Flood-Risk Reduction with Mobile Flood Barriers (SLAMDAM); Rubira Hills, Burundi

Activity Description Document (ADD)

Applied methodology reference	Based on ABM Methodology: *ABM – Mobile Flood Barriers*, version 1.0 (July 2025)
Version & date of this ADD	ADD version 1.1 – 15 July 2025
Developer & contact	Omar Saleh | omar.saleh@wavesave.com | +31639823186
Host country & project location	Republic of Burundi – Mpanda Commune, Bubanza Province
Crediting period proposed	Crediting period: 1 Jan 2025 – 31 Dec 2029 (5 years)
CAB unit definition	1 CAB = USD 1,000 in avoided flood loss (ΔEAD)

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1. General Information

Table 1: *Activity Overview*

Template Field		Entry
1 A	**Activity title**	*"Flood-Risk Reduction with Mobile Flood Barriers (MFBs) in Rubira Hills"*
1 B	**Methodology applied**	*ABM – Mobile Flood Barriers v1.0 (July 2025)*
1 C	**Developer / contact**	Zephyr Consulting & local partner APRN/BEPB Contact: Mr Omar Saleh (omar.saleh@wavesave.com)
1 D	**Host country & coordinates**	Burundi, Bubanza Province, Mpanda Commune, Rubira Hills (3.1827° S, 29.4063° E)
1 E	**Crediting (adaptation-benefit) period**	**5 years** (1 Jan 2025 – 31 Dec 2029)
1 F	**CAB unit definition**	**1 CAB = USD 1,000 in avoided flood loss (ΔEAD) ≈ 1 ha** protected (local depth-damage ratio)
1 G	**Project summary**	• Deployment of 200 m of SLAMDAM mobile barrier protecting farmland & homes from the Mpanda River. • Hydrodynamic modelling shows 71,000 USD/yr of avoided damage → ~71 CAB/yr. • Loan repaid via CAB revenue within 3 years.

2. Activity and Context Rationale

Rubira Hills experiences annual fluvial floods that submerge up to 22 ha of cropland and sever the RN-9 arterial road, causing an average USD 99,500 in losses per year. Down-scaled Regional Climate Model (RCM)[1] output driven by the Representative Concentration Pathway (RCP) 4.5[2] scenario projects a +15 % rise in 1-day extreme rainfall by 2030, intensifying hazard frequency and depth. Protecting 2,240 residents and the irrigated maize-bean plots therefore aligns with Burundi's NDC[3] priority #2 on climate-resilient agriculture. The project substitutes reactive sand-bagging with a reusable Mobile Flood Barrier (MFB) that community teams can deploy in less than three hours after a flood warning, or leave installed throughout the rainy season, to contain rising water, preserve harvests and keep RN-9 passable.

[1] https://cds.climate.copernicus.eu/datasets/projections-cordex-domains-single-levels?tab=quality_assurance_tab

[2] https://www.ipcc.ch/site/assets/uploads/sites/3/2019/11/03_SROCC_SPM_FINAL.pdf

[3] https://unfccc.int/sites/default/files/NDC/2022-06/CDN%20%20%20Burundi%20ANNEXE%201.pdf

