**Quantification of Volumetric Water Benefits
from Water Use Efficiency and Loss Reduction**

BIOCARBON CERT[®]

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Acronyms and abbreviations

ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
AWWA	American Water Works Association
CARL	Current Annual Real Losses
CV(RMSE)	Coefficient of Variation of the Root Mean Square Error
DMA	District Metered Area
EVO	Efficiency Valuation Organization
FAVAD	Fixed and Variable Area Discharge
GUM	Guide to the Expression of Uncertainty in Measurement
ILI	Infrastructure Leakage Index
IPMVP	International Performance Measurement and Verification Protocol
IWA	International Water Association
JCGM	Joint Committee for Guides in Metrology
MNF	Minimum Night Flow
NMBE	Normalized Mean Bias Error
NRW	Non-Revenue Water
NWB	Net Water Benefit
SIV	System Input Volume
UARL	Unavoidable Annual Real Losses
USAID	United States Agency for International Development
VWBA	Volumetric Water Benefit Accounting
WVC	Verified Water Credit
WRI	World Resources Institute
WSUP	Water and Sanitation for the Urban Poor

1 Introduction

Freshwater availability is affected by increasing demand, climate variability, pollution, and inefficient management. Improving water use efficiency and reducing physical losses can reduce pressure on freshwater sources where the resulting savings translate into lower withdrawal.

Distribution-system losses require careful interpretation. Physical leakage represents water lost from the network, while apparent losses arise from unauthorized use, metering inaccuracies, or data-handling errors. A reduction in reported non-revenue water does not, by itself, demonstrate a reduction in freshwater withdrawal.

This methodology establishes the procedures for identifying eligible activities, defining management units and measurement boundaries, establishing the without-project baseline, monitoring water use, and calculating net water benefits under the BioCarbon Water Standard. It applies to water use efficiency and loss reduction projects in facilities, distribution networks, irrigation systems, and portfolios of management units.

Quantification compares measured reporting-period water use with a baseline restated to comparable conditions. The approach follows the measurement and adjustment principles of the IPMVP, with statistical and uncertainty methods applied where relevant to the selected baseline approach. The project holder shall demonstrate attribution, the connection to freshwater withdrawal, and the treatment of leakage and uncertainty.

Results are expressed in cubic meters (m³) of net water benefit for each monitoring period. They support ex post issuance of Verified Water Credits only after completion of the applicable BWS audit and conformity determination process.

2 Objectives

The objective of this methodology is to provide practical and reproducible procedures for quantifying net water benefits from water use efficiency and loss reduction activities under the BioCarbon Water Standard.

The methodology establishes:

- (a) eligible project activities and applicability conditions;

- (b) the characterization of management units, measurement boundaries, and water supply arrangements;
- (c) baseline and additionality requirements;
- (d) measurement, adjustment, and calculation procedures;
- (e) the treatment of leakage, uncertainty, and changes in performance; and
- (f) monitoring, reporting, and evidence requirements supporting audit and ex post credit issuance.

The requirements shall be applied according to the activity, measurement conditions, and risk of overestimating the water benefit.

3 Version

This document corresponds to the Draft for Public Consultation Version of the methodology BWS0005 – Quantification of Volumetric Water Benefits from Water Use Efficiency and Loss Reduction, issued by BioCarbon Cert on October 13, 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, 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 quantifying, monitoring, and reporting volumetric water benefits derived from water use efficiency and loss reduction activities implemented on metered water systems.

The methodology is applicable to projects that reduce metered water use at a facility or use system, or that reduce system input volume or losses within a defined distribution zone, through demand-side or supply-side efficiency interventions, provided that the project meets the applicability conditions of this document and the requirements of the BioCarbon Water Standard.

The methodology is agnostic to the contractual, financing, or ownership arrangement used to deliver the activities. Projects may be implemented directly by a water user, by a utility, by a service provider, or under any financing model, provided that the eligibility, additionality, and quantification requirements are met and the rights to the water benefit are clearly established.

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 quantifies reductions in freshwater withdrawal attributable to water use efficiency and loss reduction activities.

Three quantities are distinguished: the measured change in water use; the gross saving attributable to the project after the baseline has been adjusted to reporting-period

conditions; and the net water benefit after the applicable deductions. These quantities shall not be treated as interchangeable.

Eligible activities may reduce physical losses in a distribution network, reduce water supplied to a facility or use system, or reduce apparent losses where an actual reduction in freshwater withdrawal is demonstrated. Internal reuse or recycling is eligible only to the extent that it reduces external freshwater input.

Measurement may occur at the abstraction point, at a facility inlet, at an isolated subsystem, or at the inlet and outlet points of a distribution zone. Where measurement occurs downstream of the abstraction point, the project holder shall demonstrate the connection between the measured saving and the reduction in freshwater withdrawal in accordance with Section 7.6.

Throughout this methodology, “metered water use” means the volume of freshwater withdrawn or supplied within the measurement boundary. It does not mean consumptive water use. References to authorized consumption in a distribution-system water balance retain their meaning under the IWA water-balance framework.

Results shall be expressed as net volumetric water benefits in cubic meters (m³) for the corresponding monitoring period. Reductions in water consumption that cannot be demonstrated through the withdrawal route are outside the scope of this version.

4.2 Scope boundaries

This methodology does not cover:

- (a) water supply enhancement activities, which increase availability, storage, infiltration, or regulated flow and are quantified under the corresponding supply-side methodology;
- (b) water quality improvement activities where the principal benefit is a reduction in pollutant load rather than a volumetric saving; quality improvements may be reported as co-benefits but shall not be quantified as water benefits under this methodology;
- (c) source substitution that merely transfers withdrawal between freshwater sources. Where reuse or another supply substitution demonstrably reduces freshwater withdrawal, only that reduction may be quantified, subject to

Section 7.6 and the applicable safeguards. The volume supplied by the alternative source shall not itself be treated as the water benefit;

- (d) activities relying solely on simulation, without any post-implementation measurement.

The same unit of water benefit shall not be accounted for, recognized, or issued more than once: within this methodology, across the activity categories of the Standard, or against any other water, carbon, or compliance-mechanism claim.

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 with another methodology of the Standard, the project holder shall apply a conservative approach and assign each volume to a single methodological category.

4.4 Scale of application

This methodology does not establish a minimum project scale. Projects may comprise a single facility, an isolated subsystem, a distribution zone, an irrigated area, or a portfolio of such units.

For this methodology, a management unit is the facility, subsystem, distribution zone, or irrigated area for which the measurement boundary, baseline, project activities, and water benefit can be separately identified and evaluated.

Each management unit shall have a unique identifier and documented measurement points. Its description shall identify the water supply arrangement, the activities implemented, the baseline conditions, and the records used for quantification.

A project may combine several activities within one management unit. Their combined effect may be quantified at a common measurement boundary, provided that the benefit is attributable to the project and is counted only once.

For portfolios, calculations shall be maintained by management unit and monitoring period. Aggregation shall exclude overlapping volumes and account for transfers of water use between units. Where units are nested within a larger metered system, the project holder shall use either the encompassing boundary or a documented allocation that prevents the same saving from being counted at both levels.

4.5 Application procedure

The methodology shall be applied through the following sequence.

