MECDM

Climate Change, Disaster Risk Mapping and related tasks within the Ministry of Environment, Climate Change, Disaster Management & Meteorology

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Australian Government
Department of Foreign Affairs and Trade

LIVE&LEARN
Environmental Education

PRRP
PACIFIC RISK RESILIENCE PROGRAMME

UNDP
Empowered lives.
Resilient nations.

Outline

- **PRRP Project: Goals, Approach & Purposes**
- **MECDM Geospatial: Objectives**
- **Hazards, Vulnerability & Disaster Risks**
- **GIS Applications: Hazards, Vulnerability & Risk Mapping**
- **Environmental Assessment**
- **Future Applications**
- **Summary**

PRRP – Pacific Risk Resilience Programme

- **Goals** – Communities' resilience to Disaster risks from Natural and climate change related hazards.
- **Approach** – Focus on strengthening the governance of natural hazards, climate and disaster risks.

- **Activities** – Stakeholders in trial locations identify risks and implement socially inclusive, effective and sustainable responses (GP & Temotu)
- **Regional** – Tonga, Fiji, Vanuatu and Solomon Islands

MECDM Geospatial: Objectives

- **To assist Government stakeholders to be better informed of CC and DRM for disaster-risk informed decision-making.**

- **To develop a GIS database that captures the spatial distribution of hazards & vulnerabilities for risk mapping purposes.**

- **Data management and information sharing – supporting information sharing within Government ministries, partner organizations and sectors.**

- **Sustain the use of GIS database and applications for risk informed planning and capacity building.**

- **Promote & support research on GIS applications**

Understanding Risk

- **Hazards** and **Vulnerability** are two components of Risk Mapping.
- Risk can be defined as the result of Hazard and Vulnerability intersection.
- **Hazard Mapping** – Shows where (Spatial locations) and the intensity and frequency of individual occurring hazard.
- **Vulnerability Mapping** – Shows Information on the Physical, environmental economic and social fabric of elements (spatially) with regards to potential hazards.
- Ranking and Weighting applied (Matrix)

Natural Hazards, Vulnerability, Exposure & Risks

Natural Hazard **+** Vulnerability & exposure **=** Risk

Risk can be thought of as the intersection of natural hazard events and the elements' vulnerability

Hazards, Vulnerability & Risks

Hazard

Flash Floods

Exposure

Living in dangerous locations

Vulnerability

Very low adaptive capacity

= **Risk**

Heavy Rainfall

risk location

Unplanned urbanization & low incomes

Identifying Natural Hazards

```
                        Natural
                        hazards
        ┌──────────┬──────────┼──────────┬──────────┐
   Biological   Geological   Climate     Water      Weather
```

Biological
- Epidemic e.g. infectious disease
- Insect infestation
- Algal Bloom

Geological
- Earthquake e.g. tsunami
- Volcanic eruption
- Mass movement dry e.g. landslide

Climate
- Extreme temperature e.g. Coral Bleaching
- Drought
- Wildfire e.g. forest fire

Water
- Flood e.g. coastal surge
- Mass movement wet e.g. mudslides

Weather
- Storm e.g. cyclone

Classifying Natural Hazards

- **Hydro-meteorological Hazards**
➤Cyclones, Heavy Rain, Storm Surge, Flooding, Landslide etc.

- **Geophysical Hazards**
➤ Earthquakes, Tsunami, Landslide, Liquefaction etc.

- **Biological**
➤Epidemic (infectious Disease), Pests Infestation (GAS)

Vulnerability Factors

1. Physical Factors

- Constructions
- critical infrastructures
- Population/urban density
- Locations i.e. exposure

3. Economic Factors

- Poverty & nutrition
- Access to critical infrastructures & services
- Access to resources
- Financing opportunity

2. Environmental Factors

- Soil and water quality/quantity
- Vegetation, biodiversity, forests
- Human developments

4. Social Factors

- Population growth
- Level of literacy & Education
- Civil participation
- Gender & Minority groups
- health

GIS Applications: Hazards, Vulnerability & Risk Mapping

- GIS (Geographic Information System) is a <u>Computer-base tool</u> design to capture, store, manage, retrieve, summarize and display spatial or geographic data.

- It enable planners & Decision-makers to analyse, see, and understand patterns and relationships.

- Since natural hazards & vulnerability are spatially oriented, **We can used the analytical capability of the GIS to identify the spatial intersection of natural hazards and vulnerable systems generating risk maps.**

