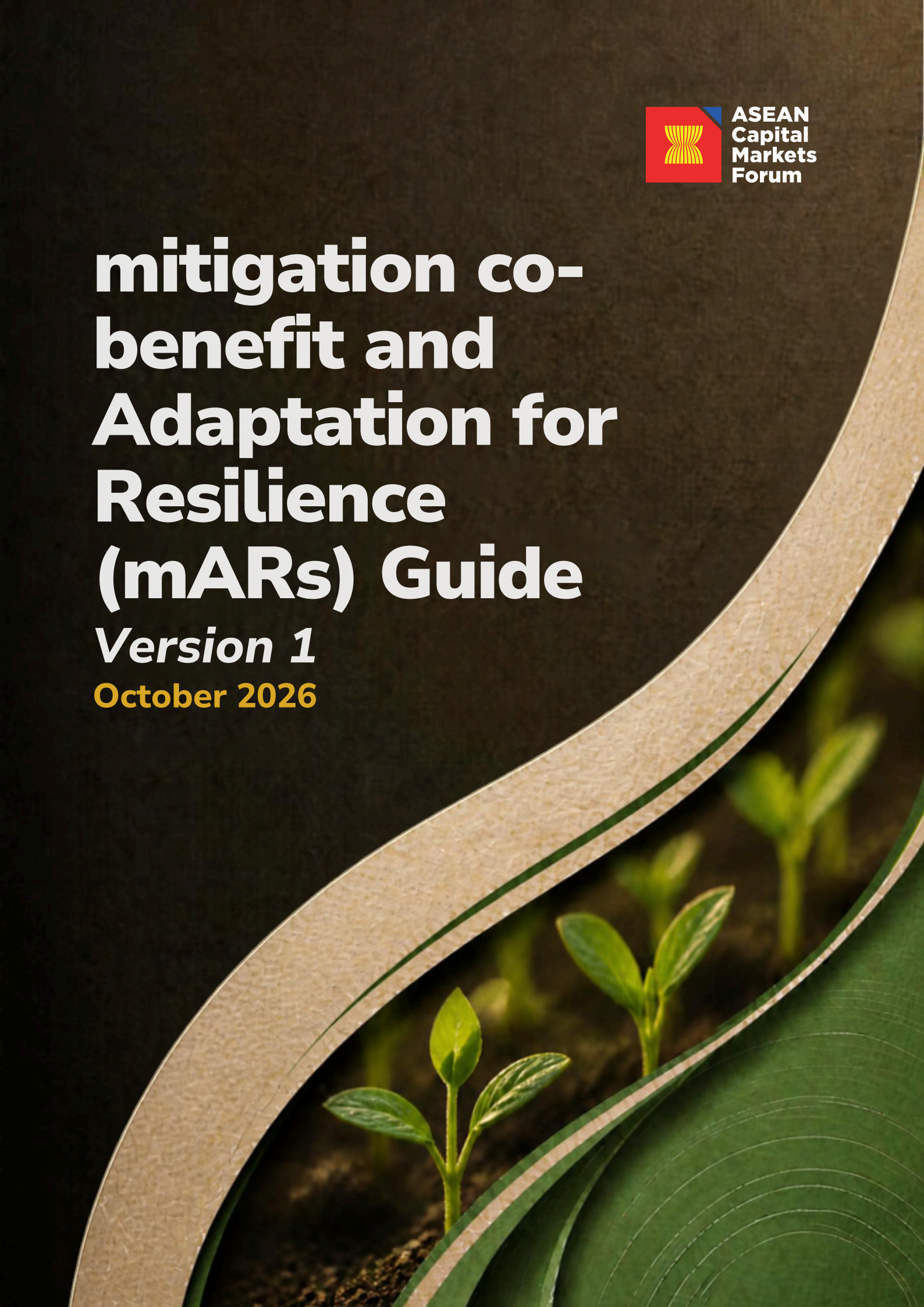
ASEAN Capital Markets Forum

mitigation co-benefit and Adaptation for Resilience (mARs) Guide

Version 1

October 2026



The mitigation co-benefit and Adaptation for Resilience (mARs) Guide

in support of the ASEAN Taxonomy for Sustainable Finance

VERSION 1

OCTOBER 2026

ASEAN Capital Markets Forum

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[1] WC-CMD-ACMF Joint Sustainable Finance Working Group Industry Advisory Panel, Working Group on Adaptation, 22 August 2025

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DEFINITIONS AND ABBREVIATIONS

ACMF	ASEAN Capital Markets Forum
ADB	Asian Development Bank
AFMGM	ASEAN Finance Ministers' and Central Bank Governors' Meeting
AMS	ASEAN Member States
APAC	Asia-Pacific
AR6	Sixth Assessment Report (of the Intergovernmental Panel on Climate Change)
ASEAN	The Association of Southeast Asian Nations
ATB	ASEAN Taxonomy Board
CRVA	Climate Risk and Vulnerability Assessment
DNSH	Do No Significant Harm
EbA	Ecosystem-based adaptation
EO	Environmental Objective
ESCAP	Economic and Social Commission for Asia and the Pacific
FF	Foundation Framework
FIs	Financial institutions
GHG	Greenhouse gas
GWP	Global warming potential
IAP	Industry Advisory Panel
IFC	International Finance Corporation
IPCC	Intergovernmental Panel on Climate Change
ISIC	International Standard Industrial Classification
IUCN	International Union for Conservation of Nature
JSFWG	ASEAN Capital Markets Forum (ACMF) and ASEAN Working Committee on Capital Market Development (WC-CMD) Joint Sustainable Finance Working Group
mARs	Mitigation co-benefit and Adaptation for Resilience
MDB	Multilateral development bank
NAP	National adaptation plan
NACE	Statistical Classification of Economic Activities in the European Community
NDC	Nationally determined contribution
NbS	Nature-based solutions
OECD	Organization for Economic Co-operation and Development
OJK	Otoritas Jasa Keuangan
PS	Plus Standard
RCP	Representative concentration pathway
RMT	Remedial Measures to Transition
SA	Social Aspects (an Essential Criterion under the ASEAN Taxonomy)
SFIA	Sustainable Finance Institute Asia
TEAG	Technical Expert Advisory Group
TSC	Technical Screening Criteria
UNDRR	United Nations Office for Disaster Risk Reduction
UNEA	United Nations Environment Assembly
UNEP	United Nations Environment Programme
UNEP FI	United Nations Environment Programme Finance Initiative
UNFCCC	United Nations Framework Convention on Climate Change
WC-CMD	ASEAN Working Committee on Capital Market Development

Table 1: Key terms and definitions in the mARs Guide

Terms	**Definitions**[2]
Risk	Potential for adverse consequences for human or ecological systems, arising from climate impacts *and* human responses.
Hazard	Potential occurrence of a natural or human-induced physical event/trend that may cause losses and impacts.
Vulnerability	Propensity to be adversely affected (incl. sensitivity/susceptibility to harm and lack of capacity to cope/adapt).
Adaptation	Adjustment to actual or expected climate and its effects to moderate harm or exploit beneficial opportunities.
Maladaptation	When actions intended to reduce vulnerability inadvertently do the opposite (i.e., increase vulnerability) to climate change impacts, either through failed adaptation solutions or cascading effects on adaptive capacity beyond the solution context. In the ASEAN Taxonomy, it includes the cases when solutions will not achieve the intended objective or may result in unintended consequences that undermine other adaptation solutions.
Resilience	Capacity of interconnected social/economic/ecological systems to cope and reorganise over time despite potential climate disruptions, while maintaining essential function/identity/utility.
Residual risk	Risk that remains after adaptation/mitigation efforts; can be redistributed (reduced in some places/groups, increased in others).
Foundation Framework	As one of the two assessment frames under the ASEAN Taxonomy, the Foundation Framework uses a principles-based assessment of Activities, assisted by guiding questions.
Plus Standard	As one of the two assessment frames under the ASEAN Taxonomy, the Plus Standard frame was designed to be more robust, using both threshold-based (quantitative) and process- or practice-based (qualitative) TSC. The TSC, as relevant, allow for the classification of Activities into three Tiers, which represent the respective Green and Amber policies of different AMS and consider the current state of technology and development across ASEAN.
DNSH (Do No Significant Harm)	The principle of ensuring that activities that contribute positively towards one environmental objective (of the ASEAN Taxonomy) do no significant harm to any of the other environmental objectives (of the ASEAN Taxonomy). As per the ASEAN Taxonomy, activities must demonstrate resilience to identified negative impacts, ensure they do not cause maladaptation or undermine the adaptation efforts of others, and actively avoid increasing the physical climate risk for other stakeholders.[3]

[2] United Nations Environment Programme Finance Initiative. Phase 1 White Paper on Key Principles and Methodological Approaches: For the development of the ASEAN mARs Guide in support of the ASEAN Taxonomy, 2025. Geneva

[3] As per the ASEAN Taxonomy Version 4, page 454, "...although significant harm relates to EOs other than that to which the Activity is intended to contribute, Activities may also not cause effects which directly or indirectly detract from the intended EO."

Scenario	Plausible, internally consistent description of how the future may develop (not a prediction); used to test implications under uncertainty.
Enabling conditions	Variables that increase feasibility of adaptation solutions (e.g., finance, technology, policy instruments, institutional capacity, multi-level governance, behaviour/lifestyles).
Resilience theme	The desired state of a system — for example agri-food, health or infrastructure — that is able to withstand and adapt to climate-related stresses and shocks. Used in the mARs Guide to organise adaptation outcomes. See Section 2a.[4]
Mitigation co-benefit	A positive effect on climate change mitigation (EO1) arising from a measure whose primary objective is climate change adaptation (EO2), increasing the total benefit to society or the environment. See Section 5.[5]

[4] As defined in mARs Phase 1 White Paper (2025)
[5] As defined in mARs Phase 1 White Paper (2025)

FOREWORD

For a farmer facing drought or a community exposed to flooding, resilience means being better prepared to protect a livelihood and plan for the future. Across ASEAN, these concerns give purpose to adaptation finance. They remind us that investment must respond to the risks people face and the outcomes they need.

Our capital markets can help connect these needs with financing. To make that connection, investors, issuers, and financial institutions need to understand the hazard, the vulnerability it creates, and whether a proposed measure can address it. The mitigation co-benefit and Adaptation for Resilience (mARs) Guide Version 1 supports this assessment.

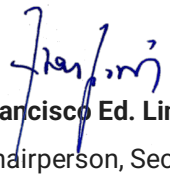
Developed under the governance and oversight of the ASEAN Capital Markets Forum (ACMF) and the ASEAN Taxonomy Board (ATB), the Guide builds on the Phase 1 mARs White Paper in 2025. It is a voluntary, non-binding complement to the ASEAN Taxonomy, supporting the consistent and robust application of Environmental Objective 2, Climate Change Adaptation. It assists users of both the Foundation Framework and the Plus Standard within the existing structure, without creating separate eligibility thresholds.

Version 1 makes this approach practical through its focus on Agriculture, Forestry and Fishing; Water Supply, Sewerage, Waste Management and Remediation Activities; and Construction and Real Estate. It addresses flooding, drought, sea level rise, and extreme heat, using resilience themes to link risks with adaptation outcomes. Practical criteria and a non-exhaustive range of technology-based and nature-based solutions help users assess suitable responses.

Choosing a suitable response also requires attention to its wider effects. The Guide therefore considers mitigation co-benefits and maladaptation, including the possibility that a measure may create unintended consequences or shift risks elsewhere. This broader assessment helps ensure that the pursuit of resilience is informed by care for those an investment may affect.

We thank the United Nations Environment Programme Finance Initiative and Cadlas for their collaboration and technical expertise, and the Sustainable Finance Institute Asia for supporting and guiding the ACMF Sustainable Finance Working Group. We also acknowledge ACMF Members, the ATB, the Technical Expert Advisory Group, the Industry Advisory Panel Working Group on Adaptation, our ASEAN colleagues, and other stakeholders. We are grateful to the European Union for its support.

Their contributions give us a resource to apply, learn from, and refine. In the spirit of “Navigating Our Future, Together,” we encourage readers to contribute to that continuing effort. May the Guide help turn a clearer understanding of climate risks into investments that strengthen resilience and support a more secure future for our communities.



Francisco Ed. Lim

Chairperson, Securities and Exchange Commission (SEC) Philippines, ACMF Chair and mARs Task Force Co-Chair

ASEAN remains highly vulnerable to the growing impacts of climate change and natural hazards, compounded by varying levels of harm and adaptive capacity across the region. This underscores the need to strengthen climate resilience and mobilise finance towards more resilient economies and communities. ASEAN's climate financing needs are substantial, with an estimated USD 422.16 billion required by 2030 to address the region's mitigation, adaptation, and loss and damage priorities.[6]

Against this backdrop, the ASEAN Taxonomy Board (ATB) welcomes the inaugural mitigation co-benefit and Adaptation for Resilience (mARs) Guide. Developed with the ASEAN Capital Markets Forum (ACMF), with technical assistance from the United Nations Environment Programme Finance Initiative (UNEP FI) and support from the Sustainable Finance Institute Asia (SFIA), the Guide marks an important step in advancing the implementation of the ASEAN Taxonomy for Sustainable Finance, particularly Environmental Objective 2 (EO2) on climate change adaptation.

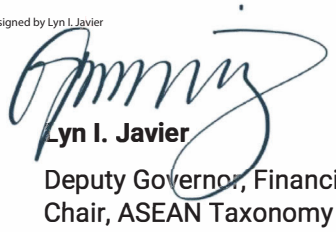
As a voluntary and complementary reference to the ASEAN Taxonomy, the mARs Guide provides a structured approach to identifying climate hazards, resilience themes, and appropriate nature-based and technology-based adaptation solutions, while remaining anchored in the Taxonomy's established assessment and classification framework. The Guide also addresses mitigation co-benefits and the potential risks of maladaptation, building on the Climate Risk and Vulnerability Analysis (CRVA) requirements and Do No Significant Harm (DNSH) criteria under EO2. This integrated approach enables a more comprehensive assessment of adaptation activities and their broader environmental implications, contributing to more informed investment decisions.

Consistent with the ASEAN Taxonomy, the mARs Guide will evolve iteratively to maintain its robustness, relevance and credibility. Future versions will broaden sectoral and hazard coverage and further develop the treatment of adaptation solutions and maladaptation risks. This will help ensure that the Guide remains science-based and responsive to the diverse circumstances of ASEAN Member States. As the ATB advances the implementation of the ASEAN Taxonomy, the mARs Guide can facilitate its wider adoption and strengthen stakeholder capacity. Experience gained from its use can also inform the continued development of the Taxonomy and help maintain its relevance to ASEAN's evolving sustainable finance landscape.

On behalf of the ATB, I extend our appreciation to the ACMF; the Technical Expert Advisory Group and Industry Advisory Panel of the Joint Sustainable Finance Working Group of the ACMF and the Working Committee on Capital Market Development (WC-CMD); the European Union; UNEP FI; SFIA; and all ATB members and partners who contributed to the development of the mARs Guide Version 1.

We encourage stakeholders to participate in the consultation process and share their experience in using the Guide. Through continued regional and global cooperation, implementation and collective learning, the mARs Guide can contribute to the effective implementation of the ASEAN Taxonomy and help mobilise finance and investment towards a more climate-resilient, risk-ready, inclusive and sustainable ASEAN.

Digitally signed by Lyn I. Javier



Lyn I. Javier
Deputy Governor, Financial Supervision Sector, Bangko Sentral ng Pilipinas
Chair, ASEAN Taxonomy Board

[6] Climate financing is comprised of USD 293.01 billion for climate mitigation and USD 129.15 for climate adaptation. Source: Climate Finance Access and Mobilization Strategy for the Member States of ASEAN (2024–2030)

Climate adaptation and resilience have become central priorities for sustainable development and financial stability across ASEAN. The region faces growing physical climate risks, including flooding, sea-level rise, droughts, extreme heat, and other climate-related hazards that threaten communities, ecosystems, infrastructure, and economic activity, with annual losses due to natural disasters already averaging USD 10 billion.[1] ASEAN has significant adaptation finance needs of at least USD 129 billion by 2030[2] and an important opportunity to mobilize both public and private capital towards solutions that strengthen resilience and support sustainable development. However, addressing these challenges requires not only greater investment in adaptation, but also practical tools that can help identify, assess, and scale financing for resilience-building activities.

For financial institutions, a changing climate poses growing challenges for assessing physical climate risks and identifying financing opportunities, while the context-specific nature of adaptation can make it difficult to determine which activities meaningfully contribute to resilience outcomes. Practical guidance is therefore needed to help financial institutions identify credible adaptation solutions, assess their potential resilience benefits, in a way that can inform financing decisions.

To support this objective, the ASEAN Capital Markets Forum (ACMF) invited the United Nations Environment Programme Finance Initiative (UNEP FI), working closely with the ASEAN Taxonomy Board (ATB) and Sustainable Finance Institute Asia (SFIA), to support the development of the mitigation co-benefit and Adaptation for Resilience (mARs) Guide. This isa voluntary companion to the ASEAN Taxonomy for Sustainable Finance (ASEAN Taxonomy). Building on the foundations established through the Phase 1 White Paper, Version 1 of this Guide represents the next step in translating principles into practical guidance that can enhance the usability and functionality of the ASEAN Taxonomy in relation to Climate Change Adaptation (Environmental Objective 2).

By providing a structured approach to understanding adaptation solutions, climate hazards, resilience outcomes, and alignment with national adaptation priorities, the mARs Guide aims to facilitate more consistent and robust assessment of adaptation solutions. It also seeks to support greater transparency, comparability, and interoperability with relevant international frameworks while remaining grounded in the ASEAN Taxonomy's existing assessment frames and ASEAN's diverse national contexts and development priorities.

The development of this Guide has benefited from extensive engagement with financial institutions, technical experts, regulators, and industry representatives from across the region. Their contributions have helped ensure that the Guide reflects both scientific understanding and practical market considerations. This collaborative process demonstrates the value of public-private dialogue in advancing adaptation finance and strengthening the sustainable finance ecosystem in ASEAN.

UNEP FI is honoured to support this important regional initiative under the leadership of ACMF and ATB, in partnership with SFIA and a wide range of stakeholders. We are also grateful for the support provided through the European Union's Sustainable Finance Advisory Hub. As climate risks continue to evolve, strengthening resilience will require sustained cooperation, innovation, and investment. We hope that the mARs Guide will contribute to these efforts by helping channel finance towards activities that protect people, strengthen economies, support nature, and enhance resilience across ASEAN.



Eric Usher

Head, United Nations Environment Programme Finance Initiative

EXECUTIVE SUMMARY

Southeast Asia is among the regions most exposed to climate change, yet adaptation finance in ASEAN remains scarce and predominantly public. Against an estimated regional need of around USD 422 billion by 2030, including roughly USD 129 billion required specifically for adaptation[7], private investment is constrained by uncertainty over the identification, measurement, and bankability of adaptation activities.[8] Sustainable finance taxonomies are a central tool for closing this gap, and the ASEAN Taxonomy for Sustainable Finance (ASEAN Taxonomy) addresses adaptation through its Environmental Objective 2, Climate Change Adaptation (EO2).

The mitigation co-benefit and Adaptation for Resilience (mARs) Guide was initiated by the ASEAN Capital Markets Forum (ACMF) in 2025, supported by the ASEAN Taxonomy Board (ATB), the United Nations Environment Programme Finance Initiative (UNEP FI) and the Sustainable Finance Institute Asia (SFIA). Based on extensive stakeholder consultation conducted in Phase 1, the White Paper on Key Principles and Methodological Approaches for the Development of the mARs Guide was published in November 2025.[9]

Phase 2 (2026) marks the development of Version 1 of the mARs Guide, under the governance and oversight of both the ACMF and ATB. Designed as a living, principles-based framework, the primary objective of the mARs Guide is to support ASEAN Taxonomy users in meeting and carrying out the EO2 assessment under both the Foundation Framework (FF) and the Plus Standard (PS). The Guide builds on the ASEAN Taxonomy's existing Guiding Principles, Guiding Questions, Technical Screening Criteria (TSC) and the use of Climate Risk and Vulnerability Assessment (CRVA). It is solely intended to support the consistent and robust application of EO2 assessments and does not introduce separate eligibility thresholds or requirements. The Guide is also intended to support the development and adoption of region-specific data, tools and resources. Thus, the Guide is intended to be read alongside the ASEAN Taxonomy and does not constitute a standalone framework.

The mARs Guide is intended to be a voluntary, non-binding companion to the ASEAN Taxonomy. As a supplementary Guide, all the approaches and recommendations presented in this document are intended for voluntary use and should not be perceived as mandatory requirements. To illustrate this, the Guide reserves “must” and “shall” for requirements that already exist in the ASEAN Taxonomy, and uses “may”, “can” and “users are encouraged to” for the voluntary guidance the mARs Guide itself offers.

Version 1 focuses on 3 sectors already covered by the ASEAN Taxonomy, which are central to ASEAN’s adaptation priorities: Water Supply; Sewerage, Waste Management and Remediation Activities (ISIC E), Agriculture, Forestry and Fishing (ISIC A), and Construction and Real Estate (ISIC F/L).

Version 1 of the mARs Guide provides:

- An entry point for users to identify climate hazards and resilience themes;
- A set of principles and criteria used to identify relevant adaptation solutions (technology-based and nature-based);
- A non-exhaustive list of adaptation solutions (technology-based and nature-based) that may be applicable to, or appropriate for, the three focus sectors. They can be used at the TSC/CRVA stage for PS, and can also be used for Guiding Questions under FF. In addition, the Guide provides the option for self-assessment of adaptation solutions, where applicable;
- Voluntary option to demonstrate & communicate mitigation co-benefit of an EO2 activity; and
- Initial considerations on screening and preventing maladaptation at the point of assessment.

[7] UNFCCC and ASEAN Secretariat, Climate Finance Access and Mobilization Strategy for the Member States of The Association of Southeast Asian Nations (2024-2031), 2024.
[8] UNEP, Adaptation Gap Report 2024, November 2024
[9] United Nations Environment Programme Finance Initiative. Phase 1 White Paper on Key Principles and Methodological Approaches: For the development of the ASEAN mARs Guide in support of the ASEAN Taxonomy, 2025. Geneva

Figure 1 below illustrates the conceptual approach underpinning the mARs Guide, including the initial screening considerations for identifying and preventing maladaptation at the point of assessment, and how these considerations operate in conjunction with the ASEAN Taxonomy.

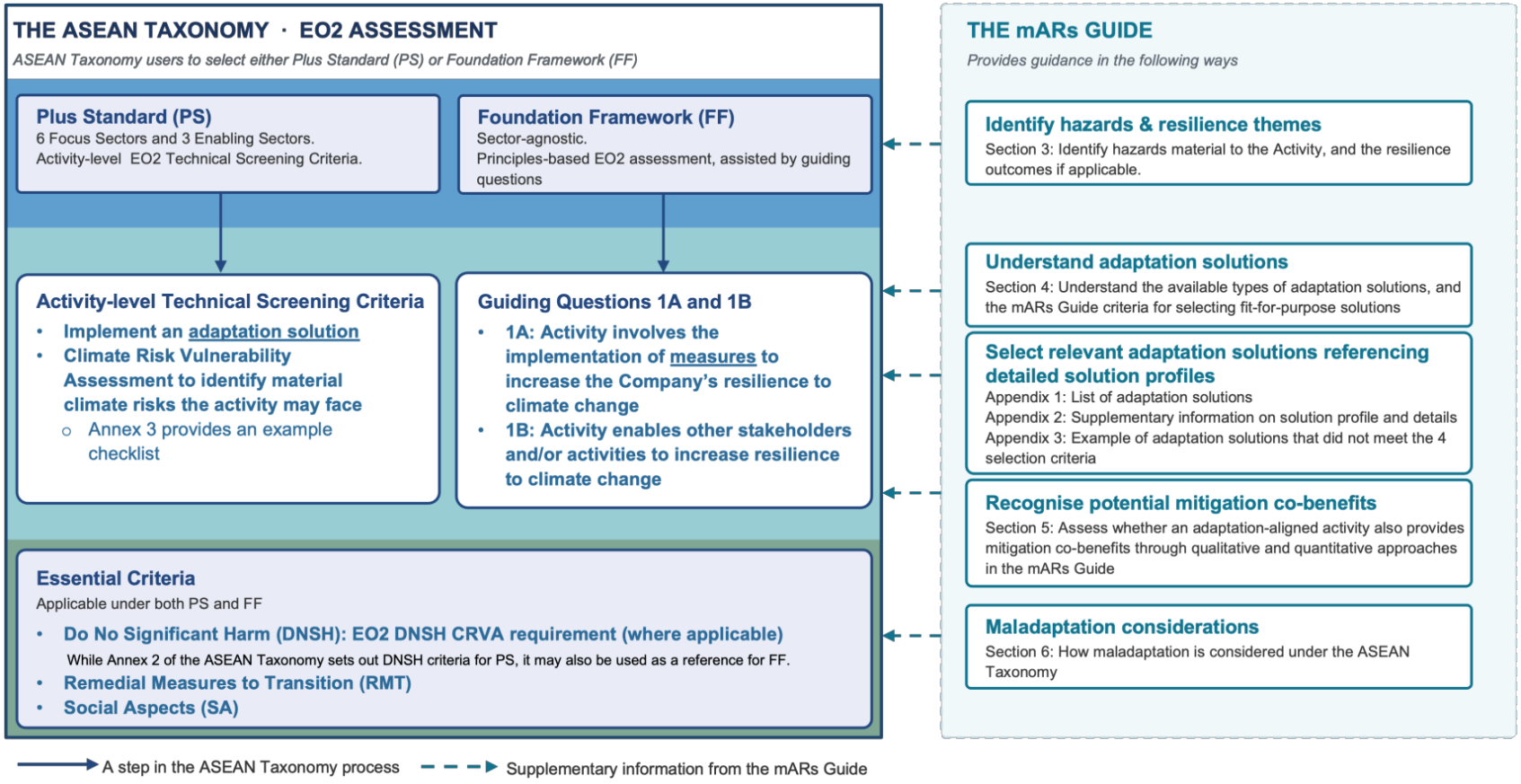


Figure 1: Conceptual approach of the mARs Guide and how it supports the ASEAN Taxonomy

The following sections of the Guide are structured as follows:

- Section 1 provides the overall context and background for the mARs Guide;
- Section 2 explains the core function of the mARs Guide and its interaction with ASEAN Taxonomy;
- Section 3 explains the prioritisation of focus hazards and ASEAN Taxonomy sectors that are covered in Version 1 of the mARs Guide;
- Section 4 provides an overview of adaptation solution types and the criteria the mARs Guide adopts for assessing solutions;
- Section 5 sets out the framework to recognise mitigation co-benefits; and
- Section 6 provides initial guidance on maladaptation considerations in a way that is aligned with the ASEAN Taxonomy, subject to further updates in future versions.

The appendices are structured as follows:

- Appendix 1 provides a non-exhaustive list of adaptation solutions;
- Appendix 2 provides supplementary information and resources on the list of adaptation solutions in Appendix 1 to further support EO2 assessments. These are for illustrative and informational purposes only;
- Appendix 3 provides examples of solutions that do not meet the adaptation solution selection criteria;
- Appendix 4 provides additional resources and references to support EO2 assessment; and
- Appendix 5 provides additional information on the governance of adaptation finance.

1. Context and background

Southeast Asia is among the regions most exposed to climate change, with more frequent and intense weather events, rising sea levels and increasing temperature extremes threatening livelihoods, food security and public health. Total estimated economic losses from natural disasters in ASEAN from 2004 to 2014 amounted to USD 91 billion[10] and 77.4 million people across the region were displaced due to hydro-meteorological disasters alone between 2008 and 2021.[11]

Climate finance needs in the ASEAN region are estimated at around USD 422 billion by 2030, of which around USD 129 billion is required specifically for climate adaptation.[12] Adaptation finance remains limited and predominantly public, sourced from governments and multilateral development banks. Private investment is constrained by several interlocking barriers: the absence of definitions and criteria for adaptation activities that are consistently understood across markets, the difficulty of measuring and verifying adaptation outcomes in the absence of agreed metrics, and — following from both — persistent uncertainty around the bankability of adaptation investments.[13]

Sustainable finance taxonomies help mobilise capital by providing a transparent and consistent classification of sustainable economic activities and a common language for market actors. The ASEAN Taxonomy for Sustainable Finance (ASEAN Taxonomy) provides such a classification for the region and includes Climate Change Adaptation as its Environmental Objective 2 (EO2).[14] Enhancing the usability and functionality of the ASEAN Taxonomy for EO2 can help direct capital towards adaptation and resilience and address the regional adaptation finance gap. Several AMS have begun incorporating the ASEAN Taxonomy in their national frameworks, including Indonesia, Malaysia, the Philippines, Singapore, Thailand and Cambodia. For example, Indonesia Taxonomy for Sustainable Finance (TKBI) is currently being implemented through a pilot reporting project covering all commercial banks in Indonesia, under which banks are expected to assess and disclose the composition of their financing portfolios based on TKBI classifications. These early implementation efforts have highlighted practical challenges in applying EO2, underscoring the need for a companion guide.

To support this, the ASEAN Capital Markets Forum (ACMF) and the ASEAN Taxonomy Board (ATB), with support from the United Nations Environment Programme Finance Initiative (UNEP FI) and the Sustainable Finance Institute Asia (SFIA), have initiated the development of the mitigation co-benefit and Adaptation for Resilience (mARs) Guide. The development process is carried out in phases:

- The first phase, completed in 2025, established the governance structure for the mARs Guide and developed its key principles and methodological approach, informed by literature review and stakeholder engagement.
- The second phase in 2026 marks the development of Version 1 of the mARs Guide, under the governance and oversight of both ACMF and ATB.

[10] ASEAN Secretariat, ASEAN Vision 2050 on Disaster Management, 2021
[11] ASEAN Secretariat, Changing Disaster Risk Landscape due to Climate Change in ASEAN, 2025
[12] UNFCCC and ASEAN Secretariat, Climate Finance Access and Mobilization Strategy for the Member States of The Association of Southeast Asian Nations (2024-2031), 2024.
[13] UNEP, Adaptation Gap Report 2024, November 2024
[14] Beyond Climate Change Mitigation (EO1) and Climate Change Adaptation (EO2), the ASEAN Taxonomy also covers Protection of Healthy Ecosystems and Biodiversity (EO3) and Resource Resilience and Circular Economy Transitions (EO4).

The role of the mARs Guide is to:

- Serve as a voluntary and non-binding companion Guide supporting the consistent and robust application of EO2 assessments under the ASEAN Taxonomy.
- Support users in conducting EO2 assessments under the Foundation Framework (FF) and Plus Standard (PS).
- Introduce resilience themes to identify relevant adaptation investments while continuing to rely on ISIC classification system, which ASEAN Taxonomy activities are classified by. Resilience themes help link activities to AMS adaptation priorities and highlight adaptation investments that cut across sectors.
- Provide a non-exhaustive and non-prescriptive list of adaptation solutions that users may consider when assessing EO2 alignment. The inclusion of a solution in the mARs Guide does not constitute regulatory endorsement, create a whitelist, or imply automatic eligibility under the ASEAN Taxonomy.

The mARs Guide draws on internationally recognised concepts and definitions of adaptation and resilience, while tailoring them to the ASEAN context and the ASEAN Taxonomy. This approach ensures that the priorities and needs of the ASEAN region are reflected, while ensuring conceptual consistency with the ASEAN Taxonomy and globally accepted concepts and definitions.

2. Core function of the mARs Guide

2a. Applying the mARs Guide alongside the ASEAN Taxonomy

Version 1 of the mARs Guide covers 3 sectors under the Plus Standard — Water Supply, Sewerage, Waste Management and Remediation Activities (ISIC E), Agriculture, Forestry and Fishing (ISIC A), and Construction and Real Estate (ISIC F/L). The rationale for the selection of the 3 sectors can be found in Section 3.

While economic activities are classified using the ASEAN Taxonomy's ISIC-based structure, the mARs Guide references resilience themes as an additional lens to help users identify and assess relevant adaptation investments. This thematic lens aligns with the adaptation priorities reflected in existing NAPs and NDCs in identifying and helps to capture adaptation activities that may cut across sectoral boundaries while strengthening the link to adaptation outcomes.

A **resilience theme** refers to the desired state of a system (e.g. agri-food, health, infrastructure, etc.) that is able to withstand and recover from climate-related stresses and shocks. The following eight resilience themes will be used in the mARs Guide, based on a review of relevant global frameworks as detailed in the Phase 1 White Paper.

- Resilient water & sanitation
- Resilient agri-food systems
- Resilient cities
- Resilient health
- Resilient industry & commerce
- Resilient infrastructure
- Resilient nature & biodiversity
- Resilient societies

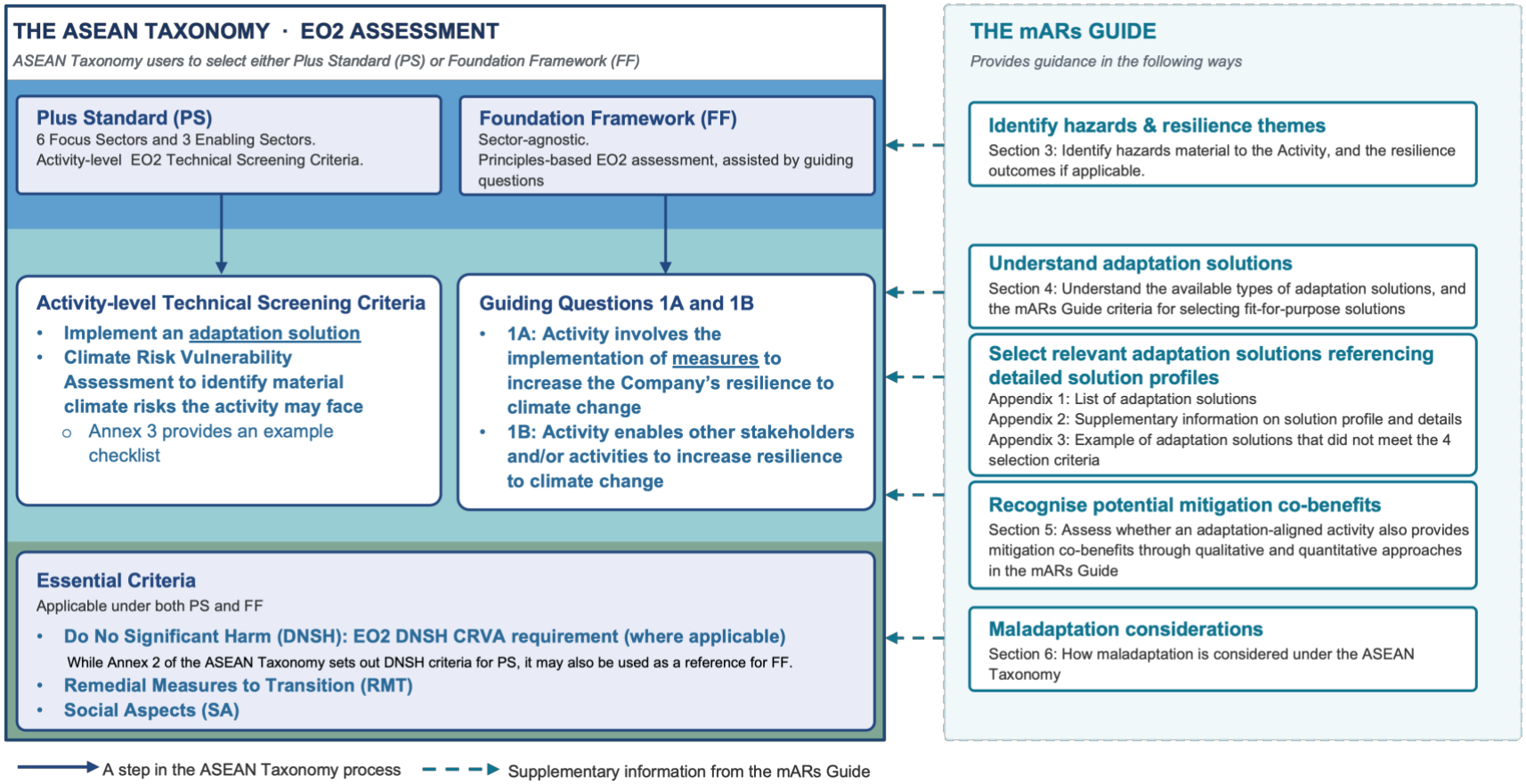


Figure 1: Conceptual approach of the mARs Guide and how it supports the ASEAN Taxonomy

This figure, reproduced from the Executive Summary, illustrates how the mARs Guide supplements the existing ASEAN Taxonomy assessment process. The mARs Guide supports EO2 assessments in the following aspects:

- **Supporting the consistent and robust application of EO2 assessments.** The Guide follows the ASEAN Taxonomy's assessment flow for EO2 and provides information and resources to support activity-level assessments — including the characteristics of adaptation technologies and solutions for a given activity (description, state of technology, scalability, environmental, social and economic impacts, and paradigm shift potential), assessment against solution selection criteria, and ASEAN Taxonomy assessment frame supporting information. In doing so it supports the assessment under both FF and PS of the ASEAN Taxonomy.
- **Providing detailed guidance, resources and data.** The Guide curates ASEAN-relevant solutions that may be implemented within a given activity to support its EO2 assessment.
- **Facilitating the identification of adaptation activities.** The Guide introduces resilience themes and climate hazard mapping to help users identify and assess adaptation activities within the ASEAN Taxonomy.