Stage	Required output
Project characterization	Description of the activities, management units, water sources, measurement boundaries, and relevant implementation dates.
Baseline and additionality	Documented baseline, selected quantification approach, and evidence supporting the without-project scenario.
Implementation and monitoring	Records demonstrating implementation, operation of the measures, and collection of the required data.
Quantification and reporting	Reproducible calculations of gross savings, adjustments, deductions, and net water benefits for each monitoring period.
Audit and conformity determination	Submission of the applicable project and monitoring documentation for independent CAB audit and BioCarbon's determination under the BWS.

The project holder prepares the documentation and calculations. The CAB evaluates the evidence and reports its audit conclusions. BioCarbon makes the determination of conformity and the applicable registration and issuance decisions.

The expression “measurement and verification” refers to the technical approaches of the IPMVP. It does not establish separate validation and verification processes under the BWS.

5 Assumptions and limitations of the methodology

This methodology relies on technical and operational assumptions necessary to quantify volumetric water benefits from efficiency and loss reduction activities.

The project holder shall assess, document, and justify these assumptions in accordance with the characteristics of the metered system, the project scale, and the availability of data.

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.

5.1 General assumptions of application

The application of this methodology rests on the following assumptions:

- (a) pre-implementation water use data from fiscal meters, billing records, or data logging are sufficiently complete and accurate to construct a representative baseline;
- (b) the measurement boundary can be delimited behind a defined meter;
- (c) routine drivers of water use can be identified and, where material, adjusted for in accordance with baseline construction procedure and the quantification procedure of this methodology, consistent with the IPMVP;
- (d) non-routine events in the baseline or reporting period can be identified and adjusted for;
- (e) the quantified saving corresponds to a demonstrable reduction in freshwater withdrawal, taking account of the supply arrangement, displacement of water use, and relevant return flows;
- (f) deductions for leakage, uncertainty, and other conservative adjustments prevent overestimation of the net water benefit.

A reduction in recorded water use may result from project activities, changes in operating conditions, measurement corrections, or a combination of these effects. The project holder shall identify their contribution to the result. Changes unrelated to the project shall be addressed through the baseline and its adjustments, while effects caused by the project shall remain in the measured result or be accounted for through the applicable deductions. Improved measurement or billing alone shall not generate a creditable saving.

Where an activity takes time to affect water use, the project holder shall document the operational start of the measure and the period over which its effect can be demonstrated. No benefit shall be quantified before sufficient post-implementation measurement is available.

5.2 Applicability limitations

This methodology shall not be applicable where:

- (a) the activity does not demonstrate reduced freshwater withdrawal under the procedures of this methodology, but merely substitutes or displaces water use;
- (b) the water benefit cannot be robustly and conservatively quantified, monitored, or verified;
- (c) the activity is required by law, regulation, or binding public policy and the project holder does not meet the Additionality Safeguard of the Standard;
- (d) the intervention restricts access to water for vulnerable users in a manner inconsistent with the right of access to sufficient water.

This 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, low quality, or insufficient resolution of metering of consumption or system input volume;
- (b) short or incomplete historical series of metered data over the baseline period;
- (c) uncertainty in the baseline and in the baseline model;
- (d) difficulty in separating the effect of the project from variation in routine drivers, such as weather, occupancy, or production;

- (e) difficulty in attributing changes in Metered water use or losses exclusively to the project rather than to concurrent operational, tariff, or behavioural changes;
- (f) changes in static factors during the reporting period that require non-routine adjustment;
- (g) uncertainty in the parameters and structure of the baseline model, including goodness-of-fit as measured by CV(RMSE) and NMBE;
- (h) the absence of representative measurement points, sub-metering, or district metered areas;
- (i) in loss-reduction activities, uncertainty in the water balance and in the estimation of real and apparent losses, including the reliability of minimum-night-flow and component-based analyses;
- (j) uncertainty in the time required for a measure to manifest in metered data;
- (k) difficulty in quantifying leakage or effects occurring outside the measurement boundary.

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

Where a baseline model is used, its suitability shall be evaluated against the requirements of Section 9.1, including the representativeness of the data, the treatment of material drivers, and the uncertainty of the resulting saving. A documented baseline rate may be used instead of a statistical model where the conditions established in Section 9.1 are met. An uncertainty deduction shall not be used to justify a model or baseline that cannot reliably represent the without-project condition.

5.4 Permanence of the benefit and conservative approach

This methodology does not assume that a reduction in water use or losses achieved in one period persists indefinitely. The water benefit consists of the reduction achieved

during each monitoring period and depends on the continued operation and maintenance of the measure.

Therefore, the permanence of the water benefit shall be assessed based on the functional continuity of the measure and the demonstrable existence of the reduction during the corresponding monitoring period. Where the measure is disabled, bypassed, degraded, or reverts to the pre-project condition, the benefit shall not be credited beyond the volumes effectively measured.

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 the gross water saving;
- (b) selection of reasonable maximum values for system losses, leakage, or non-eligible reductions;
- (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) selection of the best-supported method in accordance with the measurement hierarchy, with conservative treatment of unresolved differences that could materially affect the water benefit.

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

6 Terms and definitions

Terms defined in the glossary of the Standard apply as defined there and are not reproduced in this methodology. Where a term is used in both documents, the definition of the Standard prevails. For the purposes of this methodology, and in addition to that glossary, the following definitions apply.

Additionality

The requirement that the water benefit would not have occurred in the absence of the project activity, relative to the baseline scenario.

Adjusted baseline

The water use or system input volume expected without the project, restated to the duration and conditions of the reporting period using the selected baseline approach and the applicable adjustments.

Apparent (commercial) losses

The annual volume of water lost through unauthorized consumption and metering inaccuracies, including data-handling errors. (IWA, 2016)

Automated control system

A system that governs the operation of an efficiency or loss-reduction measure; such as the timing, rate, pressure, zoning, or scheduling of water use, conveyance, or distribution; through automated logic, whether rule-based, sensor-driven or otherwise. The control system is the means of delivering the measure; the water benefit arises from the metered reduction in water use or losses, not from the control technology itself.

Baseline scenario

The water use or system input volume that would reasonably occur without the project activities, including independently expected changes and improvements, adjusted to the conditions of the reporting period.

Baseline period

The representative period, before implementation of the project activity, over which consumption or system input volume is measured to characterize the pre-project condition. (IPMVP, EVO 2022)

Combined standard uncertainty

The standard uncertainty of a calculated result obtained by propagating and combining the relevant input uncertainties, including significant correlations where present.

Conservative approach

The consistent selection, where uncertainty exists, of assumptions, values, and methods that tend to under-estimate rather than over-estimate the water benefit, in order to avoid over-crediting.

Coverage factor

The numerical multiplier applied to the combined standard uncertainty to obtain the expanded uncertainty. The coverage factor used and its associated coverage probability shall be stated and justified; a value of $k = 2$ may be used where it provides a coverage probability of approximately 95 % under the applicable distributional assumptions. (GUM, JCGM 100:2008)

CV(RMSE)

The coefficient of variation of the root-mean-square error of the baseline model; a measure of how well the model fits the data, used as a goodness-of-fit and uncertainty criteria. (ASHRAE Guideline 14-2014)

Data-grading

The principle of assigning to each component of the water balance a confidence grade according to the quality of its data source; a required principle of the audit, with no specific tool or software being mandatory. (AWWA M36)

District metered area (DMA)

A hydraulically isolated supply area with metered inflows and outflows, enabling estimation of water loss within it. (WSUP, 2017)

Double counting

The situation in which the same volume of water benefit is counted more than once, whether across metrics, periods, participants, or programs; the project holder shall avoid double counting in all quantification and issuance.

