FRM Profile

Subproject	**FRM-CC-Cimanuk**
River basin	Cimanuk-Cisanggarung
Main river	Cimanuk River
District/Province	West Java
Agency in charge	BBWS Cimanuk-Cisanggarung (CC)
Proposed work description	The infrastructure components to be constructed along the Babakan river system will allow i) reduction in flood water levels and ii) retention of flood volumes to reduce flood exposure to households and agriculture areas. The engineering consultant engaged under ADB Loan 3455 will prepare the detailed engineering design based on the agreed basic design and concept prepared under the TRTA. The L3455 will conduct detailed surveys (topography, geotechnical, bathymetry, social, and environmental) that might slightly impact on the design. No change on design that trigger category A for environment safeguards will be made. Flood Risk Management (FRM) plans shall be prepared and implemented at the river basin scale by reflecting national priorities/initiatives and international best practices (i.e., EU Flood Directive, WMO approaches and Prevention, Preparedness and Response to manmade and natural disasters (PPRD) East study). Some of the guiding principles are presented in Appendix D of the FRM technical pre-feasibility report to serve as the basis of developing Guidelines for FRM plans in Indonesia during development of detailed engineering design plans through L3455. Upstream Watershed Management practices will be described in further detail during the detailed engineering design stage (through L3455) in collaboration with the international project partner, International Fund for Agricultural Development (IFAD). In this context, site-specific actions will be evaluated and proposed, with the support of IFAD, to enhance stability and sediment yield characteristics in the upstream parts of the watershed. Some of the preliminary practices are described in Appendix E of the FRM technical pre-feasibility report to highlight joint functioning of various technologies as one system at the watershed scale. The FRM subprojects will include i) sediment excavation; ii) detention basins, iii) raise in levee/bank elevations, which are proposed by the **BBWS CC**; and i) coastal protection, and ii) nature-based solutions, which are proposed by the **EWSIP** in the context of enhanced structural and non-structural measures. The main features of **raised banks as proposed by BBWS CC** include: i) Riverside gardens at Lapang Paris as nature-based solutions **(Subproject ID A1.a),** ii) Riverside gardens at Cimacan as nature-based solutions **(Subproject ID A1.b),** iii) Riverside gardens at Copong Barrage as nature-based solutions **(Subproject ID A1.c),** iv) Flood wall at downstream river reach through the city of Garut along 6.5km **(Subproject ID A1.d),** v) 5m high reinforced concrete walls at 2 village bank protection schemes in the vicinity of Tomo village **(Subproject ID A2.a),** vi) 5m high reinforced concrete walls in Kiararambay **(Subproject ID A2.b),** vii) Rambatan channel dike repairs, crib repairs, and new crib structures **(Subproject ID A3.a),** viii) Raising flood banks at Rambatan channel by 1 m along a river reach of 20 km **(Subproject ID A3.b)** The main features of **detention basins as proposed by EWSIP** include: i) flood and RWS reservoir storage upstream of Garut City (surface area of 4.8 ha, depth of 8 m, and temporary storage volume of 0.4M m3) **(Subproject ID A1.e),**

<table>
<tr>
<td></td>
<td>
ii) three detention basins within the Garut city; Detention basin-1 – (surface area of 1.8 ha,, depth of 2m, and temporary storage volume of 35,600 m3) in agricultural land, detention basin-2 (surface area of 2.8 ha, depth of 2m, and temporary storage volume of 55,800 m3) in agricultural land, detention basin-3 (surface area of 6.2 ha, depth of 2m, and temporary storage volume of 0.1M m3) in agricultural land (Subproject ID A1.f),
iii) linking three riverside gardens within Garut city with a vegetated riverside walk as nature-based solutions (Subproject ID A1.g)

The main features of the Coastal Protection as proposed by EWSIP include:
i) Salinity protection starting at the Rambatan channel dike and following the existing tambak - rice field boundary with a 1.5m high dike to exclude any saltwater inundation of the rice fields with associated non-return gated structures (Subproject ID A3.d),
ii) coastal protection with linkage of the Rambatan channel to the coastal area with a gated drain to replenish the sediment and provide bamboo fences to trap it; a resilient breakwater along the shoreline from tetrapods, rockfill on geogrids or geotubes, to allow a 200m band of mangroves to be planted; and protection of the coastline by widening the protective mangrove belt.
i) coastal protection with breakwater and existing mangrove belt and shortening of the Rambatan channel (Subproject ID A3.e),