Scale of Assessments: Hazards, Vulnerability & Risk Mapping

Major Hazards

4. Riverine Flooding

3. Tropical Cyclone

2. Coastal Flooding

1. Earthquake

Others

Scale of Assessments

Country
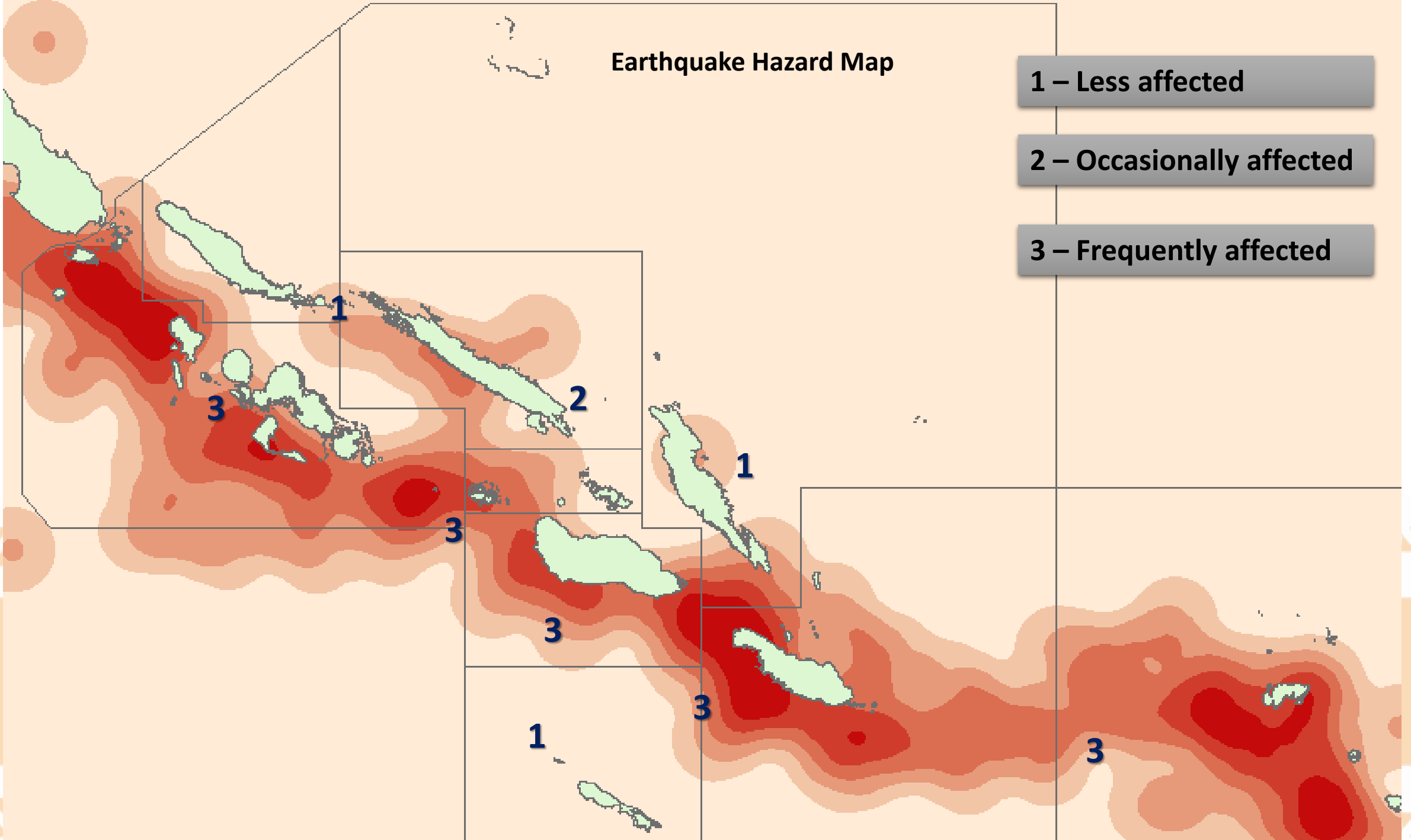
Province

Wards

Comm.
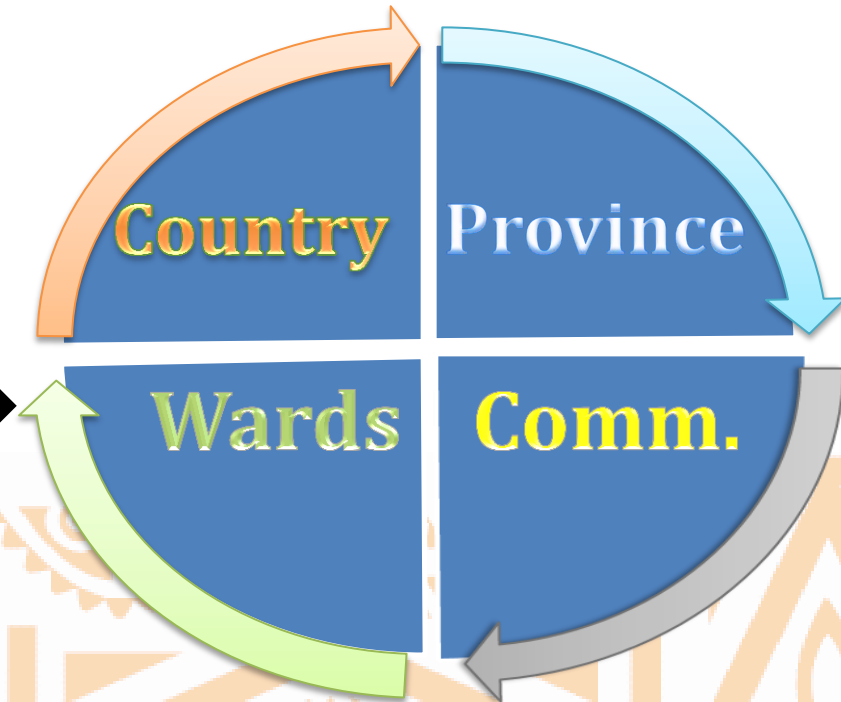
Earthquake Hotspots in the Solomon Islands
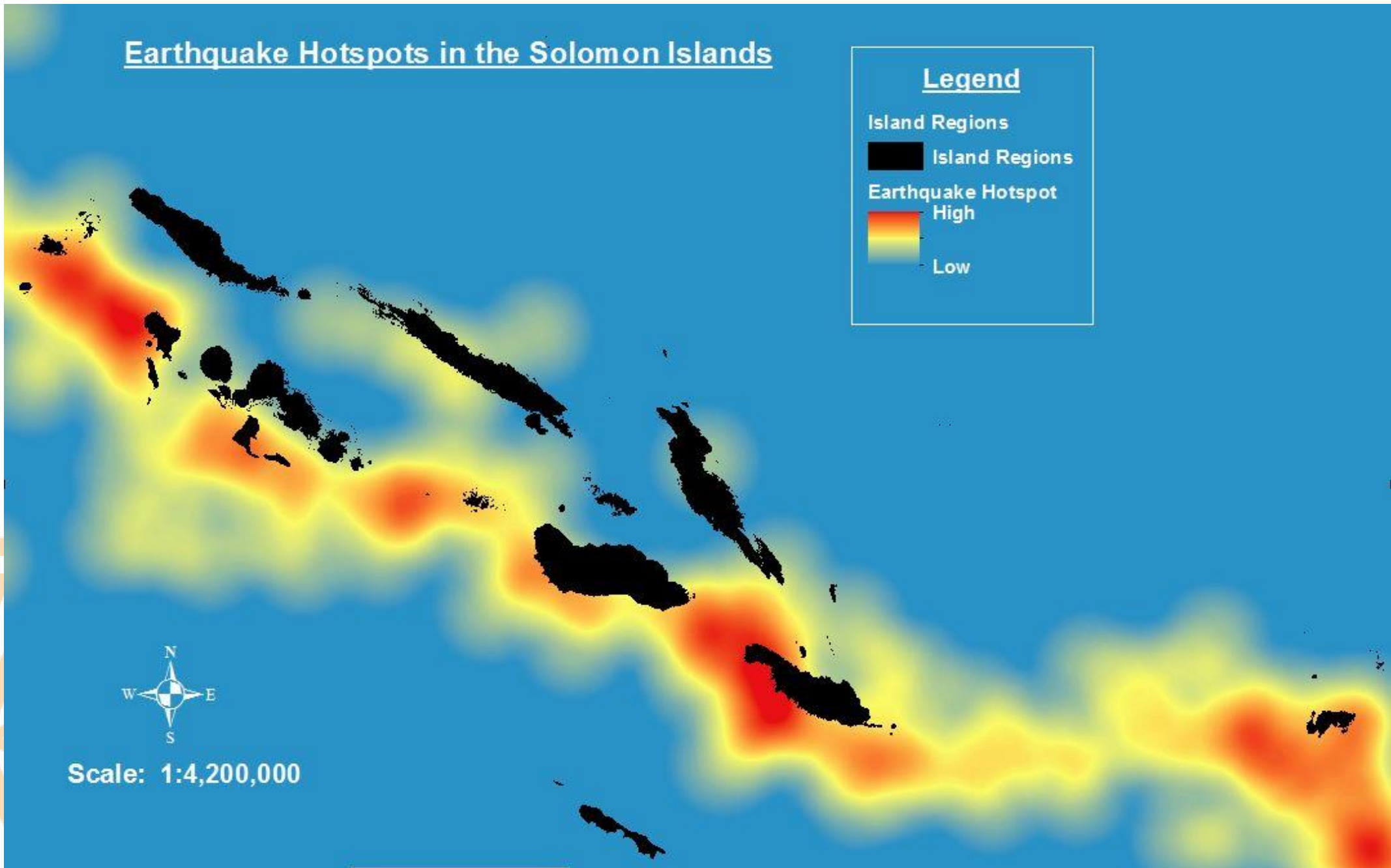
Earthquake Hazard Map