FAVAD / pressure exponent N_1

The Fixed and Variable Area Discharge relationship describing how leakage flow varies with pressure:

$$\frac{L_1}{L_0} = \left(\frac{P_1}{P_0}\right)^{N_1}$$

where L_0 and L_1 are leakage flows at pressures P_0 and P_1 , respectively, and N_1 is the pressure exponent. (Liemberger & Farley, 2004).

The exponent shall be supported by system-specific evidence or a justified value appropriate to the network. Where it is unknown, $N_1=1$ may be used only where its effect on the supporting loss assessment is evaluated and treated conservatively, in accordance with Section 10.6.

Fractional savings uncertainty

The expanded uncertainty of the quantified saving divided by that saving, expressed as a fraction at the stated confidence level. Its determination shall account for the uncertainty components relevant to the selected quantification approach. The corresponding deduction shall be applied in accordance with Section 13.

Independent variables (routine drivers)

Factors that routinely affect water use, such as weather, occupancy, production, or service demand. Their effects are represented through the selected baseline model or adjustment method where material.

Infrastructure Leakage Index (ILI)

The ratio of current annual real losses (CARL) to unavoidable annual real losses (UARL); a dimensionless indicator of how effectively physical losses are managed, independent of pressure. (Liemberger & Farley, 2004)

IPMVP options (A, B, C, D)

The four measurement-and-verification approaches of the IPMVP: A and B isolate the affected system by measuring key or all parameters; C uses whole-facility metering; and D uses calibrated simulation. (IPMVP, EVO 2022)

Leakage

Negative effects on water availability occurring outside the project's quantification boundary as a consequence of the activities implemented, which may reduce, displace, or nullify part of the reported water benefits.

Measurement boundary

The boundary of the facility, subsystem, distribution zone, or irrigated area within which water inflows, relevant outflows, and changes in storage are measured or otherwise accounted for to determine the project-attributable saving. (IPMVP, EVO 2022)

Minimum night flow (MNF)

The lowest flow into a zone, typically in the early morning; subtracting the estimated legitimate night consumption of connected users yields predominantly the real-loss component, from which the daily leakage level is derived using the FAVAD principle. (Liemberger & Farley, 2004)

Net water benefit

The additional and demonstrable reduction in freshwater withdrawal attributable to the project during a monitoring period, expressed in cubic meters (m³), after applying the deductions established by this methodology.

NMBE

The normalized mean bias error of the baseline model; a measure of systematic bias between modelled and measured values. (ASHRAE Guideline 14-2014)

Non-revenue water (NRW)

The difference between the volume of water input to the distribution system and the volume of water billed to customers; the sum of real losses, apparent losses, and unbilled authorized consumption. (IWA, 2016)

Non-routine adjustments

Adjustments that account for changes in static factors between the baseline and reporting periods that are not captured by the routine drivers. (IPMVP, EVO 2022)

Permanence

For this methodology, the functional continuity of the efficiency or loss-reduction measure and the demonstrable existence of the water benefit during the monitoring period for which it is quantified. Underperformance shall be reflected in measured water use and the resulting saving. An additional correction or deduction is required only for an effect not already captured by the measurements or existing adjustments, in accordance with Section 11.

Real (physical) losses

The annual volume of water lost through leakage, bursts, and overflows on mains, service connections, and storage tanks up to the customer meter. (IWA, 2016)

Reporting period

The period after implementation for which water use and relevant operating conditions are monitored to determine the achieved saving. Its start shall be supported by evidence that the measure was operational. Its duration and relationship to the monitoring period shall comply with the BWS.

Routine adjustments

Adjustments that account for differences in routine drivers between baseline and reporting-period conditions, incorporated through the selected baseline model or another documented adjustment method. Each routine effect shall be accounted for once, in accordance with Section 10.4.

Static factors

Characteristics within the measurement boundary that are not expected to change routinely and, if they do change, require a non-routine adjustment. (IPMVP, EVO 2022)

System input volume (SIV)

The volume of water entering the defined distribution system or zone during the specified measurement period, corrected for known measurement bias. Relevant exports and changes in storage shall be accounted for when interpreting the volume for savings quantification.

System losses

is used as a convenience label for the components of system input volume that do not contribute to the quantifiable net water benefit. Following the standard water balance, system input volume comprises authorized consumption and water losses, and water losses comprise real (physical) losses and apparent (commercial) losses, with non-revenue water additionally including unbilled authorized consumption. This label does not introduce a new accounting category, and it is distinct from leakage, which occurs outside the quantification boundary. (Liemberger & Farley, 2004)

Unavoidable annual real losses (UARL)

The lowest technically achievable level of real losses for a given system, calculated from mains length, number of service connections, private-pipe length, and average operating pressure. (Liemberger & Farley, 2004)

Water balance

The structured accounting of system input volume into its authorized-consumption and water-loss components, following the standard IWA format. (IWA, 2016)

Volumetric water benefit

The volume of water, per unit of time, resulting from a water stewardship activity that beneficially modifies hydrology or helps reduce a shared water challenge. (VWBA, WRI, 2025)

Verified Water Credit (VWC)

The unit of issuance under the Standard, where one VWC represents one cubic meter (m³) of verified net water benefit.

7 Applicability conditions

The applicability conditions establish the minimum requirements that a project shall meet in order to apply this methodology. Where a project comprises multiple management units, each unit shall satisfy them independently.

Project holders shall comply with the following conditions.

7.1 Water context

The project shall identify the water-related challenge addressed by the activity and explain why reduced freshwater withdrawal is a relevant outcome in that context.

Evidence may include existing utility or basin assessments, official water management plans, abstraction records, documented physical losses, or facility water-use records. A separate water-stress study is not required where existing evidence adequately establishes the challenge and the relevance of the intervention.

High non-revenue water or inefficient end use may support project identification, but shall not replace the demonstration of the creditable benefit.

7.2 Defined measurement boundary and metered system

The project shall have a defined measurement boundary and identifiable measurement points that allow water use before and after implementation to be compared on a consistent basis.

The Project Document shall include a diagram or map identifying the management unit, water inlets, relevant outlets, meters, storage facilities where applicable, and the interventions implemented. Multiple inlets, exports to other units, or changes in storage shall be measured or conservatively accounted for where they affect the saving.

For internal recycling or reuse, quantification shall be based on the reduction in external freshwater input. Internally recirculated volumes shall not be added to the water benefit.

Where a meter is installed, replaced, or corrected, the project holder shall demonstrate the comparability of baseline and reporting-period measurements. A

change in recorded volume resulting solely from improved meter accuracy shall not be credited..

7.3 Metered, measurable saving

The water benefit shall be measurable at the meter that defines the boundary or, where sub-system isolation is used, at the isolated system, such that pre- and post-implementation water use can be compared under a common set of conditions. For irrigation and similar activities without a utility-type meter, the applied water volume may be measured through in-line flow metering or an equivalent method, provided the measurement is verifiable and consistent between the baseline and reporting periods.

7.4 Rights to the water benefit

The project holder shall hold, or be duly authorized in respect of, the rights to claim the verified water benefit as VWCs. Where multiple parties are involved, the ownership chain shall be documented.

7.5 No double counting

The saving shall not be claimed under any other water credit or compliance mechanism for the same intervention and period.

7.6 Connection between measured savings and freshwater withdrawal

The project holder shall identify the freshwater source or supply system associated with each management unit and demonstrate how the measured saving reduces freshwater withdrawal.

Where the measurement boundary includes the abstraction point, the demonstration may rely on the abstraction measurements, adjusted to reporting-period conditions.