Figure 1 serves as a high-level roadmap for navigating the mARs Guide. The detailed guidance, resources and adaptation solutions referenced in the figure are provided in the subsequent sections and appendices.

2b. Users of the mARs Guide

Figure 2 illustrates a user entry point for those seeking to identify the climate hazards they have to address, the resilience themes they are contributing to, and the relevant adaptation solutions when conducting an EO2 assessment. Users will start by:

1) Identifying an activity from the ASEAN Taxonomy;
2) Conducting a project-level[15] assessment to identify the relevant climate hazards that may affect the activity;
3) Where applicable, recognising the relevant resilience themes associated with addressing the identified climate hazards, which may facilitate reference to broader adaptation priorities and outcomes, e.g. in NAPs and NDCs; and
4) Identifying and implementing an adaptation solution that addresses the relevant hazard, thereby supporting the activity's EO2 assessment.

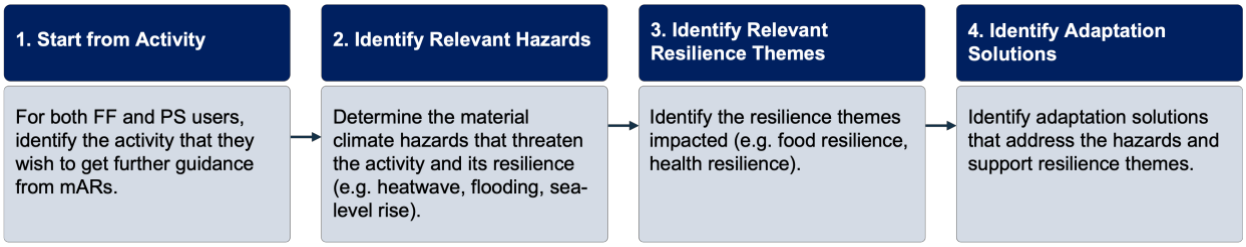


Figure 2: User entry point for ASEAN Taxonomy Users

The mARs Guide can be used by both Foundation Framework (FF) and Plus Standard (PS) users of the Taxonomy.

- For activities covered under the ASEAN Taxonomy Plus Standard, users have the option to use either PS or FF assessment frame, depending on their circumstance.
- For activities not currently covered under the ASEAN Taxonomy Plus Standard, users will default to using FF to guide the assessment of meeting EO objectives.

In both cases, users may draw on the mARs Guide as a supplementary resource to identify relevant climate hazards, resilience themes and adaptation solutions.

In supporting the two assessment frames under the ASEAN Taxonomy, the Guide works with the existing ASEAN Taxonomy assessment process rather than introducing new assessment requirements. The Guide introduces identification of hazards, resilience themes and adaptation solutions to support the consistent identification and assessment of adaptation activities under EO2, rather than serve as additional assessment requirements.

Illustrative example of FF and PS users

For example, a municipality may wish to develop and implement a city-wide heat adaptation plan, that is currently not covered under the ASEAN Taxonomy Plus Standard. In such cases, users may apply FF to assess the activity against EO2, while using the mARs Guide as a resource for relevant adaptation solutions. The relevant climate hazard is extreme heat, while the relevant resilience themes may include **Resilient Cities** and **Resilient Infrastructure**.

[15] Project is herein defined as the specific context into which the solution is being implemented.

Figure 3 illustrates how the user entry point described in Figure 2 maps onto the broader ASEAN Taxonomy EO2 assessment process and the supporting elements of the mARs Guide, described in Figure 1.

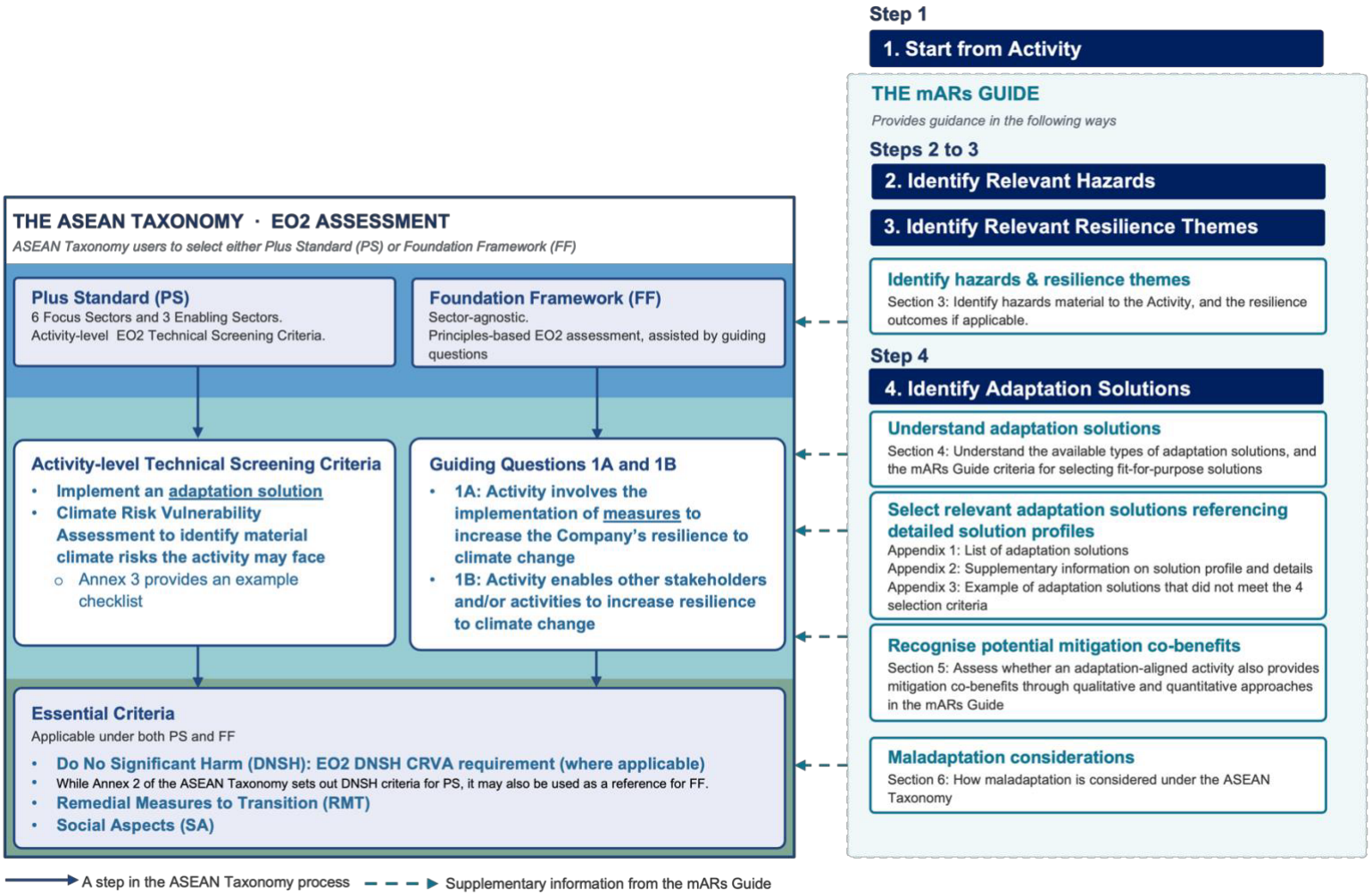


Figure 3: Where the user entry point sits with the mARs Guide and ASEAN Taxonomy

2c. Principles of the mARs Guide

Table 2 below sets out the principles for the development of the mARs Guide, which address three broad aspects (criteria setting, managing impact, users). These principles build on the existing Five Core Principles for the development of the ASEAN Taxonomy.

Table 2: Five Core Principles of the ASEAN Taxonomy and principles of the mARs Guide

Five Core Principles of the ASEAN Taxonomy	Principles of the mARs Guide
Principle 1: The ASEAN Taxonomy will be the overarching guide for all AMS, providing a common language and complementing their respective national sustainability initiatives.	**Context-relevant and locally prioritised:** Criteria for assessing relevant adaptation solutions shall reflect local vulnerabilities, priorities, and governance conditions across AMS, while remaining practicable under varying data and capacity circumstances.
Principle 2: The ASEAN Taxonomy will take into consideration widely used taxonomies and other relevant taxonomies, as appropriate, and shall be contextualized to facilitate an orderly transition towards a sustainable ASEAN.	**Interoperable and comparable:** Terminology, data fields, and outcome concepts shall be capable of mapping to relevant international taxonomies, disclosure frameworks and sustainability standards to support cross market-use and consistent interpretation.
Principle 3: The ASEAN Taxonomy shall be inclusive and beneficial to all AMS.	**Inclusive across AMS:** Requirements shall be accessible and proportionate across AMS and varying levels of market maturity, while maintaining a common baseline for assessment. Where appropriate, solutions may be adapted to reflect differences in climate hazards and local contexts.
Principle 4: The ASEAN Taxonomy shall provide a credible framework, including definitions, and where appropriate, be science-based.	**Science-based and evidence-led: Adaptation solutions** definitions and eligibility criteria shall be grounded in recognised scientific evidence (e.g., IPCC) supported by transparent methodologies, data sources, and assumptions. **Maladaptation risk management (uncertainty-aware):** Assessments should consider future uncertainty, residual risks and potential maladaptation. Adaptation solutions should avoid lock-in, burden-shifting and unintended increases in climate vulnerability, while supporting credible monitoring of adaptation outcomes. Preference should be given to robust and no-regrets options.

Five Core Principles of the ASEAN Taxonomy	Principles of the mARs Guide
Principle 5: The ASEAN Taxonomy will be aligned with the sustainability initiatives taken by the capital market, banking, and insurance sectors, or at least not in conflict.	**Usable for finance and the real economy:** The Guide shall be practical and decision-useful for various user groups, including AMS, regulators, financial institutions, providers of capital, and rating agencies, while minimising reporting burden and supporting the financing of adaptation activities.

Beyond these principles, the mARs Guide recognises that robust governance arrangements for climate adaptation financing are important to instil confidence among financiers, investors, governments and other stakeholders. This is particularly relevant for adaptation activities, where benefits may materialise over longer time horizons, the activity often involves public goods characteristics, and financing typically draws on multiple sources of capital, including public finance, development finance institutions (DFIs), multilateral development banks (MDBs), philanthropic capital and private investors.

In this respect, mARs Guide users may refer to other ASEAN and/or internationally accepted frameworks on governance arrangements for project financing including sustainable financing that exist at the national, project or financing-instrument level, which may differ across jurisdictions and types of financing. Highlighting relevant governance considerations at the regional level can therefore provide a common reference point for appropriate oversight, accountability and transparency in the mobilisation, allocation and use of adaptation finance, while complementing existing arrangements. This is particularly important given the added technical complexities of adaptation projects and the perception that such projects are less bankable.

Meanwhile, the Guide highlights common governance practices that can support a credible EO2 assessment and the development of a financeable adaptation project (See Appendix 5).

3. Prioritisation of focus hazards and ASEAN Taxonomy sectors that are covered in Version 1 of the mARs Guide

3a. Sector coverage of the mARs Guide

Version 1 of the mARs Guide covers three ASEAN Taxonomy Focus Sectors:

i. Agriculture, Forestry and Fishing (ISIC A);

ii. Water Supply; Sewerage, Waste Management and Remediation Activities (ISIC E); and

iii. Construction and Real Estate (ISIC F/L).

These sectors were selected as the initial focus of the Guide because they are consistently identified as adaptation priorities across ASEAN Member States (AMS). These three sectors contribute to three key resilience themes reflected in AMS National Adaptation Plans (NAPs) and Nationally Determined Contributions (NDCs): **resilient agri-food systems**, **resilient water and sanitation**, and **resilient infrastructure**. As shown in Table 3 below, there are 13 Activities with EO2 TSCs.

Table 3: 13 ASEAN Taxonomy Plus Standard Activities with EO2 TSCs

Water Supply; Sewerage, Waste Management and Remediation Activities (ISIC E)	Agriculture, Forestry and Fishing (ISIC A)	Construction and Real Estate (ISIC F/L)
• 36[001] Construction, extension and operation of water collection, treatment and supply systems • 36[003] Desalination • 37[003] Flood or drought risk prevention and protection, including nature-based solutions	• 02[001] Sustainable forest management • 02[002] Forestry plantation • 02[003] Conservation, restoration, and maintenance of natural forests	• 410[001] Construction of new buildings • 410[002] Renovation of existing buildings • 681[001] Acquisition and ownership of buildings • 68[001] Electric vehicle charging stations • 68[002] Energy efficient equipment • 68[004] Renewable Technologies • 68[005] Early Warning Systems

Version 1 focuses on the sectors and activities listed above. Future versions of the mARs Guide are expected to expand coverage to the remaining sectors under the ASEAN Taxonomy Plus Standard, as well as additional climate hazards where relevant.

3b. Hazard coverage

To support users to identify suitable and relevant adaptation solutions, the mARs Guide solutions are organised around climate hazards that are most relevant to the selected sectors. Version 1 prioritises four hazards: **flooding**, **drought**, **sea level rise** and **extreme heat**. These hazards were selected based on a review of AMS National Adaptation Plans (NAPs) and NDCs, where they are among the most frequently cited climate risks. Flooding is identified in the NAPs or equivalent documents of all eleven AMS, drought in nine, sea level rise in nine, and extreme heat in nine (see Table 4). As climate hazard categorisations vary across AMS NAPs, NDCs and equivalent documents, some overlap between hazard definitions may occur.

The selection of sectors and hazards in Version 1 is intended to establish and demonstrate the mARs Guide methodology. Future versions of the mARs Guide are expected to expand coverage to the remaining sectors under the ASEAN Taxonomy Plus Standard, as well as additional climate hazards where relevant.

Table 4: Key physical climate risks in ASEAN Member States

Country	Flooding	Increased sea levels	Extreme weather events	Drought	Increased temperatures	Landslides	Increased rainfall	Coastal erosion and saline intrusion	Heatwaves	Windstorms	Ocean warming and acidification	Urban heat island effect
Brunei Darussalam	■	■	■		■	■	■	■				
Cambodia	■			■				■	■	■		
Indonesia	■	■	■	■	■	■						
Lao PDR	■		■	■	■	■	■					
Malaysia	■	■	■	■	■	■	■	■	■		■	
Myanmar	■	■	■	■	■							
Philippines	■	■	■	■	■	■	■			■		
Singapore	■	■			■		■					■
Thailand	■	■	■	■	■	■						
Timor-Leste	■	■	■	■	■	■	■	■	■		■	
Viet Nam	■	■	■	■		■		■				
Total number of ASEAN Member States that identified the respective risk in their national plans	**11**	**9**	**9**	**9**	**9**	**8**	**6**	**5**	**3**	**2**	**2**	**1**

Table 5 below provides an illustrative mapping of top resilient themes and hazards across ISIC sectors in the context of ASEAN, which is based on a review of National Adaptation Plans (NAPs) and other relevant national plans and strategies. The mapping is non-exhaustive, as a few AMS have yet to complete their NAPs and/or comprehensive risk assessments. It is intended to illustrate the approach used to identify priority sectors, hazards and resilience themes for Version 1 of the mARs Guide.

Table 5: Prioritising sectors based on top resilient themes and hazards

ISIC	Sectors	Resilience themes							
		Resilient agri-food systems	Resilient cities	Resilient health	Resilient industry & commerce	Resilient infrastructure	Resilient nature and biodiversity	Resilient societies	Resilient water & sanitation
A	Agriculture, forestry and fishing								
B	Mining and quarrying								
C	Manufacturing								
D	Electricity, gas, steam, and air conditioning supply								
E	Water supply; sewerage, waste management and remediation								
F	Construction								

ISIC	Sectors	Resilience themes							
		Resilient agri-food systems	Resilient cities	Resilient health	Resilient industry & commerce	Resilient infrastructure	Resilient nature and biodiversity	Resilient societies	Resilient water & sanitation
G	Wholesale and retail trade; repair of motor vehicles	☀	💧		💧 🌬 ☀	💧		🌊	
H	Transportation and storage	💧	💧 🔥		🌬	💧 🌊 🌬 🔥		🌊 🌬	💧
I	Accommodation and food service activities	☀	💧	🔥	💧 🌊 🌬	💧	🌬	🌊 🌬	☀
J	Information and communication		💧		🌬	💧 🌬		🌊 🌬	
K	Financial and insurance activities	☀	💧 🌬 🌊	🔥	💧 🌊 ☀	💧 🌊	💧	🌊 💧	☀ 🌊
L	Real estate		💧 🌬 🌊 🔥	🔥	💧	💧 🌬 🌊		💧 🌬	💧 🌊
M	Professional, scientific, and technical activities	☀	💧	🔥	🌊	🌬	💧	🌊	☀

Legend: 💧 Flooding ☀ Drought 🔥 Extreme heat 🌊 Sea level rise 🌬 Extreme weather (storms, typhoons, rainstorms and hailstorms). The first four are the priority hazards for Version 1 of the mARs Guide; extreme weather appears in this mapping but is not prioritised in Version 1, for the reason given below.

Note that rows in light grey are ISIC sectors that are not yet covered under the Plus Standard of the ASEAN Taxonomy.

Table 6: Priority hazards for Version 1 of the mARs Guide, and the basis for prioritising them

Hazards	**AMS Coverage** (identified in NAPs or equivalent)	**Resilience themes most affected**	**Principal impacts**	**Included in Version 1**
Flooding	11 out of 11 AMS	Resilient water & sanitation; Resilient agri-food systems; Resilient infrastructure	Agriculture: crop loss and soil erosion. Water systems: contamination and infrastructure damage. Built environment: structural damage and displacement.	Yes — foundational across all three themes
Drought	9 out of 11 AMS	Resilient water & sanitation; Resilient agri-food systems	Threatens water supply and food production, affecting irrigation, reservoir management and urban water security. Increasingly compounds with heat.	Yes
Sea level rise	9 out of 11 AMS	Resilient infrastructure; Resilient water & sanitation	Threatens coastal settlements, water supply through saline intrusion, agricultural land and critical infrastructure. Particularly material given ASEAN's extensive coastlines.	Yes

Hazards	AMS Coverage (identified in NAPs or equivalent)	Resilience themes most affected	Principal impacts	Included in Version 1
Extreme heat	9 out of 11 AMS	Resilient cities; Resilient agri-food systems; Resilient infrastructure	Drives urban heat-island effects, raises cooling demand, reduces crop yields and stresses water systems. Combines with humidity to create compound risks specific to the region's tropical context.	Yes
Extreme weather events	9 out of 11 AMS	Resilient water & sanitation; Resilient agri-food systems; Resilient infrastructure	Storms, typhoons, rainstorms and hailstorms. In effect a broader grouping of hazards that overlaps others already defined in AMS NAPs and NDCs, for example windstorms.	No — excluded from Version 1 to avoid overlap

Although extreme weather events (including storms, typhoons, rainstorms, hailstorms, etc.) are also identified in NAPs/NDCs or equivalent by 9 out of 11 AMS, this hazard is not included in the initial set of hazards under Version 1 of the mARs Guide. This is because extreme weather events form a broader group of hazards and overlaps with other hazards defined by AMS NAPs/NDCs. To maintain a more focused and actionable set of hazards, Version 1 instead prioritises extreme heat as a more specific hazard which can also be classified as extreme weather events, due to it being widely identified across AMS to have pervasive impacts on human health, labour productivity and economic activity.

Based on the mapping above, Table 7 presents the priority ASEAN Taxonomy sectors, hazards and resilience themes for Version 1 of the mARs Guide.

Table 7: Priority sectors and themes for Version 1 of the mARs Guide

3 priority ASEAN Taxonomy (Plus Standard) sectors	4 priority hazards	3 resilience themes
• Agriculture, Forestry and Fishing • Water Supply; Sewerage, Waste Management and Remediation Activities • Construction and Real Estate	• Flooding • Drought • Extreme heat • Sea level rise	• Resilient water & sanitation • Resilient agri-food systems • Resilient infrastructure

4. Adaptation solutions and selection methodology

4a. Types of solutions (Technology-based and Nature-based)

The mARs Guide has identified a non-exhaustive list of solutions that can allow users of the Plus Standard under the ASEAN Taxonomy to mitigate against the priority hazards. Adaptation solutions in the mARs Guide are grouped into two broad categories: **Technology-based** and **Nature-based**. These categories are intended as a practical framework for understanding and classifying adaptation solutions, rather than as mutually exclusive categories. In practice, some solutions may combine elements of both approaches, while others may not fit neatly within either category.

- **Technology-based Solutions** refers to engineered or built solutions that deliver a defined adaptation function through physical infrastructure or technical systems.
- **Nature-based Solutions (NbS)** are actions to protect, manage or restore ecosystems that deliver adaptation outcomes through ecosystem function,[16] with ecosystem-based adaptation (EbA) as the adaptation-focused subset.
    - A solution is treated as NbS where an ecosystem-based, vegetation-, wetland- or soil-led, or hybrid system provides the adaptive function.
    - Technology may also play an enabling role for NbS — for example sensors, early-warning systems and monitoring platforms supporting adaptive management of a restored catchment — which is distinct from the NbS itself.

The same climate hazard may call for different adaptation solutions across sectors and activities. For example, solutions that address flooding in the water sector may differ significantly from those applied in agriculture or the built environment. The methodology set out below focuses on how a solution performs against a specific climate hazard within a defined activity and context, rather than on the solution itself. This helps ensure that solutions included in the Guide are relevant to the identified climate risk and contribute meaningfully to reducing climate vulnerability.

4b. Criteria and methodology for selecting adaptation solutions

For the selection of adaptation solutions included in the mARs Guide, the following four criteria have been identified to ascertain whether a solution is fit for purpose for the activity and context to which it is applied. These criteria are identified based on the principles for the development of the mARs Guide (see Table 8 below).

[16] IUCN (2026). IUCN Global Standard for Nature-based Solutions™. A user-friendly framework for assessing, implementing, and monitoring scalable, high-integrity NbS. Second Edition. Gland, Switzerland: IUCN. DOI: 10.2305/KKSO4573.

Table 8: Linkage between adaptation solution selection criteria and the principles for the development of the mARs Guide

Principles for the development of the mARs Guide	Criteria for selecting adaptation solutions
Context-relevant and locally prioritized	• **Clear risk fit:** the solution addresses a specific climate hazard and exposure in a defined place. • **Clear effect:** the solution demonstrates how it supports the stated resilience theme, including through a clear reduction in damage, disruption, or vulnerability
Interoperable and comparable	These principles are reflected in the approach used to identify and describe adaptation solutions, including (but not limited to) consistent use of names, descriptions and terminologies in the ASEAN Taxonomy as well as AMS-relevant references. While the Guide seeks to promote interoperability and relevance across AMS, certain solutions may be more applicable to specific AMS contexts or use cases.
Inclusive across AMS	
Science-based and evidence-led	• **Works under uncertainty:** the solution is assessed against plausible future conditions, not a single historical baseline. • **Does not conflict with mitigation objectives:** the solution, by design, does not conflict with mitigation objectives.
Maladaptation risk management (uncertainty-aware)	
Usable for finance and the real economy	• **Clear risk fit** • **Clear effect**

These criteria do not replace the EO2 assessment requirements under either the Foundation Framework (FF) or Plus Standard (PS) of the ASEAN Taxonomy. Rather, they are intended to help users identify and assess adaptation solutions in a structured and consistent manner. The process of selecting a solution also does not replace activity-level DNSH assessment. Users may additionally apply these criteria when considering solutions that are not included in the Guide, as described in Section 4d.

Table 9: Summary of adaptation solutions selection criteria

Selection criteria	Rationale for each criterion
1. Clear risk fit: the solution addresses a specific climate hazard and exposure in a defined place.	Ensures the solution is relevant to the climate hazard and exposure affecting the activity in its specific context, rather than being a generic adaptation measure. A solution that is appropriate for drought in one AMS may be ineffective or even maladaptive in a flood-prone context.
2. Clear effect: the solution demonstrates how it supports the stated resilience theme, including through a clear reduction in damage, disruption, or vulnerability	Ensures the solution is clearly defined for the stated resilience theme "by design" of the specific solution and demonstrates additionality through measurable adaptation benefits, rather than broad or unsubstantiated benefits that risks greenwashing.
3. Works under uncertainty: the solution is assessed against plausible future conditions, not a single historical baseline.	Ensures the solution is robust under changing climate risk scenarios and future vulnerability considerations. This will help ensure that the solution withstands changes in the environment.
4. Does not conflict with mitigation objectives: the solution, by design, does not conflict with mitigation objectives.	Ensures the solution itself does not inherently conflict with climate mitigation objectives. This criterion is applied at the solution level for selecting a solution, and does not replace the activity-level DNSH assessment required under the ASEAN Taxonomy.

4c. Examples of how adaptation solutions can be applied

The following examples illustrate how users may apply the mARs Guide when identifying climate hazards, resilience themes and adaptation solutions for a given activity. The examples also show how these outputs can support, but do not replace, the EO2 assessment requirements under the ASEAN Taxonomy. The full list of adaptation solutions is provided in Appendix 1, while solutions not included in the Guide may be self-assessed against the four selection criteria described in Section 4d.

Example 1:

Step 1: Identify the Activity ASEAN Taxonomy assessment element	**36[001] Construction, extension and operation of water collection, treatment and supply systems**
Step 2: Select the assessment frame (Foundation Framework or Plus Standard) ASEAN Taxonomy assessment element	Check whether 36[001] has EO2 TSC in the Plus Standard. If it does, either the Plus Standard or the Foundation Framework may be used; if not, the Foundation Framework applies. Step 5 shows what each frame then requires.
Step 3: Identify the material hazard and resilience theme mARs Guide supporting element · voluntary	**Hazard:** Flood (inundation, debris loading and high turbidity at the raw-water intake) **Resilience theme:** Resilient water & sanitation; Resilient infrastructure
Step 4: Select an adaptation solution mARs Guide supporting element · voluntary	**Hardened/flood-resilient water intake structures** Type of solution: Technology-based Listed in Appendix 1, so the four selection criteria have already been assessed, as summarised below.
Step 4 (continued): How the solution meets the four selection criteria mARs Guide supporting element · voluntary	• **Clear Risk Fit:** Addresses source intake continuity. • **Clear Effect:** Maintains intake function under high turbidity, debris loading and inundation. • **Works Under Uncertainty:** Robust design tolerates events beyond the standard return period. • **Does not conflict with mitigation objectives:** One-off civil works with embedded carbon only; no ongoing energy penalty. Embedded emissions are a construction-stage consideration, not an operational lock-in.

Step 5: Complete the EO2 assessment under the selected frame ASEAN Taxonomy assessment element	**Foundation Framework:** the solution supports Guiding Question 1A, since it keeps the Company's own supply operations functioning through floods, and may support 1B where uninterrupted supply helps the communities served to cope with flooding. **Plus Standard:** the Activity-level EO2 TSC and the CRVA, with the CRVA identifying flood exposure at the intake and recording the hardened intake as the response. **Under either frame:** the Essential Criteria (DNSH, Remedial Measures to Transition and Social Aspects) must also be met. The four-criteria assessment at Step 4 informs this step but does not replace it.
Step 6: Recognise a mitigation co-benefit mARs Guide supporting element · voluntary	Voluntary. No mitigation co-benefit is expected: the intake works carry embedded carbon only and do not reduce emissions. The EO2 classification is unaffected.

Example 2:

Step 1: Identify the Activity ASEAN Taxonomy assessment element	**37[003] Flood and drought risk prevention and protection, including NbS**
Step 2: Select the assessment frame (Foundation Framework or Plus Standard) ASEAN Taxonomy assessment element	Check whether 37[003] has EO2 TSC in the Plus Standard. If it does, either the Plus Standard or the Foundation Framework may be used; if not, the Foundation Framework applies. Step 5 shows what each frame then requires.
Step 3: Identify the material hazard and resilience theme mARs Guide supporting element · voluntary	**Hazard:** Flood (pluvial flooding of urban services and property) **Resilience theme:** Resilient water & sanitation; Resilient infrastructure
Step 4: Select an adaptation solution mARs Guide supporting element · voluntary	**Sustainable urban drainage systems (SuDS/WSUD)** Type of solution: NbS Listed in Appendix 1, so the four selection criteria have already been assessed, as summarised below.

Step 4 (continued): How the solution meets the four selection criteria mARs Guide supporting element · voluntary	• **Clear Risk Fit:** Addresses urban services and property exposure to pluvial flooding. • **Clear Effect:** Manages surface water at source via permeable surfaces, bioswales and rain gardens, cutting runoff volumes and peaks before they reach the drainage network • **Works Under Uncertainty:** Modular and expandable. • **Does not conflict with mitigation objectives:** Green infrastructure sequesters carbon and reduces urban heat alongside the drainage function.
Step 5: Complete the EO2 assessment under the selected frame ASEAN Taxonomy assessment element	**Foundation Framework:** the solution supports Guiding Question 1B, since it reduces surface water flooding for the properties and services in the area it drains, and 1A where it also protects the Company's own assets. **Plus Standard:** the Activity-level EO2 TSC and the CRVA, with the CRVA identifying pluvial flood exposure across the drained area and recording SuDS/WSUD as the response. **Under either frame:** the Essential Criteria (DNSH, Remedial Measures to Transition and Social Aspects) must also be met. The four-criteria assessment at Step 4 informs this step but does not replace it.
Step 6: Recognise a mitigation co-benefit mARs Guide supporting element · voluntary	Voluntary. The carbon sequestered by the green infrastructure could be recognised as a mitigation co-benefit using Section 5. The EO2 classification is unchanged either way.

Example 3:

Step 1: Identify the Activity ASEAN Taxonomy assessment element	**02[003] — Conservation, restoration, and maintenance of natural forests**
Step 2: Select the assessment frame (Foundation Framework or Plus Standard) ASEAN Taxonomy assessment element	Check whether 02[003] has EO2 TSC in the Plus Standard. If it does, either the Plus Standard or the Foundation Framework may be used; if not, the Foundation Framework applies. Step 5 shows what each frame then requires.

Step 3: Identify the material hazard and resilience theme mARs Guide supporting element · voluntary	**Hazard:** Extreme heat (peat fire risk on drained tropical peatland) **Resilience theme:** Resilient agri-food systems
Step 4: Select an adaptation solution mARs Guide supporting element · voluntary	**Peatland rewetting and water-table management** Type of solution: NbS Listed in Appendix 1, so the four selection criteria have already been assessed, as summarised below.
Step 4 (continued): How the solution meets the four selection criteria mARs Guide supporting element · voluntary	• **Clear Risk Fit:** Addresses peat fire and subsidence risk on drained tropical peatland • **Clear Effect:** Raises the water table to an acceptable threshold, substantially cutting fire risk. • **Works Under Uncertainty:** Partially met. A higher water table slows subsidence and lowers fire risk whatever the climate trajectory, so the measure is low-regret, but it is less reliable in extreme drought. In Riau, rewetting cut the number of extreme fire-hazard events but their mean duration increased (Taufik et al., 2023); in Central Kalimantan, canal blocking had no statistically significant net effect on fires in the 2019 El Niño year, with damaged blocks a possible cause (Castro et al., 2026). Performance therefore depends on monitoring water levels and maintaining canal blocks through dry years. • **Does not conflict with mitigation objectives:** Rewetting reverts degraded peat from a carbon source toward a sink and avoids fire emissions; peatland contributes the majority of Indonesia's natural-climate-solution mitigation potential, so the co-benefit is large.
Step 5: Complete the EO2 assessment under the selected frame ASEAN Taxonomy assessment element	**Foundation Framework:** the solution supports Guiding Question 1A where the Company manages the peatland, since it lowers fire and subsidence risk to its own land, and 1B, since fewer fires reduce risk for neighbouring land users and communities. **Plus Standard:** the Activity-level EO2 TSC and the CRVA, with the CRVA identifying fire and subsidence exposure. Because Works Under

	Uncertainty is only partially met, the CRVA can usefully set out how water levels will be monitored and canal blocks maintained through dry years. **Under either frame:** the Essential Criteria (DNSH, Remedial Measures to Transition and Social Aspects) must also be met. The four-criteria assessment at Step 4 informs this step but does not replace it.
Step 6: Recognise a mitigation co-benefit mARs Guide supporting element · voluntary	Voluntary. The avoided fire emissions, and the shift of degraded peat from carbon source towards sink noted under the fourth criterion, could be recognised as a mitigation co-benefit using Section 5. The EO2 classification is unchanged either way.

Example 4:

Step 1: Identify the Activity ASEAN Taxonomy assessment element	**410[001] — Construction of new buildings**
Step 2: Select the assessment frame (Foundation Framework or Plus Standard) ASEAN Taxonomy assessment element	Check whether 410[001] has EO2 TSC in the Plus Standard. If it does, either the Plus Standard or the Foundation Framework may be used; if not, the Foundation Framework applies. Step 5 shows what each frame then requires.
Step 3: Identify the material hazard and resilience theme mARs Guide supporting element · voluntary	**Hazard:** Flood (stormwater runoff and surface water flooding on site) **Resilience theme:** Resilient infrastructure
Step 4: Select an adaptation solution mARs Guide supporting element · voluntary	**On-site SuDS[17]: permeable surfaces, rain gardens, detention** Type of solution: Technology-based Listed in Appendix 1, so the four selection criteria have already been assessed, as summarised below.
Step 4 (continued): How the solution meets the four selection criteria	• **Clear Risk Fit:** Addressed risk: stormwater runoff reduction.

[17] "SuDS" refers to sustainable drainage systems.

mARs Guide supporting element · voluntary	• **Clear Effect:** Absorbs stormwater runoff and recharges groundwater tables. • **Works Under Uncertainty:** Continuously channels rainfall straight into the underlying soil regardless of unpredictable stormwater accumulation rates. • **Does not conflict with mitigation objectives:** Reduces energy-intensive wastewater treatment.
Step 5: Complete the EO2 assessment under the selected frame ASEAN Taxonomy assessment element	**Foundation Framework:** the solution supports Guiding Question 1A, since it protects the building and its occupants from surface water flooding, and may support 1B where it reduces runoff to neighbouring sites and public drains. **Plus Standard:** the Activity-level EO2 TSC and the CRVA, with the CRVA identifying surface water flood exposure at the site and recording on-site SuDS as the response. **Under either frame:** the Essential Criteria (DNSH, Remedial Measures to Transition and Social Aspects) must also be met. The four-criteria assessment at Step 4 informs this step but does not replace it.
Step 6: Recognise a mitigation co-benefit mARs Guide supporting element · voluntary	Voluntary. Where the site drains to a combined sewer, the reduced volume sent for energy-intensive wastewater treatment could be recognised as a mitigation co-benefit using Section 5. The EO2 classification is unchanged either way.

4d. How users can self-assess solutions not in the list

The solutions in the mARs Guide are non-exhaustive. Given the breadth of adaptation and resilience technologies across sectors, geographies, and risk contexts, it is not practical nor intended for the Guide to capture the full universe of eligible solutions. New solutions, materials, and approaches will also emerge as technologies and market practices evolve.

For this reason, users may identify and implement other adaptation solutions that are not included in the mARs Guide solution list, where they consider these relevant to the climate hazards being addressed and the adaptation outcomes.