The main features of nature-based solutions proposed by EWSIP (as defined through Subproject ID A1.a, A1.b, A1.c, A1.d, A2.a, A2.b, A3.a and A3.b) include:
i) side slopes of proposed channels with 1:0.5 to be implemented by using gabions or reinforced soil design,
ii) natural vegetative protection is proposed along straight sections of the channel based on vetiver grasses in a 3m x 3m cell shape filled in with native vegetation,
iii) removal of housing to be considered within 15m of river banks, and

Nature-based solutions along the watershed include improvement in poor agricultural practices such as cultivation of cassava and maize with downslope ridges,

A soft measure (as proposed by EWSIP) without implications for structural interventions include; upgrade in the flood warning system by placing greater intensity of water level sensors connected by SCADA to BBWS CC control centre for flood forecast and early warning.
</td>
</tr>
<tr>
<td>EWSIP added value</td>
<td>
EWSIP outputs are strategically linked to the BAPPENAS quick-win programs as defined below:
<table>
<tr><th>BAPPENAS Programs</th><th>EWSIP Outputs</th></tr>
<tr><td>Program 1: Smart Water Management</td><td>Output 1: Planning for water resources optimized</td></tr>
<tr><td>Program 2: Water for Food Security and Nutrition</td><td>Output 2: RWS infrastructure and services improved</td></tr>
<tr><td>Program 3: Multipurpose Storage for Water, Food, Flood, and Energy</td><td>Output 2: RWS infrastructure and services improved</td></tr>
<tr><td>Program 4: Disaster Resilience Infrastructure</td><td>Output 3: FRM enhanced</td></tr>
<tr><td>Program 5: North Java Integrated Coastal Development</td><td>Output 3: FRM enhanced</td></tr>
<tr><td>Program 6: Green Infrastructure</td><td>Output 1: Planning for water resources optimized</td></tr>
<tr><td>Program 7: Water Safety Plan</td><td>Output 1: Planning for water resources optimized</td></tr>
</table>
</td>
</tr>
</table>

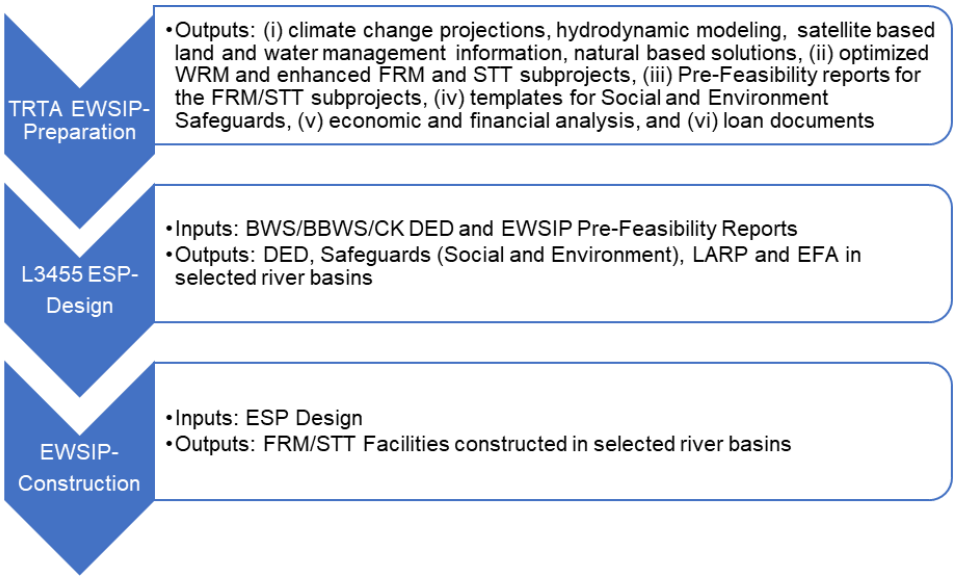
<table>
<tr><td>Alignment with spatial plan</td><td>The subproject is consistent with the spatial plan of West Java Province year 2009-2029[1].</td></tr>
<tr><td>Potential Involuntary Resettlement impact</td><td>The subprojects are expected result in Land Acquisition (LA) as documented below. The final LA requirements for all subprojects shall follow detailed site-specific surveys to be implemented during the detailed engineering design stage through L3455.