Where water is supplied by a utility or another operator, the demonstration may use source or supply-system records, a documented water balance, or operating information showing how reduced demand affects abstraction. A documented statement from the supplier may support the assessment where it explains the

operating relationship and identifies the records or procedures on which it relies. A statement that merely confirms lower customer consumption is insufficient.

The assessment shall consider relevant transfers, changes in storage, and the reallocation of saved water. Where the measured saving is wholly or partly used to supply additional demand without reducing withdrawal, that portion shall not be credited as reduced withdrawal under this methodology.

If the supported reduction in freshwater withdrawal is lower than the gross saving measured at the project boundary, the difference shall be excluded through D_O in Equation 1. An effect already included in this exclusion shall not be deducted again as leakage.

The evidence shall be proportionate to the supply arrangement and the risk of overestimation. A basin-wide hydrological model is not required where measurements and documented operating information are sufficient. Where the connection cannot be demonstrated, the unsupported volume shall be excluded.

8 Eligible activities

Eligible activities shall generate an additional reduction in freshwater withdrawal that can be attributed to the project, measured, and quantified in accordance with this methodology. Inclusion in the following categories does not, by itself, establish eligibility.

8.1 Loss reduction activities

Eligible interventions may include active leak detection and repair, pressure management, targeted replacement of leaking pipes or storage components, and operational controls that reduce physical losses.

Measures addressing unauthorized use or apparent losses are eligible only where they produce a demonstrable reduction in freshwater withdrawal. Improved billing, customer-meter accuracy, or data handling shall not generate credits solely because reported non-revenue water decreases.

Pressure management shall maintain the applicable service requirements. Reductions resulting from inadequate supply, interruption of service, or restrictions inconsistent with the BWS safeguards shall not be credited.

8.2 Water use efficiency activities

Eligible interventions may include efficient fixtures and equipment, process improvements, operational or behavioral programs, irrigation management, and internal water reuse or recycling that reduces external freshwater input.

The project holder shall distinguish efficiency gains from changes in production, occupancy, weather, service provision, or other conditions unrelated to the project. Irrigation activities shall also meet Section 10.7.

8.3 Complementary activities

Meters, district metered areas, telemetry, data logging, and monitoring equipment may support project implementation and quantification. Their installation does not independently generate a water benefit.

Where such equipment enables an operational intervention, the benefit shall be attributed to the demonstrated reduction in water use or losses, rather than to the installation itself.

8.4 Automated control and optimization

Eligible measures may be implemented through automated control of pressure, flow, scheduling, irrigation, leak isolation, or process water use.

The control system is the means of implementing the measure. Quantification shall rely on the monitored water use and the applicable baseline, rather than on savings predicted by the control system. Operational records shall identify material changes in control settings, periods of bypass, and system failures.

8.5 Activity characterization and evidence

The Project Document shall describe what changes, how the change reduces freshwater withdrawal, and how the result will be demonstrated. The following requirements apply as relevant to the activity.

Activity	Saving mechanism	Minimum supporting evidence and principal exclusions
Leak repair or pipe replacement	Reduced physical losses	Intervention records, comparable input-volume measurements, and a water balance or suitable loss assessment. Exclude changes caused by meter error, unrelated demand reduction, or reduced service.
Pressure management	Reduced leakage at an appropriate service pressure	Pressure and flow records, control settings, and evidence that service requirements are maintained. Account for changes in legitimate demand.
Efficient fixtures or process equipment	Lower freshwater input for comparable operating conditions	Equipment or process description, installation records, water measurements, and relevant occupancy or production data.
Operational or behavioral measures	Changes in practices that reduce freshwater demand	Description and implementation records of the measures, water measurements, and evidence separating their effects from unrelated changes.
Internal reuse or recycling	Replacement of external freshwater input	Measurements of external freshwater input and a process water balance. Do not credit recirculated volumes; assess relevant changes in discharges or recoverable return flows.
Irrigation management	Reduced source withdrawal under comparable crop and climatic conditions	Applied-water or abstraction measurements, crop and area records, climatic adjustment, and return-flow assessment under Section 10.7.

9 Baseline scenario and additionality

9.1 Identification of the baseline scenario

The baseline shall represent water use or system input volume that would reasonably occur without the project. It shall account for historical conditions and for changes or improvements expected to occur independently of the project.

The baseline shall be established for each management unit through the following steps.

Step 1. Define the measurement boundary.

Identify the management unit, measurement points, supply arrangement, relevant outflows, and changes in storage. Document their relationship to the project activities and to the freshwater source or supply system.

Step 2. Establish a representative baseline period.

Use reliable pre-implementation measurements covering the operating and climatic conditions relevant to water use. Twelve consecutive months should normally be used where annual seasonality is material. A different period may be used where its representativeness is demonstrated. Where the relevant production or cropping cycle is longer than twelve months, the data shall cover at least one complete cycle.

If adequate historical measurements are unavailable, collect representative baseline measurements before implementing the water-saving measure. Data collected after implementation shall not be presented as measurements of the pre-project condition.

Step 3. Select the baseline approach.

Identify the factors that materially affect water use, including climate, occupancy, production, service demand, or cropping conditions, as applicable.

A documented baseline rate may be used where the evidence demonstrates sufficiently stable conditions and no material effect from variations in these factors. The justification shall address the observed variability and its contribution to savings uncertainty.

Where material routine drivers vary, use a model or another documented adjustment method that represents their effect on baseline water use. A material driver shall not be omitted solely because its statistical relationship is difficult to establish.

For regression models, report the variables, coefficients, number and frequency of observations, residual behavior, and goodness-of-fit statistics. The default acceptance

criteria are an absolute NMBE not exceeding 5% and a CV(RMSE) not exceeding 15% for monthly data; for hourly data, the corresponding values are 10% and 30%¹.

These thresholds are methodological acceptance criteria adopted for this document. For another data frequency, or where a model does not meet the default thresholds, the project holder shall justify the criteria used and demonstrate that the approach can reliably resolve the expected saving. Acceptance shall be supported by predictive-performance checks appropriate to the available data and by the uncertainty assessment. An unreliable model shall not be accepted solely by increasing the uncertainty deduction.

Step 4. Identify independently expected changes and non-routine events.

Document relevant changes in infrastructure, regulation, operations, tariffs, or planned maintenance that would occur without the project. Include their expected effect in the baseline where supported by evidence.

Identify changes in static factors and exceptional events requiring non-routine adjustment. Project-induced increases in water demand shall not be removed from the results through an upward baseline adjustment.

Step 5. Calculate the baseline and assess uncertainty.

Determine the baseline rate or model and its uncertainty in accordance with Section 13. Specify how the baseline will be restated to the duration and conditions of each reporting period.

Where reporting-period conditions fall outside the range represented by the baseline data, demonstrate the suitability of the extrapolation or apply a supported conservative alternative. Where neither is possible, exclude the unsupported saving.

Step 6. Document the selected baseline.

Provide the data, calculations, assumptions, adjustments, and reasons for selecting the approach. Apply the measurement hierarchy and use the best-supported method.

¹ The default goodness-of-fit thresholds are adopted by this methodology with reference to ASHRAE Guideline 14-2014. They apply to the model assessment described in Section 9.1 and do not require a regression model where a documented baseline rate is appropriate.

Where a material difference between equally supported alternatives cannot be resolved, use the alternative that yields the lower saving.

Step 7. Submit the baseline for assessment.