Users can apply the four mARs Guide criteria set out in Section 4b to conduct a self-assessment of adaptation solutions that are not included in the Guide. Applying all four criteria ensures consistency with the approach used to assess the solutions included in the Guide and provides a robust basis for assessing whether a non-listed solution satisfies the mARs Guide's selection criteria.

Beyond the mARs Guide, ASEAN Taxonomy users may still identify, implement, or finance adaptation solutions that are not included in the Guide, where they consider these relevant to the climate hazards being addressed and the adaptation outcomes sought. The absence of a solution from the Guide does not, by itself, indicate that the solution is unsuitable or ineligible under the ASEAN Taxonomy.

Illustrative example of a self-assessment process

An enterprise intends to install shaded, insulated cold storage to protect harvested produce from heat damage and wishes to assess whether the solution is aligned with the mARs Guide methodology. Table 10 provides illustrative examples of evidence that users may draw on when assessing alignment with the adaptation solution selection criteria.

Table 10: Typical evidence for self-assessment of solutions against selection criteria

Criterion	Description	Typical evidence
C1: Clear risk fit	The solution addresses an identified hazard and exposure in a defined place — not category membership alone.	Hazard–exposure–measure linkage anchored in a CRVA or qualitative narrative proportionate to scale.
C2: Clear effect	A defined adaptation outcome, attributable by design, with additionality over the baseline.	Stated, measurable outcome traced to the design; baseline comparison.

Criterion	Description	Typical evidence
C3: Works under uncertainty	Effective across a plausible range of futures, not a single projection; favours flexible, modular or staged design.	Testing across scenarios (e.g. RCP 4.5 and 8.5) over a horizon matched to asset life; review triggers where material.
C4 Does not conflict with mitigation objectives	The solution, by design, does not conflict with mitigation objectives.	Statement of any energy or emissions penalty inherent to the solution, drawn from the environmental, social and economic impact dimension of the technology details; cross-reference to the activity-level DNSH assessment against EO1.

For example, the enterprise could potentially go through an internal assessment of an adaptation solution as presented below:

Criterion	Example evidence for an internal assessment
C1: Clear risk fit	Citing the district-level heat data in its national adaptation plan
C2: Clear effect	Recording spoilage rates before and after installation
C3: Works under uncertainty	Noting that the measure is modular and reversible with a short asset life
C4: Does not conflict with mitigation objectives	Stating the additional electricity demand and how it is supplied

For such internal assessment, no modelled projections, external consultant or third-party assurance are needed at that scale. Consistency comes from the evidence being traceable — dated, sourced and repeatable — rather than from its volume.

Independent technical review may strengthen the credibility of a self-assessment, particularly where an EO2 claim will be relied upon by third parties. Given the technical complexity of adaptation assessment, users may obtain an independent review of the assessments on which the EO2 claim rests, including the CRVA, the hazard and exposure analysis, the assessment of substantial contribution to EO2, and the screening for maladaptation risks. The occurrence and depth of an independent technical review should be proportionate to the size and complexity of the enterprise as well the as the evidence itself. For the small enterprise in the example above, none is expected. For a large, long-lived or high-lock-in activity, and particularly one seeking external financing, independent review of the CRVA and of the adaptation outcome claimed is established practice and is likely to be expected by financiers and assurance providers irrespective of this Guide.

5. Process for recognising mitigation co-benefit

5a. Context setting

Many adaptation and resilience solutions can also reduce greenhouse gas emissions and contribute to climate change mitigation. Recognising these mitigation co-benefits helps provide a more complete picture of a solution's contribution to climate goals and may support investment decision-making by making these additional benefits more visible.

The IPCC currently defines a co-benefit as a positive effect that a measure aimed at one objective has on another objective, increasing the total benefit to society or the environment.[18] For example, wetland restoration delivers flood retention and drought baseflow benefits, while also sequestering carbon in restored peat and biomass.

To reflect this, the mARs Guide introduces a **voluntary option** for users to demonstrate and communicate that an activity meeting Environmental Objective 2 (EO2) requirements also generates co-benefits for Environmental Objective 1 (EO1), Climate Change Mitigation. This does not in any way alter the activity's EO2 classification or require the EO2 activity to meet EO1 criteria.

At present, the option for recognition of co-benefit is limited to EO1. It does not apply to EO3 (Protection of Healthy Ecosystems and Biodiversity) or EO4 (Resource Resilience and the Transition to a Circular Economy).

[18] IPCC Glossary: https://apps.ipcc.ch/glossary

5b. Two options to voluntarily demonstrate mitigation co-benefit

Users of the mARs Guide may demonstrate co-benefits through either a **Qualitative Approach** or a **Quantitative Approach**. The Qualitative Approach is available to all users and relies on existing evidence and documentation. The Quantitative Approach is an optional additional step for users who are more advanced and are able to measure and verify mitigation outcomes. Both approaches are voluntary and may be applied under either the Foundation Framework (FF) or Plus Standard (PS).

Note that the voluntary demonstration of mitigation co-benefit under either approach does not equate substantial contribution to EO1 nor ASEAN Taxonomy alignment, and should not be presented or reported as such.

Qualitative Approach

The Qualitative Approach allows users to voluntarily demonstrate and communicate mitigation co-benefits, where a mitigation effect can be reasonably evidenced but not quantified. Under this approach, an activity that meets its primary Environmental Objective (EO) criteria, in this case EO2 (Climate Change Adaptation), may also demonstrate a positive contribution to EO1 (Climate Change Mitigation) through a short narrative supported by available evidence and reasonable assumptions. The activity is not required to meet the EO1 criteria.

Unlike DNSH, which demonstrates the absence of harm, the Qualitative Approach requires an identifiable positive contribution to climate change mitigation. Quantified additionality and counterfactual analysis are not required.

Users may rely on **any one** of the following evidence types:

Evidence Types	Examples
Type A: Environmental permits & licences	**Examples:** • EIA conditions; • Regulator-approved management plans; • Concession terms; • Sector-specific licences that explicitly address EO1
Type B: Audits	**Examples:** • Independently verified alignment with an external standard implying the co-benefit (SBTi, IFC PS, FSC, ISO 14001/14064); • NDC/NAP-listed measures
Type C: Design documentation	**Examples:** • Project design documents; • Feasibility studies; • Board approvals;

Evidence Types	Examples
	• Investment committee papers naming EO1 as an intended outcome
Type D: Qualitative justification	**Examples:** • Short structured narrative (≤½ page) identifying mechanism of contribution, with at least one citation to sector literature or MDB methodology

Quantitative Approach

Users who have access to relevant data, methodologies, and supporting documentation may also choose to demonstrate mitigation co-benefits through a Quantitative Approach. Under this approach, an activity that meets its primary Environmental Objective (EO) criteria additionally demonstrates a measurable contribution to EO1 (Climate Change Mitigation) using defined metrics and recognised methodologies.

The Quantitative Approach may be used by users seeking to communicate mitigation co-benefits in a more measurable and comparable manner. This approach combines quantified metrics, recognised methodologies, supporting records, and independent verification to provide a robust basis for demonstrating mitigation co-benefits.

Users need to provide **all four elements** of relevant evidence under this approach:

Elements of Evidence	Information Needed	Additional Guidance
Element 1: Quantified metric + baseline	**What's needed:** Activity-level indicator aligned to EO1 (tCO_2e avoided; ha restored; m^3 water saved; total tCO_2e sequestered). Stated baseline and measurement boundary.	The user reports the metric that the cited methodology defines, per year and over the life of the solution. Adaptation results, such as hectares restored or water saved, belong in the EO2 claim. The **baseline** is what would have happened without the solution: the alternative most likely to have been used to manage the same risk (e.g. in Example 3 in Section 5c later, the same building built to the minimum envelope requirements of the building energy code) or, where there is none, conditions before the project (e.g. Examples 1 and 2 in Section 5c). The user explains the choice and fixes it

Elements of Evidence	Information Needed	Additional Guidance
		at the start; an unrealistic, high-emitting alternative overstates the co-benefit. The **boundary** covers the solution and subtracts its own emissions from construction, operation and maintenance. For land-based solutions, it also covers activity displaced to other land and the risk that stored carbon is lost, for example through fire or storm damage.
Element 2: Methodology reference	**What's needed:** Calculation follows recognized approaches: MDB joint methodology; ICMA Climate Transition Finance Handbook; CBI sector criteria; national NDC/NAP accounting; or sector equivalent, cited explicitly.	The cited methodology calculates GHG emissions or removals. • For frameworks that define eligible activities or set disclosure expectations (e.g. the MDB–IDFC Common Principles for Climate Mitigation Finance Tracking and the ICMA Climate Transition Finance Handbook), they may be cited only for a GHG emission calculation method they specify. • National emission factors, such as a published grid emission factor, may be used where the methodology allows. • Methodologies designed for carbon crediting may be used, but their additionality tests do not apply: the user does not need to show that the solution would not have happened without the financing. The co-benefit is therefore not a carbon credit and is not used to offset other emissions. If

Elements of Evidence	Information Needed	Additional Guidance
		the same reductions are sold as carbon credits or claimed by another party, the user says so.
Element 3: Records or threshold performance	**What's needed:** Operational records evidencing the metric meets or exceeds the Tier 3 threshold of the Activity set in the ASEAN Taxonomy technical annex for the secondary EO.	The **benchmark** is the ASEAN Taxonomy EO1 threshold for the Activity, where one exists. The co-benefit does not have to meet it, as the Guide does not require an EO2 Activity to meet EO1 criteria (Section 5a). Meeting it does not make the Activity EO1-aligned; an EO1 claim requires assessment against all EO1 criteria and the Essential Criteria. The comparison is meaningful only where performance is measured on the same basis as the threshold, for example a whole-building figure against a whole-building threshold. Where the ASEAN Taxonomy sets no EO1 threshold for the Activity, operational records alone satisfy this element.
Element 4: Audits & inspections	**What's needed:** Independent review in accordance with the ASEAN Taxonomy and/or existing assurance requirements based on jurisdiction or entity (e.g. MDB)	The depth of review is proportionate to the claim. The user discloses the methodology, baseline, boundary, emission factors and global warming potential (GWP) values, so that a reviewer can repeat the calculation. Where the exposure is large or the figure is used for external targets, verification to a recognised standard such as ISO 14064-3:2019 may be appropriate.

The type of information is open to customisability. Users may identify additional reference options to those in the table above, which may provide flexibility in generating different evidence elements. As stated above, the mitigation co-benefit should be evidence from operational records that at least the Tier 3 EO1 threshold for the Activity in question as set out in the ASEAN Taxonomy technical annex should be met.

Table 11 below provides some examples of methodology references for Element 2 of relevant evidence under the Quantitative Approach. For EO1 the metric is tCO_2e or a direct derivative of it — annual tCO_2e avoided, annual tCO_2e sequestered, or tCO_2e per unit of output — and the metric a user reports should be the one the cited methodology defines. The methodologies themselves set out the calculation, the permitted assumptions, the acceptable data sources and the assurance expected.

Table 11: Example co-benefit methodology references

Secondary EO	Methodology	What it provides
EO1 Mitigation (tCO_2e)	GHG Protocol Project Protocol (+ LULUCF Guidance)	Project-level reductions against a counterfactual baseline; core additionality method
EO1 Mitigation (tCO_2e)	ISO 14064-2:2019 (verify via ISO 14064-3)	Project-level quantification, monitoring, reporting; confirmed current 2024
EO1 Mitigation (tCO_2e)	2006 IPCC GLs + 2019 Refinement	Emission factors / activity-data tiers underpinning the calculation
EO1 Mitigation (tCO_2e)	MDB–IDFC Common Principles, Mitigation, v4 2023	MDB methodology reference; aligns with Foundation-option MDB citations

5c. Worked examples

The following examples are used to demonstrate how the two options of recognising co-benefit could be applied in practice.

Example 1

	Qualitative Approach	Quantitative Approach
ASEAN Taxonomy sector	Water Supply; Sewerage, Waste Management and Remediation Activities (ISIC E)	
ASEAN Taxonomy activity name and code	37[003] Flood and drought risk prevention and protection, including nature-based solutions	
Solution example	Wetland restoration for flood and drought protection	
Example user	A Thai water utility cooperative as a Foundation Framework user	An MDB-financed Mekong wetland restoration programme (Plus Standard user)
Evidence for the primary EO2 claim	Substantial contribution through flood retention and drought baseflow, evidenced as the EO2 assessment requires.	Flood retention is evidenced through the CRVA.
Evidence for the mitigation co-benefit claim	Users may choose to provide any one of the following evidence types • **Type A (environmental permits and licences):** carbon sequestration in restored peat and biomass, evidenced by any one of — a provincial wetland concession referencing carbon outcomes; OR • **Type B (audits and verified alignment with an external standard):** alignment with the IUCN Global Standard for NbS; OR • **Type C (design documentation):** an investment-committee paper naming restoration of sequestration capacity as a secondary outcome; OR	A mitigation co-benefit claim is met by meeting all four of the following elements: • **Element 1 (quantified metric and baseline):** sequestration of around 3.5 tonnes of CO_2e per hectare per year, with the baseline set as pre-restoration peat respiration and the measurement boundary as the restored area plus a 100 m buffer; AND • **Element 2 (methodology reference):** the IPCC 2013 Wetlands Supplement Tier 2 method, together with the MDB joint methodology; AND • **Element 3 (records or threshold performance):** programme monitoring

	• **Type D (qualitative justification):** a half-page narrative citing the IPCC Wetlands Supplement.	records evidencing that the metric meets or exceeds the Tier 3 EO1 threshold for the activity in the ASEAN Taxonomy technical annex; AND • **Element 4 (audits and inspections):** assurance scaled from sub-project to programme level. All four elements are therefore satisfied, which is what the Quantitative Approach requires.
Outcome	Primary EO = EO2, plus qualitative mitigation co-benefit.	Primary EO = EO2, plus quantified mitigation co-benefit.

Example 2

	Qualitative Approach	**Quantitative Approach**
ASEAN Taxonomy sector	Agriculture, Forestry and Fishing (ISIC A)	
ASEAN Taxonomy activity name and code	02[003] Conservation, restoration and maintenance of natural forests	
Solution example	Assisted natural regeneration (ANR) of degraded forest	
Example user	A plantation company as a Plus Standard user	A plantation company as a Plus Standard user
Evidence for the primary EO2 claim	Regeneration of canopy cover reduces fire spread and surface temperature and stabilises slopes against erosion during high-intensity rainfall, evidenced through the CRVA.	Regeneration of canopy cover reduces fire spread and surface temperature and stabilises slopes against erosion during high-intensity rainfall, evidenced through the CRVA.
Evidence for the mitigation co-benefit claim	Users may choose to provide any one of the following evidence types • **Type A (environmental permits and licences):** N/A	A mitigation co-benefit claim is met by meeting all four of the following elements:

	• **Type B (audits and verified alignment with an external standard):** above- and below-ground carbon accumulation in regenerating forest, evidenced by FSC certification covering the concession; OR • **Type C (design documentation):** a management plan naming carbon stock recovery as an intended outcome; OR • **Type D (qualitative justification):** N/A.	• **Element 1:** net carbon accumulation in tCO_2e per hectare per year against a baseline of the degraded state, with the boundary as the ANR intervention area. • **Element 2:** the 2006 IPCC Guidelines with the 2019 Refinement for the emission factors, and the MDB–IDFC Common Principles for the mitigation accounting. • **Element 3:** plot-based monitoring records evidencing performance against the Tier 3 EO1 threshold for the activity. • **Element 4:** independent verification of the monitoring at concession level.
Outcome	Primary EO = EO2, plus qualitative mitigation co-benefit.	Primary EO = EO2, plus quantified mitigation co-benefit.

Example 3

	Qualitative Approach	**Quantitative Approach**
ASEAN Taxonomy sector	Construction and Real Estate (ISIC F / L)	
ASEAN Taxonomy activity name and code	410[001] Construction of new buildings	
Solution example	Cool / reflective roofs and high-performance envelope	
Example user	A residential developer as a Foundation Framework user	A commercial office developer as a Plus Standard user
Evidence for the primary EO2 claim	Hazard: extreme heat. Address risk: envelope heat gain and urban heat island. Reflects solar gain; lowers surface and internal temperatures. Evidenced as the EO2 assessment requires.	Hazard: extreme heat. Address risk: envelope heat gain and urban heat island. Reflects solar gain; lowers surface and internal temperatures. Evidenced through the CRVA.

Evidence for the mitigation co-benefit claim	Users may choose to provide any one of the following evidence types • **Type A (environmental permits and licences):** N/A • **Type B (audits and verified alignment with an external standard):** reduces cooling load, evidenced by EDGE certification or a national green building rating that assesses energy performance; OR • **Type C (design documentation):** a design-stage energy model or design report naming reduced cooling load as an intended outcome; OR • **Type D (qualitative justification):** a half-page narrative explaining how the solution reduces cooling load, citing Akbari, Menon and Rosenfeld (2009).	A mitigation co-benefit claim is met by meeting all four of the following elements: • **Element 1:** annual tCO_2e avoided from the reduced cooling load, against a baseline of the same building designed to the minimum envelope requirements of the applicable building energy code, with the boundary as the building's cooling energy use; AND • **Element 2:** energy savings estimated by calibrated simulation under IPMVP Option D and converted to tCO_2e using the grid emission factor, following the GHG Protocol Project Protocol; AND • **Element 3:** metered energy records from the first year of operation evidencing performance against the Tier 3 EO1 threshold for the activity in the ASEAN Taxonomy technical annex; AND • **Element 4:** independent verification of the savings by a third-party measurement and verification assessor.
Outcome	Primary EO = EO2, plus qualitative mitigation co-benefit.	Primary EO = EO2, plus quantified mitigation co-benefit.

6. Initial considerations on maladaptation

6a. Context setting

Maladaptation refers to actions intended to reduce vulnerability to climate change impacts that inadvertently increase vulnerability to climate change impacts.

Adaptation measures can leave people, assets or ecosystems more exposed than before. For example, deepening groundwater wells to offset a falling water table can accelerate land subsidence and increase flood exposure. Fixed ground-floor occupation behind a sea wall in a subsiding coastal zone gives protection only up to the wall's design level, and fails abruptly once that level is exceeded. An activity classified under EO2 that produces such an outcome fails to deliver the resilience it was financed for, and weakens confidence in the classification itself.

The ASEAN Taxonomy currently addresses this risk through requirements that already form part of the assessment: the EO2 Substantial Contribution criteria under both the Foundation Framework and the Plus Standard (Table 12), the Climate Risk and Vulnerability Assessment (CRVA), and the Do No Significant Harm (DNSH) assessment in relation to EO2. This section explains how each of these operates and sets out initial considerations to help users identify maladaptive outcomes. It does not add to the ASEAN Taxonomy's requirements.

Maladaptation refers to a situation in which actions that are intended to reduce vulnerability to climate change impacts inadvertently result in increasing vulnerability to climate change impacts.

- **Maladaptation is built into EO2 Substantial Contribution assessment, across both FF and PS** (see Table 12 below). When assessing whether an activity substantially contributes to Climate Change Adaptation (EO2), the activity must not only improve resilience, but also avoid creating maladaptation outcomes.
- **Maladaptation becomes operational under the CRVA**. A CRVA is required for activities seeking classification under EO2, and for those under other EOs where EO2 DNSH needs to be demonstrated.
- **Maladaptation is also considered under the DNSH**. DNSH requires that an activity contributing to one EO must not significantly harm another EO.
    - The DNSH assessment to EO2 asks whether the activity i) increases vulnerability to climate change; ii) impedes adaptation; iii) increases physical climate risks; iv) fails to consider future climate conditions and v) hamper adaptation elsewhere.
    - So if an activity contributes to Climate Change Mitigation (EO1), Protection of Healthy Ecosystems and Biodiversity (EO3) or Resource Resilience and the Transition to a Circular Economy (EO4), it still has to avoid maladaptive outcomes through the DNSH to EO2 assessment.
    - Maladaptation also matters for EO2 activities themselves. Annex 2 of the ASEAN Taxonomy states that an Activity may not cause effects which "directly or indirectly detract from the intended EO", and that such an effect results in the Activity not meeting the criteria for that EO and being classified as Red. An EO2 activity that results in maladaptation would therefore not meet the EO2 criteria.

Table 12: How maladaptation is addressed in EO2 Substantial Contribution under FF and PS

Assessment frame	How maladaptation is addressed and mentioned
Foundation Framework	Maladaptation is implicitly mentioned under the EO2 Guiding Questions[19], e.g.: • 1A: "Does the Activity avoid leading to an increased adverse impact of the current climate and the expected future climate, on the Activity itself or on people, nature or assets?" OR • 1B: "Does the Activity avoid impeding upstream and/or downstream stakeholders from increasing their resilience to climate change?"
Plus Standard	EO2 TSC make reference to CRVA Guidance in Annex 3: "Adaptation solutions must: **Not result in any form of maladaptation**, including solutions which will not achieve the intended objective or may result in unintended side effects…".[20]

[19] ASEAN Taxonomy Version 4, pages 46-47
[20] ASEAN Taxonomy Version 4, pages 493-494

6b. Comparison with other jurisdictions

Maladaptation is typically addressed as a safeguard within sustainable finance taxonomies. Table 13 below provides a high-level overview of how maladaptation is referenced or incorporated in other taxonomies. While there is currently no single prevalent approach in addressing maladaptation across taxonomies, the ASEAN Taxonomy's existing approach is broadly consistent with that of the EU Taxonomy and the Singapore-Asia Taxonomy.

Table 13: How maladaptation is referenced or incorporated in a few selected taxonomies

Taxonomy	Key Points
EU Taxonomy	Maladaptation is not explicitly mentioned, but is implicitly covered by a requirement within the Technical Screening Criteria for Substantial Contribution to Adaptation: "*The adaptation solutions implemented do not adversely affect the adaptation efforts or the level of resilience to physical climate risks of other people, of nature, of cultural heritage, of assets and of other economic activities*".
Singapore-Asia Taxonomy	TSCs are mitigation-focused. For climate change adaptation objective, it states that activities "*should not adversely affect adaptation efforts by others*". Maladaptation is embedded within DNSH, similar to EU Taxonomy.
Indonesian Taxonomy for Sustainable Finance	Conceptually uses the ASEAN Taxonomy as its primary reference. The CRVA framework includes the criterion: "*Does not result in any form of maladaptation, including solutions that do not achieve the intended objectives or may lead to undesirable side effects*."
Thailand Taxonomy	Thailand Taxonomy provides guidance on conducting a CRVA, including consideration of maladaptation. The guidance mentions "*Adaptation solutions must not result in any form of maladaptation, including solutions which will not achieve the intended objective or may result in unintended side effects*".
Hong Kong Taxonomy	Providers pre-approved lists of adapting measures (whitelist-approach) rather than requiring an explicit maladaptation assessment.
CBRT (Climate Bonds)	Includes explicit "No Maladaptation" requirement as a safeguard within the assessment of Substantial Contribution to Climate Resilience. • Use expert judgement to pre-identify, where possible, adapting measures that are commonly associated with higher risks of maladaptation • For all other investment types, considered as part of process-based assessment Sector-specific Technical Working Groups to conduct a more thorough check into maladaptation risks of included solutions

Furthermore, it is worth highlighting that the ASEAN Taxonomy and the EU Taxonomy share several common conceptual elements in their approach to climate change adaptation, including the use of climate risk and vulnerability assessments (CRVA), the identification of material climate hazards, and the implementation of adaptation measures that address identified risks. These common elements may facilitate the use of similar evidence and assessment approaches across taxonomies, although taxonomy-specific requirements continue to apply. Table 14 below provides a high-level illustration of areas where methodological comparability exists and where additional assessment may still be required.

Table 14: High-level comparison of adaptation assessment elements between ASEAN Taxonomy and EU Taxonomy

Taxonomy	ASEAN Taxonomy	EU Taxonomy
Activity Classification	Based on ISIC codes	Based on NACE industry codes
Substantial Contribution to Adaptation	Contribution to climate change adaptation (EO2) assessed through one of the two assessment frames, Foundation Framework (against EO2 Guiding Questions) or Plus Standard (against TSC/CRVA)	Adaptation criteria assessed against EU Taxonomy technical screening criteria
CRVA	See Box 1 below	See Box 1 below
DNSH	Part of Essential Criteria, assessed via Guiding Questions in the Foundation Framework or TSC in the Plus Standard.	Strict activity-level scientific criteria and specific quantitative/qualitative performance thresholds set across all other environmental objectives.
Social Safeguards / Minimum safeguards	Social Aspects serves as part of Essential Criteria, prioritising human rights, labour rights (explicitly covering informal labour), and impacts on local communities/people living close to investments.	Minimum Safeguards strictly linked to international frameworks: UN Guiding Principles, OECD Guidelines for Multinational Enterprises, ILO Fundamental Conventions, and International Bill of Human Rights.

Important: Evidence prepared using the mARs Guide may facilitate future assessments against other taxonomies, including the EU Taxonomy. However, the use of common methodologies does not imply automatic equivalence, mutual recognition, or cross-taxonomy alignment.

Box 1 provides a comparison of steps for conducting a CRVA between the ASEAN Taxonomy and the EU Taxonomy.

Box 1: Comparison of steps for conducting a CRVA between the ASEAN Taxonomy and the EU Taxonomy

The ASEAN Taxonomy adopts an approach to CRVA that is closely aligned with the EU Taxonomy. The ASEAN Taxonomy's CRVA Guidance (Annex 3) is based on a 2022 guidance prepared by the German Environment Agency for conducting taxonomy-aligned CRVAs, drawing on the principles and framework of ISO 14091. The table below compares the key steps as described in each framework.

Steps as per the ASEAN Taxonomy	Steps as per the EU Taxonomy
"... Step 1: Identify the lifespan of the Activity under assessment, and identify the specific components (i.e., factors, processes, materials, etc., of the Activity) that would require an investigation under a risk assessment. *Step 2: Screening of climate-related hazards from Table 2, Chapter 2 in this Annex and identify those with most potential risks to the Activity and/or objects under assessment.* *Step 3: Conduct the risk assessment. For current potential risks, it is recommended to use past climate trends and climate projections based on these trends. For future potential risks, it is recommended to use a range of climate projections based on future scenarios.* ○ *For an Activity with a lifespan of less than 10 years may use extrapolated past trends data assessment;* ○ *For an Activity with a lifespan of more than 10 years, an assessment of both current and future risks based on modelled data is required.* *Step 4: Identify adequate and effective adaptation solutions to reduce the risks that are material to the Activity, including:* ○ *Identifying a range of possible solutions/measures; and* ○ *Assessing the different solutions for their costs, benefits, effectiveness for reducing or eliminating the risk, the adaptation efforts or the level of resilience ..."*	*"... (a) screening of the activity to identify which physical climate risks from the list in Section II of this Appendix may affect the performance of the economic activity during its expected lifetime;* *(b) where the activity is assessed to be at risk from one or more of the physical climate risks listed in Section II of this Appendix, a climate risk and vulnerability assessment to assess the materiality of the physical climate risks on the economic activity;* *(c) an assessment of adaptation solutions that can reduce the identified physical climate risk.* *The climate risk and vulnerability assessment is proportionate to the scale of the activity and its expected lifespan, such that:* *(a) for activities with an expected lifespan of less than 10 years, the assessment is performed, at least by using climate projections at the smallest appropriate scale;* *(b) for all other activities, the assessment is performed using the highest available resolution, state-of-the-art climate projections across the existing range of future scenarios consistent with the expected lifetime of the activity, including, at least, 10 to 30 year climate projections scenarios for major investments ..."*

The mARs Guide follows the ASEAN Taxonomy's CRVA Guidance by providing additional supporting information to enhance its usability.

6c. Early thinking of maladaptation for solutions proposed in the mARs Guide

Version 1 of the mARs Guide provides only initial considerations relating to maladaptation. Future versions of the mARs Guide may provide more comprehensive coverage of the process of assessing maladaptation risks, including worked examples and practical considerations for applying existing ASEAN Taxonomy requirements.

This reflects stakeholder feedback that preventing maladaptation is an important aspect of climate adaptation assessment. Future iterations of the Guide may further explore how maladaptation considerations interact with CRVA, EO2 assessment, and DNSH requirements under the ASEAN Taxonomy.

APPENDICES

Appendix 1: List of adaptation solutions

Appendix 2: Adaptation solution profiles

Appendix 3: Non-qualifying examples by sector

Appendix 4: Resources to support the mARs Guide

Appendix 5: Governance considerations for adaptation activities

Appendix 1: List of adaptation solutions

This Appendix provides a non-exhaustive list of 90 solutions across 13 ASEAN Taxonomy Plus Standard activities:

- Solutions are listed by activity, with the hazard(s) each addresses.
- Each solution is identified as a technology or a nature-based solution (NbS); NbS rows are shaded green.

Note that inclusion in this list of adaptation solutions, or satisfaction of the four selection criteria through self-assessment by users, should not be interpreted as establishing alignment with the ASEAN Taxonomy, which is activity-based.

Water Supply; Sewerage, Waste Management and Remediation Activities (ISIC E)

Activity 36[001] — Construction, extension and operation of water collection, treatment and supply systems

Solution	Hazard	Technology / NbS
36[001]-S1 Elevated pump stations and switchgear	Flooding	Technology
36[001]-S2 Hardened/flood-resilient water intake structures	Flooding	Technology
36[001]-S3 Backflow prevention valves on trunk mains	Flooding	Technology
36[001]-S4 Aquifer storage and recovery (ASR)	Drought	Technology
36[001]-S5 System-scale rainwater harvesting (utility-managed)	Drought	Technology
36[001]-S6 Smart metering networks	Drought, extreme heat	Technology
36[001]-S7 Pressure management infrastructure (PRVs, district metered areas)	Drought	Technology
36[001]-S8 Active leak detection systems (acoustic loggers, satellite-based)	Drought	Technology
36[001]-S9 Saline intrusion barriers (subsurface or surface)	Sea level rise	Technology
36[001]-S10 Relocated/upstream-shifted coastal water intakes	Sea level rise	Technology
36[001]-S11 Real-time salinity monitoring networks	Sea level rise	Technology
36[001]-S12 Covered/underground reservoir storage	Extreme heat	Technology
36[001]-S13 UV/advanced oxidation treatment for algal blooms	Extreme heat	Technology

Activity 36[003] — Desalination

Solution	Hazard	Technology / NbS
36[003]-S1 Elevated/flood-protected desalination plant siting	Flooding	Technology
36[003]-S2 Seawater reverse osmosis plant (climate-resilient siting and design)	Drought, sea level rise	Technology
36[003]-S3 Renewable energy-paired desalination	Drought, sea level rise	Technology
36[003]-S4 Brackish groundwater reverse osmosis	Sea level rise	Technology

Activity 37[003] — Flood or drought risk prevention and protection, including nature-based solutions

Solution	Hazard	Technology / NbS
37[003]-S1 Floodplain reconnection and restoration	Flooding	NbS
37[003]-S2 Freshwater wetland restoration and creation	Flooding	NbS
37[003]-S3 Riparian buffer and riverbank restoration	Flooding	NbS
37[003]-S4 Sustainable urban drainage systems (SuDS/WSUD)	Flooding	NbS
37[003]-S5 Vegetated detention/retention basins with overflow pathways	Flooding	NbS
37[003]-S6 Setback embankments with restored floodplain storage	Flooding	NbS
37[003]-S7 Stormwater detention basin upgrades (capacity expansion)	Flooding	Technology
37[003]-S8 Flood early warning systems (sensors, modelling, dissemination)	Flooding	Technology
37[003]-S9 Urban blue-green drainage networks	Flooding, extreme heat	NbS
37[003]-S10 Mangrove restoration and coastal wetland buffers	Sea level rise	NbS
37[003]-S11 Hybrid grey-green coastal defences (revetments with mangrove foreshore)	Sea level rise	NbS
37[003]-S12 Catchment rehabilitation and afforestation	Drought	NbS
37[003]-S13 Agroforestry and soil moisture retention (mulching, terracing at catchment scale)	Drought	NbS
37[003]-S14 Managed aquifer recharge via infiltration basins	Drought	Technology
37[003]-S15 Drought early warning and water allocation systems	Drought	Technology

Agriculture, Forestry and Fishing (ISIC A)

Activity 02[001] — Sustainable forest management

Solution	Hazard	Technology / NbS
02[001]-S1 Drought-tolerant species / provenance selection and assisted migration	Drought	NbS
02[001]-S2 Reduced-impact logging and continuous-cover silviculture	Drought	NbS
02[001]-S3 Fuel-load management and firebreak networks	Extreme heat	Technology
02[001]-S4 Early fire detection (towers, sensors, satellite)	Extreme heat	Technology
02[001]-S5 Climate-driven pest and disease surveillance and response	Extreme heat	Technology
02[001]-S6 Retention and widening of riparian buffer strips within managed forest	Flooding	NbS
02[001]-S7 Forest-road drainage and stream-crossing upgrades	Flooding	Technology

Activity 02[002] — Forestry plantation

Solution	Hazard	Technology / NbS
02[002]-S1 Diversified / mixed-species and drought-tolerant planting stock	Drought	Technology
02[002]-S2 Soil-moisture conservation (mulching, cover crops, contour planting)	Drought	NbS
02[002]-S3 Fire-resistant plantation design (breaks, low-flammability buffers, compartmentation)	Extreme heat	Technology
02[002]-S4 Shade / nurse-tree systems for heat-sensitive establishment	Extreme heat	NbS
02[002]-S5 Site drainage and raised (mound) planting on flood-prone ground	Flooding	Technology
02[002]-S6 Provenance / clonal diversity to limit pest and disease vulnerability	Extreme heat	Technology

Activity 02[003] — Conservation, restoration, and maintenance of natural forests

Solution	Hazard	Technology / NbS
02[003]-S1 Mangrove restoration and protection of coastal forest belts	Sea level rise	NbS
02[003]-S2 Managed landward-migration corridors and accommodation space	Sea level rise	NbS
02[003]-S3 Peatland rewetting and water-table management	Drought	NbS
02[003]-S4 Assisted natural regeneration (ANR) of degraded forest	Drought	NbS
02[003]-S5 Upper-catchment forest protection and restoration for flow regulation	Flooding	NbS
02[003]-S6 Peat and forest fire prevention and community fire management	Extreme heat	NbS

Construction and Real Estate (ISIC F / L)

Activity 410[001] — Construction of new buildings

Solution	Hazard	Technology / NbS
410[001]-S1 Raised finished-floor levels and dry / wet flood-proofing	Flooding	Technology
410[001]-S2 Elevated / protected critical systems (electrical, plant, backup)	Flooding	Technology
410[001]-S3 On-site SuDS: permeable surfaces, rain gardens, detention	Flooding	NbS
410[001]-S4 Passive cooling design (orientation, shading, thermal mass, natural ventilation)	Extreme heat	Technology
410[001]-S5 Cool / reflective roofs and high-performance envelope	Extreme heat	Technology
410[001]-S6 Green roofs / walls and site greening	Extreme heat	NbS
410[001]-S7 Water-efficient fixtures and rainwater harvesting / reuse	Drought	Technology
410[001]-S8 Coastal siting / setback and freeboard for sea-level rise	Sea level rise	Technology

Activity 410[002] — Renovation of existing buildings

Solution	Hazard	Technology / NbS
410[002]-S1 Flood barriers, non-return valves and flood-resilient materials retrofit	Flooding	Technology
410[002]-S2 Relocation of critical systems above flood level (retrofit)	Flooding	Technology
410[002]-S3 Cool-roof and reflective-coating retrofit	Extreme heat	Technology
410[002]-S4 External shading, glazing upgrades and insulation retrofit	Extreme heat	Technology
410[002]-S5 Retrofit green roof / wall or shading vegetation	Extreme heat	NbS
410[002]-S6 Retrofit water efficiency and rainwater / greywater reuse	Drought	Technology

Activity 681[001] — Acquisition and ownership of buildings

Solution	Hazard	Technology / NbS
681[001]-S1 Climate-risk screening (CRVA) at acquisition and portfolio level	Flooding	Technology
681[001]-S2 Flood-proofing and drainage upgrades to owned assets	Flooding	Technology
681[001]-S3 Cool-roof, shading and passive-cooling upgrades across the portfolio	Extreme heat	Technology
681[001]-S4 Backup power and cooling for critical / occupant-safety functions	Extreme heat	Technology
681[001]-S5 Portfolio water-efficiency and reuse programme	Drought	Technology
681[001]-S6 Adaptation / managed-exit strategy for coastal assets under SLR	Sea level rise	Technology

Activity 68[001] — Electric vehicle charging stations

Solution	Hazard	Technology / NbS
68[001]-S1 Elevated / flood-protected siting of charging units and switchgear	Flooding	Technology
68[001]-S2 IP-rated / water-resistant enclosures and drainage	Flooding	Technology
68[001]-S3 Heat-rated components and active / passive thermal management	Extreme heat	Technology
68[001]-S4 Shaded charging canopies (optionally solar)	Extreme heat	Technology
68[001]-S5 On-site storage / backup with islanding capability	Flooding, extreme heat	Technology

Activity 68[002] — Energy efficient equipment

Solution	Hazard	Technology / NbS
68[002]-S1 Cooling equipment sized / rated for higher design temperatures	Extreme heat	Technology
68[002]-S2 High-efficiency, low-temperature-sensitivity HVAC and controls	Extreme heat	Technology
68[002]-S3 Flood-resilient siting / protection of plant and equipment	Flooding	Technology

68[002]-S4 Air-cooled / water-efficient equipment where water-cooled is at risk	Drought	Technology
68[002]-S5 Backup / redundancy for critical equipment	Flooding, extreme heat	Technology

Activity 68[004] — Renewable Technologies

Solution	Hazard	Technology / NbS
68[004]-S1 Flood-protected siting of inverters and balance-of-system; roof-mounted arrays	Flooding	Technology
68[004]-S2 High-temperature-rated PV modules and ventilated mounting	Extreme heat	Technology
68[004]-S3 Corrosion-resistant, elevated mounting for coastal installations	Sea level rise	Technology
68[004]-S4 Renewables with storage for backup and grid-independent operation	Flooding, extreme heat	Technology

Activity 68[005] — Early Warning Systems

Solution	Hazard	Technology / NbS
68[005]-S1 Flood forecasting, monitoring and dissemination systems	Flooding	Technology
68[005]-S2 Heat–health early warning and action systems	Extreme heat	Technology
68[005]-S3 Drought monitoring and water-allocation early warning	Drought	Technology
68[005]-S4 Coastal / storm-surge and salinity early warning	Sea level rise	Technology
68[005]-S5 Multi-hazard impact-based forecasting and last-mile dissemination	Flooding, drought, extreme heat, sea level rise	Technology

Appendix 2: Adaptation solution profiles

This appendix provides detailed profiles of selected solutions listed in Appendix 1.