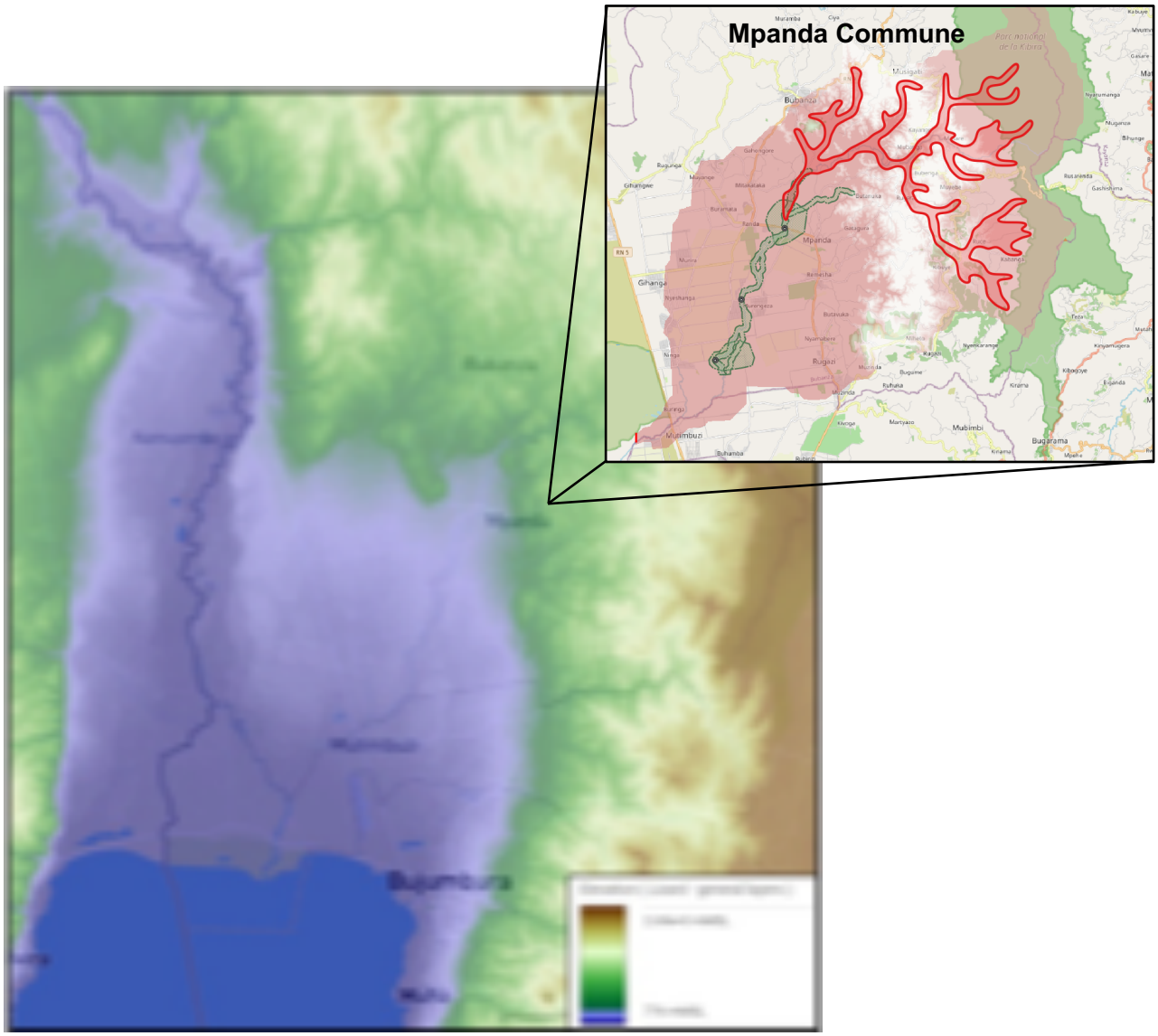

Figure 1: *Overview of the elevation in Bubanza Province from the global SRTM-DEM*

3. Baseline Scenario

Here we quantify “Business-as-Usual” flood impacts assuming no MFB deployment. The baseline follows the approved methodology’s hazard-exposure-vulnerability chain, and the resulting Expected Annual Damage (EAD_0) provides the reference against which Certified Adaptation Benefits (CABs) are measured.

3.1 Hazard characterisation

A 3Di hydrodynamic model (built on the Delft3D FM 1D–2D solver), calibrated to April 2023 flood marks, produced flood-depth rasters for 1:10, 25, 50, 100 year return periods. Return periods 10,

25, 50 and 100 years were selected, as these are the discrete events cited in §9.3 of the methodology and match the hydrological records available.