Include the baseline in the Project Document and submit it for CAB audit and BioCarbon's determination of conformity under the BWS. Document and submit subsequent material changes through the applicable project procedures.

9.1.1 Baseline validity and reassessment

Reassess the baseline in accordance with Section 15.2 of the BWS, or earlier where a change materially affects its representativeness. Reassessment shall preserve the without-project condition; it shall not replace that condition with water use already reduced by the project. Updates shall apply prospectively, except for corrections of material errors governed by the BWS.

9.2 Additionality

The project holder shall demonstrate that the water benefit is attributable to the project and would not occur under the without-project scenario.

The demonstration shall identify the intervention, explain the expected without-project condition, and provide evidence supporting the difference between the two. Relevant evidence may include historical water-use records, investment and maintenance plans, approved budgets, replacement schedules, operational requirements, and applicable legal obligations.

Repairs, replacements, or efficiency improvements that would occur independently of the project shall be reflected in the baseline. An existing plan or commitment shall be evaluated according to its scope, implementation status, and supporting evidence; its existence shall not automatically establish or negate additionality.

For activities required by law, regulation, or binding public policy, the project holder shall demonstrate compliance with the Additionality Safeguard in Section 10.3.1.1 of the BWS.

The evidence shall be proportionate to the activity and to the uncertainty of the without-project scenario. A separate financial analysis is required only where the

additionality demonstration relies on financial conditions or where otherwise required by the BWS.

Retroactive claims remain subject to the same additionality requirements. The availability of a retroactive period does not establish additionality or permit the inclusion of reductions that would occur without the project.

10 Quantification of volumetric water benefits

10.1 General quantification principle

The gross saving is the difference between the baseline water use restated to reporting-period conditions and the measured water use during that period. Net water benefit is obtained after applying the relevant deductions.

Routine adjustments account for variations in the factors that regularly affect water use. Non-routine adjustments account for documented changes in static factors unrelated to the project. Where the evidence demonstrates that an adjustment is unnecessary, its value may be zero and the justification shall be documented.

A before-and-after comparison is acceptable only where comparability has been demonstrated and all material differences have been addressed. Routine and non-routine adjustments are incorporated into the adjusted baseline and shall not be applied again when calculating the gross saving.

$$NWB = S_{gross} - D_L - D_U - D_O \quad \text{Equation 1}^2$$

Where:

NWB = Net water benefits attributable to the project during the reporting period;
m³

S_{gross} = Gross water saving, per Equation 2 or Equation 5; m³

D_L = Deduction for quantified leakage, determined as set out for leakage; m³

² The net water benefit and its deductions follow the form established by the BWS. The determination of the saving from which they are deducted follows the general measurement and verification principle of the IPMVP (EVO, 2022).

- D_U = Deduction for uncertainty, determined as set out for uncertainty management; m^3
- D_O = Other documented exclusions or conservative deductions required to determine the eligible net water benefit, including unsupported portions of the measured saving under Section 7.6. Effects already included in the baseline, measured water use, D_L , or D_U shall not be included again; m^3 .

The comparison with the baseline is incorporated into S_{gross} . D_O includes exclusions needed to limit the result to the supported reduction in freshwater withdrawal, including the exclusion required by Section 7.6.

All deductions shall be non-negative. Each effect shall be accounted for once, whether through the adjusted baseline, measured reporting-period water use, or a deduction. The calculation shall identify where each material effect has been addressed.

Where NWB is zero or negative, no VWCs shall be issued for the affected result. One VWC represents one cubic meter (m^3) of net water benefit.

10.2 Selection of the water benefit metric

The principal metric shall be selected according to the measurement boundary:

- (a) reduced metered freshwater input to a facility or isolated subsystem, for water use efficiency activities; or
- (b) reduced system input volume to a defined distribution zone, for loss reduction activities.

Both metrics shall satisfy the connection to freshwater withdrawal required by Section 7.6.

For distribution zones, baseline system input volume shall be adjusted for legitimate demand and other relevant conditions. A reduction caused by unrelated demand changes or inadequate service shall not be credited.

Water-balance components, minimum night flow, and leakage indicators may corroborate attribution. They shall not generate an additional creditable volume separate from the saving measured at the selected boundary.

Where several activities affect the same measured volume, quantify their combined effect once. Separate quantification is permitted only where the boundaries and calculations demonstrate that the volumes do not overlap.

10.3 Gross water saving

The gross saving is the difference between the adjusted baseline water use and the metered reporting-period water use:

$$S_{gross} = C_{BL,adj} - C_R \quad \text{Equation 2}^3$$

Where:

- $C_{BL,adj}$ = Adjusted baseline water use, per Equation 3 or Equation 4, as applicable; m³
- C_R = Metered water use within the measurement boundary during the reporting period; m³

Because $C_{BL,adj}$ already incorporates the routine and non-routine adjustments under Equation 3 or Equation 4, as applicable, no further adjustment shall be applied in this equation. Where S_{gross} is less than or equal to zero, no water benefit shall be quantified for the period. The saving shall be determined over the monitoring period as a whole, and sub-periods with negative results shall not be excluded or set to zero in order to increase the aggregate benefit.

10.4 Adjusted baseline

The adjusted baseline shall represent water use that would occur without the project over the duration and conditions of the reporting period.

Where a baseline rate is used, calculate:

$$C_{BL,adj} = B_{rate} \times d_R + A_R + A_{NR} \quad \text{Equation 3}^4$$

³ Derived from: IPMVP Core Concepts (EVO, 2022) and ASHRAE Guideline 14-2014, Measurement of Energy, Demand, and Water Savings.

⁴ Equations 3 and 4 implement the adjusted-baseline approach described in Section 10.4, consistent with the adjustment principles of the IPMVP (EVO, 2022). Equation 3 applies explicit adjustments to a baseline rate;

Where:

- $C_{BL,adj}$ = Adjusted baseline water use for the reporting period; m³
- B_{rate} = Documented baseline water-use rate; m³/day
- d_R = Duration of the reporting period; days
- A_R = Signed adjustment for differences in routine drivers relative to the reference conditions represented by the baseline rate; m³
- A_{NR} = Signed adjustment for documented changes in static factors unrelated to the project; m³

Where a baseline model directly predicts water use under reporting-period conditions, calculate:

$$C_{BL,adj} = \sum_{t=1}^n \hat{C}_{BL,t}(X_{R,t}) + A_{NR} \quad \text{Equation 4}$$

Here, $\hat{C}_{BL,t}(X_{R,t})$ is the baseline-model prediction, in m³, for reporting interval (t), using the observed reporting-period values of the routine drivers $X_{R,t}$. The intervals shall cover the reporting period without gaps or overlap and shall account for their actual duration.

Routine adjustment is already included in these predictions. A separate A_R shall not be added when Equation 4 is used.

Adjustments may be positive or negative. Changes that reduce the baseline shall be addressed with the same rigor as changes that increase it. Each adjustment shall have a documented cause, calculation method, data source, and sign.

Project-induced increases in water use shall remain in the project result and shall not be removed through a baseline adjustment. Unsupported positive adjustments shall not increase the baseline.

Where an adjustment cannot be determined reliably, use a justified conservative value or exclude the saving that depends on that adjustment.

Equation 4 incorporates routine adjustment in the model predictions. The two treatments shall not be combined in a way that counts the same adjustment twice.

A_R or A_{NR} may equal zero where the absence of a material adjustment requirement is demonstrated.