Disclaimer

The solution profiles included in this appendix are provided for illustrative and informational purposes only. Their inclusion does not imply regulatory approval, endorsement, certification, or validation by the ASEAN Taxonomy Board, the ASEAN Capital Markets Forum, national regulators, supervisory authorities, or any participating institutions including UNEP FI and Sustainable Finance Institute Asia.

The solution profiles are intended to demonstrate examples of adaptation solutions that may be relevant in specific contexts and sectors. They do not constitute mandatory requirements, prescribed measures, minimum standards, or an exhaustive list of eligible adaptation activities.

Users remain responsible for assessing the suitability, effectiveness, feasibility, and applicability of any adaptation solution based on their own circumstances, objectives, risk assessments, and applicable laws, regulations, policies, and standards.

The absence of a solution profile from this Guide should not be interpreted as indicating that a particular adaptation solution is ineffective, ineligible, or inconsistent with the principles of the mARs Guide. Likewise, inclusion of a solution profile should not be interpreted as evidence that a solution automatically satisfies all relevant criteria under the mARs Guide or assessments under the ASEAN Taxonomy for Sustainable Finance.

The identification of environmental, social and economic impacts at solution level does not replace the assessment of all applicable ASEAN Taxonomy Essential Criteria, including DNSH, Social Aspects and Remedial Measures to Transition where relevant.

The mARs Guide is voluntary in nature. The solution profiles are intended solely as supporting reference material to assist users in identifying and evaluating potential adaptation responses.

Water Supply; Sewerage, Waste Management and Remediation Activities (ISIC E)

Activity 36[001] — Construction, extension and operation of water collection, treatment and supply systems

Activity-level solution navigator				
Priority hazards for VERSION 1 of the mARs Guide	Flooding	Drought	Extreme heat	Sea level rise
Applicable technologies & solutions	• **36[001]-S1 Elevated pump stations and switchgear** • **36[001]-S2 Hardened/flood-resilient water intake structures** • 36[001]-S3 Backflow prevention valves on trunk mains	• **36[001]-S4 Aquifer storage and recovery (ASR)** • 36[001]-S5 System-scale rainwater harvesting (utility-managed) • **36[001]-S6 Smart metering networks *** • 36[001]-S7 Pressure management infrastructure (PRVs, district metered areas) • 36[001]-S8 Active leak detection systems (acoustic loggers, satellite-based)	• **36[001]-S6 Smart metering networks *** • **36[001]-S12 Covered/underground reservoir storage** • 36[001]-S13 UV/advanced oxidation treatment for algal blooms	• 36[001]-S9 Saline intrusion barriers (subsurface or surface) • 36[001]-S10 Relocated/upstream-shifted coastal water intakes • **36[001]-S11 Real-time salinity monitoring networks**

*Note: 1) Solution marked * addresses more than one priority hazard. 2) Solutions in **bold** have a detailed solution profile below; the remainder are listed in Appendix 1 and are profiled progressively. 3) Solution codes follow Appendix 1.*

36[001]-S1 — Elevated pump stations and switchgear	
Detailed solution profile	
Technology/solution	Elevated pump stations and switchgear
[Technology ID — internal reference only]	*36[001]-S1*
Description	Raises critical electrical/mechanical components above the design flood level, removing the dominant failure mode for pumped supply during flood events; supply continuity is maintained rather than restored after the event.
Type of solution	Technology-based solution (engineered)
Targeted climate risk(s)	Flood (river/urban)
Relevant resilience theme(s)	Resilient water & sanitation; Resilient infrastructure
Technology details	**State of technology:** Established flood-resilient utility practice; standard where ASEAN urban utilities upgrade against pluvial and fluvial flooding. **Scalability:** Single facility to network-wide programmes across a utility service area. **Environmental, social, and economic impact:** Passive civil-works measure; no incremental operational energy demand, so no conflict at the DNSH (climate change mitigation) step. **Paradigm shift potential:** Moves utilities from post-event restoration to continuity-by-design.
Fit-for-purpose criteria (Section 4b — rationale for inclusion in the mARs Guide)	
Criterion 1 — Clear risk fit	**Yes —** Hazard: flood (river/urban). Addresses loss of water supply continuity when electrical and mechanical plant is inundated. The hazard–asset–consequence chain is direct and demonstrable in the CRVA (PS) or qualitative narrative (FF). Regional flood exposure is well evidenced: Asia and the Pacific accounts for around 41% of global floods. **Evidence:** *ADB (2025). Asian Water Development Outlook 2025: The Index of Water Security for Asia and the Pacific. Asian Development Bank, Manila.*
Criterion 2 — Clear effect	**Yes —** Raises critical electrical/mechanical components above the design flood level, removing the dominant failure mode for pumped supply during flood events; supply continuity is maintained rather than restored after the event. **Evidence:** *Zevenbergen, C. et al. (2010). Urban Flood Management. CRC Press.*
Criterion 3 — Works under uncertainty	**Yes —** Elevation can be designed with freeboard margin above projected flood levels, so performance is robust across a range of climate scenarios; the measure does not depend on a single hazard projection being correct. **Evidence:** *Zevenbergen, C. et al. (2010). Urban Flood Management. CRC Press.*

36[001]-S1 — Elevated pump stations and switchgear	
Criterion 4 — Does not conflict with mitigation objectives	**Yes —** Passive civil-works measure; no incremental operational energy demand, so no conflict at the DNSH (climate change mitigation) step. **Evidence:** *Inferred from the nature of the measure; no external source required for this step.*
ASEAN Taxonomy Assessment Frame support	
CRVA assessment considerations	**Life span:** Civil-works asset life (multi-decadal), matched to the pumping/treatment asset it protects. **Adequacy and effectiveness:** Hazard: flood (river/urban). Addresses loss of water supply continuity when electrical and mechanical plant is inundated. The hazard–asset–consequence chain is direct and demonstrable in the CRVA (PS) or qualitative narrative (FF). Regional flood exposure is well evidenced: Asia and the Pacific accounts for around 41% of global floods. Elevation can be designed with freeboard margin above projected flood levels, so performance is robust across a range of climate scenarios; the measure does not depend on a single hazard projection being correct. **Maladaptation:** Low; no risk transfer where freeboard is set against forward-looking levels in the CRVA.
Additional support on Foundation Framework 1A guiding questions	GQ1A: a CRVA establishes the design flood level for the site; elevating plant above it with freeboard removes the dominant flood failure mode, so the utility's own pumped supply continues rather than being restored. Freeboard is set from forward-looking flood projections; the measure aligns with AMS flood-adaptation priorities in NAPs; the benefit is measurable as avoided supply interruptions and asset damage during floods.
Additional support on Foundation Framework 1B guiding questions	GQ1B: by keeping supply running through floods the measure enables connected households, health facilities and businesses to sustain their own resilience during and after events; it does not impede downstream users' water security.

36[001]-S2 — Hardened/flood-resilient water intake structures	
Detailed solution profile	
Technology/solution	Hardened/flood-resilient water intake structures
[Technology ID — internal reference only]	*36[001]-S2*
Description	Maintains intake function under high turbidity, debris loading and inundation, so treatment and supply continue through the event; effect is on the asset that defines system availability.
Type of solution	Technology-based solution (engineered)
Targeted climate risk(s)	Flood (river/coastal)
Relevant resilience theme(s)	Resilient water & sanitation; Resilient infrastructure

36[001]-S2 — Hardened/flood-resilient water intake structures	
Technology details	**State of technology:** Established civil-engineering practice for raw-water intakes; applied across ASEAN river and coastal abstraction points. **Scalability:** Single intake to system-wide hardening of all abstraction points. **Environmental, social, and economic impact:** One-off civil works with embedded carbon only; no ongoing energy penalty. Embedded emissions are a construction-stage consideration, not an operational lock-in. **Paradigm shift potential:** Treats the intake as the availability-defining asset rather than an unprotected system edge.
Fit-for-purpose criteria (Section 4b — rationale for inclusion in the mARs Guide)	
Criterion 1 — Clear risk fit	**Yes —** Hazard: flood (river/coastal). Addresses source intake continuity — raw-water intakes are the single point of entry for the whole supply system, and flood damage or blockage at the intake propagates system-wide. Direct CRVA linkage. **Evidence:** *Inferred from the nature of the measure; no external source required for this step.*
Criterion 2 — Clear effect	**Yes —** Maintains intake function under high turbidity, debris loading and inundation, so treatment and supply continue through the event; effect is on the asset that defines system availability. **Evidence:** *Zevenbergen, C. et al. (2010). Urban Flood Management. CRC Press.*
Criterion 3 — Works under uncertainty	**Yes —** Robust design tolerates events beyond the standard return period — hardening is not calibrated to a single design flood, so residual performance degrades gracefully rather than failing at threshold exceedance. **Evidence:** *Inferred from the nature of the measure; no external source required for this step.*
Criterion 4 — Does not conflict with mitigation objectives	**Yes —** One-off civil works with embedded carbon only; no ongoing energy penalty. Embedded emissions are a construction-stage consideration, not an operational lock-in. **Evidence:** *Inferred from the nature of the measure; no external source required for this step.*
ASEAN Taxonomy Assessment Frame support	
CRVA assessment considerations	**Life span:** Civil-works asset life (multi-decadal). **Adequacy and effectiveness:** Hazard: flood (river/coastal). Addresses source intake continuity — raw-water intakes are the single point of entry for the whole supply system, and flood damage or blockage at the intake propagates system-wide. Direct CRVA linkage. Robust design tolerates events beyond the standard return period — hardening is not calibrated to a single design flood, so residual performance degrades gracefully rather than failing at threshold exceedance. **Maladaptation:** Low; hardening is not calibrated to a single design flood, so performance degrades gracefully rather than transferring risk.
Additional support on Foundation Framework 1A guiding questions	GQ1A: the CRVA identifies the intake as the single point of entry whose failure propagates system-wide; hardening maintains intake function under turbidity, debris and inundation, protecting the operator's own

36[001]-S2 — Hardened/flood-resilient water intake structures	
	supply availability. Designed against forward-looking flood and turbidity conditions; measurable as maintained abstraction through high-flow events.
Additional support on Foundation Framework 1B guiding questions	GQ1B: a continuous raw-water intake underpins downstream treatment and distribution, enabling connected users to retain water security through floods; no risk transferred to other abstractors.

36[001]-S4 — Aquifer storage and recovery (ASR)	
Detailed solution profile	
Technology/solution	Aquifer storage and recovery (ASR)
[Technology ID — internal reference only]	*36[001]-S4*
Description	Stores treated wet-season water in aquifers for dry-season recovery, converting seasonal surplus into firm dry-season yield; international evidence base on MAR performance and governance is mature.
Type of solution	Technology-based solution (managed aquifer recharge)
Targeted climate risk(s)	Drought
Relevant resilience theme(s)	Resilient water & sanitation
Technology details	**State of technology:** Mature managed-aquifer-recharge practice with established governance; used where ASEAN utilities face rainfall-dependent dry-season shortfalls. **Scalability:** Scheme-level storage, scalable in volume and adjustable year-to-year. **Environmental, social, and economic impact:** Low energy intensity relative to alternative firm-supply options (notably desalination); offsets higher-energy alternatives, supporting rather than undermining the mitigation objective. **Paradigm shift potential:** Uses the aquifer as seasonal storage rather than expanding built storage.
Fit-for-purpose criteria (Section 4b — rationale for inclusion in the mARs Guide)	
Criterion 1 — Clear risk fit	**Yes —** Hazard: drought. Addresses dry-season supply continuity where surface sources are rainfall-dependent. Drought and salinity stress on dry-season supply is acutely documented in the region, e.g. the 2019–20 Mekong dry season. **Evidence:** *UNEP-DHI (2026). Strengthening Salinity Intrusion Data Sharing and Forecasting for Adaptation to Climate Change Impacts in the Mekong Delta of Viet Nam (project; documents 2019–20 dry-season intrusion reaching c. 125 km inland). — 'Land use change in the Vietnamese Mekong Delta: long-term impacts of drought and salinity intrusion using satellite and monitoring data', iScience (2025).*

36[001]-S4 — Aquifer storage and recovery (ASR)	
Criterion 2 — Clear effect	**Yes —** Stores treated wet-season water in aquifers for dry-season recovery, converting seasonal surplus into firm dry-season yield; international evidence base on MAR performance and governance is mature. **Evidence:** *Dillon, P. et al. (2022). Managed Aquifer Recharge: Overview and Governance. IAH Special Publication, International Association of Hydrogeologists.*
Criterion 3 — Works under uncertainty	**Partially —** Storage volumes are scalable and operation can be adjusted year-to-year, but recovery efficiency depends on aquifer behaviour (hydrogeology, native water quality, clogging), which must be established site-specifically. This is the reason the slide records 'Partially' rather than 'Yes'. **Evidence:** *Dillon, P. et al. (2022). Managed Aquifer Recharge: Overview and Governance. IAH Special Publication, International Association of Hydrogeologists.*
Criterion 4 — Does not conflict with mitigation objectives	**Yes —** Low energy intensity relative to alternative firm-supply options (notably desalination); offsets higher-energy alternatives, supporting rather than undermining the mitigation objective. **Evidence:** *World Bank (2019). The Role of Desalination in an Increasingly Water-Scarce World. World Bank, Washington, DC. — Dillon, P. et al. (2022). Managed Aquifer Recharge: Overview and Governance. IAH Special Publication, International Association of Hydrogeologists.*
ASEAN Taxonomy Assessment Frame support	
CRVA assessment considerations	**Life span:** Sub-surface storage asset; multi-decadal with managed operation. **Adequacy and effectiveness:** Hazard: drought. Addresses dry-season supply continuity where surface sources are rainfall-dependent. Drought and salinity stress on dry-season supply is acutely documented in the region, e.g. the 2019–20 Mekong dry season. Storage volumes are scalable and operation can be adjusted year-to-year, but recovery efficiency depends on aquifer behaviour (hydrogeology, native water quality, clogging), which must be established site-specifically. This is the reason the slide records 'Partially' rather than 'Yes'. **Maladaptation:** Recovery efficiency is aquifer-dependent (assessed 'Partially' under works-under-uncertainty). Deepened abstraction chasing a falling water table is the maladaptive configuration — it accelerates depletion and subsidence (Appendix 4).
Additional support on Foundation Framework 1A guiding questions	GQ1A: the CRVA establishes dry-season supply risk where surface sources are rainfall-dependent; ASR converts wet-season surplus into firm dry-season yield for the operator's own supply. Robustness is site-dependent on aquifer behaviour (rated 'Partially'); measurable as firm dry-season volume recovered.
Additional support on Foundation Framework 1B guiding questions	GQ1B: firming dry-season supply enables connected users and, where recharge supports the shared aquifer, other abstractors to sustain their own resilience; managed recharge avoids depleting the resource others depend on.

36[001]-S6 — Smart metering networks	
Detailed solution profile	
Technology/solution	Smart metering networks
[Technology ID — internal reference only]	*36[001]-S6*
Description	Enables real-time leak detection at customer level and demand response (tariffs, restrictions, targeted communication), directly extending available supply during drought.
Type of solution	Technology-based solution (information / demand management)
Targeted climate risk(s)	Drought; extreme heat
Relevant resilience theme(s)	Resilient water & sanitation
Technology details	**State of technology:** Established utility digital infrastructure; deployed across ASEAN utilities for non-revenue-water and drought response. **Scalability:** District-metered-area to utility-wide roll-out. **Environmental, social, and economic impact:** Enables demand reduction; low operational footprint relative to supply-side equivalents. **Paradigm shift potential:** Makes demand the first-response resource in drought, not only supply.
Fit-for-purpose criteria (Section 4b — rationale for inclusion in the mARs Guide)	
Criterion 1 — Clear risk fit	**Yes —** Hazard: drought; extreme heat. Addresses service efficiency and demand response when available supply tightens — demand-side levers become the fastest-acting resource in drought. **Evidence:** *ADB (2020). Asian Water Development Outlook 2020: Advancing Water Security across Asia and the Pacific. Asian Development Bank, Manila.*
Criterion 2 — Clear effect	**Yes —** Enables real-time leak detection at customer level and demand response (tariffs, restrictions, targeted communication), directly extending available supply during drought. **Evidence:** *ADB (2020). Asian Water Development Outlook 2020: Advancing Water Security across Asia and the Pacific. Asian Development Bank, Manila. — Climate Bonds Initiative (2024). Climate Bonds Resilience Taxonomy, Prototype v1.0 (July 2024).*
Criterion 3 — Works under uncertainty	**Yes —** Thresholds and demand-response triggers are adjustable as conditions change; data quality improves over time, so the measure strengthens rather than decays under evolving climate conditions. **Evidence:** *Inferred from the nature of the measure; no external source required for this step.*
Criterion 4 — Does not conflict with mitigation objectives	**Yes —** Enables demand reduction; low operational footprint relative to supply-side equivalents. **Evidence:** *Inferred from the nature of the measure; no external source required for this step.*
ASEAN Taxonomy Assessment Frame support	

36[001]-S6 — Smart metering networks	
CRVA assessment considerations	**Life span:** Metering and data infrastructure; upgradeable on a rolling cycle. **Adequacy and effectiveness:** Hazard: drought; extreme heat. Addresses service efficiency and demand response when available supply tightens — demand-side levers become the fastest-acting resource in drought. Thresholds and demand-response triggers are adjustable as conditions change; data quality improves over time, so the measure strengthens rather than decays under evolving climate conditions. **Maladaptation:** Low; demand-side and adjustable, with no lock-in.
Additional support on Foundation Framework 1A guiding questions	GQ1A: real-time consumption data let the utility detect customer-side leakage and manage demand as supply tightens, protecting its own service reliability; thresholds are adjustable as conditions evolve; measurable as reduced non-revenue water and demand shed during drought.
Additional support on Foundation Framework 1B guiding questions	GQ1B (primary): the network enables customers and the wider service area to reduce and reschedule demand during drought through tariffs, restrictions and targeted communication — directly extending available supply for other users; no barrier raised to others' adaptation.

36[001]-S11 — Real-time salinity monitoring networks	
Detailed solution profile	
Technology/solution	Real-time salinity monitoring networks
[Technology ID — internal reference only]	*36[001]-S11*
Description	Provides operational triggers to switch sources, restrict abstraction or deploy alternatives before salinity breaches treatment limits; Mekong Delta monitoring and forecasting programmes demonstrate the protective value.
Type of solution	Technology-based solution (information / early warning)
Targeted climate risk(s)	Sea-level rise; drought (compound)
Relevant resilience theme(s)	Resilient water & sanitation
Technology details	**State of technology:** Established sensing-and-forecasting practice; demonstrated in Mekong Delta salinity programmes. **Scalability:** Point sensors to basin-scale networks. **Environmental, social, and economic impact:** Low-power sensing; enables avoided losses and avoided emergency response. **Paradigm shift potential:** Replaces static salinity assumptions with dynamic, forecast-based operation.
Fit-for-purpose criteria (Section 4b — rationale for inclusion in the mARs Guide)	

36[001]-S11 — Real-time salinity monitoring networks	
Criterion 1 — Clear risk fit	**Yes —** Hazard: sea-level rise; drought (compound). Addresses operational water quality risk — the saline front in delta systems moves with tide, flow and season, so static assumptions fail. **Evidence:** *UNEP-DHI (2026). Strengthening Salinity Intrusion Data Sharing and Forecasting for Adaptation to Climate Change Impacts in the Mekong Delta of Viet Nam (project; documents 2019–20 dry-season intrusion reaching c. 125 km inland). — 'Brief communication: Seasonal prediction of salinity intrusion in the Mekong Delta', Natural Hazards and Earth System Sciences, 20, 1609 (2020). — 'Land use change in the Vietnamese Mekong Delta: long-term impacts of drought and salinity intrusion using satellite and monitoring data', iScience (2025).*
Criterion 2 — Clear effect	**Yes —** Provides operational triggers to switch sources, restrict abstraction or deploy alternatives before salinity breaches treatment limits; Mekong Delta monitoring and forecasting programmes demonstrate the protective value. **Evidence:** *UNEP-DHI (2026). Strengthening Salinity Intrusion Data Sharing and Forecasting for Adaptation to Climate Change Impacts in the Mekong Delta of Viet Nam (project; documents 2019–20 dry-season intrusion reaching c. 125 km inland). — 'Land use change in the Vietnamese Mekong Delta: long-term impacts of drought and salinity intrusion using satellite and monitoring data', iScience (2025).*
Criterion 3 — Works under uncertainty	**Yes —** Sensors, thresholds and forecast models are upgradeable; the system is explicitly designed for variability and improves with data accumulation. **Evidence:** *'Brief communication: Seasonal prediction of salinity intrusion in the Mekong Delta', Natural Hazards and Earth System Sciences, 20, 1609 (2020).*
Criterion 4 — Does not conflict with mitigation objectives	**Yes —** Low-power sensing; enables avoided losses and avoided emergency response. **Evidence:** *Inferred from the nature of the measure; no external source required for this step.*
ASEAN Taxonomy Assessment Frame support	
CRVA assessment considerations	**Life span:** Sensor and model infrastructure; upgradeable. **Adequacy and effectiveness:** Hazard: sea-level rise; drought (compound). Addresses operational water quality risk — the saline front in delta systems moves with tide, flow and season, so static assumptions fail. Sensors, thresholds and forecast models are upgradeable; the system is explicitly designed for variability and improves with data accumulation. **Maladaptation:** Low; informational and upgradeable, with no risk transfer.
Additional support on Foundation Framework 1A guiding questions	GQ1A: continuous salinity data give the operator triggers to switch sources or restrict abstraction before treatment limits are breached, protecting its own supply quality; forecasts use forward-looking data; measurable as avoided salinity exceedances.
Additional support on Foundation Framework 1B guiding questions	GQ1B (primary): shared salinity data and forecasts enable downstream utilities, irrigators and communities across the delta to act ahead of

36[001]-S11 — Real-time salinity monitoring networks	
	intrusion, reducing their own exposure; the network supports water–agriculture coordination.

36[001]-S12 — Covered/underground reservoir storage	
Detailed solution profile	
Technology/solution	Covered/underground reservoir storage
[Technology ID — internal reference only]	*36[001]-S12*
Description	Reduces evaporation losses and thermal degradation (algal growth, disinfection by-product formation) of stored water, preserving both volume and quality through heat events.
Type of solution	Technology-based solution (engineered)
Targeted climate risk(s)	Extreme heat
Relevant resilience theme(s)	Resilient water & sanitation
Technology details	**State of technology:** Established storage practice; relevant where ASEAN utilities face evaporative and thermal-quality losses under sustained heat. **Scalability:** Single reservoir to network storage. **Environmental, social, and economic impact:** Passive thermal protection; no energy input. **Paradigm shift potential:** Treats stored-water quality and volume as heat-exposed assets to be protected passively.
Fit-for-purpose criteria (Section 4b — rationale for inclusion in the mARs Guide)	
Criterion 1 — Clear risk fit	**Yes —** Hazard: extreme heat. Addresses stored water quality and evaporative losses under sustained higher temperatures. **Evidence:** *Inferred from the nature of the measure; no external source required for this step.*
Criterion 2 — Clear effect	**Yes —** Reduces evaporation losses and thermal degradation (algal growth, disinfection by-product formation) of stored water, preserving both volume and quality through heat events. **Evidence:** *Inferred from the nature of the measure; no external source required for this step.*
Criterion 3 — Works under uncertainty	**Yes —** Passive protection whose effectiveness is stable under higher temperature scenarios — performance does not depend on the magnitude of warming being correctly projected. **Evidence:** *Inferred from the nature of the measure; no external source required for this step.*
Criterion 4 — Does not conflict with mitigation objectives	**Yes —** Passive thermal protection; no energy input. **Evidence:** *Inferred from the nature of the measure; no external source required for this step.*

36[001]-S12 — Covered/underground reservoir storage	
ASEAN Taxonomy Assessment Frame support	
CRVA assessment considerations	**Life span:** Civil-works asset life (multi-decadal). **Adequacy and effectiveness:** Hazard: extreme heat. Addresses stored water quality and evaporative losses under sustained higher temperatures. Passive protection whose effectiveness is stable under higher temperature scenarios — performance does not depend on the magnitude of warming being correctly projected. **Maladaptation:** Low; passive protection with no risk transfer.
Additional support on Foundation Framework 1A guiding questions	GQ1A: covering storage reduces evaporation and thermal degradation of the operator's own stored water under sustained heat, preserving volume and quality; passive protection is stable across warming scenarios; measurable as reduced evaporative loss and disinfection-by-product formation.
Additional support on Foundation Framework 1B guiding questions	GQ1B: preserved stored volume and quality supports continued supply to connected users during heat events; no adverse effect on others' resilience.

Activity 36[003] — Desalination

Activity-level solution navigator				
Priority hazards for VERSION 1 of the mARs Guide	Flooding	Drought	Extreme heat	Sea level rise
Applicable technologies & solutions	• 36[003]-S1 Elevated/flood-protected desalination plant siting	• **36[003]-S2 Seawater reverse osmosis plant (climate-resilient siting and design) *** • **36[003]-S3 Renewable energy-paired desalination ***	*None listed in Appendix 1*	• **36[003]-S2 Seawater reverse osmosis plant (climate-resilient siting and design) *** • **36[003]-S3 Renewable energy-paired desalination *** • **36[003]-S4 Brackish groundwater reverse osmosis**

*Note: 1) Solution marked * addresses more than one priority hazard. 2) Solutions in **bold** have a detailed solution profile below; the remainder are listed in Appendix 1 and are profiled progressively. 3) Solution codes follow Appendix 1.*

36[003]-S2 — Seawater reverse osmosis plant (climate-resilient siting and design)	
Detailed solution profile	
Technology/solution	Seawater reverse osmosis plant (climate-resilient siting and design)
[Technology ID — internal reference only]	*36[003]-S2*
Description	Provides rainfall-independent freshwater from seawater; firm yield is decoupled from the hazard entirely, which is the strongest possible form of the 'clear effect' linkage for drought.
Type of solution	Technology-based solution (engineered)
Targeted climate risk(s)	Drought; sea-level rise
Relevant resilience theme(s)	Resilient water & sanitation

36[003]-S2 — Seawater reverse osmosis plant (climate-resilient siting and design)	
Technology details	**State of technology:** Mature membrane desalination technology; deployed regionally where rainfall-dependent sources are increasingly unreliable. **Scalability:** Modular; staged expansion against observed rather than projected demand. **Environmental, social, and economic impact:** High energy intensity is the defining DNSH issue for desalination; mitigation via renewable pairing, energy-recovery devices and efficient membranes must be evidenced at Step 2. **Paradigm shift potential:** Decouples firm supply from rainfall entirely.
Fit-for-purpose criteria (Section 4b — rationale for inclusion in the mARs Guide)	
Criterion 1 — Clear risk fit	**Yes —** Hazard: drought; sea-level rise. Addresses rainfall-independent supply where conventional sources are increasingly unreliable — the core regional driver for desalination uptake. **Evidence:** *World Bank (2019). The Role of Desalination in an Increasingly Water-Scarce World. World Bank, Washington, DC.*
Criterion 2 — Clear effect	**Yes —** Provides rainfall-independent freshwater from seawater; firm yield is decoupled from the hazard entirely, which is the strongest possible form of the 'clear effect' linkage for drought. **Evidence:** *World Bank (2019). The Role of Desalination in an Increasingly Water-Scarce World. World Bank, Washington, DC.*
Criterion 3 — Works under uncertainty	**Yes —** Output independent of rainfall; SWRO capacity is scalable in modules, allowing staged expansion against observed rather than projected demand. **Evidence:** *World Bank (2019). The Role of Desalination in an Increasingly Water-Scarce World. World Bank, Washington, DC.*
Criterion 4 — Does not conflict with mitigation objectives	**Conditional —** High energy intensity is the defining DNSH issue for desalination; mitigation via renewable pairing, energy-recovery devices and efficient membranes must be evidenced at Step 2. **Evidence:** *World Bank (2019). The Role of Desalination in an Increasingly Water-Scarce World. World Bank, Washington, DC.*
ASEAN Taxonomy Assessment Frame support	
CRVA assessment considerations	**Life span:** Industrial asset; multi-decadal. **Adequacy and effectiveness:** Hazard: drought; sea-level rise. Addresses rainfall-independent supply where conventional sources are increasingly unreliable — the core regional driver for desalination uptake. Output independent of rainfall; SWRO capacity is scalable in modules, allowing staged expansion against observed rather than projected demand. **Maladaptation:** Energy intensity is the risk (DNSH-to-mitigation 'Conditional'). Fossil-fired thermal desalination without abatement, and a single monolithic plant sized to one deterministic forecast, are the maladaptive configurations (Appendix 4); modular staging and renewable pairing mitigate.
Additional support on Foundation Framework 1A guiding questions	GQ1A: the CRVA establishes rainfall-dependence risk; SWRO provides firm, rainfall-independent yield for the operator's own supply. The material DNSH consideration is energy intensity (C4 'Conditional'); measurable as firm freshwater volume decoupled from drought.

36[003]-S2 — Seawater reverse osmosis plant (climate-resilient siting and design)	
Additional support on Foundation Framework 1B guiding questions	GQ1B: firm supply underpins water security for connected users and can free conventional sources for other abstractors, provided the energy source does not shift a burden onto others.

36[003]-S3 — Renewable energy-paired desalination	
Detailed solution profile	
Technology/solution	Renewable energy-paired desalination
[Technology ID — internal reference only]	*36[003]-S3*
Description	Avoids maladaptive fossil-energy dependency for a high-energy process; the resilience effect (firm supply) is delivered without the emissions liability that would otherwise undermine it.
Type of solution	Technology-based solution (engineered, renewable-integrated)
Targeted climate risk(s)	Drought; sea-level rise
Relevant resilience theme(s)	Resilient water & sanitation
Technology details	**State of technology:** Established; deployment depends on the local energy mix and renewable resource. **Scalability:** Scales with the paired renewable capacity and grid arrangements. **Environmental, social, and economic impact:** Directly addresses the mitigation co-benefit by design; this is the configuration that converts a Conditional row into a Yes. **Paradigm shift potential:** Converts a high-energy adaptation into a low-carbon one by design.
Fit-for-purpose criteria (Section 4b — rationale for inclusion in the mARs Guide)	
Criterion 1 — Clear risk fit	**Yes —** Hazard: drought; sea-level rise. Addresses the high-energy maladaptation risk inherent in conventional desalination — the measure exists to fix the criterion-4 weakness of the asset class. **Evidence:** *World Bank (2019). The Role of Desalination in an Increasingly Water-Scarce World. World Bank, Washington, DC.*
Criterion 2 — Clear effect	**Yes —** Avoids maladaptive fossil-energy dependency for a high-energy process; the resilience effect (firm supply) is delivered without the emissions liability that would otherwise undermine it. **Evidence:** *World Bank (2019). The Role of Desalination in an Increasingly Water-Scarce World. World Bank, Washington, DC.*
Criterion 3 — Works under uncertainty	**Partially —** Pairing effectiveness depends on the local energy mix, grid arrangements and renewable resource availability; the 'Partially' reflects context-dependence rather than technology immaturity. **Evidence:** *Inferred from the nature of the measure; no external source required for this step.*

36[003]-S3 — Renewable energy-paired desalination	
Criterion 4 — Does not conflict with mitigation objectives	**Yes —** Directly addresses the mitigation co-benefit by design; this is the configuration that converts a Conditional row into a Yes. **Evidence:** *Inferred from the nature of the measure; no external source required for this step.*
ASEAN Taxonomy Assessment Frame support	
CRVA assessment considerations	**Life span:** Industrial asset; multi-decadal. **Adequacy and effectiveness:** Hazard: drought; sea-level rise. Addresses the high-energy maladaptation risk inherent in conventional desalination — the measure exists to fix the criterion-4 weakness of the asset class. Pairing effectiveness depends on the local energy mix, grid arrangements and renewable resource availability; the 'Partially' reflects context-dependence rather than technology immaturity. **Maladaptation:** Low; addresses the energy-dependency maladaptation of conventional desalination by design.
Additional support on Foundation Framework 1A guiding questions	GQ1A: delivers the operator's firm rainfall-independent supply while removing the fossil-energy dependency that would otherwise undermine it; pairing effectiveness is context-dependent (C3 'Partially'); measurable as firm yield with tracked emissions intensity.
Additional support on Foundation Framework 1B guiding questions	GQ1B: firm low-carbon supply supports connected users' resilience without transferring an emissions burden to others.

36[003]-S4 — Brackish groundwater reverse osmosis	
Detailed solution profile	
Technology/solution	Brackish groundwater reverse osmosis
[Technology ID — internal reference only]	*36[003]-S4*
Description	Treats saline-contaminated groundwater back to potable standard, recovering an otherwise lost source rather than abandoning it.
Type of solution	Technology-based solution (engineered)
Targeted climate risk(s)	Sea-level rise
Relevant resilience theme(s)	Resilient water & sanitation
Technology details	**State of technology:** Mature membrane technology; energy demand materially lower than seawater RO. **Scalability:** Wellfield to system scale. **Environmental, social, and economic impact:** Energy-intensive treatment (though materially lower than seawater RO); pair with renewable supply — same Step 2 evidence requirement as SWRO. **Paradigm shift potential:** Keeps salinising aquifers in use rather than abandoning them.