1 – Less affected

2 – Occasionally affected

3 – Frequently affected

Regions' Exposure to Tropical Cyclone

Map Legend

Island Regions

Exposure
High

Low

N
W E
S

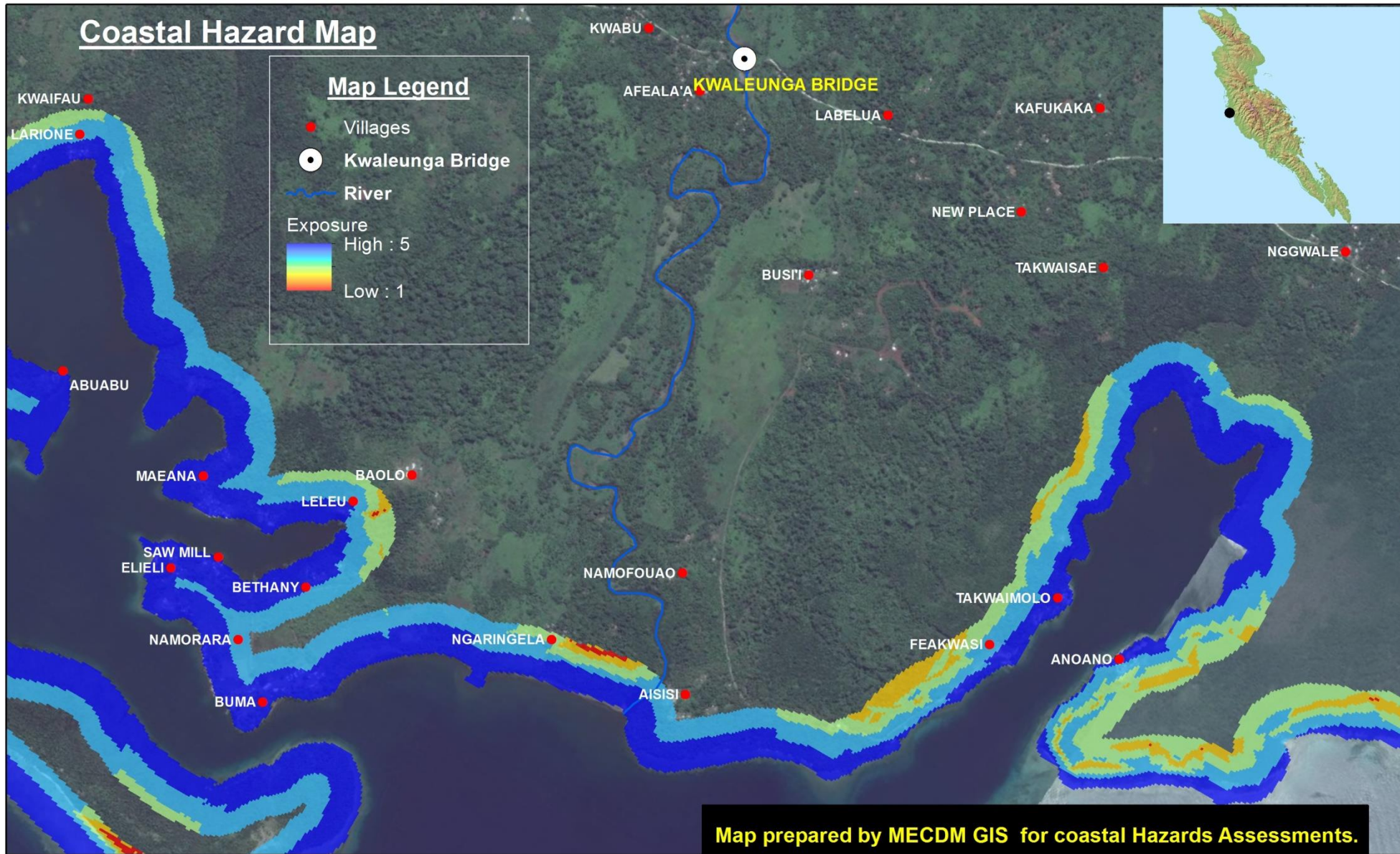0   75   150   225   300
Kilometres
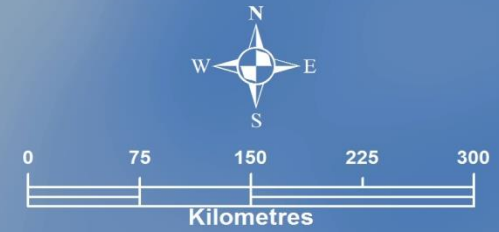
Note: This Map shows the locations
where most cyclones have frequently passed through
based on point density analysis of historical
Tropical Cyclone data.

MECDM GIS

## Map Representation

■ (green)	Island Regions
■ (blue)	Very Low
■ (grey-blue)	Low
■ (pale yellow)	Moderate
■ (orange)	High
■ (red)	Very High
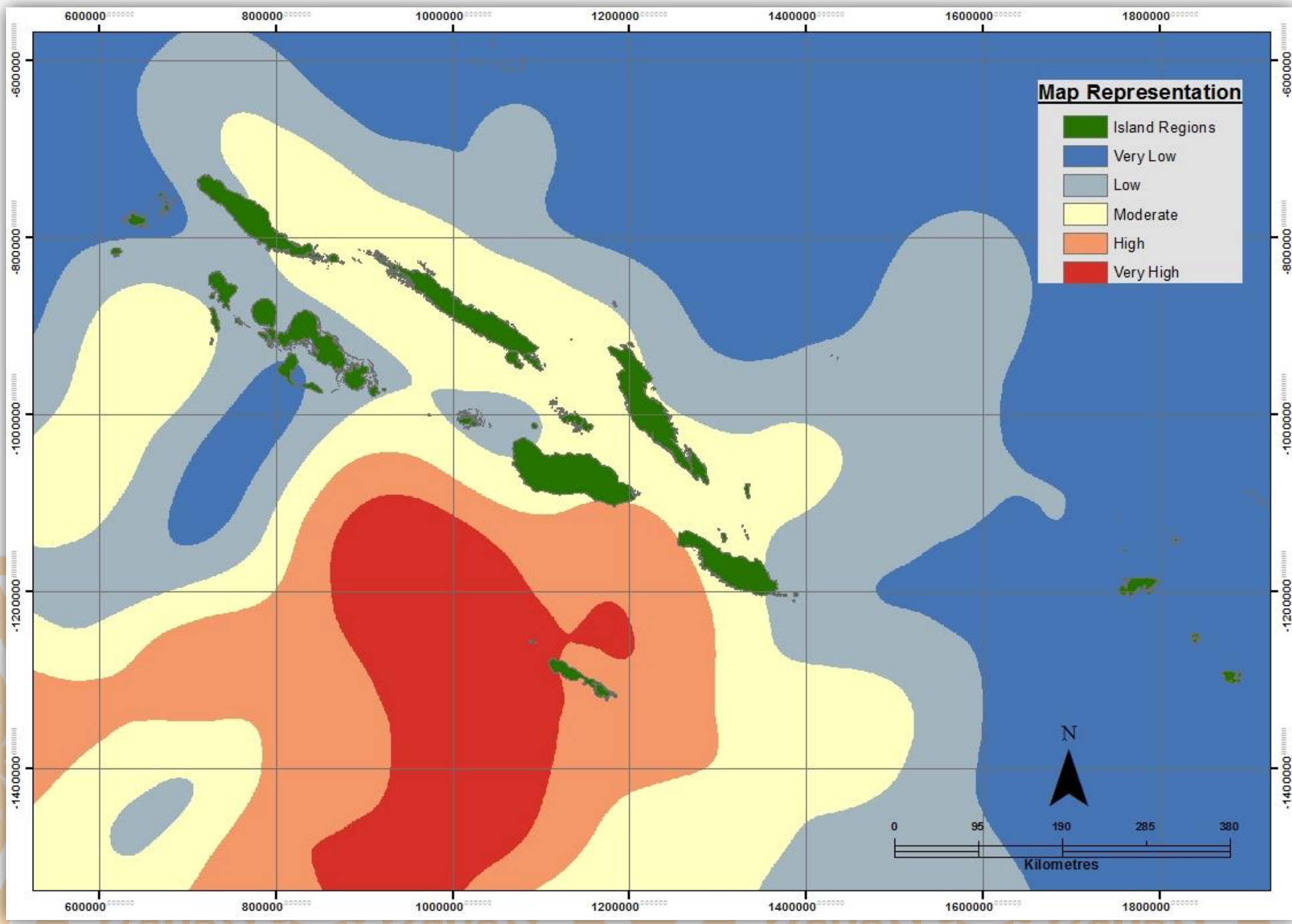
Coastal Hazard Map