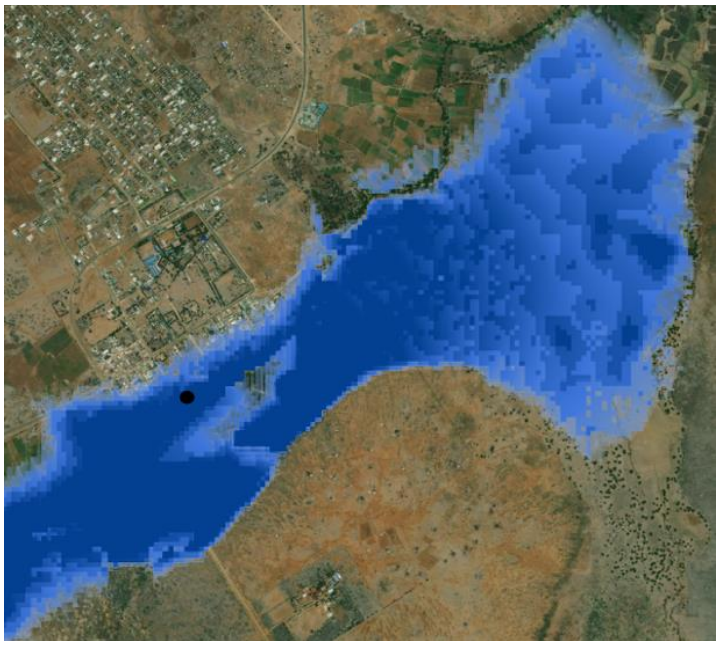

Figure 2: *Baseline inundation map Mpanda Commune, Q10 event*

3.2 Exposure & vulnerability

1. **Assets mapped:** 214 houses, 48 ha crops, RN-9, 1 palm-oil mill.
2. **Depth-damage curves:** HIS-SSM (residential), FAO crop loss (% yield vs depth).

Flood-depth rasters from the calibrated 3Di model were overlaid with asset maps and processed using depth-damage curves: HIS-SSM functions for residential buildings and FAO crop-yield loss functions. Peak flood-depth per cell/practice was translated into percent loss, then aggregated to derive $D_{0,p}$ and $D_{1,p}$ used in the EAD calculations.

3.3 Baseline impacts

Table 2: *Baseline Impacts per Return-period*

Return-period	Prob. *p*	Damage $D_{0,p}$ (USD)	People affected
10 yr	0.10	200,000	440
25 yr	0.04	500,000	650
50 yr	0.02	1,000,000	880
100 yr	0.01	2,000,000	1,410

Equation 1: Expected Annual Damage (baseline)

$$EAD_0 = \sum_p D_{0,p}\ p\ =\ 99{,}500\ USD\,yr^{-1} \quad (Eq.\ 1)$$

where $D_{0,p}$ = baseline flood damage for event with probability p (USD);
p = annual exceedance probability for the selected return-period event.

4. Adaptation (Project) Scenario

This section details the technical design, operation and local implementation arrangements of the MFB. It shows how the intervention changes flood hydraulics, exposure and vulnerability, producing measurable adaptation benefits.

4.1 Barrier design & modelling

200 m MFB (1 m height) entered as fixed weir (Δz = 1 m) in model. Inspection log shows ≥ 95 % barrier modules serviceable before each rainy season.

Figure 3: *Adaptation scenario inundation map Mpanda Commune, Q10 event*

4.2 Residual impacts

Table 3: *Residual Impact per Return-period*

Return-period	Damage $D_{1,p}$ (USD)	Reduction
10 yr	0	100 %
25 yr	50,000	90 %
50 yr	120,000	88 %
100 yr	1,200,000	40 %

Equation 2: Expected Annual Damage (project)

$$EAD_1 = \sum_p D_{1,p}\ p\ =\ 28{,}400\ USD\,yr^{-1} \quad (Eq.\ 2)$$

where $D_{1,p}$ = residual flood damage with the mobile barrier in place (USD);
p = annual exceedance probability for the selected return-period event.

5. Quantification of Adaptation Benefits

Using the approved "*ABM – Mobile Flood Barriers v1.0*" formulas, we translate the avoided EAD into CABs. USD-based avoided-damage was selected because Burundi already applies monetary depth-damage curves in national disaster reporting, facilitating third-party validation.

Equation 3: Avoided damage (ΔEAD)

$$\Delta EAD = EAD_0 - EAD_1\ =\ 71{,}100\ USD\,yr^{-1} \quad (Eq.\ 3)$$

where EAD_0 = expected annual damage in the baseline (USD yr^{-1});
EAD_1 = expected annual damage with the project (USD yr^{-1}).