36[003]-S4 — Brackish groundwater reverse osmosis	
Fit-for-purpose criteria (Section 4b — rationale for inclusion in the mARs Guide)	
Criterion 1 — Clear risk fit	**Yes —** Hazard: sea-level rise. Addresses groundwater source salinisation as intrusion advances — regionally evidenced in delta aquifers and coastal wellfields. **Evidence:** *UNEP-DHI (2026). Strengthening Salinity Intrusion Data Sharing and Forecasting for Adaptation to Climate Change Impacts in the Mekong Delta of Viet Nam (project; documents 2019–20 dry-season intrusion reaching c. 125 km inland). — 'Land use change in the Vietnamese Mekong Delta: long-term impacts of drought and salinity intrusion using satellite and monitoring data', iScience (2025).*
Criterion 2 — Clear effect	**Yes —** Treats saline-contaminated groundwater back to potable standard, recovering an otherwise lost source rather than abandoning it. **Evidence:** *World Bank (2019). The Role of Desalination in an Increasingly Water-Scarce World. World Bank, Washington, DC.*
Criterion 3 — Works under uncertainty	**Yes —** Feedwater salinity range can be designed to the anticipated worst case, with membrane configuration adjustable as salinity evolves. **Evidence:** *Inferred from the nature of the measure; no external source required for this step.*
Criterion 4 — Does not conflict with mitigation objectives	**Conditional —** Energy-intensive treatment (though materially lower than seawater RO); pair with renewable supply — same Step 2 evidence requirement as SWRO. **Evidence:** *World Bank (2019). The Role of Desalination in an Increasingly Water-Scarce World. World Bank, Washington, DC.*
ASEAN Taxonomy Assessment Frame support	
CRVA assessment considerations	**Life span:** Industrial asset; multi-decadal. **Adequacy and effectiveness:** Hazard: sea-level rise. Addresses groundwater source salinisation as intrusion advances — regionally evidenced in delta aquifers and coastal wellfields. Feedwater salinity range can be designed to the anticipated worst case, with membrane configuration adjustable as salinity evolves. **Maladaptation:** Energy intensity ('Conditional', materially lower than seawater RO); pair with renewable supply. Substituting desalination for unmanaged groundwater over-abstraction, with no demand-side measures, is the maladaptive configuration (Appendix 2).
Additional support on Foundation Framework 1A guiding questions	GQ1A: as intrusion salinises the source, BWRO recovers it to potable standard for the operator's own supply; feedwater range designed to worst-case salinity. DNSH energy consideration ('Conditional', lower than SWRO); measurable as recovered potable volume from a salinising source.
Additional support on Foundation Framework 1B guiding questions	GQ1B: recovering an otherwise-lost source relieves pressure on the shared freshwater other users depend on; no risk transferred where energy is managed.

Activity 37[003] — Flood or drought risk prevention and protection, including nature-based solutions

Activity-level solution navigator				
Priority hazards for VERSION 1 of the mARs Guide	Flooding	Drought	Extreme heat	Sea level rise
Applicable technologies & solutions	• 37[003]-S1 Floodplain reconnection and restoration • 37[003]-S2 Freshwater wetland restoration and creation • 37[003]-S3 Riparian buffer and riverbank restoration • **37[003]-S4 Sustainable urban drainage systems (SuDS/WSUD)** • 37[003]-S5 Vegetated detention/retention basins with overflow pathways • **37[003]-S6 Setback embankments with restored floodplain storage** • 37[003]-S7 Stormwater detention basin upgrades (capacity expansion) • **37[003]-S8 Flood early warning**	• **37[003]-S12 Catchment rehabilitation and afforestation** • 37[003]-S13 Agroforestry and soil moisture retention (mulching, terracing at catchment scale) • 37[003]-S14 Managed aquifer recharge via infiltration basins • **37[003]-S15 Drought early warning and water allocation systems**	• 37[003]-S9 Urban blue-green drainage networks *	• **37[003]-S10 Mangrove restoration and coastal wetland buffers** • **37[003]-S11 Hybrid grey-green coastal defences (revetments with mangrove foreshore)**

	systems (sensors, modelling, dissemination) • 37[003]-S9 Urban blue-green drainage networks *			

*Note: 1) Solution marked * addresses more than one priority hazard. 2) Solutions in **bold** have a detailed solution profile below; the remainder are listed in Appendix 1 and are profiled progressively. 3) Solution codes follow Appendix 1.*

37[003]-S4 — Sustainable urban drainage systems (SuDS/WSUD) (NbS)	
Detailed solution profile	
Technology/solution	Sustainable urban drainage systems (SuDS/WSUD)
[Technology ID — internal reference only]	*37[003]-S4*
Description	Manages surface water at source via permeable surfaces, bioswales and rain gardens, cutting runoff volumes and peaks before they reach the drainage network; Bishan-Ang Mo Kio demonstrates capacity gains from naturalised conveyance.
Type of solution	Nature-based solution (NbS)
Targeted climate risk(s)	Flood (urban)
Relevant resilience theme(s)	Resilient water & sanitation; Resilient infrastructure
Technology details	**State of technology:** Established at programme scale in ASEAN (Singapore ABC Waters, 120+ certified projects since 2006). **Scalability:** Modular and expandable across a catchment; component to city-wide. **Environmental, social, and economic impact:** Green infrastructure sequesters carbon and reduces urban heat alongside the drainage function. **Paradigm shift potential:** Manages stormwater at source rather than conveying it away.
Fit-for-purpose criteria (Section 4b — rationale for inclusion in the mARs Guide)	
Criterion 1 — Clear risk fit	**Yes —** Hazard: flood (urban). Addresses urban services and property exposure to pluvial flooding — the dominant urban flood mode as impermeable cover expands. Regional precedent at programme scale: Singapore's ABC Waters Programme, running since 2006 with over 120 certified projects. **Evidence:** *C40 Cities. Singapore: Bio-Engineering Works at Bishan-Ang Mo Kio Park to Prevent Urban Flooding (case study); PUB ABC Waters Programme and Design Guidelines (first published 2009).*

37[003]-S4 — Sustainable urban drainage systems (SuDS/WSUD) (NbS)	
Criterion 2 — Clear effect	**Yes —** Manages surface water at source via permeable surfaces, bioswales and rain gardens, cutting runoff volumes and peaks before they reach the drainage network; Bishan-Ang Mo Kio demonstrates capacity gains from naturalised conveyance. **Evidence:** *C40 Cities. Singapore: Bio-Engineering Works at Bishan-Ang Mo Kio Park to Prevent Urban Flooding (case study); PUB ABC Waters Programme and Design Guidelines (first published 2009). — Zevenbergen, C. et al. (2010). Urban Flood Management. CRC Press.*
Criterion 3 — Works under uncertainty	**Yes —** Modular and expandable; an SuDS network has multiple distributed failure modes rather than a single point of failure, so exceedance is partial rather than total. **Evidence:** *Zevenbergen, C. et al. (2010). Urban Flood Management. CRC Press. — C40 Cities. Singapore: Bio-Engineering Works at Bishan-Ang Mo Kio Park to Prevent Urban Flooding (case study); PUB ABC Waters Programme and Design Guidelines (first published 2009).*
Criterion 4 — Does not conflict with mitigation objectives	**Yes —** Green infrastructure sequesters carbon and reduces urban heat alongside the drainage function. **Evidence:** *UNEP-DHI, UNEP and IUCN (2018). Nature-Based Solutions for Water Management: A Primer.*
ASEAN Taxonomy Assessment Frame support	
CRVA assessment considerations	**Life span:** Green-infrastructure network; long-lived with maintenance, improving as vegetation matures. **Adequacy and effectiveness:** Hazard: flood (urban). Addresses urban services and property exposure to pluvial flooding — the dominant urban flood mode as impermeable cover expands. Regional precedent at programme scale: Singapore's ABC Waters Programme, running since 2006 with over 120 certified projects. Modular and expandable; an SuDS network has multiple distributed failure modes rather than a single point of failure, so exceedance is partial rather than total. **Maladaptation:** Low; distributed source control. Concrete channelisation of urban waterways is the maladaptive configuration — it accelerates downstream peaks (Appendix 4).
Additional support on Foundation Framework 1A guiding questions	GQ1A: for a developer or utility managing a defined urban area, SuDS cuts runoff volumes and peaks at source, reducing its own pluvial-flood exposure; distributed design is robust to exceedance; measurable as reduced runoff and peak load.
Additional support on Foundation Framework 1B guiding questions	GQ1B: cutting runoff at source relieves the shared drainage network and lowers flood peaks for downstream properties and the wider catchment, enabling others' resilience; supports water–urban outcomes.

37[003]-S6 — Setback embankments with restored floodplain storage (NbS)	
Detailed solution profile	
Technology/solution	Setback embankments with restored floodplain storage
[Technology ID — internal reference only]	*37[003]-S6*
Description	Combines structural protection with restored natural storage on the floodplain side; protection and retention are delivered together instead of traded off.
Type of solution	Nature-based solution (NbS, hybrid)
Targeted climate risk(s)	Flood (river/urban)
Relevant resilience theme(s)	Resilient water & sanitation; Resilient infrastructure
Technology details	**State of technology:** Established adaptive floodplain-management practice; responsive to documented Mekong high-dyke risk transfer. **Scalability:** Reach to river-system scale. **Environmental, social, and economic impact:** Earthworks have embedded carbon; floodplain restoration offsets operational/ecosystem carbon but the construction-stage balance should be evidenced. **Paradigm shift potential:** Replaces full-exclusion dyking with room-for-the-river design.
Fit-for-purpose criteria (Section 4b — rationale for inclusion in the mARs Guide)	
Criterion 1 — Clear risk fit	**Yes —** Hazard: flood (river/urban). Addresses people/assets exposure while retaining — rather than eliminating — floodplain retention; directly responsive to the documented downstream-transfer failure of close-set high dykes in the region. **Evidence:** *'Flooding in the Mekong Delta: the impact of dyke systems on downstream hydrodynamics', Hydrology and Earth System Sciences, 24, 189–212 (2020), and modelling literature cited therein on high-dyke development in An Giang and Dong Thap provinces.*
Criterion 2 — Clear effect	**Yes —** Combines structural protection with restored natural storage on the floodplain side; protection and retention are delivered together instead of traded off. **Evidence:** *World Bank / GFDRR (2018). Nature-Based Solutions for Disaster Risk Management. World Bank, Washington, DC. — 'Flooding in the Mekong Delta: the impact of dyke systems on downstream hydrodynamics', Hydrology and Earth System Sciences, 24, 189–212 (2020), and modelling literature cited therein on high-dyke development in An Giang and Dong Thap provinces.*
Criterion 3 — Works under uncertainty	**Yes —** Provides a safe exceedance pathway and the alignment is adjustable over time — a recognised adaptive-pathway configuration. **Evidence:** *World Bank / GFDRR (2018). Nature-Based Solutions for Disaster Risk Management. World Bank, Washington, DC.*
Criterion 4 — Does not conflict with mitigation objectives	**Conditional —** Earthworks have embedded carbon; floodplain restoration offsets operational/ecosystem carbon but the construction-stage balance should be evidenced.

37[003]-S6 — Setback embankments with restored floodplain storage (NbS)	
	Evidence: *Inferred from the nature of the measure; no external source required for this step.*
ASEAN Taxonomy Assessment Frame support	
CRVA assessment considerations	**Life span:** Civil and ecosystem asset; alignment adjustable over decades. **Adequacy and effectiveness:** Hazard: flood (river/urban). Addresses people/assets exposure while retaining — rather than eliminating — floodplain retention; directly responsive to the documented downstream-transfer failure of close-set high dykes in the region. Provides a safe exceedance pathway and the alignment is adjustable over time — a recognised adaptive-pathway configuration. **Maladaptation:** Low; retains floodplain storage and a safe exceedance pathway. Close-set high ring dykes enabling full floodplain exclusion transfer flood hazard downstream — the maladaptive configuration (Appendix 2).
Additional support on Foundation Framework 1A guiding questions	GQ1A: protects the defended assets while retaining floodplain storage; the CRVA sets the alignment against forward-looking flows with a safe exceedance pathway; measurable as protected area with retained conveyance.
Additional support on Foundation Framework 1B guiding questions	GQ1B (material): by retaining floodplain storage and sediment rather than excluding them, the measure avoids transferring flood hazard to neighbouring and downstream communities — the explicit contrast with close-set high dykes; supports basin-level resilience.

37[003]-S8 — Flood early warning systems (sensors, modelling, dissemination)	
Detailed solution profile	
Technology/solution	Flood early warning systems (sensors, modelling, dissemination)
[Technology ID — internal reference only]	*37[003]-S8*
Description	Provides forecast lead time, reducing loss of life and moveable asset losses; the protective value of warning lead time is among the best-evidenced results in disaster risk management.
Type of solution	Technology-based solution (information / early warning)
Targeted climate risk(s)	Flood (river/urban/coastal)
Relevant resilience theme(s)	Resilient water & sanitation; Resilient infrastructure
Technology details	**State of technology:** Established disaster-risk-management practice across ASEAN basins and cities. **Scalability:** Local to basin-wide coverage. **Environmental, social, and economic impact:** Low-energy sensing and computation; enables avoided losses.

37[003]-S8 — Flood early warning systems (sensors, modelling, dissemination)	
	Paradigm shift potential: Converts unavoidable exposure into avoidable loss through lead time.
Fit-for-purpose criteria (Section 4b — rationale for inclusion in the mARs Guide)	
Criterion 1 — Clear risk fit	**Yes —** Hazard: flood (river/urban/coastal). Addresses lead time for protective action — exposure of life and moveable assets is reducible even where structural protection is not feasible. **Evidence:** *World Bank / GFDRR (2018). Nature-Based Solutions for Disaster Risk Management. World Bank, Washington, DC.*
Criterion 2 — Clear effect	**Yes —** Provides forecast lead time, reducing loss of life and moveable asset losses; the protective value of warning lead time is among the best-evidenced results in disaster risk management. **Evidence:** *World Bank / GFDRR (2018). Nature-Based Solutions for Disaster Risk Management. World Bank, Washington, DC.*
Criterion 3 — Works under uncertainty	**Yes —** Adjustable thresholds; sensors and models are upgradeable as the hazard evolves — the system is built for changing baselines. **Evidence:** *Inferred from the nature of the measure; no external source required for this step.*
Criterion 4 — Does not conflict with mitigation objectives	**Yes —** Low-energy sensing and computation; enables avoided losses. **Evidence:** *Inferred from the nature of the measure; no external source required for this step.*
ASEAN Taxonomy Assessment Frame support	
CRVA assessment considerations	**Life span:** Sensor and model infrastructure; upgradeable as the hazard evolves. **Adequacy and effectiveness:** Hazard: flood (river/urban/coastal). Addresses lead time for protective action — exposure of life and moveable assets is reducible even where structural protection is not feasible. Adjustable thresholds; sensors and models are upgradeable as the hazard evolves — the system is built for changing baselines. **Maladaptation:** Low; adjustable thresholds and upgradeable models, with no risk transfer.
Additional support on Foundation Framework 1A guiding questions	GQ1A: for the operating entity, the system protects its own moveable assets and continuity through forecast lead time; thresholds are upgradeable; measurable as warning lead time and avoided losses.
Additional support on Foundation Framework 1B guiding questions	GQ1B (primary): the warning service enables people, activities and assets across the service area to take protective action ahead of floods — the best-evidenced protective value in disaster risk management; supports cross-sector emergency response.

37[003]-S10 — Mangrove restoration and coastal wetland buffers (NbS)	
Detailed solution profile	
Technology/solution	Mangrove restoration and coastal wetland buffers
[Technology ID — internal reference only]	*37[003]-S10*
Description	Attenuates wave energy, reduces coastal erosion and traps sediment; in Demak, permeable structures restored sediment dynamics to enable natural mangrove recovery along a 20 km coastline.
Type of solution	Nature-based solution (NbS)
Targeted climate risk(s)	Sea-level rise; storm surge
Relevant resilience theme(s)	Resilient water & sanitation; Resilient infrastructure
Technology details	**State of technology:** Established, with a regional reference programme (Building with Nature, Demak). **Scalability:** Site to coastline (Demak restored a 20 km coastline). **Environmental, social, and economic impact:** Mangroves are high-density carbon sinks; among the strongest sequestration co-benefits available in the sector. **Paradigm shift potential:** Uses a self-maintaining ecosystem as coastal defence.
Fit-for-purpose criteria (Section 4b — rationale for inclusion in the mARs Guide)	
Criterion 1 — Clear risk fit	**Yes —** Hazard: sea-level rise; storm surge. Addresses coastal erosion, surge and trap-sediment loss — regionally evidenced: even a 100 m mangrove strip reduces wave heights by 13–66% (Demak research base). **Evidence:** *Wetlands International / EcoShape et al. (2021). Building with Nature in Indonesia: Restoring an Eroding Coastline and Inspiring Action at Scale (2015–2021). Demak, Central Java. — World Bank / GFDRR (2018). Nature-Based Solutions for Disaster Risk Management. World Bank, Washington, DC.*
Criterion 2 — Clear effect	**Yes —** Attenuates wave energy, reduces coastal erosion and traps sediment; in Demak, permeable structures restored sediment dynamics to enable natural mangrove recovery along a 20 km coastline. **Evidence:** *Wetlands International / EcoShape et al. (2021). Building with Nature in Indonesia: Restoring an Eroding Coastline and Inspiring Action at Scale (2015–2021). Demak, Central Java.*
Criterion 3 — Works under uncertainty	**Yes —** Self-maintaining if conditions allow: mangroves can migrate landward and accrete vertically with sea-level rise — with the important Demak caveat that severe land subsidence can outpace this capacity (see non-qualifying examples). **Evidence:** *Wetlands International / EcoShape et al. (2021). Building with Nature in Indonesia: Restoring an Eroding Coastline and Inspiring Action at Scale (2015–2021). Demak, Central Java.*

37[003]-S10 — Mangrove restoration and coastal wetland buffers (NbS)	
Criterion 4 — Does not conflict with mitigation objectives	**Yes —** Mangroves are high-density carbon sinks; among the strongest sequestration co-benefits available in the sector. **Evidence:** *UNEP-DHI, UNEP and IUCN (2018). Nature-Based Solutions for Water Management: A Primer.*
ASEAN Taxonomy Assessment Frame support	
CRVA assessment considerations	**Life span:** Ecosystem asset; self-maintaining where conditions allow, with landward migration and vertical accretion. **Adequacy and effectiveness:** Hazard: sea-level rise; storm surge. Addresses coastal erosion, surge and trap-sediment loss — regionally evidenced: even a 100 m mangrove strip reduces wave heights by 13–66% (Demak research base). Self-maintaining if conditions allow: mangroves can migrate landward and accrete vertically with sea-level rise — with the important Demak caveat that severe land subsidence can outpace this capacity (see non-qualifying examples). **Maladaptation:** Self-maintaining where conditions allow, but severe land subsidence (from groundwater over-abstraction) can outpace vertical accretion (Appendix 4 — Demak).
Additional support on Foundation Framework 1A guiding questions	GQ1A: for the coastal asset owner, restored mangrove attenuates wave energy and reduces erosion, lowering the asset's own surge and erosion exposure; self-maintaining under sea-level rise where subsidence does not outpace accretion; measurable as wave-height reduction and shoreline stability.
Additional support on Foundation Framework 1B guiding questions	GQ1B: the mangrove belt reduces surge and erosion for the wider coastline and the communities behind it, and delivers fisheries and carbon co-benefits others share; supports coastal-community resilience.

37[003]-S11 — Hybrid grey-green coastal defences (revetments with mangrove foreshore) (NbS)	
Detailed solution profile	
Technology/solution	Hybrid grey-green coastal defences (revetments with mangrove foreshore)
[Technology ID — internal reference only]	*37[003]-S11*
Description	Combines an engineered structural baseline with NbS adaptive capacity; the engineered layer provides certainty of protection while the NbS layer provides the adaptive function.
Type of solution	Nature-based solution (NbS, hybrid engineered)
Targeted climate risk(s)	Sea-level rise; storm surge
Relevant resilience theme(s)	Resilient water & sanitation; Resilient infrastructure
Technology details	**State of technology:** Established; the Demak permeable-structure approach is reflected in an Indonesian national guideline. **Scalability:** Reach to coastline.

37[003]-S11 — Hybrid grey-green coastal defences (revetments with mangrove foreshore) (NbS)	
	Environmental, social, and economic impact: The engineered component has embedded carbon; the NbS layer offsets. Net position should be evidenced at Step 2. **Paradigm shift potential:** Hedges hard and soft protection together rather than choosing one.
Fit-for-purpose criteria (Section 4b — rationale for inclusion in the mARs Guide)	
Criterion 1 — Clear risk fit	**Yes —** Hazard: sea-level rise; storm surge. Addresses coastal assets and people exposure where space or conditions preclude a pure NbS foreshore; the Demak permeable-structure approach is the regional reference for hybrid engineering, now reflected in an Indonesian national guideline. **Evidence:** *Wetlands International / EcoShape et al. (2021). Building with Nature in Indonesia: Restoring an Eroding Coastline and Inspiring Action at Scale (2015–2021). Demak, Central Java.*
Criterion 2 — Clear effect	**Yes —** Combines an engineered structural baseline with NbS adaptive capacity; the engineered layer provides certainty of protection while the NbS layer provides the adaptive function. **Evidence:** *Wetlands International / EcoShape et al. (2021). Building with Nature in Indonesia: Restoring an Eroding Coastline and Inspiring Action at Scale (2015–2021). Demak, Central Java. — World Bank / GFDRR (2018). Nature-Based Solutions for Disaster Risk Management. World Bank, Washington, DC.*
Criterion 3 — Works under uncertainty	**Yes —** The engineered component provides a performance baseline while the NbS component adds adaptive capacity that grows over time; the combination hedges both ways under uncertainty. **Evidence:** *World Bank / GFDRR (2018). Nature-Based Solutions for Disaster Risk Management. World Bank, Washington, DC. — Wetlands International / EcoShape et al. (2021). Building with Nature in Indonesia: Restoring an Eroding Coastline and Inspiring Action at Scale (2015–2021). Demak, Central Java.*
Criterion 4 — Does not conflict with mitigation objectives	**Conditional —** The engineered component has embedded carbon; the NbS layer offsets. Net position should be evidenced at Step 2. **Evidence:** *Inferred from the nature of the measure; no external source required for this step.*
ASEAN Taxonomy Assessment Frame support	
CRVA assessment considerations	**Life span:** Engineered and ecosystem asset; NbS capacity grows over time. **Adequacy and effectiveness:** Hazard: sea-level rise; storm surge. Addresses coastal assets and people exposure where space or conditions preclude a pure NbS foreshore; the Demak permeable-structure approach is the regional reference for hybrid engineering, now reflected in an Indonesian national guideline. The engineered component provides a performance baseline while the NbS component adds adaptive capacity that grows over time; the combination hedges both ways under uncertainty. **Maladaptation:** Low; the engineered baseline plus growing NbS capacity hedges both ways under uncertainty.

37[003]-S11 — Hybrid grey-green coastal defences (revetments with mangrove foreshore) (NbS)	
Additional support on Foundation Framework 1A guiding questions	GQ1A: the engineered baseline gives the asset owner a certain protection level while the NbS foreshore adds adaptive capacity; robust both ways under sea-level-rise uncertainty; measurable as protection standard plus foreshore accretion.
Additional support on Foundation Framework 1B guiding questions	GQ1B: the defence protects assets and people behind it and, via the NbS foreshore, delivers shared coastal and habitat benefits; no downdrift risk transfer of the kind hard-only defences cause.

37[003]-S12 — Catchment rehabilitation and afforestation (NbS)	
Detailed solution profile	
Technology/solution	Catchment rehabilitation and afforestation
[Technology ID — internal reference only]	*37[003]-S12*
Description	Improves baseflow maintenance, infiltration and groundwater recharge; the hydrological effect operates at the level of the resource itself rather than a single asset.
Type of solution	Nature-based solution (NbS)
Targeted climate risk(s)	Drought
Relevant resilience theme(s)	Resilient water & sanitation
Technology details	**State of technology:** Established watershed-management / NbS practice. **Scalability:** Sub-catchment to basin programme. **Environmental, social, and economic impact:** Afforestation directly sequesters carbon; strong co-benefit. (Species selection matters — see non-qualifying examples for the monoculture failure case.) **Paradigm shift potential:** Moves water security from built-only supply to catchment-based source protection.
Fit-for-purpose criteria (Section 4b — rationale for inclusion in the mARs Guide)	
Criterion 1 — Clear risk fit	**Yes —** Hazard: drought. Addresses supply, yields and ecosystem condition by restoring the catchment processes that sustain dry-season flows. **Evidence:** *UNEP-DHI, UNEP and IUCN (2018). Nature-Based Solutions for Water Management: A Primer.*
Criterion 2 — Clear effect	**Yes —** Improves baseflow maintenance, infiltration and groundwater recharge; the hydrological effect operates at the level of the resource itself rather than a single asset. **Evidence:** *UNEP-DHI, UNEP and IUCN (2018). Nature-Based Solutions for Water Management: A Primer. — World Bank / GFDRR (2018). Nature-Based Solutions for Disaster Risk Management. World Bank, Washington, DC.*

37[003]-S12 — Catchment rehabilitation and afforestation (NbS)	
Criterion 3 — Works under uncertainty	**Yes —** Resilience improves with ecosystem maturity; benefits are robust across climate scenarios because improved infiltration is unconditionally useful. **Evidence:** *World Bank / GFDRR (2018). Nature-Based Solutions for Disaster Risk Management. World Bank, Washington, DC.*
Criterion 4 — Does not conflict with mitigation objectives	**Yes —** Afforestation directly sequesters carbon; strong co-benefit. (Species selection matters — see non-qualifying examples for the monoculture failure case.) **Evidence:** *Inferred from the nature of the measure; no external source required for this step.*
ASEAN Taxonomy Assessment Frame support	
CRVA assessment considerations	**Life span:** Ecosystem asset; multi-decadal, strengthening as it matures. **Adequacy and effectiveness:** Hazard: drought. Addresses supply, yields and ecosystem condition by restoring the catchment processes that sustain dry-season flows. Resilience improves with ecosystem maturity; benefits are robust across climate scenarios because improved infiltration is unconditionally useful. **Maladaptation:** Low where native and diverse. High-water-demand exotic monoculture presented as 'afforestation' can reduce dry-season baseflow — the maladaptive configuration (Appendix 2); species and siting govern the outcome.
Additional support on Foundation Framework 1A guiding questions	GQ1A: for a utility or programme relying on the catchment, restoration rebuilds baseflow, infiltration and recharge that sustain its own dry-season source; robust as improved infiltration is unconditionally useful; measurable as baseflow and recharge indicators against a pre-restoration baseline.
Additional support on Foundation Framework 1B guiding questions	GQ1B (material): operating at the resource level, restored catchment processes sustain dry-season flows for all downstream users — utilities, irrigators, ecosystems — enabling their resilience; native, diverse planting avoids the baseflow-reducing monoculture failure.

37[003]-S15 — Drought early warning and water allocation systems	
Detailed solution profile	
Technology/solution	Drought early warning and water allocation systems
[Technology ID — internal reference only]	*37[003]-S15*
Description	Enables proactive demand management, allocation decisions and crop-calendar adjustment before crisis; documented loss-reduction value in VMD drought/salinity seasons.
Type of solution	Technology-based solution (information / early warning)
Targeted climate risk(s)	Drought

37[003]-S15 — Drought early warning and water allocation systems	
Relevant resilience theme(s)	Resilient water & sanitation
Technology details	**State of technology:** Established forecasting-and-allocation practice; demonstrated in Mekong drought and salinity seasons. **Scalability:** Sub-basin to basin. **Environmental, social, and economic impact:** Low-energy sensing and modelling; enables avoided losses. **Paradigm shift potential:** Shifts drought response from crisis reaction to anticipatory allocation.
Fit-for-purpose criteria (Section 4b — rationale for inclusion in the mARs Guide)	
Criterion 1 — Clear risk fit	**Yes —** Hazard: drought. Addresses management lead time — in the Mekong Delta the binding constraint in 2019–20 was timely warning and preparation, not only physical scarcity. **Evidence:** *UNEP-DHI (2026). Strengthening Salinity Intrusion Data Sharing and Forecasting for Adaptation to Climate Change Impacts in the Mekong Delta of Viet Nam (project; documents 2019–20 dry-season intrusion reaching c. 125 km inland). — 'Land use change in the Vietnamese Mekong Delta: long-term impacts of drought and salinity intrusion using satellite and monitoring data', iScience (2025).*
Criterion 2 — Clear effect	**Yes —** Enables proactive demand management, allocation decisions and crop-calendar adjustment before crisis; documented loss-reduction value in VMD drought/salinity seasons. **Evidence:** *UNEP-DHI (2026). Strengthening Salinity Intrusion Data Sharing and Forecasting for Adaptation to Climate Change Impacts in the Mekong Delta of Viet Nam (project; documents 2019–20 dry-season intrusion reaching c. 125 km inland). — 'Brief communication: Seasonal prediction of salinity intrusion in the Mekong Delta', Natural Hazards and Earth System Sciences, 20, 1609 (2020). — 'Land use change in the Vietnamese Mekong Delta: long-term impacts of drought and salinity intrusion using satellite and monitoring data', iScience (2025).*
Criterion 3 — Works under uncertainty	**Yes —** Adjustable triggers; scalable with data availability; forecast skill improves with each season of data. **Evidence:** *'Brief communication: Seasonal prediction of salinity intrusion in the Mekong Delta', Natural Hazards and Earth System Sciences, 20, 1609 (2020).*
Criterion 4 — Does not conflict with mitigation objectives	**Yes —** Low-energy sensing and modelling; enables avoided losses. **Evidence:** *Inferred from the nature of the measure; no external source required for this step.*
ASEAN Taxonomy Assessment Frame support	
CRVA assessment considerations	**Life span:** Sensor and model infrastructure; upgradeable, forecast skill improving each season. **Adequacy and effectiveness:** Hazard: drought. Addresses management lead time — in the Mekong Delta the binding constraint in 2019–20 was timely warning and preparation, not only physical scarcity. Adjustable triggers; scalable with data availability; forecast skill improves with each season of data. **Maladaptation:** Low; adjustable triggers and no risk transfer.

37[003]-S15 — Drought early warning and water allocation systems	
Additional support on Foundation Framework 1A guiding questions	GQ1A: the operating authority uses lead time to manage its own demand and allocation ahead of scarcity; triggers adjustable; measurable as avoided losses through earlier action.
Additional support on Foundation Framework 1B guiding questions	GQ1B (primary): warning and allocation enable water users, irrigators and communities to adjust demand and crop calendars before crisis — the Mekong 2019–20 binding constraint was timely warning; supports water–agriculture coordination.

Agriculture, Forestry and Fishing (ISIC A)

Activity 02[001] — Sustainable forest management

Activity-level solution navigator				
Priority hazards for VERSION 1 of the mARs Guide	Flooding	Drought	Extreme heat	Sea level rise
Applicable technologies & solutions	• 02[001]-S6 Retention and widening of riparian buffer strips within managed forest • 02[001]-S7 Forest-road drainage and stream-crossing upgrades	• 02[001]-S1 Drought-tolerant species / provenance selection and assisted migration • **02[001]-S2 Reduced-impact logging and continuous-cover silviculture**	• 02[001]-S3 Fuel-load management and firebreak networks • 02[001]-S4 Early fire detection (towers, sensors, satellite) • 02[001]-S5 Climate-driven pest and disease surveillance and response	*None listed in Appendix 1*

*Note: 1) Solution marked * addresses more than one priority hazard. 2) Solutions in **bold** have a detailed solution profile below; the remainder are listed in Appendix 1 and are profiled progressively. 3) Solution codes follow Appendix 1.*

02[001]-S2 — Reduced-impact logging and continuous-cover silviculture	
Detailed solution profile	
Technology/solution	Reduced-impact logging and continuous-cover silviculture
[Technology ID — internal reference only]	*02[001]-S2*
Description	Planned and supervised selective harvesting that limits damage to the forest left standing: pre-harvest inventory and mapping, directional felling, pre-planned skid trails and winching, climber cutting, and protection of retained trees and watercourses, applied within a polycyclic system that keeps a continuous canopy between harvests. Limiting canopy opening retains the cooler, more humid forest

02[001]-S2 — Reduced-impact logging and continuous-cover silviculture	
	microclimate and avoids the build-up of dry logging debris that leaves logged forest more exposed to drought stress and fire.
Type of solution	Nature-based solution (forest management practice)
Targeted climate risk(s)	Drought, including El Niño-driven drought and the associated fire risk in logged forest
Relevant resilience theme(s)	Resilient agri-food systems
Technology details	**State of technology:** Established and codified for the region in the FAO Code of Practice for Forest Harvesting in Asia-Pacific (1999), published under the Asia-Pacific Forestry Commission. Applied at operational scale in ASEAN since the 1990s: Sabah's Deramakot Forest Reserve, managed under reduced-impact logging, was certified by the Forest Stewardship Council in 1997 as the first natural forest reserve in Southeast Asia recognised as sustainably managed (Mannan et al., 2008). Carbon-focused variants (RIL-C) were developed from field studies of commercial concessions in East Kalimantan (Griscom et al., 2014). **Scalability:** Applied at concession or forest management unit level and replicable across production forests under selective logging in AMS; the binding constraint is crew training and supervision rather than equipment. **Environmental, social, and economic impact:** Environmental: less residual stand damage and soil disturbance; in Deramakot, RIL-managed forest retained canopy tree richness and composition at the level of unlogged forest. Social: lower flammability of the managed forest reduces fire and haze exposure for neighbouring communities and land users. Economic: higher planning and supervision costs, partly offset by less timber waste and access to certified markets (inferred from the nature of the measure). **Paradigm shift potential:** Treats harvesting damage as a drought and fire resilience variable for the forest estate, not only as a yield or certification issue.
Fit-for-purpose criteria (Section 4b — rationale for inclusion in the mARs Guide)	
Criterion 1 — Clear risk fit	**Yes —** Hazard: drought. Address risk: canopy moisture and microclimate loss. Logged forest is hotter, drier and more fire-prone than intact forest. In East Kalimantan during the 1997–98 El Niño drought, fires mainly affected recently logged forest, while primary forest and forest logged long before were less affected; 5.2 million ha burned, 2.6 million ha of it forest (Siegert et al., 2001). Canopy opening also changes the microclimate: in Sabah, primary forest was up to 2.5 °C cooler than logged forest (Hardwick et al., 2015). The hazard–asset–consequence chain can be set out in the CRVA (PS) or qualitative narrative (FF). **Evidence:** *Siegert, F., Ruecker, G., Hinrichs, A. and Hoffmann, A.A. (2001). 'Increased damage from fires in logged forests during droughts caused by El Niño', Nature, 414, 437–440. Hardwick, S.R. et al. (2015). 'The*

02[001]-S2 — Reduced-impact logging and continuous-cover silviculture	
	relationship between leaf area index and microclimate in tropical forest and oil palm plantation: forest disturbance drives changes in microclimate', Agricultural and Forest Meteorology, 201, 187–195.
Criterion 2 — Clear effect	**Yes —** Retains canopy cover and soil moisture, avoiding the drying that follows clear-felling and limiting the canopy damage of conventional selective logging. In Deramakot, RIL-managed forest stored 156 ± 18 t/ha of carbon against 123 ± 11 t/ha in conventionally logged forest, and kept canopy tree richness at the level of unlogged forest (Mannan et al., 2008). The effect is measurable as post-harvest canopy cover and residual stand damage. **Evidence:** *Mannan, S., Kitayama, K., Lee, Y.F., Chung, A., Radin, A. and Lagan, P. (2008). 'RIL for biodiversity and carbon conservation: Deramakot forest shows positive conservation impacts of reduced impact logging', ITTO Tropical Forest Update, 18(2).*
Criterion 3 — Works under uncertainty	**Yes —** Applicable across rotations and site conditions. Retaining canopy and limiting damage reduces vulnerability whatever the drought trajectory, and harvest plans are revised at each felling cycle, so intensity and retention can be adjusted as conditions change. The measure reduces rather than removes exposure: the 1997–98 El Niño drought temporarily halted the carbon sink of intact Bornean forest by increasing tree mortality (Qie et al., 2017), so RIL is complemented by fire prevention and detection under severe drought. **Evidence:** *Qie, L. et al. (2017). 'Long-term carbon sink in Borneo's forests halted by drought and vulnerable to edge effects', Nature Communications, 8, 1966. Adaptive revision of harvest plans inferred from the nature of the measure.*
Criterion 4 — Does not conflict with mitigation objectives	**Yes —** Avoids clear-fell emissions and retains standing stock. Against conventional selective logging, full implementation of RIL-C practices would cut tropical selective logging emissions by an estimated 44% while maintaining timber production (Ellis et al., 2019). In East Kalimantan, FSC-certified concessions had lower skidding emissions but not lower total logging emissions than non-certified ones, so the benefit depends on the specific practices adopted rather than on certification status (Griscom et al., 2014). **Evidence:** *Ellis, P.W. et al. (2019). 'Reduced-impact logging for climate change mitigation (RIL-C) can halve selective logging emissions from tropical forests', Forest Ecology and Management, 438, 255–266. Griscom, B., Ellis, P. and Putz, F.E. (2014). 'Carbon emissions performance of commercial logging in East Kalimantan, Indonesia', Global Change Biology, 20, 923–937.*
ASEAN Taxonomy Assessment Frame support	
CRVA assessment considerations	**Life span:** Permanent forest asset managed over successive multi-decadal felling cycles; the practice applies at every harvest entry. With a lifespan above 10 years, Annex 3 calls for assessment of current and future risk on modelled data.