Map Legend

- ● Villages
- ⊙ Kwaleunga Bridge
- ～ River

Exposure
High : 5
Low : 1

KWABU

⊙ KWALEUNGA BRIDGE

AFEALA'A

LABELUA

KAFUKAKA

KWAIFAU

LARIONE

NEW PLACE

NGGWALE

BUSI'I

TAKWAISAE

ABUABU

MAEANA

BAOLO

LELEU

SAW MILL

ELIELI

BETHANY

NAMOFOUAO

TAKWAIMOLO

NAMORARA

NGARINGELA

FEAKWASI

ANOANO

BUMA

AISISI

Map prepared by MECDM GIS for coastal Hazards Assessments.

Coordinate System: WGS 1984 UTM Zone 57S
Projection: Transverse Mercator
Datum: WGS 1984

1:20,000

| 0 | 0.375 | 0.75 | 1.125 | 1.5 |

Kilometers

N
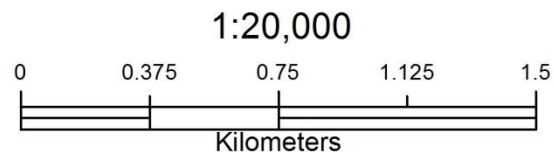
The map shows low-lying coastal areas that
are exposed to coastal hazards.

GIS Applications: Suitability Analysis for Riverine Flood Hazard

Table 1: Suitability Criteria

Elevation AMSL (Metres)	Slope steepness (degrees)	Distance from River (metres)	Descriptions	Vulnerability Scale
0 –50	0 – 3	0 – 50	Very high	5
50 – 100	3 – 6	50 – 60	High	4
100 – 150	6 – 9	60 – 70	Moderate	3
150 – 200	9 – 12	70 – 80	Low	2
Above 200	Above 12	beyond 80	Very low/None	1
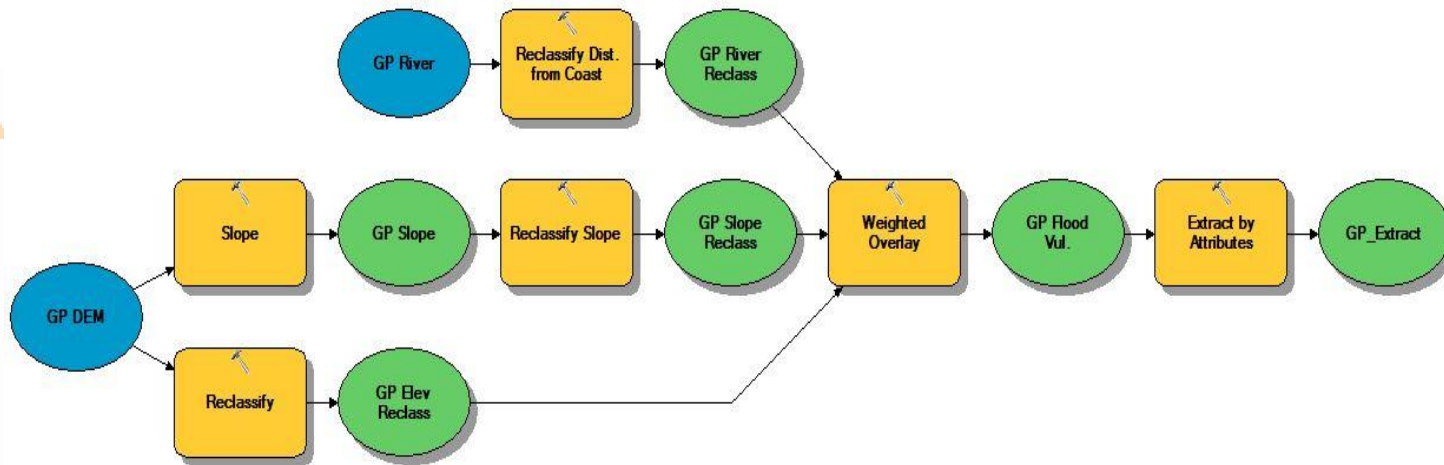
Fig 1: Geoprocessing using Model Builder