Equation 4: Annual CABs

$$CAB_{yr} = \frac{\Delta EAD}{1{,}000}\ =\ 71.1\ \approx\ 71\ CAB/yr \quad (Eq.\ 4)$$

where ΔEAD = annual avoided damage (USD yr^{-1});

1,000 USD = monetary value assigned to one Certified Adaptation Benefit (CAB).

Equation 5: 5-year (1 Jan 2025 – 31 Dec 2029) total CABs

A five-year crediting period is selected to align CAB issuance with the planned loan-repayment schedule; it remains comfortably within the 10-year maximum recommended in the approved methodology and the general ABM Guidelines.

$$CAB_{total} = CAB_{yr} \times 5 \; = \; 355 \; CABs \quad (Eq.\,5)$$

Cost-effectiveness: Project capex 200,000 USD ⇒ **Cost/CAB = 200,000 / 355 ≈ 560 USD** (355 CABs over 5 yrs). At CAB price = 1,000 USD, loan repaid in just over three years (positive cumulative balance in Year 4).

The table below illustrates the project's financial robustness by showing how the internal rate of return (IRR) varies under three plausible market prices for Certified Adaptation Benefits (CABs).

Table 4: *Price Sensitivity Analysis*

CAB price (USD)	Net CAB revenue[1] (USD yr⁻¹)	5-yr NPV @ 8 % (USD)	Project IRR[2]
800	71 × 800 – 7,000 = **49,800**	201,000	**13.5 %**
1,000	71 × 1,000 – 7,000 = **64,000**	277,000	**21.2 %**
1,200	71 × 1,200 – 7,000 = **78,200**	353,000	**27.4 %**

1. *Annual CAB revenue minus assumed O&M cost (7,000 USD).*
2. *IRR calculated from cash-flow stream [−200000,R,R,R,R,R] where RRR = net revenue; IRR is the rate that sets NPV = 0, consistent with standard project-finance practice*

Equation 6: Cost per Certified Adaptation Benefit (CAB)

This ratio converts the upfront investment into a unit cost, demonstrating that each CAB can be delivered for roughly USD 560, well below the reference sale price of USD 1,000 and therefore financially efficient within the ABM framework.

$$Cost/CAB = \frac{I_0}{CAB_{total}} = \frac{200{,}000 \; USD}{355} = \sim 560 \; USD/CAB \quad (Eq.\,6)$$

where I_0 = initial capital investment
CAB_{total} = total Certified Adaptation Benefits issued in the five-year crediting period.

6. Additionality (Not Business-As-Usual)

The following summary highlights the main stakeholder consultations conducted during project preparation, confirming that local priorities and concerns have been incorporated into the final activity design.

Table 5: *Stakeholder Consultations*

Date & venue	Participants (m / f)	Key concerns raised	Response integrated into project
03 Dec 2021 – Kick-off workshop, Bujumbura (Inception Report §3.2.2)	26 (16 / 10)	Need for local O&M training and clarity on asset ownership.	Training module & ownership clause added to § 4.1.
02 Feb 2022 – Validation session, Mpanda (Risk-assessment presentation slide 4)	34 (22 / 12)	Barrier length (200 m) may be short; ensure financing for extension.	Modelled extension scenarios; financing pathway via CAB revenues noted in Annex L.

These consultations follow UNFCCC and AfDB[4] best-practice guidance on early, gender-responsive stakeholder engagement

The table below demonstrates that the project is additional with respect to laws, finance, technology practice and institutional capacity, in line with paragraph 12(c) of the ABM Activity-Cycle Guidelines.