10.5 Measurement hierarchy and IPMVP option

Direct measurement shall take precedence. The applicable IPMVP option shall be selected according to the measurement boundary:

- (a) Option C Whole Facility. The primary approach, applicable where the boundary is a whole facility or distribution zone measured at a fiscal or bulk meter;
- (b) Options A and B Retrofit Isolation. Applicable where only part of a system is affected and the isolated sub-system can be metered. Option A may be used only where the project holder demonstrates that the estimated parameters have a minor effect on the resulting saving and treats them conservatively.

Model-based estimates or default values may be used only where higher-quality data are not reasonably obtainable; their use shall be justified, and their inputs and outputs shall be treated conservatively. Option D (calibrated simulation) is not accepted as a stand-alone basis for crediting, because crediting requires post-implementation measurement, as established in the scope boundaries.

Where an automated control system delivers the efficiency or loss-reduction measure, that system is the means of delivering the measure and is not itself a basis for quantification. The water benefit shall be quantified from the metered reduction in water use or system losses under the applicable IPMVP option, and not from any estimate, prediction, recommendation, or other output generated by the control system. The exclusion of simulation-only approaches established in the scope boundaries is therefore not triggered by the use of such systems, provided that post-implementation measurement of consumption or system input volume is available.

10.6 Quantification of loss reduction

For loss reduction projects, the gross saving is the reduction in system input volume into the defined zone. The baseline system input volume shall be adjusted using Equation 3 or Equation 4, as applicable, and the gross saving shall be calculated as follows:

$$S_{gross} = SIV_{BL,adj} - SIV_R \quad \text{Equation 5}^5$$

Where:

- $SIV_{BL,adj}$ = Adjusted baseline system input volume of the zone, constructed under the baseline construction procedure and adjusted per Equation 3 or Equation 4, as applicable; m³
- SIV_R = Metered system input volume of the zone during the reporting period; m³

The reduction in system input volume shall be supported by a water balance identifying authorized consumption, relevant exports and storage changes, and real and apparent losses. The assessment shall demonstrate that the saving is attributable to the project rather than to unrelated demand changes, reduced service, or changes in measurement accuracy.

Component analysis, minimum night flow, or other suitable field methods shall be used where necessary to resolve material uncertainty in attribution. Minimum night flow is required only where night-time operating conditions permit a representative assessment. Where supply is intermittent or legitimate night demand cannot be reliably distinguished, the project holder shall use another documented method.

Where minimum night flow is used, subtract legitimate night demand and account for the pressure profile when estimating daily physical losses. Differences between supporting methods shall be investigated. Unresolved material differences shall be treated conservatively.

Meter accuracy shall be assessed in accordance with Section 14.4. Meter failure or replacement shall trigger an assessment of data comparability and any required correction. It shall not automatically be treated as a change in actual water demand.

As supporting performance indicators, and not as a direct basis for crediting, which remains the metered System Input Volume, the project may report the Infrastructure

⁵ The equation applies the general measurement and verification principle of the IPMVP (EVO, 2022) to the metered System Input Volume of the defined zone. The disaggregation of that volume into its authorized-consumption and water-loss components follows the standard water balance of the International Water Association, as presented in Liemberger & Farley (2004).

Leakage Index (ILI) and the Unavoidable Annual Real Losses (UARL), defined as follows:

$$ILI = \frac{CARL}{UARL}$$

Equation 6

$$\begin{aligned} UARL^6 \text{ (liters/day)} \\ = (18 \times L_m + 0.8 \times N_c + 25 \times L_p) \times P \end{aligned}$$

Where:

- CARL* = Current annual real losses, from the water balance of the zone;
- UARL* = unavoidable annual real losses, as calculated above;
- L_m* = mains length (km);
- N_c* = number of service connections;
- L_p* = total length of private pipe between the property boundary and the customer meter (km);
- P* = average operating pressure (m).

Before calculating ILI, express CARL and UARL in the same volume unit and for the same time basis. The UARL equation above yields liters per day. For comparison with annual CARL expressed in m³/year, multiply the daily UARL by the number of days represented by the annual assessment and divide by 1,000. The conversion and assessment period shall be stated.

Where the FAVAD relationship is used, the pressure exponent *N₁* shall be supported by system-specific evidence or a justified value appropriate to the network. If *N₁* is unknown, *N₁* = 1 may be used only where its effect on the supporting loss assessment is evaluated and treated conservatively. A sensitivity assessment shall be used where the choice of exponent materially affects attribution. This supporting assessment shall not replace the metered system-input-volume calculation.

The confidence assigned to each component of the water balance shall follow a data-grading principle, whereby each input is graded according to the quality of its data source. Data-grading is a required principle of the audit; no specific software or tool is mandatory (AWWA M36).

⁶ Source: Liemberger & Farley (2004), based on the IWA Water Loss Task Force performance indicators.

10.7 Quantification of irrigation water efficiency

This version quantifies irrigation benefits through reduced freshwater withdrawal only. Irrigation activities shall meet the following requirements.

Measurement and connection to the source

Measure abstraction or applied water using identifiable and verifiable measurement points. Where applied water is measured downstream of the abstraction point, account for relevant conveyance losses, transfers, and storage changes and demonstrate the connection required by Section 7.6.

Baseline comparability

Document the irrigated area, crop or cropping pattern, irrigation method, cropping calendar, and relevant operating conditions for the baseline and reporting periods.

Restate baseline water use to reporting-period climatic conditions using a documented method based on effective precipitation and, where material, reference evapotranspiration and crop coefficients. The method may use a suitable baseline model or a crop-water balance supported by site measurements and representative climatic data.

The calculation shall preserve the baseline irrigation-system characteristics when estimating the without-project withdrawal. It shall not substitute the improved project-system efficiency into the baseline. The data sources, effective-precipitation method, coefficients, and conversion from crop-water requirements to withdrawal shall be documented.

Climatic normalization constitutes the routine climatic adjustment. It shall not be applied a second time through another adjustment term.

Recoverable return flows

Identify whether baseline seepage, percolation, or runoff contributes to recoverable water available to the source system or other users. Use measurements, drainage or irrigation records, or a site-specific assessment supported by suitable technical evidence.

The withdrawal route is applicable only where the project does not materially reduce recoverable return flows. A reduction is material where it exceeds 5% of the gross saving for the monitoring period.

A quantified reduction at or below this threshold shall be excluded through D_O unless already accounted for in another adjustment or deduction. If a material reduction cannot be ruled out or conservatively bounded, the affected volume is not eligible under this version. A separate groundwater model is not required where available evidence is sufficient to support the assessment.

Expansion and rebound

Project-induced expansion of irrigated area or increases in water demand shall not be removed through an upward baseline adjustment. Effects within the measurement boundary shall remain in the measured result. Effects outside that boundary shall be assessed under Section 12. Each effect shall be accounted for once.

Reporting

Provide the measured volumes, climatic adjustment, return-flow assessment, applicable exclusions, and net-water-benefit calculation. No benefit shall be claimed where the result is non-positive or depends on unsupported assumptions.

Activities requiring a consumption-based calculation are outside the scope of this version.

Technical basis: WRI, Volumetric Water Benefit Accounting 2.0, Appendix D-2; FAO Irrigation and Drainage Paper 56; and Perry, Steduto, and Karajeh (2017).