<table>
<tr><th>ID</th><th>FRM Subprojects</th><th>Estimate for LA area (ha)</th></tr>
<tr><td></td><td><u>BBWS CC Upper Cimanuk Proposals</u></td><td></td></tr>
<tr><td>A1.a</td><td>River garden at Lapang Paris</td><td>1.1</td></tr>
<tr><td>A1.b</td><td>River garden at Cimican</td><td>1.5</td></tr>
<tr><td>A1.c</td><td>River garden at Copon Barrage</td><td>0</td></tr>
<tr><td>A1.d</td><td>Raising dikes on 6.5 km of Cimanuk</td><td>2.0</td></tr>
<tr><td colspan="2">Sub-total for BBWS CC Upper Cimanuk</td><td>4.6</td></tr>
<tr><td></td><td><u>EWSIP Upper Cimanuk Proposals</u></td><td></td></tr>
<tr><td>A1.e</td><td>Flood diversion and flood & RWS storage</td><td>4.8</td></tr>
<tr><td>A1.f</td><td>Small detention basins 3 No</td><td>10.8</td></tr>
<tr><td>A1.g</td><td>Walkway improvements</td><td>2.0</td></tr>
<tr><td colspan="2">Sub-total for EWSIP Upper Cimanuk</td><td>17.5</td></tr>
<tr><td></td><td><u>BBWS CC Mid Cimanuk Proposals</u></td><td></td></tr>
<tr><td>A2.a</td><td>Tomo enhanced erotion protection</td><td>0.3</td></tr>
<tr><td>A2.b</td><td>Kiararambay enhanced erosion protection</td><td>0.3</td></tr>
<tr><td colspan="2">Sub-total for BBWS CC Mid Cimanuk</td><td>0.6</td></tr>
<tr><td></td><td><u>BBWS CC Rambatan Proposals</u></td><td></td></tr>
<tr><td>A3.a</td><td>Repairing channel banks</td><td>-</td></tr>
<tr><td>A3.b</td><td>Raising flood banks - by 1m</td><td>-</td></tr>
<tr><td>A3.c</td><td>Irrigation intake at Desa Lamiran Tarung</td><td>-</td></tr>
<tr><td colspan="2">Sub-total for BBWS CC Rambatan</td><td>-</td></tr>
<tr><td></td><td><u>EWSIP Rambatan Proposals</u></td><td></td></tr>
<tr><td>A3.d</td><td>Riceland protected from saline inundation</td><td>19.2</td></tr>
<tr><td>A3.e</td><td>Coastal protection from threat to Rambatan</td><td>4</td></tr>
<tr><td colspan="2">Sub-total for EWSIP Rambatan</td><td>23.2</td></tr>
<tr><td colspan="2">Total estimate for land acquisition</td><td>45.9</td></tr>
</table>

There are no documents on land acquisition, socio-economic conditions and resettlement needs along the project corridor (i.e, AMDAL, LARP, LARAP, IP&IR, etc.)</td></tr>
<tr><td>Potential Indigenous people impact</td><td>The preliminary findings indicate that the proposed subproject doesn’t cross any Indigenous People (IP) area.