02[001]-S2 — Reduced-impact logging and continuous-cover silviculture	
	Adequacy and effectiveness: The CRVA can set out the management unit's drought and fire exposure (El Niño frequency, fire history, presence of peat), the residual-damage and canopy-retention limits written into the harvest plan, and post-harvest monitoring of both. The reduction in drought and fire vulnerability rests on canopy retention: no study located measures fire outcomes in RIL stands during drought, so canopy cover and residual damage are the measurable evidence. RIL does not address peat fire: where the unit contains or adjoins peat, it is paired with water-table management (02[003]-S3) and with fuel-load management and early fire detection (02[001]-S3, 02[001]-S4). **Maladaptation:** Low where harvest intensity stays within sustained-yield limits and RIL-C practices are actually applied. Risk arises where the RIL label is used without the practices (Griscom et al., 2014), or where new roads and skid trails open access for encroachment and ignition during dry periods (inferred from the nature of the measure).
Additional support on Foundation Framework 1A guiding questions	GQ1A: a CRVA establishes the drought and fire exposure of the production forest; limiting canopy opening and residual damage keeps the operator's own standing stock and future harvests less exposed to drought mortality and fire. The benefit is measurable as residual damage and canopy cover against a conventional-logging baseline.
Additional support on Foundation Framework 1B guiding questions	GQ1B: a less flammable managed forest reduces fire spread to neighbouring land, smallholdings and communities, and the haze exposure that follows; the measure does not transfer risk to other stakeholders.

Activity 02[002] — Forestry plantation

Activity-level solution navigator				
Priority hazards for VERSION 1 of the mARs Guide	Flooding	Drought	Extreme heat	Sea level rise
Applicable technologies & solutions	• 02[002]-S5 Site drainage and raised (mound) planting on flood-prone ground	• **02[002]-S1 Diversified / mixed-species and drought-tolerant planting stock** • 02[002]-S2 Soil-moisture conservation (mulching, cover crops, contour planting)	• 02[002]-S3 Fire-resistant plantation design (breaks, low-flammability buffers, compartmentation) • 02[002]-S4 Shade / nurse-tree systems for heat-sensitive establishment • 02[002]-S6 Provenance / clonal diversity to limit pest and disease vulnerability	*None listed in Appendix 1*

*Note: 1) Solutions in **bold** have a detailed solution profile below; the remainder are listed in Appendix 1 and are profiled progressively. 2) Solution codes follow Appendix 1.*

02[002]-S1 — Diversified / mixed-species and drought-tolerant planting stock	
Detailed solution profile	
Technology/solution	Diversified / mixed-species and drought-tolerant planting stock
[Technology ID — internal reference only]	*02[002]-S1*
Description	Mixing species and selecting drought-tolerant provenances raises resistance to pests, disease and disturbance and improves carbon storage, with meta-analysis finding no clear yield loss relative to the best monoculture; species-specific drought response (e.g. Chukrasia tabularis versus Toona ciliata) provides a basis for provenance selection.
Type of solution	Technology-based solution (silvicultural / land management)

02[002]-S1 — Diversified / mixed-species and drought-tolerant planting stock	
Targeted climate risk(s)	Drought; extreme heat; pest and disease pressure that intensifies with climate stress
Relevant resilience theme(s)	Resilient agri-food systems
Technology details	**State of technology:** Established silvicultural practice; provenance selection informed by species-specific drought response. **Scalability:** Stand to estate scale. **Environmental, social, and economic impact:** Mixed-species plantations store more carbon than monocultures while delivering the resilience gain; a sequestration co-benefit alongside the adaptation function. **Paradigm shift potential:** Moves production forestry from yield-maximising monoculture to diversity-as-resilience design.
Fit-for-purpose criteria (Section 4b — rationale for inclusion in the mARs Guide)	
Criterion 1 — Clear risk fit	**Yes —** Hazard: drought; extreme heat; and the pest/disease pressure that intensifies with climate stress. Addresses the high vulnerability of the even-aged single-species plantations that dominate Southeast Asian production forestry (Eucalyptus, Acacia, pine, teak), which are exposed to correlated failure under drought and outbreak. **Evidence:** *Liu, C.L.C. et al. (2018). 'Mixed-species versus monocultures in plantation forestry: development, benefits, ecosystem services and perspectives for the future', Global Ecology and Conservation, 15, e00419.*
Criterion 2 — Clear effect	**Yes —** Mixing species and selecting drought-tolerant provenances raises resistance to pests, disease and disturbance and improves carbon storage, with meta-analysis finding no clear yield loss relative to the best monoculture; species-specific drought response (e.g. Chukrasia tabularis versus Toona ciliata) provides a basis for provenance selection. **Evidence:** *Frontiers in Forests and Global Change (2023), 'Young mixed planted forests store more carbon than monocultures — a meta-analysis'; species-specific drought resilience in Forest Ecology and Management (2018), Rema-Kalenga, Bangladesh (Indo-Burma hotspot).*
Criterion 3 — Works under uncertainty	**Yes —** Diversity is itself the uncertainty hedge: species-rich stands show greater temporal stability of carbon capture and are more resistant to drought than monodominant plantations, which lose capacity disproportionately in dry years. The investment retains value across a range of climate outcomes. **Evidence:** *Researchgate review (2024), 'Impact of Monoculture and Mixed Species Plantation Practices on Biodiversity' — monocultures show higher mortality and lower drought resistance over consecutive dry years.*
Criterion 4 — Does not conflict with mitigation objectives	**Yes —** Mixed-species plantations store more carbon than monocultures while delivering the resilience gain; a sequestration co-benefit alongside the adaptation function. **Evidence:** *Frontiers in Forests and Global Change (2023) meta-analysis — mixed planted forests store more carbon than monocultures.*
ASEAN Taxonomy Assessment Frame support	

02[002]-S1 — Diversified / mixed-species and drought-tolerant planting stock	
CRVA assessment considerations	**Life span:** Rotation-length asset; resilience improves with stand maturity. **Adequacy and effectiveness:** Hazard: drought; extreme heat; and the pest/disease pressure that intensifies with climate stress. Addresses the high vulnerability of the even-aged single-species plantations that dominate Southeast Asian production forestry (Eucalyptus, Acacia, pine, teak), which are exposed to correlated failure under drought and outbreak. Diversity is itself the uncertainty hedge: species-rich stands show greater temporal stability of carbon capture and are more resistant to drought than monodominant plantations, which lose capacity disproportionately in dry years. The investment retains value across a range of climate outcomes. **Maladaptation:** Low. Fast-growing exotic even-aged monoculture is the maladaptive configuration — it concentrates drought, pest, disease and fire fragility (Appendix 4); species and provenance diversity is the hedge.
Additional support on Foundation Framework 1A guiding questions	GQ1A: for the plantation operator, species mixtures and drought-tolerant provenances reduce the estate's own exposure to correlated drought, pest and disease failure; diversity is the uncertainty hedge; measurable as stand survival and yield stability across dry years.
Additional support on Foundation Framework 1B guiding questions	GQ1B: more stable, disease-resistant stands sustain timber supply chains and reduce fire and pest spillover to neighbouring forest, supporting others' resilience; carbon co-benefit shared.

Activity 02[003] — Conservation, restoration and maintenance of natural forests

Activity-level solution navigator				
Priority hazards for VERSION 1 of the mARs Guide	Flooding	Drought	Extreme heat	Sea level rise
Applicable technologies & solutions	• 02[003]-S5 Upper-catchment forest protection and restoration for flow regulation	• **02[003]-S3 Peatland rewetting and water-table management** • **02[003]-S4 Assisted natural regeneration (ANR) of degraded forest**	• **02[003]-S6 Peat and forest fire prevention and community fire management**	• 02[003]-S1 Mangrove restoration and protection of coastal forest belts • 02[003]-S2 Managed landward-migration corridors and accommodation space

*Note: 1) Solutions in **bold** have a detailed solution profile below; the remainder are listed in Appendix 1 and are profiled progressively. 2) Solution codes follow Appendix 1.*

02[003]-S3 — Peatland rewetting and water-table management (NbS)	
Detailed solution profile	
Technology/solution	Peatland rewetting and water-table management
[Technology ID — internal reference only]	*02[003]-S3*
Description	Rewetting through canal-blocking and backfilling raises the groundwater table toward the ~40 cm-below-surface threshold at which fire risk falls substantially, and revegetation with native peat-swamp species restores hydrological function; BRG/BRGM built 3,992 canal blocks across 2017–2022.
Type of solution	Nature-based solution (NbS)
Targeted climate risk(s)	Extreme heat and drought driving peat fire, plus ongoing subsidence of drained peat
Relevant resilience theme(s)	Resilient agri-food systems
Technology details	**State of technology:** Established restoration practice at national programme scale (BRG/BRGM). **Scalability:** Site to landscape; the national programme built 3,992 canal blocks (2017–2022).

02[003]-S3 — Peatland rewetting and water-table management (NbS)	
	Environmental, social, and economic impact: Rewetting reverts degraded peat from a carbon source toward a sink and avoids fire emissions; peatland contributes the majority of Indonesia's natural-climate-solution mitigation potential, so the co-benefit is large. **Paradigm shift potential:** Shifts peat management from drainage-and-burn to hydrological restoration.
Fit-for-purpose criteria (Section 4b — rationale for inclusion in the mARs Guide)	
Criterion 1 — Clear risk fit	**Yes —** Hazard: extreme heat and drought driving peat fire, plus ongoing subsidence of drained peat. Addresses the risk that made Indonesian peatlands a recurrent disaster source — the 2015 fires released more carbon per day at their peak than the entire US economy — by restoring the hydrology that keeps peat wet. **Evidence:** *The Gecko Project / CIFOR reporting on the 2015 peat fires; programme established as the Peatland Restoration Agency (BRG), later Peatland and Mangrove Restoration Agency (BRGM).*
Criterion 2 — Clear effect	**Yes —** Rewetting through canal-blocking and backfilling raises the groundwater table toward the ~40 cm-below-surface threshold at which fire risk falls substantially, and revegetation with native peat-swamp species restores hydrological function; BRG/BRGM built 3,992 canal blocks across 2017–2022. **Evidence:** *ScienceDirect (2026), 'Effective restoration can avoid peatland fires: large-scale counterfactual assessment in Kalimantan' (3,992 canal blocks, 2017–2022); 40 cm water-table threshold per BRG guidelines.*
Criterion 3 — Works under uncertainty	**Partially —** Performance is conditional on sustained water levels: rewetted area fluctuates sharply between wet and dry seasons (down to around 500,000 ha mid-2022 dry season against multi-million-ha targets), and benefits depend on maintained infrastructure. Robustness therefore requires ongoing management, not one-off works. **Evidence:** *Mongabay (2023) / The Gecko Project investigations — area meeting the 40 cm threshold has hovered near 2.7 million ha and falls steeply in dry seasons; MDPI Sustainability (2023), Riau WRF drought–fire modelling.*
Criterion 4 — Does not conflict with mitigation objectives	**Yes —** Rewetting reverts degraded peat from a carbon source toward a sink and avoids fire emissions; peatland contributes the majority of Indonesia's natural-climate-solution mitigation potential, so the co-benefit is large. **Evidence:** *IOPscience (2022), peatland restoration as an affordable nature-based climate solution; YKAN/Novita et al. (2024) — peat as up to ~74% of Indonesia's NCS mitigation potential.*
ASEAN Taxonomy Assessment Frame support	
CRVA assessment considerations	**Life span:** Ecosystem asset; multi-decadal with maintained water levels. **Adequacy and effectiveness:** Hazard: extreme heat and drought driving peat fire, plus ongoing subsidence of drained peat. Addresses the risk that made Indonesian peatlands a recurrent disaster source — the 2015 fires released more carbon per day at their peak than the entire US economy — by restoring the hydrology that keeps peat wet. Performance is conditional on sustained water levels: rewetted area fluctuates sharply between wet and dry seasons (down to around 500,000 ha mid-2022 dry

02[003]-S3 — Peatland rewetting and water-table management (NbS)	
	season against multi-million-ha targets), and benefits depend on maintained infrastructure. Robustness therefore requires ongoing management, not one-off works. **Maladaptation:** Conditional on maintained water levels: rewetted area fluctuates sharply between seasons (assessed 'Partially' under works-under-uncertainty). Planting without first rewetting the peat leaves the fire-and-subsidence driver untouched — the maladaptive configuration (Appendix 2).
Additional support on Foundation Framework 1A guiding questions	GQ1A: for the land manager, rewetting raises the water table toward the ~40 cm fire-risk threshold, cutting the site's own fire and subsidence risk; robustness conditional on maintained levels (C3 'Partially'); measurable as water-table depth and fire incidence.
Additional support on Foundation Framework 1B guiding questions	GQ1B: restored peat hydrology reduces landscape-scale fire and transboundary haze risk and protects the carbon store others depend on, enabling wider resilience; supports land–health outcomes.

02[003]-S4 — Assisted natural regeneration (ANR) of degraded forest (NbS)	
Detailed solution profile	
Technology/solution	Assisted natural regeneration (ANR) of degraded forest
[Technology ID — internal reference only]	*02[003]-S4*
Description	Low-cost interventions — liberating natural regenerants by ring-weeding, suppressing competing grasses, and protecting sites with firebreaks — accelerate recovery of native forest and its ecosystem services; FAO-supported projects restored 400 ha in Bohol and 605 ha in Bataan with community management.
Type of solution	Nature-based solution (NbS)
Targeted climate risk(s)	Drought, flooding, landslide and erosion in degraded upland watersheds
Relevant resilience theme(s)	Resilient agri-food systems
Technology details	**State of technology:** Established, low-cost restoration method; applied in ASEAN FLR programmes (Bohol, Bataan). **Scalability:** Community-managed sites to landscape programmes. **Environmental, social, and economic impact:** ANR regrows native forest — and its carbon — at low cost and minimal energy input; a strong sequestration co-benefit, and one that natural forest delivers more stably than plantation under drought. **Paradigm shift potential:** Shifts restoration from costly plantation establishment to accelerated natural succession.
Fit-for-purpose criteria (Section 4b — rationale for inclusion in the mARs Guide)	
Criterion 1 — Clear risk fit	**Yes —** Hazard: drought, flooding, landslide and erosion in degraded upland watersheds. Addresses the loss of catchment regulation where

02[003]-S4 — Assisted natural regeneration (ANR) of degraded forest (NbS)	
	second-growth forest — about 83% of Philippine forest cover — recovers slowly because of soil degradation and recurring disturbance. **Evidence:** *Shono, K., Cadaweng, E.A. & Durst, P.B. (2007). 'Application of Assisted Natural Regeneration to Restore Degraded Tropical Forestlands', Restoration Ecology, 15(4), 620–626 (FAO RAP).*
Criterion 2 — Clear effect	**Yes —** Low-cost interventions — liberating natural regenerants by ring-weeding, suppressing competing grasses, and protecting sites with firebreaks — accelerate recovery of native forest and its ecosystem services; FAO-supported projects restored 400 ha in Bohol and 605 ha in Bataan with community management. **Evidence:** *ScienceDirect (2025), 'Assisted natural regeneration for tropical forest and landscape restoration in the Philippines' (Carood/Bohol and AFoCO/Zambales, DENR Technical Bulletin No. 27); FAO/IKI Philippines FLR programme.*
Criterion 3 — Works under uncertainty	**Yes —** Because ANR accelerates rather than replaces natural succession, it adapts to site conditions rather than imposing a fixed planting design; it is low-regret and reversible, though outcomes emerge more slowly in harsher sites — a timing, not a performance, limitation. **Evidence:** *FAO (2024), Assisted natural regeneration programme; Philippine Mindanao ANR field study (2016) — effectiveness varies with site conditions and biotic legacies.*
Criterion 4 — Does not conflict with mitigation objectives	**Yes —** ANR regrows native forest — and its carbon — at low cost and minimal energy input; a strong sequestration co-benefit, and one that natural forest delivers more stably than plantation under drought. **Evidence:** *FAO (2024) and Shono et al. (2007) — ANR as a cost-effective restoration method enhancing carbon and ecosystem function on degraded land.*
ASEAN Taxonomy Assessment Frame support	
CRVA assessment considerations	**Life span:** Ecosystem asset; low-regret and reversible, benefits emerging over succession. **Adequacy and effectiveness:** Hazard: drought, flooding, landslide and erosion in degraded upland watersheds. Addresses the loss of catchment regulation where second-growth forest — about 83% of Philippine forest cover — recovers slowly because of soil degradation and recurring disturbance. Because ANR accelerates rather than replaces natural succession, it adapts to site conditions rather than imposing a fixed planting design; it is low-regret and reversible, though outcomes emerge more slowly in harsher sites — a timing, not a performance, limitation. **Maladaptation:** Low; low-regret and reversible. Dense planting over drained peat or intact natural forest is the maladaptive configuration (Appendix 2).
Additional support on Foundation Framework 1A guiding questions	GQ1A: for the site manager, accelerated native recovery restores the watershed's own regulation against erosion, flooding and fire; adapts to site conditions; measurable as recovery rate and ground-cover / erosion indicators.

02[003]-S4 — Assisted natural regeneration (ANR) of degraded forest (NbS)	
Additional support on Foundation Framework 1B guiding questions	GQ1B: restored upland forest sustains catchment regulation — flood attenuation, baseflow, erosion control — for downstream communities, enabling their resilience; native recovery avoids the intact-forest-clearance failure.

02[003]-S6 — Peat and forest fire prevention and community fire management (NbS)	
Detailed solution profile	
Technology/solution	Peat and forest fire prevention and community fire management
[Technology ID — internal reference only]	*02[003]-S6*
Description	Prevents peat and forest fire through community-led prevention, detection and early suppression — village fire-care groups (Masyarakat Peduli Api), maintained firebreaks and canal-block infrastructure, patrols and fire-danger watch through El Niño dry periods, and no-burn land-preparation alternatives — coordinated with water-table management on adjacent drained peat.
Type of solution	Nature-based solution (NbS), delivered through community institutional arrangements
Targeted climate risk(s)	Extreme heat and drought driving peat and forest fire, and the associated transboundary haze
Relevant resilience theme(s)	Resilient agri-food systems
Technology details	**State of technology:** Established practice in Indonesia and Malaysia, institutionalised through village fire-care groups (Masyarakat Peduli Api) and integrated fire management programmes run with BRGM, CIFOR-ICRAF and provincial agencies. **Scalability:** Village to landscape; effectiveness rises sharply where neighbouring villages and concession holders act together across a whole peat hydrological unit. **Environmental, social, and economic impact:** Avoided fire emissions are large — peat fire is among the region's most significant episodic emission sources — and avoided haze delivers substantial public-health and economic benefits across ASEAN Member States; the measure creates local employment but depends on viable no-burn livelihood alternatives. **Paradigm shift potential:** Moves fire management from seasonal emergency suppression by the state to year-round prevention held by the communities living on the landscape.
Fit-for-purpose criteria (Section 4b — rationale for inclusion in the mARs Guide)	
Criterion 1 — Clear risk fit	**Yes** — Hazard: extreme heat and drought driving peat and forest fire. Addresses fire risk in fire-prone managed forest and peat landscapes, which becomes acute under El Niño drought; the hazard–exposure–consequence chain runs from a lowered water table and available fuel,

02[003]-S6 — Peat and forest fire prevention and community fire management (NbS)	
	through ignition at the forest and plantation margin, to loss of the peat carbon store, damage to standing forest and transboundary haze. **Evidence**: *ASEAN Agreement on Transboundary Haze Pollution (2002) and successive ASEAN Specialised Meteorological Centre fire-danger assessments; The Gecko Project / CIFOR reporting on the 2015 fire season.*
Criterion 2 — Clear effect	**Yes** — Community fire brigades with maintained firebreaks, patrols and early suppression measurably reduce fire occurrence: modelling of targeted land-management strategies in Central Kalimantan indicates peatland fire occurrence could be roughly halved, and the solutions matrix in Part 1 records an approximately 40% reduction where community brigades operate. **Evidence**: *'Targeted land management strategies could halve peatland fire occurrences in Central Kalimantan, Indonesia', Communications Earth & Environment (2022); 'Community-based fire prevention and peatland restoration in Indonesia: a participatory action research approach', CIFOR-ICRAF (2024).*
Criterion 3 — Works under uncertainty	**Partially** — Readiness scales with the fire-danger forecast, so the measure tracks conditions rather than a single baseline, but effectiveness is conditional on sustained funding, functioning local institutions and the availability of no-burn land-preparation alternatives. Where any of the three lapses, performance falls away quickly; robustness therefore depends on continuing institutional support rather than on one-off works. **Evidence**: '*Community-Based Fire Management and Peatland Restoration in Indonesia', Springer (2023); CIFOR-ICRAF participatory action research (2024).*
Criterion 4 — Does not conflict with mitigation objectives	**Yes** — Avoided peat and forest fire prevents very large emissions from the peat carbon store, and the measure carries no material operational energy demand, so there is no conflict at the DNSH (climate change mitigation) step. **Evidence**: *as for Criterion 2.*
ASEAN Taxonomy Assessment Frame support	
CRVA assessment considerations	**Life span:** Institutional and programmatic; effective for as long as funding, training and community organisation are maintained, with readiness renewed before each dry season. **Adequacy and effectiveness:** Hazard: extreme heat and drought driving peat and forest fire. Prevention, detection and early suppression reduce fire occurrence at village and landscape scale, but performance is conditional on sustained funding, local institutions and no-burn alternatives (assessed 'Partially' under works-under-uncertainty). **Maladaptation:** Low as an integrated measure. Suppression capacity presented as a substitute for rewetting is the maladaptive configuration — it leaves the drained-peat driver untouched and entrenches annual firefighting as the response (Appendix 2). Reliance on unpaid volunteer labour without sustained funding also transfers the burden to the communities least able to carry it.

02[003]-S6 — Peat and forest fire prevention and community fire management (NbS)	
Additional support on Foundation Framework 1A guiding questions	GQ1A: for the land manager, community fire management reduces the site's own exposure to fire loss and to liability where fire escapes a concession or village boundary; a CRVA establishes fire-danger seasonality, fuel load and water-table conditions for the site, and performance is measurable as fire incidence, area burned and response time. Robustness is conditional (C3 'Partially') on maintained institutional support.
Additional support on Foundation Framework 1B guiding questions	GQ1B: fire prevention at village scale reduces landscape-scale fire and transboundary haze, enabling neighbouring communities, downwind AMS and connected health systems to sustain their own resilience; no fire risk is transferred to adjacent land. Delivery depends on, and strengthens, local institutions and no-burn livelihood alternatives.

Construction and Real Estate (ISIC F/L)

Activity 410[001] — Construction of new buildings

Activity-level solution navigator				
Priority hazards for VERSION 1 of the mARs Guide	Flooding	Drought	Extreme heat	Sea level rise
Applicable technologies & solutions	• 410[001]-S1 Raised finished-floor levels and dry / wet flood-proofing • 410[001]-S2 Elevated / protected critical systems (electrical, plant, backup) • **410[001]-S3 On-site SuDS: permeable surfaces, rain gardens, detention** • **410[001]-S6a Green roofs / walls and site greening — intensive green roofs** • **410[001]-S6b Green roofs / walls and site greening — urban green spaces**	• 410[001]-S7 Water-efficient fixtures and rainwater harvesting / reuse	• 410[001]-S4 Passive cooling design (orientation, shading, thermal mass, natural ventilation) • **410[001]-S5 Cool / reflective roofs and high-performance envelope** • **410[001]-S6c Green roofs / walls and site greening — green corridors**	• 410[001]-S8 Coastal siting / setback and freeboard for sea-level rise

*Note: 1) Solutions in **bold** have a detailed solution profile below; the remainder are listed in Appendix 1 and are profiled progressively. 2) Solution codes follow Appendix 1. 3) Profiles for 410[001]-S6a, 410[001]-S6b and 410[001]-S6c are collectively listed as 410[001]-S6 "Green roofs / walls and site greening" in Appendix 1.*

410[001]-S6a — Green roofs / walls and site greening — intensive green roofs (NbS)	
Detailed solution profile	
Technology/solution	Green roofs / walls and site greening — intensive green roofs
[Technology ID — internal reference only]	*410[001]-S6a*
Description	Reduces the risk of urban flooding by managing stormwater runoff.
Type of solution	Nature-based solution (NbS)
Targeted climate risk(s)	Flood (urban)
Relevant resilience theme(s)	Resilient infrastructure
Technology details	**State of technology:** Established building technology; deployed in ASEAN dense-urban retrofit and new build. **Scalability:** Building to portfolio. **Environmental, social, and economic impact:** Reduces energy demand for heating and cooling. **Paradigm shift potential:** Turns roof area into stormwater and thermal management.
Fit-for-purpose criteria (Section 4b — rationale for inclusion in the mARs Guide)	
Criterion 1 — Clear risk fit	**Yes —** Hazard: flood (urban). Addressed risk: stormwater runoff reduction.
Criterion 2 — Clear effect	**Yes —** Reduces the risk of urban flooding by managing stormwater runoff.
Criterion 3 — Works under uncertainty	**Yes —** Provides a consistent stormwater retention buffer, holding and slowing runoff regardless of changing seasonal rainfall volumes.
Criterion 4 — Does not conflict with mitigation objectives	**Yes —** Reduces energy demand for heating and cooling.
Reference	*UNFCCC Technology Executive Committee (TEC), GlobalABC & MIT Climate Policy Center (2025). Deploying Established Climate Technologies and Solutions for Buildings.*
ASEAN Taxonomy Assessment Frame support	
CRVA assessment considerations	**Life span:** Building-component life; long-lived with maintenance. **Adequacy and effectiveness:** Hazard: flood (urban). Addressed risk: stormwater runoff reduction. Provides a consistent stormwater retention buffer, holding and slowing runoff regardless of changing seasonal rainfall volumes. **Maladaptation:** Low; source retention. Sealed impermeable hardscaping that channels runoff off-site is the maladaptive configuration (Appendix 2).
Additional support on Foundation Framework 1A guiding questions	GQ1A: for the building owner, the green roof retains stormwater and cuts cooling load, reducing the building's own pluvial-flood and heat exposure; consistent retention across rainfall ranges; measurable as runoff retained and energy saved.

410[001]-S6a — Green roofs / walls and site greening — intensive green roofs (NbS)	
Additional support on Foundation Framework 1B guiding questions	GQ1B: reduced discharge relieves the shared drainage network for neighbouring properties; contributes to district-scale urban cooling.

410[001]-S3 — On-site SuDS: permeable surfaces, rain gardens, detention	
Detailed solution profile	
Technology/solution	On-site SuDS: permeable surfaces, rain gardens, detention
[Technology ID — internal reference only]	*410[001]-S3*
Description	Absorbs stormwater runoff and recharges groundwater tables.
Type of solution	Technology-based solution (engineered surface)
Targeted climate risk(s)	Flood (urban)
Relevant resilience theme(s)	Resilient infrastructure
Technology details	**State of technology:** Established construction material; standard in ASEAN sustainable-drainage design. **Scalability:** Plot to development scale. **Environmental, social, and economic impact:** Reduces energy-intensive wastewater treatment. **Paradigm shift potential:** Treats hardscape as an infiltration surface rather than a runoff surface.
Fit-for-purpose criteria (Section 4b — rationale for inclusion in the mARs Guide)	
Criterion 1 — Clear risk fit	**Yes —** Hazard: flood (urban). Addressed risk: stormwater runoff reduction.
Criterion 2 — Clear effect	**Yes —** Absorbs stormwater runoff and recharges groundwater tables.
Criterion 3 — Works under uncertainty	**Yes —** Continuously channels rainfall straight into the underlying soil regardless of unpredictable stormwater accumulation rates.
Criterion 4 — Does not conflict with mitigation objectives	**Yes —** Reduces energy-intensive wastewater treatment.
Reference	*Hong, Y.-M. (2021). 'The simplified design method of permeable pavement system for urban catchment', Environmental Challenges, 2, 100014.*
ASEAN Taxonomy Assessment Frame support	
CRVA assessment considerations	**Life span:** Pavement asset life. **Adequacy and effectiveness:** Hazard: flood (urban). Addressed risk: stormwater runoff reduction. Continuously channels rainfall straight into the underlying soil regardless of unpredictable stormwater accumulation rates.

410[001]-S3 — On-site SuDS: permeable surfaces, rain gardens, detention	
	Maladaptation: Low; source infiltration. Sealed impermeable hardscaping that channels runoff off-site is the maladaptive configuration (Appendix 2).
Additional support on Foundation Framework 1A guiding questions	GQ1A: for the site owner, permeable surfacing infiltrates rainfall on-site, reducing the plot's own surface-flood exposure regardless of accumulation rate; measurable as infiltration and runoff reduction.
Additional support on Foundation Framework 1B guiding questions	GQ1B: on-site infiltration reduces off-site discharge and downstream flood load for neighbours; recharges shared groundwater.

410[001]-S6b — Green roofs / walls and site greening — urban green spaces (NbS)	
Detailed solution profile	
Technology/solution	Green roofs / walls and site greening — urban green spaces
[Technology ID — internal reference only]	*410[001]-S6b*
Description	Creates natural retention basins and reduces the peak stormwater load on stormwater and sewerage systems.
Type of solution	Nature-based solution (NbS)
Targeted climate risk(s)	Flood (urban)
Relevant resilience theme(s)	Resilient infrastructure
Technology details	**State of technology:** Established urban-planning measure; applied across ASEAN city greening. **Scalability:** Site to district. **Environmental, social, and economic impact:** Zero-energy flood management, relying on gravity and natural soil infiltration. **Paradigm shift potential:** Uses open space as distributed flood storage.
Fit-for-purpose criteria (Section 4b — rationale for inclusion in the mARs Guide)	
Criterion 1 — Clear risk fit	**Yes —** Hazard: flood (urban). Addressed risk: stormwater runoff reduction.
Criterion 2 — Clear effect	**Yes —** Creates natural retention basins and reduces the peak stormwater load on stormwater and sewerage systems.
Criterion 3 — Works under uncertainty	**Yes —** Functions reliably as an immediate flood buffer even when rain volumes overwhelm infrastructure.
Criterion 4 — Does not conflict with mitigation objectives	**Yes —** Zero-energy flood management, relying on gravity and natural soil infiltration.
Reference	*World Bank (2021). A Catalogue of Nature-based Solutions for Urban Resilience. Washington, D.C.: World Bank Group.*

410[001]-S6b — Green roofs / walls and site greening — urban green spaces (NbS)	
ASEAN Taxonomy Assessment Frame support	
CRVA assessment considerations	**Life span:** Long-lived green asset. **Adequacy and effectiveness:** Hazard: flood (urban). Addressed risk: stormwater runoff reduction. Functions reliably as an immediate flood buffer even when rain volumes overwhelm infrastructure. **Maladaptation:** Low; source retention. Sealed impermeable hardscaping that channels runoff off-site is the maladaptive configuration (Appendix 2).
Additional support on Foundation Framework 1A guiding questions	GQ1A: for the site or estate, green space provides natural retention that buffers the development's own flood exposure even when infrastructure is overwhelmed; measurable as retention capacity and peak-load reduction.
Additional support on Foundation Framework 1B guiding questions	GQ1B: distributed retention cuts peak load on shared drainage and lowers flood risk for the surrounding area; delivers shared amenity and cooling.

410[001]-S6c — Green roofs / walls and site greening — green corridors (NbS)	
Detailed solution profile	
Technology/solution	Green roofs / walls and site greening — green corridors
[Technology ID — internal reference only]	*410[001]-S6c*
Description	Reduces temperatures through evapotranspiration and creates shade.
Type of solution	Nature-based solution (NbS)
Targeted climate risk(s)	Extreme heat
Relevant resilience theme(s)	Resilient infrastructure
Technology details	**State of technology:** Established urban-greening measure; applied in ASEAN heat-adaptation planning. **Scalability:** Street to city network. **Environmental, social, and economic impact:** Trees store and sequester carbon. **Paradigm shift potential:** Builds cooling into urban form rather than compensating with mechanical cooling.
Fit-for-purpose criteria (Section 4b — rationale for inclusion in the mARs Guide)	
Criterion 1 — Clear risk fit	**Yes —** Hazard: extreme heat. Addressed risk: thermal heat trapping.
Criterion 2 — Clear effect	**Yes —** Reduces temperatures through evapotranspiration and creates shade.
Criterion 3 — Works under uncertainty	**Yes —** Continuously shields ground areas and blocks thermal radiation regardless of how high ambient temperatures rise.

410[001]-S6c — Green roofs / walls and site greening — green corridors (NbS)	
Criterion 4 — Does not conflict with mitigation objectives	**Yes —** Trees store and sequester carbon.
Reference	*World Bank (2021). A Catalogue of Nature-based Solutions for Urban Resilience. Washington, D.C.: World Bank Group.*
ASEAN Taxonomy Assessment Frame support	
CRVA assessment considerations	**Life span:** Long-lived green asset. **Adequacy and effectiveness:** Hazard: extreme heat. Addressed risk: thermal heat trapping. Continuously shields ground areas and blocks thermal radiation regardless of how high ambient temperatures rise. **Maladaptation:** Low; passive cooling with no risk transfer.
Additional support on Foundation Framework 1A guiding questions	GQ1A: for the development, corridor planting cools its own microclimate through shade and evapotranspiration, reducing heat exposure and cooling demand; measurable as temperature reduction and cooling-energy saved.
Additional support on Foundation Framework 1B guiding questions	GQ1B: connected greening cools the surrounding urban area and reduces heat-island effects for the wider community; carbon co-benefit shared.

410[001]-S5 — Cool / reflective roofs and high-performance envelope	
Detailed solution profile	
Technology/solution	Cool / reflective roofs and high-performance envelope
[Technology ID — internal reference only]	*410[001]-S5*
Description	Reflects solar radiation to maintain and enhance indoor comfort.
Type of solution	Technology-based solution (engineered coating)
Targeted climate risk(s)	Extreme heat
Relevant resilience theme(s)	Resilient infrastructure
Technology details	**State of technology:** Established coating technology; low-cost and widely applicable in ASEAN's tropical context. **Scalability:** Building to portfolio. **Environmental, social, and economic impact:** Reduces energy demand for cooling. **Paradigm shift potential:** Passive reflective control of heat gain.
Fit-for-purpose criteria (Section 4b — rationale for inclusion in the mARs Guide)	
Criterion 1 — Clear risk fit	**Yes —** Hazard: extreme heat. Addressed risk: thermal heat trapping.
Criterion 2 — Clear effect	**Yes —** Reflects solar radiation to maintain and enhance indoor comfort.

410[001]-S5 — Cool / reflective roofs and high-performance envelope	
Criterion 3 — Works under uncertainty	**Yes —** Functions at top capacity during unpredictable heat episodes.
Criterion 4 — Does not conflict with mitigation objectives	**Yes —** Reduces energy demand for cooling.
Reference	*Elnabawi, M.H., Hamza, N. & Raveendran, R. (2023). 'Super cool roofs': mitigating the UHI effect and enhancing urban thermal comfort with high-albedo-coated roofs.*
ASEAN Taxonomy Assessment Frame support	
CRVA assessment considerations	**Life span:** Coating life; renewable on maintenance cycle. **Adequacy and effectiveness:** Hazard: extreme heat. Addressed risk: thermal heat trapping. Functions at top capacity during unpredictable heat episodes. **Maladaptation:** Low; passive reflective control with no risk transfer.
Additional support on Foundation Framework 1A guiding questions	GQ1A: for the building owner, reflective coating cuts solar heat gain and cooling demand, reducing the building's own heat exposure; performs at full capacity during heat episodes; measurable as indoor-temperature and cooling-energy reduction.
Additional support on Foundation Framework 1B guiding questions	GQ1B: at scale, higher-albedo roofs marginally reduce local heat-island intensity for the surrounding area.