10.8 Crediting and periods

VWCs shall be issued ex post for each monitoring period, on the basis of audited and conformity-determined net water benefits. Monitoring periods shall be continuous, non-overlapping, and of the duration established by the Standard. There shall be no forward crediting, and unaudited benefits shall not be carried forward to subsequent periods. Where a project claim benefits retroactively, the retroactive window is governed by the retroactivity provisions of the Standard, which the project holder shall verify in the version of the Standard in force; each monitoring period shall in all cases comply with the duration limits set out above.

10.9 Co-benefits

Reductions in energy use for pumping and treatment, and any improvement in water quality, may be reported as co-benefits but shall not be credited under this methodology.

10.10 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.

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

- (a) water saved through demand-side efficiency under this methodology;
- (b) water recovered through supply-side loss reduction under this 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 (WRI, 2025).

10.11 Quantification traceability requirements

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

- (a) field and meter measurement data;
- (b) the selected baseline rate or model, its supporting data and justification, and, where a model is used, its independent variables and applicable performance statistics;
- (c) records of system operation and maintenance;
- (d) the assumptions and parameters used;
- (e) intermediate calculations;
- (f) the water balance and, where applicable, minimum night flow analysis;
- (g) evidence of instrument calibration or verification;
- (h) the justification of deductions, adjustment factors, and conservative assumptions;

- (i) 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.

The quantified water benefit shall be calculated using the baseline approach, measurements, adjustments, and deductions required by this methodology. Figures reported in greenhouse-gas inventories, corporate water-footprint reports, or audits prepared for other purposes shall not be adopted directly as the creditable water benefit. Their underlying records may be used as supporting evidence where their quality, boundaries, timing, and applicability are demonstrated.

11 Permanence of the water benefit and performance adjustments

Water savings are credited ex post for the monitoring period in which they are demonstrated. Continued performance is required to generate benefits in subsequent periods.

A later decline in performance does not, by itself, undo a volume of water demonstrably not withdrawn during an earlier period. Where new evidence identifies an overstatement of previously issued benefits, or another event falling within the BWS reversal provisions, the applicable BWS correction or reversal procedure shall be followed.

11.1 Operation and maintenance

The project holder shall maintain records demonstrating that the measures and measurement system operated during the monitoring period. The operation and maintenance arrangements shall be proportionate to the activity and may be incorporated into existing facility or utility procedures.

Records shall identify material failures, bypasses, changes in control settings, repairs, and meter problems. Automated measures shall have records sufficient to demonstrate their operating status.

11.2 Performance adjustments

Underperformance within a monitoring period shall be reflected in the measured water use and the resulting saving. Where its effect is already incorporated in the calculation, no additional deduction shall be applied for the same effect.

An additional correction or deduction is required only for an effect not captured by the measurements or existing adjustments. Its calculation and placement in the net-water-benefit calculation shall be documented.

Changes unrelated to the project that materially affect baseline assumptions shall be addressed through non-routine adjustment or baseline reassessment, as applicable. Project-induced increases in demand shall remain in the result or be addressed as leakage where they occur outside the measurement boundary.

12 Leakage

Leakage is a project-induced increase in water use or another adverse effect on water availability outside the measurement boundary that reduces the project's net water benefit. Physical leakage from distribution pipes is distinct: reducing it may generate a saving within the project boundary.

The project holder shall identify plausible leakage pathways, assess their relevance, and quantify material effects. The assessment shall focus on connections, sites, users, and water sources to which the project could reasonably displace or induce demand. Effects already included in measured water use, baseline adjustments, or D_O shall not be deducted again through D_L .

12.1 Difference between system losses and leakage

The project holder shall clearly differentiate between the loss components of the water balance and leakage. Following the standard water balance, system input volume comprises authorized consumption and water losses, and water losses comprise real (physical) losses and apparent (commercial) losses. These components correspond to volumes of water that enter the distribution or use system but do not contribute to the eligible water benefit within the quantification boundary, including real (physical) losses, apparent (commercial) losses, and non-eligible authorized consumption. These components lie within the quantification boundary: their reduction is the source of the saving in loss-reduction activities, and the volumes that remain are

addressed during the calculation of the gross or adjusted saving. Leakage, in contrast, corresponds to indirect or displaced negative effects occurring outside the quantification boundary as a consequence of the activities implemented.

12.2 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) the displacement of consumption to a connection, site, or user located outside the measurement boundary but under the same user or asset owner;
- (b) an induced or rebound increase in water use enabled by the efficiency gain, including the expansion of irrigated or served area, intensification of use, or increased frequency of operation, whether or not the measure is delivered through an automated control system. Where the induced increase occurs within the measurement boundary, it is captured by the metered value of the monitoring period and shall not be deducted again. A non-routine adjustment shall not be applied for a change in a static factor induced by the project activity. Where the induced increase occurs outside the measurement boundary, it shall be quantified for the relevant connections or sites identified in accordance with Section 12.3 and deducted, where material, in accordance with Section 12.4;
- (c) the transfer of water use, abstraction, or pressure toward other sources, zones, or periods;
- (d) the reallocation of water saved to new or expanded water-demanding activities that would not have occurred in the absence of the project;
- (e) indirect operational changes that reduce the net water benefit reported within the quantification boundary;

12.3 Spatial boundary for leakage assessment

The leakage assessment boundary shall cover the locations and supply arrangements where project-induced displacement or additional demand could reasonably occur.

The project holder shall identify relevant connections or sites under the same user or asset owner where a plausible leakage pathway exists. Monitoring may use meter records, production or area records, operating information, or another documented method suitable for estimating the effect.

Ownership or proximity alone does not require additional metering where the absence of a relevant pathway is supported by evidence. Conversely, the assessment shall include a relevant pathway even where the affected location is not adjacent or is operated by another party.

Review the assessment for each monitoring period and apply the non-permissible conditions established by the BWS.

12.4 Materiality and deduction

Leakage may be considered negligible where the combined effect of all relevant pathways is below 5% of the gross saving and this conclusion is supported by documented evidence or a conservative upper-bound estimate.

The threshold shall be applied to the combined effect, rather than separately to each pathway. It shall not be used to disregard adverse effects on ecological flows, sensitive ecosystems, vulnerable users, or existing use rights.

Where leakage is material, deduct its full quantified volume through D_L . If it cannot be reliably quantified, use a defensible conservative estimate or exclude the affected saving. Where leakage cannot be reasonably assessed or conservatively quantified, apply the BWS eligibility restrictions.

An effect accounted for elsewhere in the calculation shall not be deducted again.

13 Uncertainty management

The project holder shall assess uncertainty in the quantified saving at a 95% confidence level.

The assessment shall include the relevant contributions from water measurements, the baseline rate or model, routine and non-routine adjustments, sampling, reconstructed data, and supporting estimates that materially affect attribution. Where an estimate is used to exclude unsupported volumes, its uncertainty shall also be addressed.

The following procedure shall apply:

- (a) identify the uncertainty sources and document the basis of each estimate;

- (b) express input uncertainties as standard uncertainties and propagate their effects to the saving in m³, using the applicable measurement or baseline model;
- (c) combine independent contributions in quadrature and account for significant correlations where present;
- (d) obtain expanded uncertainty using a justified coverage factor or an appropriate statistical method; and
- (e) divide expanded uncertainty by the positive gross saving to obtain the expanded relative uncertainty u .

Components already included in the baseline-model uncertainty shall not be counted again. Percentages referring to different input quantities shall not be combined directly without propagation to a common result.

A coverage factor $k = 2$ may be used where the applicable assumptions support approximately 95% coverage. Where those assumptions do not hold, use a suitable factor or method and document its basis.