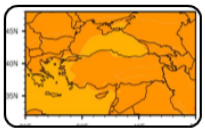
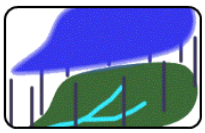
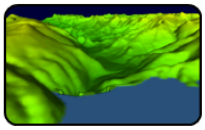
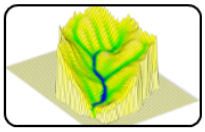
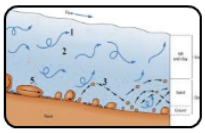
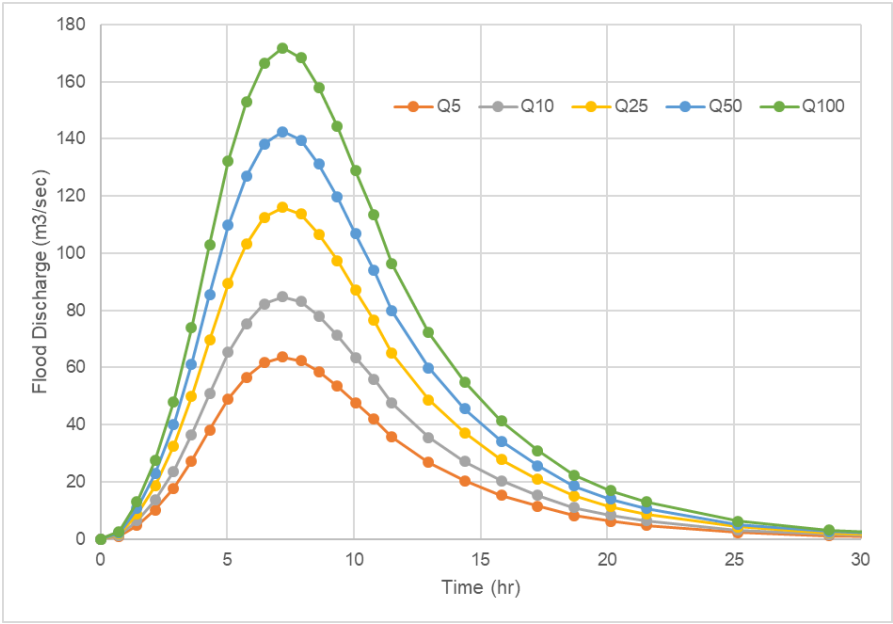
The final status on the potential for crossing areas with IP should be evaluated by i) reviewing the BRWA (Indigenous Territory Registration Agency) database[2], ii) reviewing the AMAN (Indigenous Peoples Alliance of the Archipelago) database[3], and iii) site-specific surveys.</td></tr>
</table>

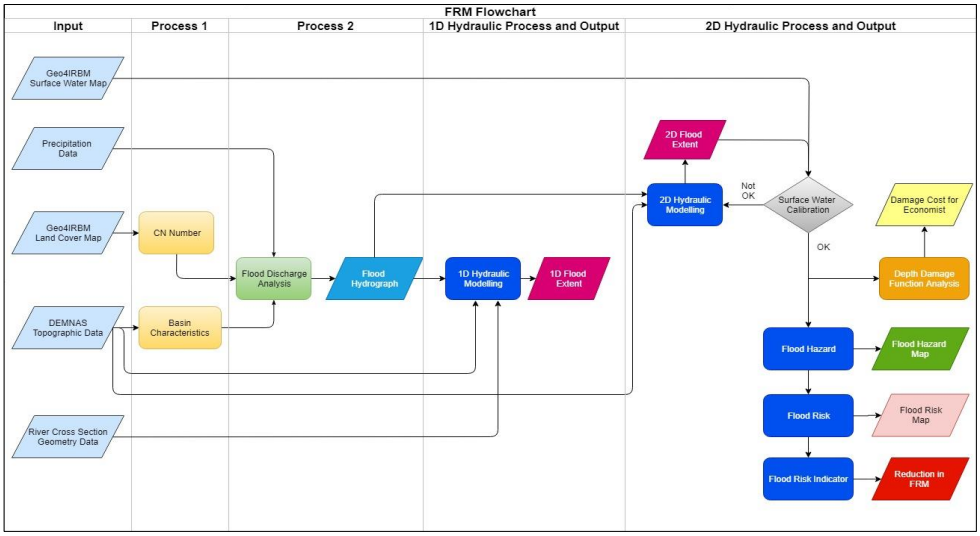
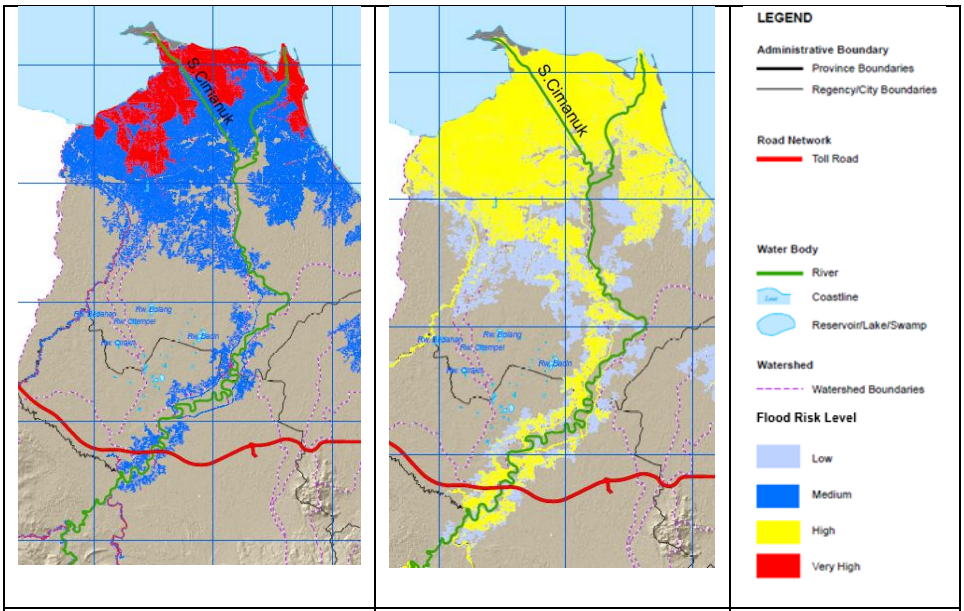
[1] http://bappeda.jabarprov.go.id/wp-content/uploads/2017/03/Perda-No-22-Tahun-2010-Tentang-RTRWP-Jawa-Barat-2009-2029.pdf, last accessed in July 2019.
[2] http://brwa.or.id/sig/, last access in June 2019.
[3] http://www.aman.or.id/peta/, last access in June 2019.