Flood Hazard Map of Fulo Bridge
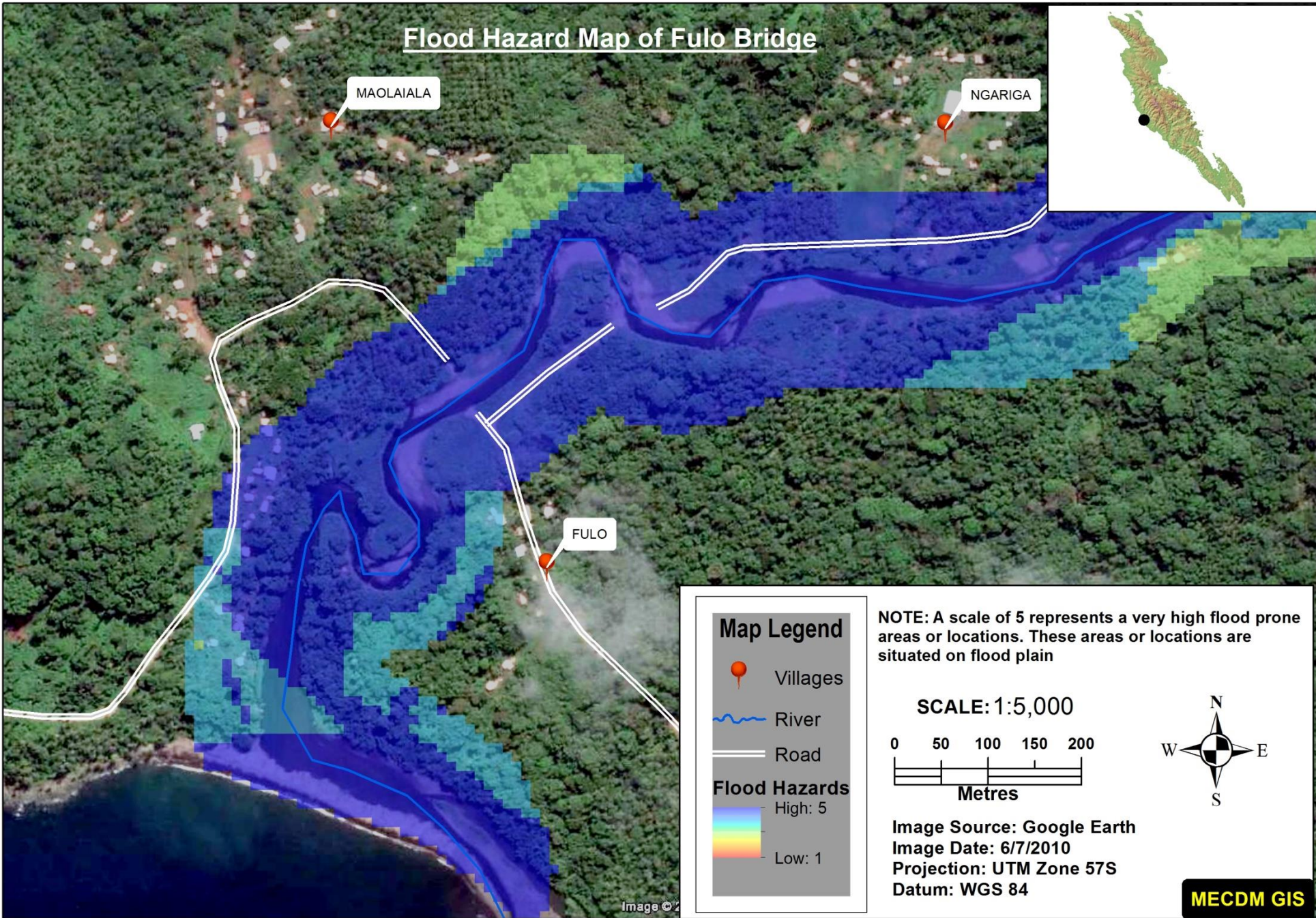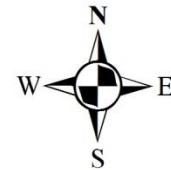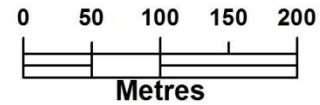
Mataniko Flash Flood: 3 Dimensional