Activity 410[002] — Renovation of existing buildings

Activity-level solution navigator				
Priority hazards for VERSION 1 of the mARs Guide	Flooding	Drought	Extreme heat	Sea level rise
Applicable technologies & solutions	• **410[002]-S1 Flood barriers, non-return valves and flood-resilient materials retrofit** • 410[002]-S2 Relocation of critical systems above flood level (retrofit)	• 410[002]-S6 Retrofit water efficiency and rainwater / greywater reuse	• 410[002]-S3 Cool-roof and reflective-coating retrofit • 410[002]-S4 External shading, glazing upgrades and insulation retrofit • 410[002]-S5 Retrofit green roof / wall or shading vegetation	*None listed in Appendix 1*

*Note: 1) Solutions in **bold** have a detailed solution profile below; the remainder are listed in Appendix 1 and are profiled progressively. 2) Solution codes follow Appendix 1.*

410[002]-S1 — Flood barriers, non-return valves and flood-resilient materials retrofit	
Detailed solution profile	
Technology/solution	Flood barriers, non-return valves and flood-resilient materials retrofit
[Technology ID — internal reference only]	*410[002]-S1*
Description	Retrofits an existing building to keep floodwater out up to a safe design depth (demountable barriers at doors and openings, sealed service penetrations, non-return valves on drains and sewer connections) and to limit damage and speed recovery when water does enter (water-resistant floor, wall and joinery materials, and raised sockets and services). The package is selected from a survey of the property's flood sources, likely depths and the structure's capacity to withstand water pressure.
Type of solution	Technology-based solution (engineered retrofit)

410[002]-S1 — Flood barriers, non-return valves and flood-resilient materials retrofit	
Targeted climate risk(s)	Flood (urban / river), including backflow from surcharged sewers
Relevant resilience theme(s)	Resilient infrastructure; Resilient cities
Technology details	**State of technology:** Established, with a recognised code of practice: CIRIA's Code of practice for property flood resilience (2nd edition, 2021) sets six standards from survey to maintenance and distinguishes resistance measures, which reduce the water entering a building, from recoverability measures, which limit damage when water does enter. Components are commercially available; non-return valves are standard drainage fittings. **Scalability:** Single dwelling or shophouse to street- or estate-wide retrofit programmes; suited to dense existing stock where raising or relocating buildings is impractical. **Environmental, social, and economic impact:** Environmental: small material footprint compared with repeated strip-out and replacement after floods (inferred from the nature of the measure). Social: reduces displacement and repeated losses for occupants, including tenants and small businesses; demountable barriers depend on timely warning and on someone being present to fit them, which matters for elderly or absent occupants. Economic: after the 2002 Elbe flood, households with flood-adapted use and adapted interior fittings had building damage around 46% and 53% lower respectively (Kreibich et al., 2005). **Paradigm shift potential:** Extends flood adaptation to the existing building stock rather than relying on standards for new construction alone, and moves owners from post-event repair to pre-event retrofit.
Fit-for-purpose criteria (Section 4b — rationale for inclusion in the mARs Guide)	
Criterion 1 — Clear risk fit	**Yes —** Hazard: flood (urban / river). Address risk: repeated inundation damage to existing buildings and contents, including backflow from surcharged sewers into ground floors. Exposure of the existing stock in ASEAN is well documented: the 2011 Thailand floods affected some 1.9 million houses and destroyed about 19,000 (World Bank, 2012), and the 2021–22 floods in Malaysia caused RM1.6 billion of losses to living quarters out of RM6.1 billion in total (DOSM, 2022). The source–pathway–building chain is direct and can be set out in the CRVA (PS) or qualitative narrative (FF). **Evidence:** *World Bank (2012). Thai Flood 2011: Rapid Assessment for Resilient Recovery and Reconstruction Planning. World Bank. DOSM (2022). Special Report on Impact of Floods in Malaysia 2021. Department of Statistics Malaysia.*
Criterion 2 — Clear effect	**Yes —** Keeps water out and enables rapid recovery via water-tolerant finishes: resistance measures cut water entry up to the design depth, and recoverability measures limit damage and drying-out time beyond it. The effect is material in observed events: after the 2002 Elbe flood, flood-adapted use reduced building damage by 46% and adapted interior fittings by 53%, and the measures reduced losses even in that

410[002]-S1 — Flood barriers, non-return valves and flood-resilient materials retrofit	
	extreme event (Kreibich et al., 2005). The outcome is measurable as avoided damage and time to reoccupation. **Evidence:** *Kreibich, H., Thieken, A.H., Petrow, Th., Müller, M. and Merz, B. (2005). 'Flood loss reduction of private households due to building precautionary measures – lessons learned from the Elbe flood in August 2002', Natural Hazards and Earth System Sciences, 5, 117–126.*
Criterion 3 — Works under uncertainty	**Yes —** Barrier heights are set to the forward-looking flood level, and water-tolerant finishes and raised services limit damage if that level is exceeded. The exclusion height must stay within the structure's safe limit: standard masonry buildings are at significant risk of structural damage once the water level difference between outside and inside reaches about 0.6 m, and UK construction guidance advises allowing water to enter above that depth (DCLG, 2007). Where forward-looking levels exceed that limit, the retrofit relies on recoverability rather than exclusion; a water-exclusion-only design would fail abruptly on exceedance, like the fixed-defence example in Appendix 3. **Evidence:** *DCLG (2007). Improving the Flood Performance of New Buildings: Flood Resilient Construction. Department for Communities and Local Government, London. Kelly, D. et al. (2021). Code of practice for property flood resilience, 2nd edition (C790a). CIRIA, London.*
Criterion 4 — Does not conflict with mitigation objectives	**Yes —** Minor works; embodied carbon only, with no operational energy demand. Embodied emissions are limited to the materials and products installed and are likely to be lower than those of repeated strip-out and replacement after floods. **Evidence:** *Inferred from the nature of the measure; no external source required for this step.*
ASEAN Taxonomy Assessment Frame support	
CRVA assessment considerations	**Life span:** Components range from short-lived (barrier seals, valve flaps) to the life of the fit-out (resilient floors and finishes); the retrofit serves the remaining life of the building, which in most cases exceeds 10 years, so Annex 3 calls for assessment of current and future risk on modelled data. **Adequacy and effectiveness:** The CRVA can record flood sources (river, surface water, sewer), expected depths and durations, and the structural limit for water exclusion; set the exclusion depth below that limit with recoverability measures above it; include non-return valves where sewer backflow is a pathway; and state the warning time needed to deploy demountable barriers and who deploys them. **Maladaptation:** Moderate where barriers are fitted without recoverability measures or a structural check, since exceedance then brings abrupt failure and possible structural damage; low where the two are combined. Where many properties on one sewer fit non-return valves, surcharge may emerge at manholes or unprotected properties, so programmes are best coordinated with the drainage authority (inferred from the nature of the measure).

410[002]-S1 — Flood barriers, non-return valves and flood-resilient materials retrofit	
Additional support on Foundation Framework 1A guiding questions	GQ1A: a CRVA establishes the building's flood sources and depths; the retrofit keeps water out up to a safe design depth and limits damage and recovery time beyond it, protecting the asset, its occupants and their contents. Measurable as avoided damage and reduced time to reoccupation after flood events.
Additional support on Foundation Framework 1B guiding questions	GQ1B: reduces displacement of residents and disruption to businesses occupying the building; property-level measures do not impede neighbours' resilience, provided sewer backflow protection is coordinated as noted above.

Activity 681[001] — Acquisition and ownership of buildings

Activity-level solution navigator				
Priority hazards for VERSION 1 of the mARs Guide	Flooding	Drought	Extreme heat	Sea level rise
Applicable technologies & solutions	• 681[001]-S1 Climate-risk screening (CRVA) at acquisition and portfolio level • 681[001]-S2 Flood-proofing and drainage upgrades to owned assets	• **681[001]-S5 Portfolio water-efficiency and reuse programme**	• 681[001]-S3 Cool-roof, shading and passive-cooling upgrades across the portfolio • 681[001]-S4 Backup power and cooling for critical / occupant-safety functions	• 681[001]-S6 Adaptation / managed-exit strategy for coastal assets under SLR

*Note: 1) Solution marked * addresses more than one priority hazard. 2) Solutions in **bold** have a detailed solution profile below; the remainder are listed in Appendix 1 and are profiled progressively. 3) Solution codes follow Appendix 1.*

681[001]-S5 — Portfolio water-efficiency and reuse programme	
Detailed solution profile	
Technology/solution	Portfolio water-efficiency and reuse programme
[Technology ID — internal reference only]	*681[001]-S5*
Description	An owner-led programme across a building portfolio that sub-meters water use, replaces high-flow fittings, optimises cooling-tower and irrigation demand, and adds rainwater harvesting or greywater reuse with on-site storage where viable. It reduces each building's dependence on mains supply, so occupation and operations can continue when drought forces supply rationing.
Type of solution	Technology-based solution (engineered and operational programme)
Targeted climate risk(s)	Drought (rationing and interruption of mains water supply)
Relevant resilience theme(s)	Resilient infrastructure; Resilient cities

681[001]-S5 — Portfolio water-efficiency and reuse programme	
Technology details	**State of technology:** Established. In Singapore, large water users with net consumption of at least 60,000 m³ a year have been required since January 2015 to install private meters at key usage areas and to submit an annual Water Efficiency Management Plan to PUB, which shows that building-level water use can be metered, benchmarked and managed. Efficient fittings, cooling-tower water management and rainwater harvesting are mature technologies. **Scalability:** Designed for portfolio scale: one programme applied across many assets, prioritised by water intensity and supply risk; replicable by owners in any AMS. **Environmental, social, and economic impact:** Environmental: lower abstraction and wastewater volumes, and lower energy use for water supply and treatment. Social: greywater reuse needs treatment and management to protect occupants' health, for which WHO guidance applies (WHO, 2006). Economic: lower utility costs and fewer operational disruptions during rationing; the capital cost of storage and reuse varies by building (inferred from the nature of the measure). **Paradigm shift potential:** Treats water security as a portfolio-level operational risk managed by the owner, not only as a utility-supply problem.
Fit-for-purpose criteria (Section 4b — rationale for inclusion in the mARs Guide)	
Criterion 1 — Clear risk fit	**Yes —** Hazard: drought. Address risk: supply restriction across holdings, as drought forces rationing of mains supply to occupied buildings. In March 2019, an El Niño dry spell combined with shortcomings in supply management led to service interruptions across parts of Metro Manila, in what has been described as the region's worst water crisis of the past decade (Lee et al., 2020). Exposure is direct for buildings that depend on a single mains supply with limited storage, and can be set out in the CRVA (PS) or qualitative narrative (FF). **Evidence:** *Lee, H., Son, J., Joo, D., Ha, J., Yun, S., Lim, C.-H. and Lee, W.-K. (2020). 'Sustainable water security based on the SDG framework: a case study of the 2019 Metro Manila water crisis', Sustainability, 12(17), 6860.*
Criterion 2 — Clear effect	**Yes —** Reduces demand and adds resilience across owned stock: it lowers the volume each building needs to function and, where storage and reuse are added, provides supply that does not depend on the mains during rationing. The effect is measurable by sub-metering against a pre-programme baseline, as the Singapore framework requires. At city scale, water-efficiency labelling, fitting replacement and pricing measures accompanied a fall in Singapore's per capita household consumption from 154 litres a day in 2010 to 141 litres in 2019 (NLB, 2021). **Evidence:** *PUB, Singapore's National Water Agency. Mandatory Water Efficiency Requirements (Water Efficiency Management Plan). National Library Board Singapore (2021). Singapore Infopedia entry on water conservation in Singapore, by Lim Tin Seng.*
Criterion 3 — Works under uncertainty	**Partially —** Scalable across the portfolio, and demand reduction is low-regret under any drought trajectory. On-site storage and reuse, however,

681[001]-S5 — Portfolio water-efficiency and reuse programme	
	buffer supply only for the rationing period they are sized for; a longer or deeper drought exhausts the buffer, so protection degrades in proportion to the severity of the event, as with system-scale rainwater harvesting (36[001]-S5). Storage and reuse can be extended if supply risk rises. **Evidence:** *Inferred from the nature of the measure.*
Criterion 4 — Does not conflict with mitigation objectives	**Yes —** Cuts pumping and treatment energy: it reduces the energy embedded in water supply, wastewater treatment and water heating; water and wastewater services account for around 4% of global electricity consumption (IEA, 2017). On-site treatment for greywater reuse adds a small energy demand, which can be stated where material. **Evidence:** *IEA (2017). Water-Energy Nexus. International Energy Agency, Paris.*
ASEAN Taxonomy Assessment Frame support	
CRVA assessment considerations	**Life span:** Fittings and controls are renewed within the holding period; storage tanks and reuse plant are longer-lived. Where the holding period exceeds 10 years, Annex 3 calls for assessment of current and future risk on modelled data. **Adequacy and effectiveness:** The CRVA can identify, asset by asset, the supplying utility's drought exposure and rationing history, the building's critical water uses and existing storage, and the target reduction; record the sub-metered baseline and results; and size storage to cover critical uses for a defined rationing period. **Maladaptation:** Low. Greywater reuse without adequate treatment creates a health risk (WHO, 2006), and open or poorly sealed rainwater storage can provide mosquito breeding sites in tropical climates (inferred from the nature of the measure). Replacing mains supply with new private groundwater abstraction is outside this solution and would be maladaptive (see Appendix 3, deepened groundwater abstraction wells).
Additional support on Foundation Framework 1A guiding questions	GQ1A: a CRVA identifies each asset's dependence on drought-exposed mains supply; lower demand and on-site storage and reuse keep buildings usable through rationing, protecting occupiers' operations and the owner's income. Measurable as sub-metered consumption against baseline and days of autonomy for critical uses.
Additional support on Foundation Framework 1B guiding questions	GQ1B: lower portfolio demand eases pressure on shared supply during drought, leaving more water for other users; by excluding new groundwater abstraction, the programme does not shift scarcity or subsidence risk to others.

Activity 68[001] – Electric vehicle charging stations

Activity-level solution navigator				
Priority hazards for VERSION 1 of the mARs Guide	Flooding	Drought	Extreme heat	Sea level rise
Applicable technologies & solutions	• **68[001]-S1 Elevated / flood-protected siting of charging units and switchgear** • 68[001]-S2 IP-rated / water-resistant enclosures and drainage • 68[001]-S5 On-site storage / backup with islanding capability	*None listed in Appendix 1*	• 68[001]-S3 Heat-rated components and active / passive thermal management • 68[001]-S4 Shaded charging canopies (optionally solar) • 68[001]-S5 On-site storage / backup with islanding capability *	*None listed in Appendix 1*

*Note: 1) Solution marked * addresses more than one priority hazard. 2) Solutions in **bold** have a detailed solution profile below; the remainder are listed in Appendix 1 and are profiled progressively. 3) Solution codes follow Appendix 1.*

68[001]-S1 — Elevated / flood-protected siting of charging units and switchgear	
Detailed solution profile	
Technology/solution	Elevated / flood-protected siting of charging units and switchgear
[Technology ID — internal reference only]	*68[001]-S1*
Description	Places EV charging units, their supply switchgear and metering above the design flood level, on raised plinths, upper decks of multi-storey car parks or behind flood protection, and routes and seals cabling so that inundation does not reach live components. Chargers remain available, or can be re-energised quickly after a flood, and energised equipment is kept out of floodwater.
Type of solution	Technology-based solution (engineered)

68[001]-S1 — Elevated / flood-protected siting of charging units and switchgear	
Targeted climate risk(s)	Flood (urban / coastal), including flooding of at-grade and basement parking
Relevant resilience theme(s)	Resilient infrastructure; Resilient cities
Technology details	**State of technology:** Established electrical practice of placing equipment above flood level, now being applied to EV charging. Enclosure ratings under IEC 60529 distinguish protection against splashing and water jets from protection against immersion (IPX7 and IPX8); the ratings typically specified for outdoor charging equipment do not cover immersion, so siting rather than the enclosure is the main protection against inundation. **Scalability:** Single charger to whole car parks and public networks; lowest cost when specified at installation rather than retrofitted. **Environmental, social, and economic impact:** Environmental: avoids premature replacement of flood-damaged power electronics. Social: keeps energised equipment out of flooded public spaces and keeps charging available for electric delivery, ride-hailing and emergency fleets after floods. Economic: raised plinths and sealed cable entries add capital cost but avoid weeks of downtime and equipment replacement. **Paradigm shift potential:** Treats charging as part of the urban service network that must function after floods, as transport electrification makes mobility services depend on it.
Fit-for-purpose criteria (Section 4b — rationale for inclusion in the mARs Guide)	
Criterion 1 — Clear risk fit	**Yes —** Hazard: flood (urban / coastal). Address risk: equipment inundation, electrical safety and outage, in at-grade and basement parking. In late December 2025, heavy rainfall submerged street-level chargers in North and Central Jakarta; operators, including PLN, shut sites down automatically and many remained offline for weeks for moisture testing and re-commissioning, disrupting electric delivery and ride-hailing services (Pope, 2026). Parking areas are routinely exposed: vehicles accounted for RM1.0 billion of the RM6.1 billion losses in Malaysia's 2021–22 floods (DOSM, 2022). **Evidence:** *Pope, N. (2026). 'Jakarta's heavy rainfall damages EV chargers and sparks resilience push', Global Fleet, 12 January 2026. DOSM (2022). Special Report on Impact of Floods in Malaysia 2021. Department of Statistics Malaysia.*
Criterion 2 — Clear effect	**Yes —** Raises live equipment above the design flood level and maintains availability. Keeping live components above the flood level removes the dominant failure mode, water ingress into power electronics and switchgear, so chargers avoid the drying, testing and re-commissioning that kept the Jakarta sites offline, and energised equipment is not left standing in floodwater. The outcome is measurable as avoided equipment replacement and charger downtime after flood events. **Evidence:** *Inferred from the nature of the measure. IEC 60529, Degrees of protection provided by enclosures (IP Code).*

68[001]-S1 — Elevated / flood-protected siting of charging units and switchgear	
Criterion 3 — Works under uncertainty	**Yes —** Siting to the forward-looking flood level. Siting can include freeboard above that level, and upper decks of multi-storey car parks give a large margin. Charging units are modular and can be raised or relocated at replacement if projected levels rise. **Evidence:** *Inferred from the nature of the measure; no external source required for this step.*
Criterion 4 — Does not conflict with mitigation objectives	**Yes —** Passive; no added energy. A siting measure with no operational energy demand, it protects equipment whose function supports the electrification of transport. **Evidence:** *Inferred from the nature of the measure; no external source required for this step.*
ASEAN Taxonomy Assessment Frame support	
CRVA assessment considerations	**Life span:** Charging units are shorter-lived than the host building or car park, so siting can be revisited at each replacement. Where the installation's life is under 10 years, Annex 3 permits assessment on extrapolated past trends; fixed civil elements (plinths, raised decks, cable routes) are longer-lived and are better set against projected flood levels. **Adequacy and effectiveness:** The CRVA can identify flood sources and depths at the site, including basement ramps and local drainage capacity; set a minimum mounting height with freeboard for chargers, switchgear and meters; and specify sealed cable entries and automatic isolation on water ingress (inferred from the nature of the measure). **Maladaptation:** Low where chargers are sited above flood level. Charging bays in flood-prone basements concentrate vehicles whose lithium-ion batteries can ignite after saltwater immersion, sometimes weeks later, as US authorities warned after Hurricane Ian (ABC7, 2022); locating charging in such basements without flood protection increases risk rather than reducing it.
Additional support on Foundation Framework 1A guiding questions	GQ1A: a CRVA establishes flood depths at the charging site; elevating live components keeps the operator's charging assets in service, or quickly restorable, after floods. Measurable as avoided equipment replacement and downtime.
Additional support on Foundation Framework 1B guiding questions	GQ1B: charging that remains available after floods supports electric delivery, ride-hailing and emergency mobility in affected districts, and energised equipment is kept out of floodwater in public areas; no risk is transferred to others.

Activity 68[002] – Energy efficient equipment

Activity-level solution navigator				
Priority hazards for VERSION 1 of the mARs Guide	Flooding	Drought	Extreme heat	Sea level rise
Applicable technologies & solutions	• 68[002]-S3 Flood-resilient siting / protection of plant and equipment • 68[002]-S5 Backup / redundancy for critical equipment	• 68[002]-S4 Air-cooled / water-efficient equipment where water-cooled is at risk	• 68[002]-S1 Cooling equipment sized / rated for higher design temperatures • **68[002]-S2 High-efficiency, low-temperature-sensitivity HVAC and controls** • 68[002]-S5 Backup / redundancy for critical equipment *	*None listed in Appendix 1*

*Note: 1) Solution marked * addresses more than one priority hazard. 2) Solutions in **bold** have a detailed solution profile below; the remainder are listed in Appendix 1 and are profiled progressively. 3) Solution codes follow Appendix 1.*

68[002]-S2 — High-efficiency, low-temperature-sensitivity HVAC and controls	
Detailed solution profile	
Technology/solution	High-efficiency, low-temperature-sensitivity HVAC and controls
[Technology ID — internal reference only]	*68[002]-S2*
Description	Specifies cooling equipment and controls that hold capacity and efficiency at high outdoor temperatures: variable-speed (inverter) compressors, equipment rated and selected at hot-climate test conditions, adequately sized and ventilated heat rejection, and controls that manage part load and peak demand. Indoor conditions are maintained through heatwaves with lower electricity demand and less risk of equipment tripping or failing at peak.

68[002]-S2 — High-efficiency, low-temperature-sensitivity HVAC and controls	
Type of solution	Technology-based solution (engineered)
Targeted climate risk(s)	Extreme heat
Relevant resilience theme(s)	Resilient infrastructure; Resilient cities
Technology details	**State of technology:** Commercially mature. ISO 5151:2017 defines a hot-climate rating condition (T3, 46 °C outdoor dry-bulb) alongside the moderate condition (T1, 35 °C), so performance at high ambient temperature can be specified and verified. ASEAN has pursued harmonised air-conditioner test methods and minimum energy performance standards through the ASEAN SHINE regional policy roadmap (UNEP, CLASP and ICA, 2015). **Scalability:** From room units to central plant; equipment replacement cycles allow progressive upgrade across building stocks. **Environmental, social, and economic impact:** Environmental: lower electricity use and emissions for the same cooling, and less heat rejected to the street; refrigerant choice matters under the HFC phase-down of the Kigali Amendment to the Montreal Protocol, in force since 1 January 2019. Social: keeps indoor temperatures safe for occupants during heat events, including in buildings serving vulnerable people. Economic: higher purchase cost offset by lower running costs; across Southeast Asia, stronger efficiency policies could deliver savings of as much as 110 TWh by 2040 (IEA, 2019). **Paradigm shift potential:** Shifts procurement from nameplate efficiency at moderate conditions to performance at the temperatures equipment will face in heatwaves, supporting the grid when it is most stressed.
Fit-for-purpose criteria (Section 4b — rationale for inclusion in the mARs Guide)	
Criterion 1 — Clear risk fit	**Yes —** Hazard: extreme heat. Address risk: efficiency loss and peak-load stress, as conventional equipment loses cooling capacity and draws more power during heatwaves, when indoor overheating risk and grid stress peak together. Laboratory tests of rated split units found cooling capacity fell by about 1.4% and efficiency by about 2.5% for each degree of outdoor temperature above 35 °C (CSE, 2016). Cooling could account for as much as 30% of Southeast Asia's peak electricity demand under current policies (IEA, 2019). **Evidence:** *Centre for Science and Environment (2016). Laboratory testing of the energy performance of room air conditioners, reported in Down To Earth, 27 July 2016. IEA (2019). The Future of Cooling in Southeast Asia. International Energy Agency, Paris.*
Criterion 2 — Clear effect	**Yes —** Sustains efficient operation and demand response under heat. Equipment rated and selected for T3 conditions, with variable-speed compressors and demand controls, maintains capacity at heatwave temperatures and draws less power at peak, so indoor conditions hold without tripping or overloading supply. The effect is material at building level: in tropical climates, air conditioning can account for over half of a

68[002]-S2 — High-efficiency, low-temperature-sensitivity HVAC and controls	
	building's total energy use (Chua et al., 2013). It is measurable as indoor temperature compliance and peak power draw during heat events. **Evidence:** *ISO 5151:2017, Non-ducted air conditioners and heat pumps: testing and rating for performance. Chua, K.J., Chou, S.K., Yang, W.M. and Yan, J. (2013). 'Achieving better energy-efficient air conditioning – a review of technologies and strategies', Applied Energy, 104, 87–104.*
Criterion 3 — Works under uncertainty	**Yes —** Controls are adjustable to changing loads. Rating at 46 °C gives a wide margin above the 35 °C moderate condition as heat extremes intensify, and variable-speed operation performs across a wide load range rather than at a single design point. Equipment is replaced well within the life of the building, so specifications can be updated as projections change. **Evidence:** *ISO 5151:2017. Replacement-cycle point inferred from the nature of the measure.*
Criterion 4 — Does not conflict with mitigation objectives	**Yes —** Reduces peak and total energy, and with it emissions per unit of cooling. The refrigerant is the main residual mitigation consideration; equipment using low-GWP refrigerants consistent with the Kigali Amendment HFC phase-down avoids a conflict. **Evidence:** *IEA (2019). The Future of Cooling in Southeast Asia. Kigali Amendment to the Montreal Protocol (2016).*
ASEAN Taxonomy Assessment Frame support	
CRVA assessment considerations	**Life span:** Plant is replaced within the building's life; where equipment life exceeds 10 years, Annex 3 calls for modelled projections, and design temperatures are in any case better taken from projected than from historical extremes. **Adequacy and effectiveness:** The CRVA can set outdoor design temperatures from projected heat extremes rather than historical design data; specify capacity and efficiency at T3 or at the projected design temperature; place heat-rejection units where they are shaded and ventilated so that hot exhaust is not recirculated; and include controls for peak demand. **Maladaptation:** Moderate if used as the only response to extreme heat. Heat rejected by air conditioning warms the surrounding urban area (modelling for Singapore attributes up to 1.4 °C of local warming to air-conditioning systems; Singh et al., 2022), and reliance on mechanical cooling alone leaves occupants exposed when power fails. Pairing with passive measures (for example 410[002]-S3 and 410[002]-S4) avoids this; see the Appendix 3 example of conventional mechanical air-conditioning as the sole extreme-heat response.
Additional support on Foundation Framework 1A guiding questions	GQ1A: a CRVA sets projected outdoor design temperatures; equipment rated for them maintains indoor conditions and protects occupants and operations during heatwaves. Measurable as indoor temperature compliance and peak power draw.

68[002]-S2 — High-efficiency, low-temperature-sensitivity HVAC and controls	
Additional support on Foundation Framework 1B guiding questions	GQ1B: lower peak demand eases strain on the grid during heatwaves, helping protect supply to other users, and more efficient equipment rejects less heat to the street for the same cooling.

Activity 68[004] — Renewable technologies

Activity-level solution navigator				
Priority hazards for VERSION 1 of the mARs Guide	Flooding	Drought	Extreme heat	Sea level rise
Applicable technologies & solutions	• 68[004]-S1 Flood-protected siting of inverters and balance-of-system; roof-mounted arrays • **68[004]-S4 Renewables with storage for backup and grid-independent operation ***	*None listed in Appendix 1*	• 68[004]-S2 High-temperature-rated PV modules and ventilated mounting • **68[004]-S4 Renewables with storage for backup and grid-independent operation ***	• 68[004]-S3 Corrosion-resistant, elevated mounting for coastal installations

*Note: 1) Solution marked * addresses more than one priority hazard. 2) Solutions in **bold** have a detailed solution profile below; the remainder are listed in Appendix 1 and are profiled progressively. 3) Solution codes follow Appendix 1.*

68[004]-S4 — Renewables with storage for backup and grid-independent operation	
Detailed solution profile	
Technology/solution	Renewables with storage for backup and grid-independent operation
[Technology ID — internal reference only]	*68[004]-S4*
Description	Pairs on-site renewable generation, typically rooftop solar PV, with battery storage and islanding-capable inverters and transfer equipment, so the system supplies critical building loads when the grid fails. Grid-connected PV without these components disconnects during an outage, so the renewable installation provides no power when it is most needed.
Type of solution	Technology-based solution (engineered)
Targeted climate risk(s)	Flood and extreme heat (grid disruption)
Relevant resilience theme(s)	Resilient infrastructure; Resilient cities

68[004]-S4 — Renewables with storage for backup and grid-independent operation	
Technology details	**State of technology:** Commercially mature for buildings. Grid-connected PV inverters are tested to disconnect when the grid fails (IEC 62116), so backup operation needs storage together with dedicated islanding and transfer equipment. Safety requirements for grid-integrated electrochemical storage are set out in IEC 62933-5-2:2020. **Scalability:** Single buildings to campuses and community microgrids; storage capacity can be added in modules. **Environmental, social, and economic impact:** Environmental: displaces diesel backup and grid electricity; batteries need responsible sourcing and end-of-life recycling. Social: keeps critical services such as lighting, communications, water pumping, cold storage of medicines and cooled refuge space running during outages. Economic: valuing avoided outage costs can change the investment case; NREL found that including resilience value increased the net benefit of PV-plus-storage for a school and made an otherwise uneconomic system viable for a large hotel (Laws et al., 2018). **Paradigm shift potential:** Turns the building's renewable installation from an energy-cost asset into a continuity-of-service asset.
Fit-for-purpose criteria (Section 4b — rationale for inclusion in the mARs Guide)	
Criterion 1 — Clear risk fit	**Yes —** Hazard: flood and extreme heat (grid disruption). Address risk: power loss during climate events. Floods de-energise urban networks for safety: in February 2020, PLN switched off 308 substations serving flooded areas of Jakarta (CNN Indonesia, 2020). Heat drives demand peaks and plant outages: in April 2024, amid record heat, the Luzon and Visayas grids were repeatedly placed on alert, with 31 plants on forced outage or derated (Baclig, 2024); in May and June 2023, heat and drought cut hydropower in northern Viet Nam, causing power shortages that the World Bank estimated cost about USD 1.4 billion, or 0.3% of GDP (AFP, 2023). **Evidence:** *CNN Indonesia (2020). 'Antisipasi banjir, PLN padamkan listrik Jakarta', 23 February 2020. Baclig, C.E. (2024). 'Record PH heat drives power supply alerts, bares grid weaknesses', Philippine Daily Inquirer, 29 April 2024. AFP (2023). 'Power crisis cost Vietnam $1.4 bn: World Bank', 11 August 2023, reporting World Bank, Taking Stock (August 2023).*
Criterion 2 — Clear effect	**Yes —** Provides resilient on-site supply when the grid is disrupted: storage and islanding let the system power defined critical loads through an outage instead of disconnecting with the grid. NREL notes that grid-connected rooftop PV does not ensure a building has power during an outage, whereas PV-plus-storage designed to island can power critical loads until supply is restored (Laws et al., 2018). Measurable as hours of autonomy for defined critical loads. **Evidence:** *Laws, N.D., Anderson, K., DiOrio, N.A., Li, X. and McLaren, J. (2018). Valuing the Resilience Provided by Solar and Battery Energy Storage Systems. NREL/BR-6A20-70679. National Renewable Energy Laboratory, Golden, CO.*
Criterion 3 — Works under uncertainty	**Yes —** Storage is sized to a plausible outage duration. The system works for outages of any cause, so it does not depend on a single hazard

68[004]-S4 — Renewables with storage for backup and grid-independent operation	
	projection, and autonomy can be extended by adding storage modules. Battery capacity fades faster at higher temperatures, so performance in hot climates depends on thermal management and on sizing for end-of-life capacity. **Evidence:** *NREL. Battery lifespan research (temperature as a driver of capacity fade). National Renewable Energy Laboratory. Modularity inferred from the nature of the measure.*
Criterion 4 — Does not conflict with mitigation objectives	**Yes —** Displaces fossil backup, a strong co-benefit: it replaces diesel standby generation, the conventional backup alternative (see Appendix 3, permanent diesel generation as the sole supply-continuity measure), and renewable output displaces grid electricity in normal operation. Battery manufacture carries embodied emissions, a construction-stage consideration rather than an operational lock-in. **Evidence:** *Inferred from the nature of the measure; no external source required for this step.*
ASEAN Taxonomy Assessment Frame support	
CRVA assessment considerations	**Life span:** PV arrays are multi-decadal; batteries and inverters are replaced within the system's life. With a system life above 10 years, Annex 3 calls for assessment of current and future risk on modelled data. **Adequacy and effectiveness:** The CRVA can define critical loads and target autonomy from local outage history and projected hazard frequency; site batteries, inverters and transfer equipment above flood level (see 68[004]-S1) in ventilated or cooled enclosures; and provide for periodic testing of islanding operation. **Maladaptation:** Low where batteries sit above flood level and fire-safety requirements are met. Lithium-ion batteries exposed to saltwater flooding can ignite days or weeks later, as US authorities warned for electric vehicles after Hurricane Ian (ABC7, 2022), so storage in flood-prone basements creates a new hazard.
Additional support on Foundation Framework 1A guiding questions	GQ1A: a CRVA identifies outage risk from floods and heat; storage and islanding keep the building's critical functions running through outages. Measurable as hours of autonomy and avoided downtime.
Additional support on Foundation Framework 1B guiding questions	GQ1B: buildings that stay powered can keep services available to occupants and the surrounding community, such as water pumping, communications and cooled refuge space, and discharging storage at peak reduces load on a stressed grid.

Activity 68[005] — Early warning systems

Activity-level solution navigator				
Priority hazards for VERSION 1 of the mARs Guide	Flooding	Drought	Extreme heat	Sea level rise
Applicable technologies & solutions	• 68[005]-S5 Multi-hazard impact-based forecasting and last-mile dissemination * • **68[005]-S1a Flood forecasting… — weather radar and precipitation nowcasting**	• 68[005]-S3 Drought monitoring and water-allocation early warning • 68[005]-S5 Multi-hazard impact-based forecasting and last-mile dissemination * • **68[005]-S3a Drought monitoring… — groundwater monitoring system** • **68[005]-S3b Drought monitoring… — soil-moisture monitoring networks**	• 68[005]-S2 Heat–health early warning and action systems • 68[005]-S5 Multi-hazard impact-based forecasting and last-mile dissemination *	• 68[005]-S4 Coastal / storm-surge and salinity early warning • 68[005]-S5 Multi-hazard impact-based forecasting and last-mile dissemination *

*Note: 1) Solutions in **bold** have a detailed solution profile below; the remainder are listed in Appendix 1 and are profiled progressively. 2) Solution codes follow Appendix 1. 3) Profile 68[005]-S1a is a subset of solution 68[005]-S1, and profiles 68[005]-S3a and 68[005]-S3b are collectively listed as solution 68[005]-S3 in Appendix 1.*

68[005]-S1a — Flood forecasting, monitoring and dissemination systems — weather radar and precipitation nowcasting	
Detailed solution profile	
Technology/solution	Flood forecasting, monitoring and dissemination systems — weather radar and precipitation nowcasting
[Technology ID — internal reference only]	*68[005]-S1a*
Description	Improves detection and forecasting of heavy rainfall.
Type of solution	Technology-based solution (information / early warning)
Targeted climate risk(s)	Flood
Relevant resilience theme(s)	Resilient infrastructure
Technology details	**State of technology:** Established meteorological infrastructure; part of ASEAN flood-warning systems. **Scalability:** Local to regional coverage. **Environmental, social, and economic impact:** Enables targeted emergency responses and can reduce the need for energy-intensive recovery efforts. **Paradigm shift potential:** Converts short lead times into actionable warning.
Fit-for-purpose criteria (Section 4b — rationale for inclusion in the mARs Guide)	
Criterion 1 — Clear risk fit	**Yes —** Hazard: flood. Addressed risk: short lead time for extreme rainfall events.
Criterion 2 — Clear effect	**Yes —** Improves detection and forecasting of heavy rainfall.
Criterion 3 — Works under uncertainty	**Yes —** Delivers high-resolution, short-term atmospheric mapping even when seasonal climate models fail.
Criterion 4 — Does not conflict with mitigation objectives	**Yes —** Enables targeted emergency responses and can reduce the need for energy-intensive recovery efforts.
Reference	*Werner, M. & Cranston, M. (2009). Understanding the Value of Radar Rainfall Nowcasts in Flood Forecasting and Warning in Flashy Catchments.*
ASEAN Taxonomy Assessment Frame support	
CRVA assessment considerations	**Life span:** Radar and computation infrastructure; upgradeable. **Adequacy and effectiveness:** Hazard: flood. Addressed risk: short lead time for extreme rainfall events. Delivers high-resolution, short-term atmospheric mapping even when seasonal climate models fail. **Maladaptation:** Low; informational and upgradeable, with no risk transfer.
Additional support on Foundation Framework 1A guiding questions	GQ1A: for the operating entity, high-resolution nowcasts improve its own short-lead detection of extreme rainfall and response; measurable as detection lead time and targeted response.