Potential Environment impact	The subproject works are not expected to cross any protected area (forest/swamp), biodiversity sanctuary or protected forest as indicated in the Indicative Moratorium Maps 15th Revision, which are published as per the Forestry Ministerial Decree of the Republic of Indonesia Number: SK.8599/MENLHK-PKTL/IPSDH/PLA.1/12/ 2018 (Scale 1:250.000)[4]. There are no documents on environmental impacts (i.e., IEE, AMDAL, etc.). The potential to cross any protected area (forest/swamp), biodiversity sanctuary or protected forest should be evaluated through site-specific surveys by the Contractor during Detailed Engineering Design. No change on design that trigger category A for environment safeguards will be made.
Estimated cost and implementation period	Implementation period is 2020 – 2023. The project costs include i) RpM 153,920 for the infrastructure by the BBWS CC, and ii) RpM 132,388 for the core enhancements by EWSIP. O&M costs are annual and to be calculated as 2% of infrastructure implementation costs through the lifecycle of proposed infrastructure over 30-years. An allowance of 5% infrastructure costs every 5 years to remove sediment in the river channel.
Readiness FS/DED/IEE-EIA/LARP/Bidding documents	DED is available for the infrastructure proposed along the Belawan River by the BWS Sumatera II. Enhancement of the existing DED and Safeguards documentation will be proposed for preparation as part of ADB ESP packages (Loan 3455). The documents that are available include: i) Rencana Pengelolaan Sumber Daya Air Wilayah Sungai Cimanuk Cisanggarung (Water Resources Management Plan in Cimanuk Cisanggarung River Basin) by the DGWR-MPWH, 2017, Sejahtera (July 1998), ii) DED Tanggul Banjir Sungai Cimanuk Kab. Garut - PT. Satyakarsa Mudatama (2017), iii) Studi Pengendalian Banjir di DAS Cimanuk - PT. Supraharmonia Consultindo (2016), and iv) DED Penanganan lokasi kritis sungai rambatan Kabupaten Indramayu - PT. Bhawana Prasasta (2017)
Linkages between EWSIP and ESP	The linkages between the TRTA, Engineering Services Project (ESP); and construction under EWSIP are schematized below: 

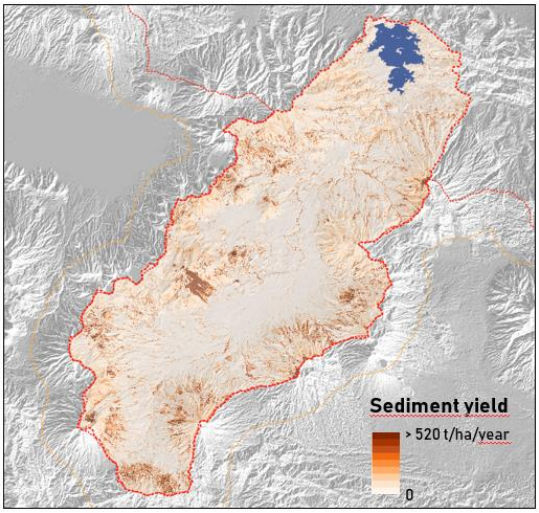
[4] http://webgis.dephut.go.id:8080/kemenhut/index.php/en/map/pipib/61-pippib/330-indicative-moratorium-map-15th-revision, last accessed in July 2019.