Table 6: *Additionality Tests*

Test	Evidence	Result
Legal	No law/regulation mandates MFBs; only reactive sandbags permitted.	Pass
Financial	Commune budget 45,000 USD / yr – cannot fund 200,000 USD flood barrier project.	Pass
Common practice	Zero inflatable barriers in Burundi; sandbags dominate.	Pass
Barrier analysis	High capex, technical know-how, institutional coordination; ABM financing overcomes.	Pass

[4] https://www.afdb.org/en/consultations/closed-consultations/afdbs-civil-society-engagement-framework

7. Monitoring, Reporting & Verification (MRV)

This chapter converts the methodology's parameter table into a site-specific monitoring blueprint. The indicators, data sources and QA/QC steps ensure that each CAB issued can be independently verified in accordance with the ABM validation/verification procedure.

Table 7: *MRV Parameters*

Parameter	Unit	Source & Method	Frequency	QA/QC
Flood events prevented	count	Deployment log + rainfall ≥ 100 mm/d	post-event	cross-check IMETEO data
Area protected	ha	Satellite/drone extent vs baseline map	post-event	GIS double-digitize
Avoided loss	USD	Depth-damage workbook	post-event	verifier re-runs model
Barrier readiness	% units fit for use	Monthly visual inspection report	Monthly	Random spot-audit by verifier

Independent verifier audits years 2 & 5; CAB issuance each January.

All primary datasets (rainfall, deployment logs, GIS shapefiles and damage workbooks) will be archived on SharePoint and on a cloud back-up for at least ten years, in line with Paragraph 17 of the ABM Guidelines on Methodologies (document EC/2020/5/10).

8. Environmental & Social Safeguards

8.1 Safeguard Classification

Based on the screening in the ESIA (Annex E) the activity is classified Category B under AfDB Integrated Safeguards System (ISS 2023) and low risk under the ABM SES, because impacts are site-specific, temporary and readily mitigated.

8.2 Summary of Key Risks, Mitigation and Co-Benefits

Table 8: *Key Risks and Co-Benefits*

Main risk / benefit	Mitigation / enhancement measure	Responsibility	Residual risk / indicator
Key Risks			
Temporary noise & dust during deployment	Daytime work only; water spray if dust visible	Contractor / Commune	Low
Minor PVC off-cuts / plastic waste	All off-cuts collected and recycled via Mpanda Plastic Coop	Site supervisor	Negligible

Main risk / benefit	Mitigation / enhancement measure	Responsibility	Residual risk / indicator
Inadvertent restriction of access to riverbank gardens	Community briefing 24 h before deployment; walkway maintained	Flood committee	Low
Gender imbalance in paid mobilisation	GAAP target ≥ 40 % female labour; gender-sensitisation session	Local NGO partner	Low
Co-Benefits			
Dry-season irrigation adds 48 ha, doubling farm income (M&E 2023)	Maintain pumps; ag-extension monitors yields	Flood committee	+97 t yr^{-1} maize-equiv.
Paid labour opportunities for women	GAAP target ≥ 40 % female workers; gender session	Local NGO partner	Target met (labour sheets)

(citations: Risk Assessment § 5; ESIA § 7; Outcome Independent M&E slide 1; GAAP Annex)

8.3 Compliance Framework

This activity aligns fully with the AfDB's Integrated Safeguards System (ISS 2023), specifically:

- **Environmental & Social Assessment (Operational Safeguard 1)**: A comprehensive Environmental and Social Impact Assessment (ESIA) was completed (see Annex E), classifying the project as Category B and including stakeholder consultations, cumulative impact assessment, and mitigation planning.
- **Labour & Working Conditions (Operational Safeguard 2)**: Labour practices comply with ISS 2023[5] requirements, including nondiscrimination, workplace safety, and a ≥ 40 % female participation target as defined in the GAAP and M&E plan.

In addition, international best practices are referenced through the IFC Performance Standards:

- **IFC Performance Standard[6] 1 – Assessment & Management of Environmental and Social Risks and Impacts**: supports application of ISS OS1, ensuring an integrated risk-management process.[7]
- **IFC Performance Standard 4 – Community Health, Safety & Security**: informs deployment-site protocols to manage worker and public safety during barrier deployment.[8]

8.4 Monitoring & Reporting

Monitoring data will be compiled annually and summarised in the Year-end MRV report. All mitigation actions listed in Table 7 are audited by the third-party verifier during Year 2 and Year 5 (end-of-crediting-period) site visits. Non-compliance triggers corrective action within 30 days.