68[005]-S1a — Flood forecasting, monitoring and dissemination systems — weather radar and precipitation nowcasting	
Additional support on Foundation Framework 1B guiding questions	GQ1B (primary): nowcasting enables people, activities and assets across the service area to respond to extreme rainfall in the short window available, reducing their losses; supports cross-sector emergency response.

68[005]-S3a — Drought monitoring and water-allocation early warning — groundwater monitoring system	
Detailed solution profile	
Technology/solution	Drought monitoring and water-allocation early warning — groundwater monitoring system
[Technology ID — internal reference only]	*68[005]-S3a*
Description	Supports early intervention before critical water shortages occur.
Type of solution	Technology-based solution (information / early warning)
Targeted climate risk(s)	Drought
Relevant resilience theme(s)	Resilient water & sanitation; Resilient infrastructure
Technology details	**State of technology:** Established monitoring infrastructure; applied across ASEAN groundwater-dependent areas. **Scalability:** Wellfield to regional network. **Environmental, social, and economic impact:** Encourages efficient water use, reducing the pressure for energy-intensive alternative water supply. **Paradigm shift potential:** Makes an invisible resource observable and manageable.
Fit-for-purpose criteria (Section 4b — rationale for inclusion in the mARs Guide)	
Criterion 1 — Clear risk fit	**Yes —** Hazard: drought. Addressed risk: declining water availability.
Criterion 2 — Clear effect	**Yes —** Supports early intervention before critical water shortages occur.
Criterion 3 — Works under uncertainty	**Yes —** Provides accurate data independent of fluctuating weather patterns.
Criterion 4 — Does not conflict with mitigation objectives	**Yes —** Encourages efficient water use, reducing the pressure for energy-intensive alternative water supply.
Reference	*Ravenscroft, P. & Lytton, L. (2022). Seeing the Invisible: A Strategic Report on Groundwater Quality. © World Bank.*
ASEAN Taxonomy Assessment Frame support	
CRVA assessment considerations	**Life span:** Monitoring infrastructure; upgradeable. **Adequacy and effectiveness:** Hazard: drought. Addressed risk: declining water availability. Provides accurate data independent of fluctuating weather patterns.

68[005]-S3a — Drought monitoring and water-allocation early warning — groundwater monitoring system	
	Maladaptation: Low; informational and upgradeable, with no risk transfer.
Additional support on Foundation Framework 1A guiding questions	GQ1A: for the operator, groundwater-level data enable intervention before critical shortage, protecting its own supply planning; data independent of weather variability; measurable as earlier action and avoided over-draw.
Additional support on Foundation Framework 1B guiding questions	GQ1B (primary): shared groundwater data enable other abstractors and managers to act before shortage and avoid depleting the common resource, enabling their resilience.

68[005]-S3b — Drought monitoring and water-allocation early warning — soil-moisture monitoring networks	
Detailed solution profile	
Technology/solution	Drought monitoring and water-allocation early warning — soil-moisture monitoring networks
[Technology ID — internal reference only]	*68[005]-S3b*
Description	Detects emerging drought conditions and supports proactive irrigation and water-conservation measures.
Type of solution	Technology-based solution (information / early warning)
Targeted climate risk(s)	Drought
Relevant resilience theme(s)	Resilient water & sanitation; Resilient infrastructure
Technology details	**State of technology:** Established sensing technology; applied in ASEAN irrigated agriculture. **Scalability:** Field to network. **Environmental, social, and economic impact:** Improves water-use efficiency and reduces the energy consumption associated with excessive irrigation. **Paradigm shift potential:** Shifts irrigation from calendar-based to condition-based.
Fit-for-purpose criteria (Section 4b — rationale for inclusion in the mARs Guide)	
Criterion 1 — Clear risk fit	**Yes —** Hazard: drought. Addressed risk: delayed identification of water stress.
Criterion 2 — Clear effect	**Yes —** Detects emerging drought conditions and supports proactive irrigation and water-conservation measures.
Criterion 3 — Works under uncertainty	**Yes —** Pinpoints real-time root-zone moisture deficits dynamically, allowing water-use planning regardless of erratic or unpredictable rainfall.

68[005]-S3b — Drought monitoring and water-allocation early warning — soil-moisture monitoring networks	
Criterion 4 — Does not conflict with mitigation objectives	**Yes —** Improves water-use efficiency and reduces the energy consumption associated with excessive irrigation.
Reference	*Wang, H. & Asefa, T. (2019). 'Drought monitoring, mitigation, and adaptation', Extreme Hydrology and Climate Variability.*
ASEAN Taxonomy Assessment Frame support	
CRVA assessment considerations	**Life span:** Sensor infrastructure; upgradeable. **Adequacy and effectiveness:** Hazard: drought. Addressed risk: delayed identification of water stress. Pinpoints real-time root-zone moisture deficits dynamically, allowing water-use planning regardless of erratic or unpredictable rainfall. **Maladaptation:** Low; informational and upgradeable, with no risk transfer.
Additional support on Foundation Framework 1A guiding questions	GQ1A: for the operator, real-time root-zone data detect emerging drought and guide its own water use; measurable as water-use efficiency and stress detected early.
Additional support on Foundation Framework 1B guiding questions	GQ1B (primary): moisture data enable farmers and water managers to conserve proactively despite erratic rainfall, enabling their resilience and reducing pressure on shared water.

Appendix 3: Non-qualifying examples by sector

The examples in this appendix are illustrative and non-exhaustive. They show configurations that would not qualify, and why — a configuration not listed here is not thereby acceptable, and a solution resembling one listed here is not thereby disqualified if its design avoids the failure described. Each entry names the criterion it fails so the reasoning can be applied to cases the list does not cover.

Water Supply; Sewerage, Waste Management and Remediation Activities (ISIC E)

Activity 36[001] Construction, extension and operation of water collection, treatment and supply systems

Non-qualifying example	Criterion failed	Why it fails
Network extension to serve demand growth (no hazard nexus)	Criterion 1 — Clear risk fit	Business-as-usual service expansion has no identified climate hazard–risk linkage to evidence in the CRVA (PS) or qualitative narrative (FF). It may be a legitimate activity under other objectives, but absent a hazard nexus it cannot be presented as an EO2 adaptation measure. Listing it would dilute the credibility of the solution list — the criterion exists precisely to screen out relabelled BAU capex. **Evidence:** *Reasoning case; no external source required.*
Deepened groundwater abstraction wells to offset declining water tables	Criterion 3 — Works under uncertainty (and triggers maladaptation screening)	Chasing a falling water table accelerates depletion and, in soft coastal sediments, land subsidence — amplifying relative sea-level rise and flood exposure. The regional evidence is unambiguous: groundwater over-abstraction is the primary driver of subsidence in Jakarta (rates locally above 20 cm/yr historically; restriction of abstraction is the core control measure in the city's coastal defence strategy), and subsidence in major coastal cities can exceed climatic sea-level rise itself. In Demak, subsidence of up to 8 cm/yr driven by industrial groundwater extraction overwhelmed otherwise successful mangrove restoration. The measure performs worse the longer the drought persists — the opposite of working under uncertainty. **Evidence:** *Tay, C. et al. (2022). 'Sea-level rise from land subsidence in major coastal cities', Nature Sustainability, 5, 1049–1057. — C40 Cities. Good Practice Guide: Jakarta – Coastal Defence Strategy and Flood Mapping (case study; restriction of groundwater abstraction as core subsidence-control measure). — Wetlands International / EcoShape et al. (2021). Building with Nature in Indonesia: Restoring an Eroding Coastline and Inspiring Action at Scale (2015–2021). Demak, Central Java.*

Permanent diesel generation as the sole supply-continuity measure	Criterion 4 — Does not conflict with mitigation objectives	Locks in fossil-fuel operational dependency with no decarbonisation pathway, where passive (elevation, hardening) or renewable-paired alternatives deliver the same continuity outcome. Fails at the DNSH (climate change mitigation) step. Temporary emergency backup is a different matter; the failure case is diesel as the designed, permanent resilience measure. **Evidence:** *Reasoning case; no external source required.*
Tankered/bottled water provision as a structural drought response	Criterion 2 — Clear effect	A coping measure, not a resilience measure: it produces no durable reduction in exposure or vulnerability of the supply system, and dependence typically grows with hazard frequency. Appropriate as emergency response; not creditable as an adaptation investment under EO2. **Evidence:** *Reasoning case; no external source required.*

Activity 36[003] Desalination

Non-qualifying example	Criterion failed	Why it fails
Fossil-fired thermal desalination (MSF/MED) without abatement or transition pathway	Criterion 4 — Does not conflict with mitigation objectives	Thermal desalination is substantially more energy- and emissions-intensive than membrane processes, and where fired on fossil energy with no credible decarbonisation pathway it fails the DNSH (mitigation) test outright. The resilience benefit (rainfall-independent supply) is identical to SWRO, so a lower-emission configuration is always available — the conditionality is not a hardship argument. **Evidence:** *World Bank (2019). The Role of Desalination in an Increasingly Water-Scarce World. World Bank, Washington, DC.*
Single large-capacity plant sized to one deterministic demand forecast	Criterion 3 — Works under uncertainty	Commits full capital to a single point projection of demand and feedwater conditions. If demand, salinity or the energy market evolve differently, the asset is stranded or operates inefficiently at part-load. Modular, staged SWRO delivering the same ultimate capacity passes the criterion; the monolithic configuration of the same technology does not. This is a useful illustration that the criteria assess configurations, not technology classes. **Evidence:** *World Bank (2019). The Role of Desalination in an Increasingly Water-Scarce World. World Bank, Washington, DC.*
Desalination substituting for unmanaged groundwater over-	Criterion 2 — Clear effect	Where the underlying exposure driver is over-abstraction (and consequent subsidence and salinisation), adding supply without abstraction control does not address the risk pathway — subsidence and intrusion continue, and

abstraction, with no demand-side measures		the new supply is absorbed by unmanaged demand growth. The clear-effect linkage to the resilience theme cannot be evidenced because the dominant risk driver is untouched. **Evidence:** *Tay, C. et al. (2022). 'Sea-level rise from land subsidence in major coastal cities', Nature Sustainability, 5, 1049–1057. — C40 Cities. Good Practice Guide: Jakarta – Coastal Defence Strategy and Flood Mapping (case study; restriction of groundwater abstraction as core subsidence-control measure).*

Activity 37[003] Flood or drought risk prevention, incl. NbS

Non-qualifying example	Criterion failed	Why it fails
High ring dykes enabling intensified floodplain cropping (close-set, full exclusion)	Criterion 2 — Clear effect at the system level (maladaptation)	Regionally documented: high-dyke development on the upper Vietnamese Mekong Delta floodplains (An Giang, Dong Thap) blocks floodplain retention and excludes sediment deposition, transferring flood hazard to neighbouring and downstream areas and degrading soils behind the dykes. Protection of the enclosed area is real, but the system-level effect — the level at which Activity 37[003] operates — is risk transfer, not risk reduction. Note the contrast with setback embankments, which retain floodplain storage and pass the criterion. **Evidence:** *'Flooding in the Mekong Delta: the impact of dyke systems on downstream hydrodynamics', Hydrology and Earth System Sciences, 24, 189–212 (2020), and modelling literature cited therein on high-dyke development in An Giang and Dong Thap provinces.*
Concrete channelisation of urban waterways	Criteria 2 and 3 — Clear effect; Works under uncertainty	Accelerates peak flows downstream rather than attenuating them, and provides a fixed conveyance capacity with no adaptive margin and abrupt failure on exceedance. The regional direction of travel is the reverse: Singapore's Bishan-Ang Mo Kio project de-channelised a concrete canal into a naturalised river precisely to gain conveyance capacity and flood resilience. **Evidence:** *Zevenbergen, C. et al. (2010). Urban Flood Management. CRC Press. — C40 Cities. Singapore: Bio-Engineering Works at Bishan-Ang Mo Kio Park to Prevent Urban Flooding (case study); PUB ABC Waters Programme and Design Guidelines (first published 2009).*
Fast-growing exotic monoculture plantations presented	Criteria 2 and 3 — Clear effect; Works under uncertainty	High-water-demand exotic monocultures in water-stressed catchments can reduce dry-season baseflow — the opposite of the intended hydrological effect — and low species diversity concentrates pest, disease and fire

as catchment 'afforestation'		fragility, undermining performance under uncertainty. The NbS evidence base supports native, diverse catchment rehabilitation; species and siting choices determine whether the row passes, not the 'afforestation' label. **Evidence:** *World Bank / GFDRR (2018). Nature-Based Solutions for Disaster Risk Management. World Bank, Washington, DC. — UNEP-DHI, UNEP and IUCN (2018). Nature-Based Solutions for Water Management: A Primer.*

Agriculture, Forestry and Fishing (ISIC A)

Activity 02[002] — forestry plantation / 02[003] — Conservation, restoration, and maintenance of natural forests

Non-qualifying example	Criterion failed	Why it fails
Fast-growing exotic even-aged monoculture presented as a 'climate-resilient' plantation	Criterion 3 — Works under uncertainty	Even-aged single-species stands (Eucalyptus, Acacia, pine) concentrate pest, disease, drought and fire fragility: monocultures show higher mortality and lose carbon-capture capacity disproportionately in consecutive dry years, while species-rich stands stay more stable. A plantation that performs in the expected scenario can fail under an unanticipated stress, so it fails the uncertainty criterion even where mean yield is high — the mixed-species/provenance configuration is what passes. **Evidence:** *Researchgate review (2024), 'Impact of Monoculture and Mixed Species Plantation Practices on Biodiversity'; Frontiers in Forests and Global Change (2023) meta-analysis on mixed-forest carbon and resilience.*
'Restoration' by dense planting on drained peat or intact natural forest	Criteria 2 — Clear effect; Criterion 4 — Does not conflict with mitigation objectives	Planting trees without first rewetting drained peat leaves the dominant fire-and-subsidence driver untouched (no clear effect), and converting or planting over intact natural forest trades a stable carbon sink and its superior drought-stability for a managed system (fails DNSH mitigation). Restoration credit attaches to rewetting and assisted recovery of native systems, not to planting per se. **Evidence:** *ScienceDirect (2026), Kalimantan peatland counterfactual (rewetting as the effective intervention); Researchgate (2024) — natural forests show more stable dry-season carbon capture than plantations.*

Construction and Real Estate (ISIC F / L)

Non-qualifying example	Criterion failed	Why it fails
Conventional mechanical air-conditioning as the sole extreme-heat response	Criterion 4 — Does not conflict with mitigation objectives	Relying on grid air-conditioning alone locks in high peak electricity demand and refrigerant load with no decarbonisation pathway, where passive measures (cool-roof coatings, green corridors) or efficient alternatives (ground-source heat pumps) deliver the same indoor comfort at far lower energy. It fails the DNSH (mitigation) step as a designed permanent measure — the lower-energy configurations on this list are always available. **Note:** *Reasoning case; no external source required.*
Sealed impermeable hardscaping that channels runoff off-site	Criterion 2 — Clear effect (at the system level)	Moving stormwater faster off the plot transfers — and can amplify — flooding downstream rather than reducing the hazard; it does not retain or infiltrate at source. Contrast the permeable pavements, green roofs and urban green spaces on this list, which reduce runoff volume and peak load where it falls. **Note:** *Reasoning case; no external source required.*
Fixed ground-floor occupation behind a sea wall in a subsiding coastal zone	Criterion 3 — Works under uncertainty	Protection holds only to the wall's design level and fails abruptly on exceedance, with no adaptive margin as sea level rises and the ground subsides — the failure worsens over time. Contrast amphibious sub-frame foundations, which adjust to rising water rather than assuming a fixed defence height. **Note:** *Reasoning case; no external source required.*

Appendix 4: Resources to support the mARs Guide

The resources below provide the underlying information that users may draw on when assembling evidence for an EO2 assessment, including hazard data, methodologies and sector-specific guidance. Most of these resources were developed for purposes other than taxonomy assessment. They are therefore not substitutes for the mARs Guide, and the mARs Guide is not intended to replace them. Rather, the mARs Guide organises and links relevant information from these resources to the specific evidence required for the ASEAN Taxonomy's EO2 assessment, on an activity-by-activity basis. Without the mARs Guide, users would need to identify the relevant resources and undertake this mapping themselves.

1. Activity identification

National context — strategies, plans and laws

Resource	What it provides for the EO2 assessment	Source / link
ASEAN State of Climate Change Report (ASCCR) and ASEAN Climate Change Strategic Action Plan (ACCSAP 2025–2030)	Regional outlook on climate risks and adaptation priorities, and the regional action roadmap; reference for AMS-level adaptation priorities.	ASEAN Secretariat with IGES (asean.org)
UNFCCC NAP Central	Repository of submitted National Adaptation Plans (NAPs), for checking activity alignment with national adaptation priorities.	UNFCCC (napcentral.org)
ACCEPT (All-Countries Common Equivalence Platform for Taxonomies).	Screening and navigation tool for taxonomy-aligned activities, as a supporting tool for working through EO2 criteria. The platform helps users navigate, compare, and analyse the ASEAN Taxonomy alongside EU Taxonomy and ASEAN member states national taxonomies.	ACCEPT (www.sfinstitute.asia/accept)
UNFCCC NDC Registry and Adaptation Communications Registry	Official NDCs and adaptation communications setting out national adaptation goals and priority sectors.	UNFCCC (unfccc.int/NDCREG)
Climate Watch	Searchable NDC content and analysis across countries, for comparing adaptation commitments.	World Resources Institute (climatewatchdata.org)
NAP Global Network	Guidance and country support on NAP–NDC alignment, and the Asia NAP Expo.	IISD-hosted (napglobalnetwork.org)

FAO NAP-Ag Guidelines	Agriculture-sector supplement to the NAP technical guidelines — useful for ISIC A activity alignment.	FAO
ECOLEX	Gateway to environmental law (treaties, national legislation, court decisions) — starting point for the AMS environmental-law compendium relevant to EO2 and DNSH.	FAO, IUCN and UNEP (ecolex.org)

Guidance: *Prioritise each AMS's own NAP, NDC and national adaptation strategy as the primary alignment reference; use ECOLEX and national gazettes to assemble the environmental-law screen relevant to DNSH and the Social Aspects criteria.*

Adaptation across multiple activities and sectors

Resource	What it provides for the EO2 assessment	Source / link
EU Taxonomy for Sustainable Activities — climate change adaptation	Reference for the adapted vs enabling activity distinction and enabling-activity examples (the origin of this distinction, per the White Paper).	European Commission
Climate Bonds Resilience Taxonomy	Investment typology (adapting measure, adapted activity, enabling measure, enabling activity), hazard clustering and enabling-contribution examples.	Climate Bonds Initiative (climatebonds.net)
World Bank / GFDRR Nature-Based Solutions guidance	ASEAN-relevant case material on cross-sector adaptation linkages (e.g. catchment and coastal NbS delivering water, agriculture and disaster-risk benefits).	World Bank / GFDRR
Taxonomy of Climate Change Adaptation Technology (2021)	A climate change adaptation technology taxonomy categorizes hardware, software, and institutional solutions that build resilience against climate hazards.	UNEP DTU dan Green Technology Center Korea/GTC Korea

Guidance: *Evidence a cross-sector linkage where an activity in one sector is relied upon by, or itself enables, resilience in another, consistent with the enabling-activity treatment in Section 2.*

Cross-border and supply-chain risks; interdependency and spillover among AMS

Resource	What it provides for the EO2 assessment	Source / link
Adaptation Without Borders — Global Transboundary Climate Risk Report	Evidence on climate risks that cross borders via trade, supply chains, finance and shared resources — for assessing spillover among AMS.	SEI and ODI (adaptationwithoutborders.org)
IFRS S2 (value-chain treatment)	Requires disclosure of material climate risks across the value chain, including upstream and downstream supply-chain exposure.	ISSB / IFRS Foundation
Mekong River Commission	Basin-scale data and assessments for the transboundary Mekong — directly relevant to water resources shared across AMS.	MRC (mrcmekong.org)

Guidance: *For shared river basins and coastlines, screen both the activity's own exposure and any risk it may transfer across an AMS border.*

2. Assessment support

CRVA-related — physical climate risk assessment

Resource	What it provides for the EO2 assessment	Source / link
ASEAN Taxonomy Annex 3	The Taxonomy's own CRVA guidance — the primary reference; the resources below supplement it.	ASEAN Taxonomy / ATB
IPCC Sixth Assessment Report, Working Group II (incl. Chapter 10, Asia)	Authoritative assessment of observed and projected physical climate risks for Asia (flooding, heat, drought, sea-level rise).	IPCC (ipcc.ch)
World Bank Climate Change Knowledge Portal (CCKP)	Historical and projected climate data, country and watershed profiles, and Climate Risk Country Profiles.	World Bank (climateknowledgeportal.worldbank.org)
GFDRR ThinkHazard!	Rapid screening of 11 natural hazards by location, with hazard ratings and risk-management guidance — a first-pass hazard screen.	GFDRR / World Bank (thinkhazard.org)
WRI Aqueduct	Water-risk mapping (stress, riverine and coastal flood, drought, agricultural water risk) with future projections to 2030 / 2050 / 2080.	World Resources Institute (wri.org/aqueduct)
GIZ Vulnerability Sourcebook and Risk Supplement	Standardised, step-wise risk and vulnerability assessment using climate impact chains, aligned to the IPCC AR5 risk concept (hazard, exposure, sensitivity, adaptive capacity).	GIZ (adaptationcommunity.net)
Mekong River Commission; SERVIR-Mekong	ASEAN-specific basin data, monitoring and decision-support / early-warning services for the Lower Mekong.	MRC; USAID–NASA SERVIR

Guidance: *Use ThinkHazard! and the CCKP for a first-pass screen, then conduct the activity-level CRVA (Annex 3 / Plus Standard) with the most authoritative AMS-specific data — national meteorological and hydrological agencies and basin authorities — for material activities, stating the scenarios and time horizon used.*

Maladaptation assessment

Resource	What it provides for the EO2 assessment	Source / link
Section 6 of this Guide	The proposed proportionate maladaptation screen — the primary reference within the Guide.	mARs Guide
REGILIENCE Self-assessment Tool for Maladaptation	A 17-question checklist (yes / partially / no) covering recognised maladaptation risk factors, applied at the planning stage — the checklist-based approach the Guide envisages.	REGILIENCE (regilience.eu)
Magnan (2014), 'Avoiding maladaptation to climate change: towards guiding principles'	Eleven practice-oriented guidelines across environmental, sociocultural and economic dimensions (the 'Assessment framework').	S.A.P.I.EN.S, 7.1
IPCC AR6 WGII (maladaptation)	Assessment of maladaptation, including lock-in, risk transfer and erosion of adaptive capacity.	IPCC

Guidance: *Apply an ex-ante (planning-stage) screen and re-test material activities against plausible future scenarios. The REGILIENCE checklist can be mapped onto the four fit-for-purpose criteria (Section 4b) and the maladaptation considerations in Section 6.*

Impact measurement

Resource	What it provides for the EO2 assessment	Source / link
UNEP Adaptation Gap Report	Annual assessment of adaptation planning, finance and implementation, distinguishing outputs, outcomes and impacts — reference for metric design and benchmarking.	UNEP / UNEP-CCC (unep.org)
IFRS S2 Climate-related Disclosures	Corporate-level disclosure of physical climate risks (acute and chronic) and climate resilience, building on the TCFD recommendations and using scenario analysis.	ISSB / IFRS Foundation (ifrs.org)
MDB–IDFC Common Principles for Climate Change Adaptation Finance Tracking; joint MDB methodology	A context- and location-specific, three-step method for identifying and reporting adaptation finance — basis for consistent outcome attribution.	MDBs and IDFC

Climate Bonds Resilience Taxonomy / Standard	Screening and, under the Standard, certification reference for resilience-labelled debt.	Climate Bonds Initiative
Coalition of Finance Ministers for Climate Action — Helsinki Principles (esp. Principle 4)	Finance-ministry tools for mainstreaming climate in fiscal policy: green budgeting and climate budget tagging (applied in Indonesia, among others).	Coalition, WB/IMF secretariat (financeministersforclimate.org)
Adaptation and Resilience Impact Measurement Toolkit: A practical framework for financial institutions	A practical approach and detailed suggested reporting template for assessing and reporting adaptation impact at investment-level and portfolio level, including indicators for identifying and assessing the operational, economic and financial consequences of climate change for investments.	UNEP-FI; Climate Adaptation Innovation & Learning Project (Global Environment Facility)
Adaptation & Resilience Impact: A measurement framework for investors	A practical and consistent framework for assessing the adaptation impact of investments.	BII; Adaptation & Resilience Investors Collaborative (ARIC)

Guidance: *Distinguish output, outcome and impact metrics; state the baseline and the basis for attribution. For Plus Standard activities, align reported metrics with the CRVA evidence (Criterion 2 — clear effect).*

Mitigation co-benefit

Resource	What it provides for the EO2 assessment	Source / link
Section 5 of this Guide	The Guide's treatment of mitigation co-benefit and primary vs secondary EO (DNSH-plus) — the primary reference.	mARs Guide
MDB–IDFC Common Principles for Climate Mitigation Finance Tracking and for Climate Change Adaptation Finance Tracking	Definitions and guidelines for tracking mitigation and adaptation finance separately and avoiding double counting across the two.	MDBs and IDFC
Joint MDB methodology for tracking climate finance	The MDBs' joint reports apply explicit rules to avoid double counting between mitigation and adaptation finance.	MDBs

Guidance: *Preserve a single primary EO classification (EO2) and record any mitigation contribution as a voluntary secondary recognition (Section 5); use the Common Principles' separation of mitigation and adaptation tracking to set the precedence and double-counting rules.*

Appendix 5: Governance considerations for adaptation activities

1. Purpose

Robust governance arrangements can support confidence, accountability and transparency in the mobilisation, allocation and use of adaptation finance, particularly given the long-term nature, technical complexities of adaptation activities, which may involve diverse sources of capital including public, development, philanthropic and private capital.

Recognising that existing governance arrangements may differ across jurisdictions and financing contexts, the mARs Guide highlights relevant governance considerations as a common regional reference point, complementing rather than replacing applicable national, project-level or financing-instrument arrangements. The governance factors outlined in this Appendix are non-exhaustive and are intended to support credible EO2 assessments and the financing and implementation of adaptation activities.

Users may consider these practices proportionately, taking into account the scale, lifespan, complexity and financing structure of the activity. The application of these practices may therefore vary according to the circumstances of the activity including the nature and complexity of the project and the sources of financing involved.

2. Good practices that strengthen bankability

(i) Independent technical assessment and verification

Independent review gives a self-assessment weight with third parties (Section 4d). For larger or externally financed activities, users may consider an independent review of the following, by a qualified reviewer who did not prepare the assessment.

- The CRVA and the hazard and exposure analysis
- The assessment of substantial contribution to EO2 and the screening for maladaptation risks
- Any quantified mitigation co-benefit claim (Section 5, Element 4)

(ii) Financial due diligence and investment appraisal, including avoided losses and operational continuity

Financiers look for assurance that a project is financially robust and can support its financing structure. For adaptation, this includes showing how resilience creates value. Points to consider include the following.

- Review of the financial model, counterparties, capital structure, insurance and risk allocation, with sensitivity tests for cost overruns, delays and revenue shortfalls
- Use of the same hazard scenarios in the financial case as in the CRVA
- A clear and repeatable explanation of avoided losses, operational continuity or protection of critical assets
- Where public funds are involved, a view on fiduciary risk using existing public financial management diagnostics

(iii) Monitoring, reporting and impact assessment across the project life

Adaptation benefits are often tested only when a hazard occurs, so monitoring is best designed in from the start. Good practice includes the following.

- Defining adaptation indicators and a baseline at design stage, with clear responsibility for data collection and reporting
- Tracking and reporting the use of proceeds until they are fully allocated
- Periodically assessing outcomes, including after significant hazard events, and disclosing material deviations from planned outcomes

(iv) Engagement with communities, agencies, indigenous and vulnerable groups, and technical experts

Engagement supports project legitimacy and long-term resilience outcomes, and helps identify where a solution may shift risk to others (Section 6). Good practice includes the following.

- Engaging early with local communities, relevant agencies and regulators, indigenous peoples and vulnerable groups where relevant, and technical experts
- Sharing project information in an accessible form before key decisions are taken
- Providing an accessible channel for grievances

(v) Procurement

Procurement is where the resilience specification becomes a physical asset. Integrity and transparency in procurement reduce the risk of cost overruns, assets built below the design standard, and corruption. Good practice includes the following.

- Competitive tendering for material contracts, with any exceptions justified
- Evaluation criteria that consider resilience performance and lifecycle cost, not lowest capital cost alone
- Conflict of interest declarations, beneficial ownership disclosure and debarment screening for contractors
- For large contracts, an independent procurement observer or integrity pact

3. Working with national laws and financier requirements

These practices are consistent with established market standards and sit alongside national procurement, environmental and anti-corruption laws, which differ across AMS, and alongside the policies of financiers. Where requirements differ, the following apply.

- National law prevails. Users need not duplicate a national requirement that already meets the purpose of a practice.
- Where an MDB or DFI provides finance, its procurement and safeguard policies apply to the financed portion through the financing agreement. Many MDBs accept national systems that are consistent with their core principles.
- Where several financiers are involved, agreeing a common approach to procurement, monitoring and reporting early avoids conflicting requirements.

4. Making governance transparent

Transparency allows financiers, investors and communities to see that governance arrangements are working, and lowers the cost of due diligence for each new financier. In proportion to the project, users may consider publishing the following in one accessible place.

- A summary of the CRVA, the EO2 assessment and any independent review
- The financing structure and the use of proceeds
- Procurement notices, contract awards and material contract variations
- Periodic reports on adaptation outcomes

The table below sets out the functions those practices serve and where each is picked up in the Guide. The practices are non-exhaustive and many will already be common practice in the market.

Table 15: Governance functions in adaptation finance and where they are addressed in this Guide

Governance function	Primary function	Illustrative stakeholders	Where addressed in this Guide
Strategic, accountability and monitoring	Oversee use of proceeds, impact reporting, disclosures and independent assurance	Auditors, trustees, assurance providers, regulators, fund managers and project sponsors	Section 5 (Elements 3 and 4) ; Appendix 5
Technical review	Validate climate risks, resilience outcomes, EO2 alignment, maladaptation screening and impact metrics	Climate scientists, engineers, CRVA specialists, research institutions, independent technical reviewers	Sections 4b and 4d (selection criteria and self-assessment); Section 5 (co-benefit claims); Section 6 (maladaptation)
Financial review	Assess bankability, financial sustainability, financing structure and risk allocation	Banks, MDBs, DFIs, investors, investment committees, financial advisers	Section 2c (principle: usable for finance and the real economy); Section 5

Governance function	Primary function	Illustrative stakeholders	Where addressed in this Guide
Stakeholder engagement and transparency	Engage affected communities, indigenous and vulnerable groups and agencies, disclose project information and handle grievances	Local communities, indigenous peoples, civil society, government agencies, technical experts	Section 2c (maladaptation risk management principle), Section 6, Appendix 5
Procurement	Award contracts competitively and with integrity, reflect resilience and lifecycle cost, and disclose awards and variations	Procuring entities, bidders and contractors, procurement observers, anti-corruption agencies, auditors	Appendix 5

REFERENCES

1 ASEAN Taxonomy, regional policy and programme references

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- ASEAN Taxonomy Board. *ASEAN Taxonomy for Sustainable Finance* (Version 4), including Annex 3 (CRVA guidance).
- ASEAN Secretariat with IGES. *ASEAN State of Climate Change Report (ASCCR)* and *ASEAN Climate Change Strategic Action Plan (ACCSAP) 2025–2030.*
- ACMF. *ASEAN Green Bond Standards; ASEAN Sustainability Bond Standards; ASEAN Sustainability-Linked Bond Standards.*
- European Commission. (2021). Commission Delegated Regulation (EU) 2021/2139 of 4 June 2021 supplementing Regulation (EU) 2020/852 by establishing the technical screening criteria for determining the conditions under which an economic activity qualifies as contributing substantially to climate change mitigation or climate change adaptation and for determining whether that activity causes no significant harm to any of the other environmental objectives. Official Journal of the European Union, L 442. https://eur-lex.europa.eu/eli/reg_del/2021/2139/oj/eng.
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- NAP Global Network (IISD). *Debt-for-Nature / Debt-for-Climate-Resilience Swaps*; NAP–NDC alignment guidance.
- The Nature Conservancy / AFD. *Financing Nature for Water Security: How-to Guide to Develop Watershed Investment Programs.*
- GFDRR / World Bank. *What Makes Catastrophe Risk Pools Work*; *Sovereign Catastrophe Risk Pools* (SEADRIF as the regional example).
- UNFCCC. *NAP Central*; *NDC Registry and Adaptation Communications Registry.*
- World Resources Institute. *Climate Watch* (climatewatchdata.org).
- FAO. *NAP-Ag Guidelines.*
- FAO, IUCN and UNEP. *ECOLEX* (environmental law gateway).
- Mekong River Commission. Basin-scale data and assessments; USAID–NASA *SERVIR-Mekong.*

2 Climate science, physical risk and assessment tools

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9 Summary of submitted national adaptation plans (NAPs) across AMS as of October 2026

Country	LDC[21] (Yes/No)	NAP Status	NAP Submission Date	Additional Documents
Brunei Darussalam	No	Submitted	24 December 2025	Brunei Darussalam Initial National Communications (2016) Brunei Darussalam Second National Communication (2017) Brunei Darussalam Third Nationally Determined Contribution (2025) Brunei Darussalam National Climate Change Policy (2020) Brunei Darussalam Biennial Transparency Report (2024)
Cambodia	Yes	Submitted	7 July 2021	Cambodia National Adaptation Plan Financing Framework and Implementation Plan (2017) Cambodia Initial Biennial Transparency Report (2024) Cambodia Third National Communication (2022) Cambodia Third Nationally Determined Contribution (2025)
Indonesia	No	Submitted	13 November 2025	Indonesia First Biennial Transparency Report (2024) Indonesia Enhanced Nationally Determined Contribution (2022) Indonesia Adaptation Communication (2022) Indonesia Third National Communication (2017)
Lao PDR	Yes	Submitted	16 October 2025	Lao PDR First Biennial Update Report (2020) Lao PDR First Nationally Determined Contribution [Updated Submission] (2021) Lao PDR Third National Communication (2024)
Malaysia	No	In progress	N/A	Malaysia's Third Iteration of the Nationally Determined Contribution (2025) Malaysia Fourth National Communication (2024) Malaysia First Biennial Transparency Report (2024) Climate Risk Country Profile: Malaysia Malaysia National Risk Register (2024)
Myanmar	Yes	In progress	N/A	Myanmar Initial National Communication (2012) Myanmar First Nationally Determined Contribution [Updated Submission] (2021)

[21] LDC is short for " Least Developed Country". The full list of LDCs can be found at https://www.un.org/ohrlls/content/list-ldcs

Country	LDC[21] (Yes/No)	NAP Status	NAP Submission Date	Additional Documents
Philippines	No	Submitted	30 May 2024	Philippines Second National Communication Philippines Nationally Determined Contribution (2026) Philippines First Biennial Transparency Report (2025)
Singapore	No	In progress	N/A	Singapore Second Nationally Determined Contribution and Accompanying Information (2025) Singapore Fifth National Communication & Fifth Biennial Update Report (2022) Singapore Fourth Biennial Update Report (2020) Charting Singapore's Low Carbon & Climate Resilient Future (2020)
Thailand	No	Submitted	18 April 2024	Thailand Fourth Biennial Update Report (2024) Thailand Fourth National Communication (2022) Thailand's 2nd Updated Nationally Determined Contribution (2022) Thailand First Biennial Transparency Report (2024)
Timor-Leste	Yes	Submitted	31 March 2021	Timor-Leste Nationally Determined Contribution (2022-2030)
Viet Nam	No	Submitted	5 September 2025	Viet Nam Third National Communication [Updated Submission] (2019) Viet Nam Third Biennial Update Report (2020) Viet Nam Nationally Determined Contribution (2022) Viet Nam NAP 2021-2030 with vision to 2050