FRM Numerical Modelling Processes

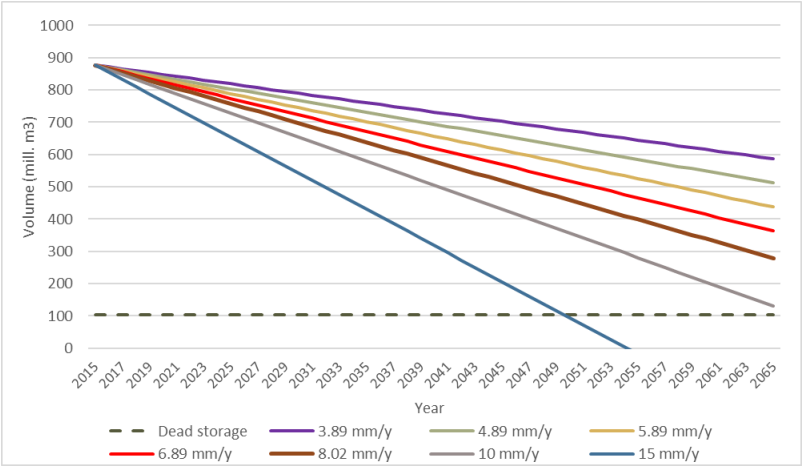
Numerical models in IFRM	ESP Consultant shall follow the numerical modelling processes in integrated flood risk modelling (IFRM) as highlighted below:  **Climate Change Modelling** - *Scope:* Climate change projections and anomalies - *Database:* Temperature, Precipitation and Evaporation (ADB)  **Hydrologic Modelling** - *Scope:* Evaluation of Rainfall to Runoff processes - *Database:* Hydromet. network (BBWS/PUSAIR), LULC (ESA)  **Hydraulic Modelling** - *Scope:* Evaluation of Runoff to River hydraulics (1D/2D) - *Database:* Flow gage network, DEM (BIG), Validatation (ESA)  **Erosion Modelling** - *Scope:* Sediment yield from the watershed - *Database:* RUSLE / MUSLE parameters  **Sediment Yield and Watershed Management** - *Scope:* Sediment yield along the watershed system - *Database:* Sediment characterization, FAO–WOCAT (World Overview of Conservation Approaches and Technologies)
Flood Hydrographs	ESP Consultant shall generate flood hydrographs (as depicted below) for existing/future conditions by using the Soil-Conservation-Service (SCS) Curve Number (CN) unit hydrograph approach. The existing/future land use and land cover data sets and climate change data sets (representing the changes in precipitation and temperature in 2030 and 2050) shall be used. 

Flood Hydraulics	The main objective of 1-dimensional hydraulic models is to i) identify existing level of flood protection (Scenario 1) along the river, ii) evaluate the proposed concepts by the BBWS DED (Scenario 2) and iii) evaluate the level of enhancement required for the flood protection services (Scenario 3). This evaluation was performed both in the context of existing hydrologic conditions (storm precipitation) and future conditions with climate change (Scenario 4). 2-dimensional hydraulic models shall be developed along the entire river basin by using the DEMNAS DEM available by the BIG. The hydraulic models shall be evaluated/validated through a combination of tools including i) BNPB database for disaster data for historical floods , ii) historical flood maps available with the BWS/BBWS, iii) Google Earth time series images to explore flood impacts, and iv) European Space Agency (ESA) satellite images of historical water extent.
Flood Risk Maps - Processes	ESP Consultant shall develop flood risk maps through the exposure, vulnerability and hazard processes and by using 1-dimensional and 2-dimensional hydraulic models. The flood risk maps for existing conditions shall be validated by using 
Flood Risk Maps - Outcomes	The outcomes shall be represented for i) building/people, and ii) agriculture at the river basin scale, as shown below.  Risk to Agriculture Areas — Risk to People/Buildings

Sediment Yield	The main findings of a recent European Space Agency study, in two river basins in Indonesia, indicate high level of sediment yield across the river basins. As an example, upstream of Jatigede reservoir, the high amount of sediment yield can lower the life-cycle of the reservoir by approximately 10 years. ESP Consultant shall evaluate the sediment yield upstream existing/proposed facilities.