Where uncertainty is material, calculate:

$$D_U = u \times S_{gross} \quad \text{Equation 7}^7$$

Where:

- D_U = Uncertainty deduction; m³
- u = Expanded relative uncertainty of the gross saving at 95% confidence;
Dimensionless
- S_{gross} = Positive gross saving calculated under Equation 2 or Equation 5; m³

Where total expanded relative uncertainty is below 5%, D_U may be set to zero only if known measurement biases have been corrected, the assessment includes all relevant contributions, and the use of the threshold is conservatively justified. The justification

⁷ The uncertainty assessment uses methods appropriate to the selected baseline and measurement approach. ASHRAE Guideline 14-2014 provides relevant statistical methods where applicable, and JCGM 100:2008 provides the framework for propagation and combination of uncertainty. The deduction and materiality treatment are established in Section 13 of this methodology.

shall consider the effect on the benefit remaining after other deductions. Where these conditions are not met, apply Equation 7.

The 5% threshold shall not be applied separately to individual components to omit a material combined uncertainty. Where u is 5% or greater, apply the full deduction calculated under Equation 7.

If a conservative lower-bound estimate already incorporates an uncertainty contribution, identify that contribution and do not deduct it again. An uncertainty deduction shall not make an unsupported baseline, missing evidence of attribution, or an ineligible activity acceptable.

Where deductions leave no positive net benefit, no credits shall be issued for the affected result.

Review the assessment in each monitoring period and update it where relevant data, instruments, operating conditions, or calculation methods change. Meter accuracy shall be addressed in accordance with Section 14.4.

14 Monitoring of project activities

14.1 Monitoring plan

The monitoring plan shall be structured around the measurement boundary, the IPMVP option selected, and the metered system, and shall be set out in the Project Document together with the monitoring periods, in accordance with the Standard. The approved monitoring plan shall be implemented throughout the project. It shall enable the comparison of the reporting-period consumption against the adjusted baseline, and the demonstration that the savings are additional, attributable, and verifiable.

14.2 Monitoring variables

The monitoring plan shall identify the parameters required for the selected activity and quantification approach. For each parameter, specify the management unit, measurement point or data source, unit, collection frequency, quality-control procedure, and treatment of missing data.

Parameter or record	Unit or format	Monitoring requirement
Water use or system input volume	m ³	Record for each measurement boundary at least monthly, with finer resolution where needed to resolve the activity or adjustment.
Routine drivers	Units appropriate to the driver	Collect at a frequency compatible with the baseline approach and reporting intervals.
Relevant outflows, transfers, and storage changes	m ³	Monitor where they affect the interpretation of measured inflows or the connection to source withdrawal.
Pressure and supporting loss indicators	m, flow units, or m ³	Collect where required for loss attribution or the selected field assessment.
Irrigated area, crops, climate, and return-flow evidence	ha, crop records, mm, m ³ , or other relevant units	Collect as required by Section 10.7.
Leakage parameters	m ³ or documented estimation inputs	Monitor relevant pathways identified under Section 12.
Operational and non-routine events	Dated records	Record events affecting attribution, baseline comparability, or measure performance.
Meter accuracy and condition	Test results, certificates, and maintenance records	Assess in accordance with Section 14.4.

Parameters that do not apply to the project need not be monitored. Their exclusion shall be explained where their relevance is not self-evident.

14.3 Data sources

Primary data are the records of the meter defining the boundary and the associated billing data, supplemented by interval data where automated metering is deployed, manual meter reads as back-up and verification, operational records of the facility, and independent meter testing reports.

14.4 Monitoring frequency and methods

Water-volume records shall be collected at least monthly. Where automated systems are used, retain interval records at the resolution needed for the selected calculation and quality controls. The collection frequency shall capture the operational and seasonal variations material to the saving.

Supporting methods shall be selected according to the activity and measurement conditions. Minimum night flow shall be used only where required and applicable under Section 10.6⁸.

Meter accuracy

At baseline establishment and during each monitoring period, demonstrate that the meters remain suitable for the flow range and operating conditions and that their accuracy supports the uncertainty assessment.

Evidence may include valid calibration or test certificates, statutory metrology records, supplier testing records, or an independent comparison with a suitable reference instrument. A new laboratory calibration is not required solely because a monitoring period has ended where current evidence remains valid and the meter condition and performance are supported.

Obtain independent accuracy testing where existing evidence is insufficient, an unexplained discrepancy occurs, the meter operates outside its specified range, or a failure, replacement, or other event may materially affect comparability. Record and correct known biases where possible; otherwise apply a supported conservative treatment.

Missing data

The monitoring plan shall define reconstruction methods appropriate to the system. Reconstruction may use redundant meters, cumulative readings, correlated

⁸ Where applicable, minimum night flow assessment draws on Liemberger and Farley (2004). WSUP (2017) and USAID-WBI (2010) provide supporting operational guidance. The selection and applicability of field methods are governed by Section 10.6.

operational records, or another documented source independent of the claimed saving.

Report the duration and location of each gap, the data used, the reconstructed volume, and its uncertainty. A gap is material where its potential effect could materially change the reported saving or prevent demonstration of attribution, regardless of its duration.

If a conservative reconstruction is supported, include it with the corresponding uncertainty treatment. Otherwise exclude the unsupported saving. Exclusion shall not remove a possible negative contribution in a manner that increases the period's result.

Outliers

Investigate unusual values before excluding them. Distinguish measurement errors from actual operating conditions. Retain real observations, including periods of poor performance. Document any correction or exclusion and its effect on the calculation.

14.5 Monitoring report and records

For each monitoring period, the project holder shall prepare a Monitoring Report containing:

- (a) the management units, activities, and reporting dates;
- (b) evidence of implementation and operation, including material failures or changes;
- (c) the measured water volumes, relevant drivers, and data-quality assessment;
- (d) the baseline version and its restatement to reporting-period conditions;
- (e) the connection between measured savings and freshwater withdrawal;
- (f) the gross saving, each adjustment and deduction, and the resulting net water benefit;
- (g) the leakage and uncertainty assessments; and
- (h) the treatment of missing data, meter changes, and other material events.

For portfolios, provide results by management unit and explain their aggregation and any overlap or transfer adjustments.

Submit the calculation files and supporting records in a form sufficient for independent reproduction. Identify where each material effect is accounted for so that it is neither omitted nor counted twice.

15 Document management, quality control, and information assurance

The project holder shall maintain traceable records linking source data, processed data, baseline calculations, adjustments, deductions, and reported net water benefits.

Document management and quality-control procedures shall be proportionate to the project. Existing facility or utility systems may be used where they meet these requirements; a separate management system or software platform is not required.

Quality control shall include documented review of the calculations by a person other than the preparer, reconciliation of primary measurements with available supporting records, and the meter checks required by Section 14.4.

Retain the original measurement records, baseline versions, calculation files, operational evidence, and submitted reports for the period required under the applicable BWS rules. Corrections shall preserve the original record and identify the reason, date, responsible person, and effect of the change.

For portfolios, include management-unit identifiers, meter identifiers, and asset references in the submitted documentation to support registry traceability and overlap checks. Meter replacement shall preserve the link between the previous and replacement identifiers.

All supporting evidence shall be available to the CAB and BioCarbon for the applicable assessment and review.

16 References

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Version 1.0 for Public Consultation	October 13, 2026	Initial public consultation version establishing eligibility, baseline, quantification, monitoring, and reporting procedures for net water benefits from water use efficiency and loss reduction activities.