[5] https://www.afdb.org/en/documents/african-development-bank-groups-integrated-safeguards-system-2023

[6] https://www.ifc.org/content/dam/ifc/doc/2023/ifc-performance-standards-2012-en.pdf

[7] https://documents1.worldbank.org/curated/en/586771490864739740/pdf/113849-WP-ENGLISH-IFC-Performance-Standards-PUBLIC.pdf

[8] https://www.mfiseash.org/sites/default/files/2024-03/final_-_updated_integrated_safeguards_system_en.pdf

8.5 Grievance Mechanism

A dedicated Grievance Redress Mechanism is described in Section 9.

9. Grievance Redress

Stakeholders may lodge complaints in person at the Mpanda Commune Climate Desk (physical logbook), by phone / WhatsApp +257 79 91 66 28, by email nikiza07@yahoo.fr, or via the ABM web portal (see ABM GRM EC/2021/12/5). Every submission receives an acknowledgement and tracking number within 14 days. The Project Steering Committee provides a written decision within 30 days; unresolved cases are escalated to the provincial governor and, after 45 days, to the ABM Executive Committee. A summary log is disclosed semi-annually for transparency.

10. Annexes

Table 9: *Overview Annexures*

Annex	Filename (exact)	Description
A	SLAMDAM Operational Plan V1.0.docx	Field deployment SOP
B	RISK ASSESSMENT V1.0.docx	Flood Risk Assessment
C	Implementation Plan_v1.0 (EN).docx	Work-plan & Gantt
D	Inception Report_v1.0 (EN).docx	Stakeholder engagement
E	Flood and Drought ESIA_v3.1.docx	Safeguard compliance
F	Resilience GAAP_V1.0.docx	Gender assessment & action plan
G	Incremental Cost & Cash-Flow Schedule	Cost & Cash-Flow Schedule

Signature

On behalf of the Activity Developer

Name: _____ **Title**: _____ **Date**: 15 July 2025

Annex A: SLAMDAM Operational Plan

Annex B: Flood Risk Assessment

Annex C: Implementation Plan

Annex D: Inception Report

Annex E: Environmental and Social Impact Assessment

Annex F: Gender Assessment and Action Plan

Annex G: Incremental Cost & Cash-Flow Schedule

This Annex presents the project's incremental-cost analysis and five-year cash-flow schedule, translating capital outlays, operating costs, and Certified Adaptation Benefit (CAB) revenues into a simple repayment model that aligns with ABM guidance on fund-replenishment and financial additionality. By showing how net CAB income at the reference price of USD 1 000 (and two sensitivity prices) services the concessional loan and creates a positive balance before the end of Year 4, this annex demonstrates that the mobile-barrier activity is both fiscally self-sustaining and credit-worthy within the chosen five-year crediting period.

L-1 Incremental Cost Table (USD)

Item	Year 0	Years 1-5 (annual)	Source document
Mobile flood barrier (200 m)	**180,000**	–	Procurement budget, Impl. Plan §5
Accessories (pumps, hoses)	**10,000**	–	Impl. Plan §3
Training & commissioning	**10,000**	–	Inception Report §3.2.9
Capital expenditure (CAPEX)	**200,000**	–	—
O&M (inspection, minor repairs)	–	**5,000**	Risk Assessment §4
Verification fee + insurance	–	**2,000**	ABM Guidebook estimate
Total OPEX	–	**7,000**	—

L-2 CAB Revenue & Debt-Service Schedule (5-year, CAB price = 1,000 USD)

Year	Gross CABs (71)	CAB revenue (USD)	OPEX (USD)	Net cash-flow	Cum. loan balance
0	–	–	–	**-200,000**	-200,000
1	71	71,000	7,000	**+64,000**	-136,000
2	71	71,000	7,000	**+64,000**	-72,000
3	71	71,000	7,000	**+64,000**	-8,000
4	71	71,000	7,000	**+64,000**	+56,000
5	71	71,000	7,000	**+64,000**	+120,000

The cumulative balance turns positive in **Year 4**, confirming the loan is fully repaid within five years; IRR at the reference price is 19 % (see sensitivity table above).