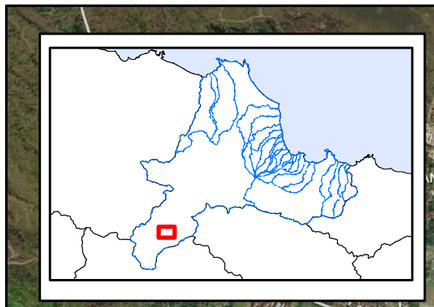


Sediment yield potential upstream of Jatigede Reservoir



Potential impact of sediment yield on the life-cycle of reservoir

EWSIP - INDICATIVE MAP OF FRM UPPER CIMANUK SUB-BASIN SUBPROJECT



Legend :

- Capital Province
- District Province
- National Boundary Line
- Province Boundary
- District Boundary
- Village Boundary
- Watershed Boundary
- River

Sub Project Information :

- Raising dikes on 6.5 km of Cimanuk
- Project Location

	BBWS CC Upper Cimanuk Proposals
A1.a	River garden at Lapang Paris
A1.b	River garden at Cimacan
A1.c	River garden at copon barrage
A1.d	Raising dikes on 6.5 km of Cimanuk
	EWSIP Upper Cimanuk Proposals
A1.e	flood diversion and flood & RWS storage
A1.f	Small detention basins
A1.g	Walkway improvements

PASAWAHAN
TANJUNGKAMUNING
PAMEKARSARI
SUKARATU
CIPICUNG
JATI
SUKASENANG
KARANGSARI
CIMANGANTEN
RANCABANGO
S.Cimanuk
A1.c
A1.d
LANGENSARI
TAROGONG
MEKARSARI
SINDANGLAYA
CIMURAH
MEKARJAYA
SUKAMANTRI
HAURPANGGUNG
LENGKONGJAYA
SIRNAJAYA
PATARUMAN
JAYARAGA
A1.b
SUKAGALIH
JATISARI
SINDANGPALAY
JAYAWARAS
SUCIKALER
KARANGMULYA
A1.f
PAMINGGIR
PAKUWON
CIWALEN
KOTAWETAN
SINDANGGALIH
A1.g
REGOL
A1.a
SUKAKARYA
SUCI
GODOG
LEBAKJAYA
A1.e
KOTAKULON
TANJUNGSARI
MUARA SANDING
LEBAKAGUNG
KERSAMENAK
MARGAWATI
CIMUNCANG
CIBUNAR
NGAMPLANGSARI
LEBAKJAYA

N

Scale 1:25,000

0 0.5 1 2 Kilometers

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

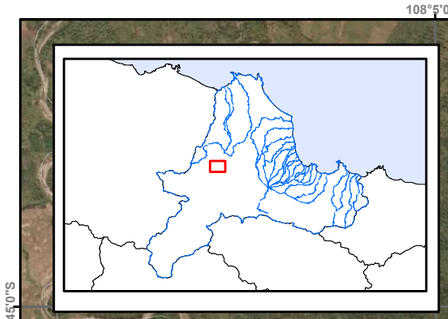
107°55'0"E

7°1'10"S

7°1'20"S

7°1'30"S

EWSIP - INDICATIVE MAP OF FRM MID CIMANUK SUB-BASIN SUBPROJECT



108°5'0"E

6°45'0"S

UJUNGJAYA

PALABUAN

KUDANGWANGI

KEBON CAU

BABAKAN ANYAR

BABAKAN ASEM

KADIPATEN

A2.a

TOMO

TOLENGAS

S. Cimanuk

KARYAMUKTI

A2.b

CIPELES

CICARIMANAH

DARMAWANGI

BONANG

MARONGGE

Legend :

- Capital Province
- District Province
- National Boundary Line
- Province Boundary
- District Boundary
- Village Boundary
- Watershed Boundary
- River

Sub Project Information :

	BBWS CC Mid Cimanuk Proposals
A2.a	Tomo enhanced erotion protection
A2.b	Kiararambay enhanced erosion protection