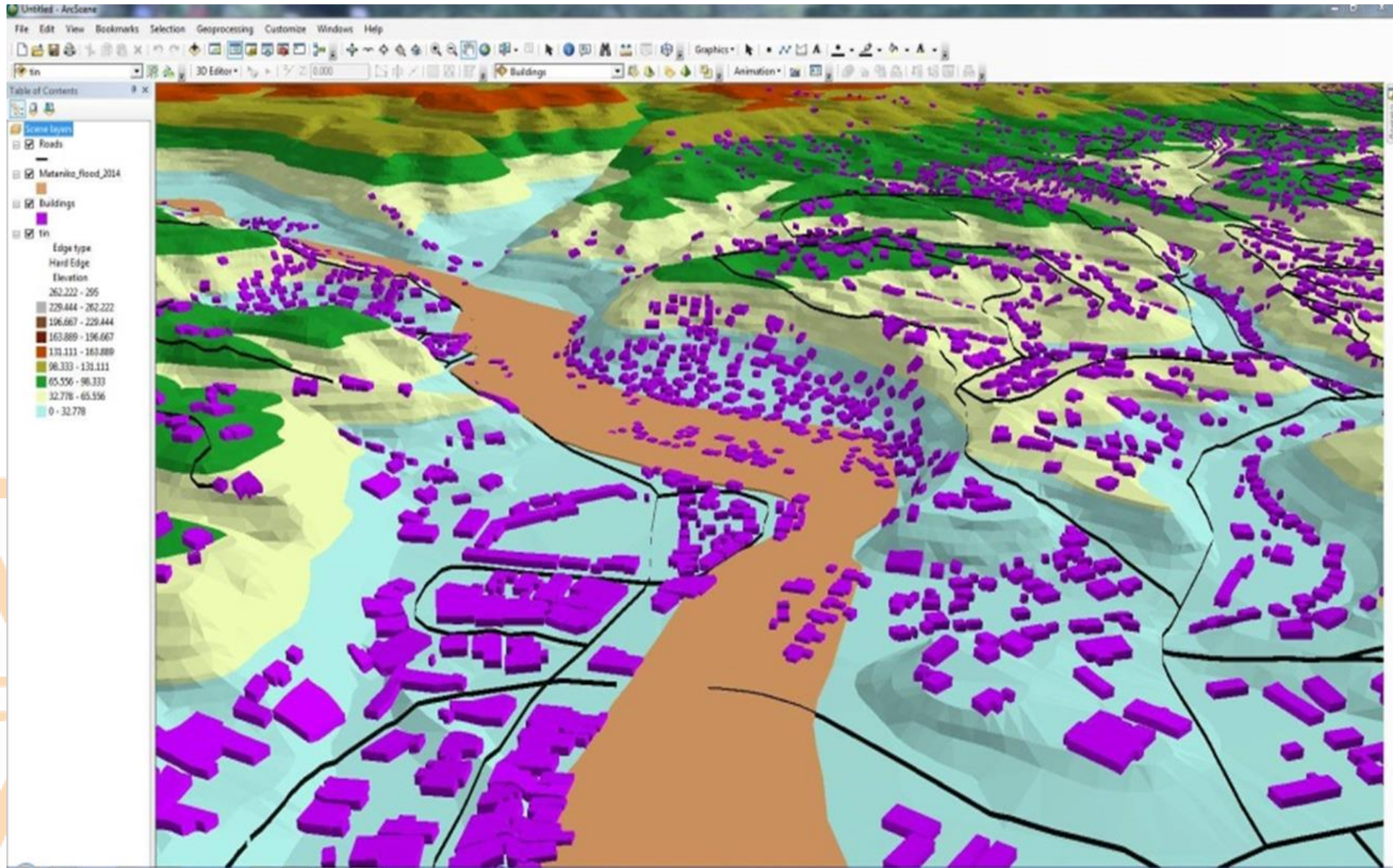
Sea Level Rise and Coastal Vulnerability
Gaito, Temotu Province
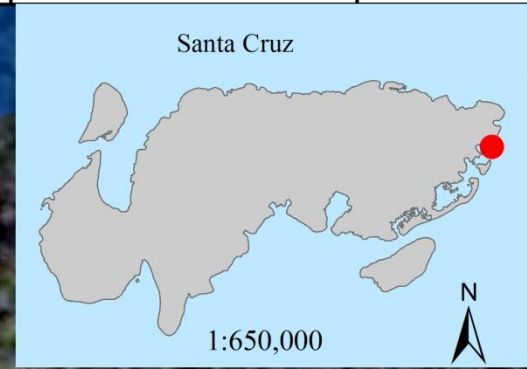
Santa Cruz