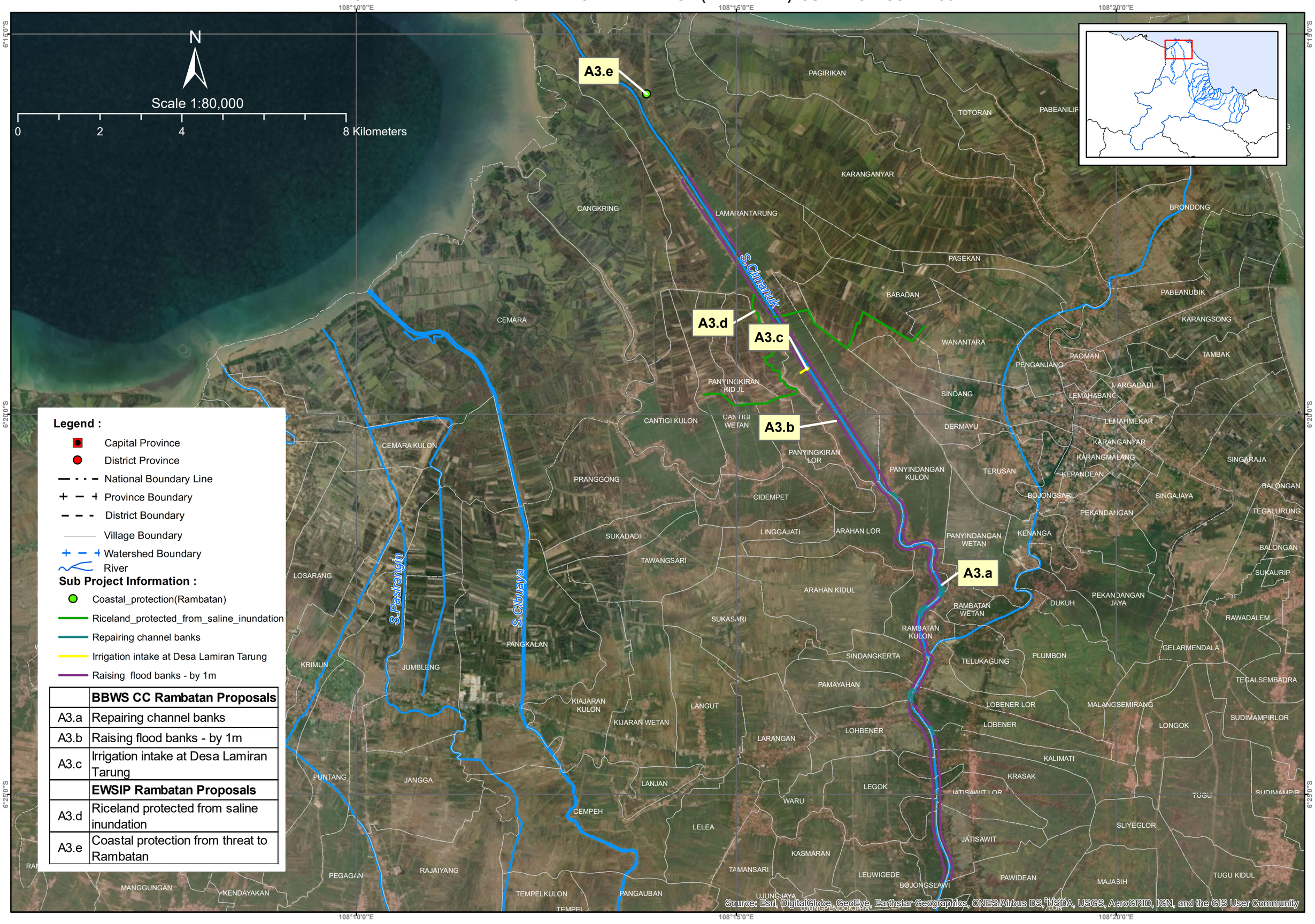
N

Scale 1:25,000

0 0.5 1 2 Kilometers

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

EWSIP - INDICATIVE MAP OF FRM LOWER CIMANUK (RAMBATAN) SUB-BASIN SUBPROJECT



Legend :

- Capital Province
- District Province
- National Boundary Line
- Province Boundary
- District Boundary
- Village Boundary
- Watershed Boundary
- River

Sub Project Information :

- Coastal_protection(Rambatan)
- Riceland_protected_from_saline_inundation
- Repairing channel banks
- Irrigation intake at Desa Lamiran Tarung
- Raising flood banks - by 1m

	BBWS CC Rambatan Proposals
A3.a	Repairing channel banks
A3.b	Raising flood banks - by 1m
A3.c	Irrigation intake at Desa Lamiran Tarung
	EWSIP Rambatan Proposals
A3.d	Riceland protected from saline inundation
A3.e	Coastal protection from threat to Rambatan