1:650,000

Current High Tidal Mark

Map Legend

Sports Field
Church
Buildings

Source of Imagery: Google Earth   Image Date:2/3/2003   Produced by MECDM GIS

Coordinate System: WGS 1984 UTM Zone 58S
Projection: Transverse Mercator
Datum: WGS 1984
Units: Meter

0   20   40   60   80
Metres

Sea Level Rise and Coastal Vulnerability
Gaito, Temotu Province

Santa Cruz

1:650,000

0.5m Projected SLR

Total Inundated Area = 0.8 Ha
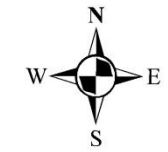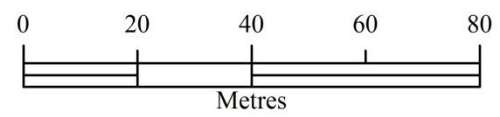
Map Legend

Sports Field
Church
Buildings

Source of Imagery: Google Earth   Image Date:2/3/2003   Produced by MECDM GIS

Coordinate System: WGS 1984 UTM Zone 58S
Projection: Transverse Mercator
Datum: WGS 1984
Units: Meter

0   20   40   60   80
Metres

Sea Level Rise and Coastal Vulnerability
Gaito, Temotu Province

Santa Cruz

1:650,000

Map Legend

Sports Field
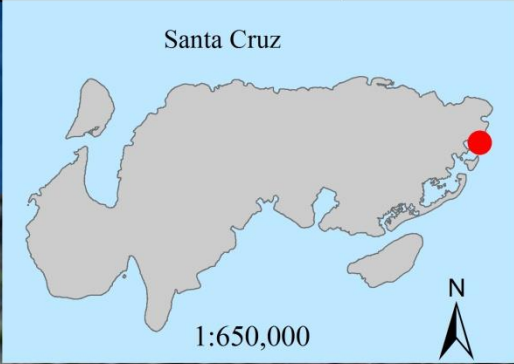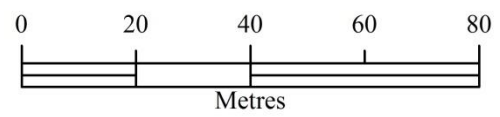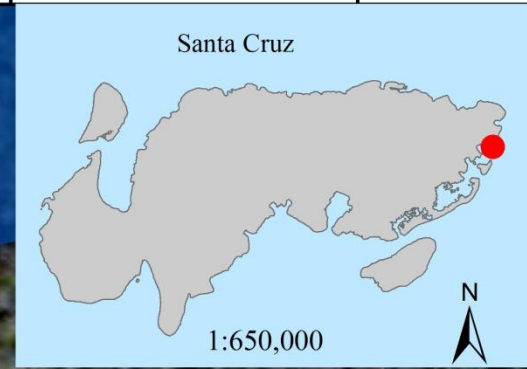Church
Buildings

1m Projected SLR

Total Inundated Area = 2 Ha

Source of Imagery: Google Earth   Image Date:2/3/2003   Produced by MECDM GIS

Coordinate System: WGS 1984 UTM Zone 58S
Projection: Transverse Mercator
Datum: WGS 1984
Units: Meter

0   20   40   60   80

Metres
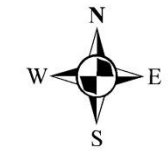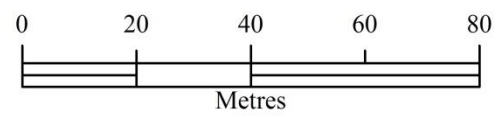
At Risk Settlements in Urban Areas
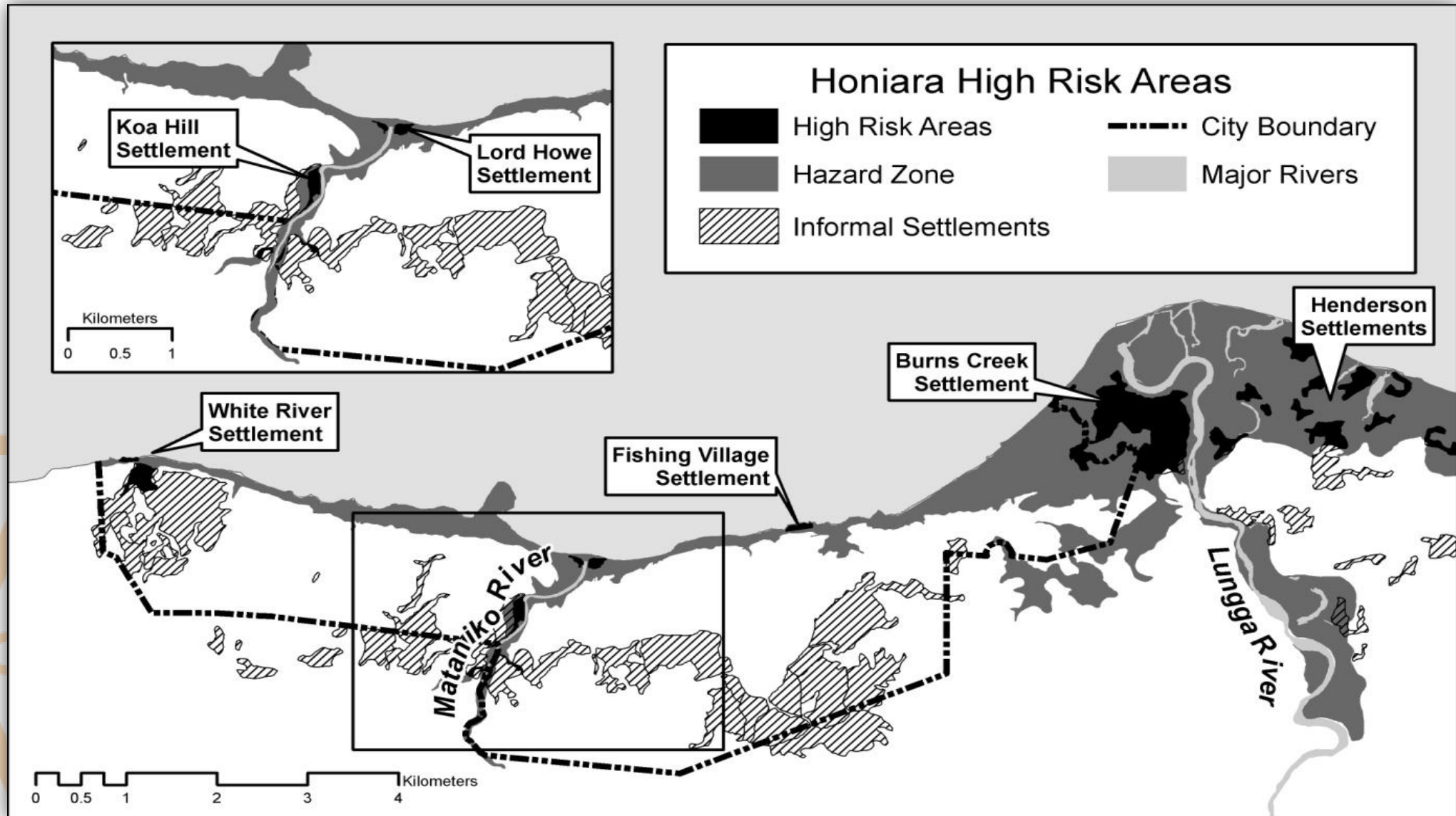
Landslide prone informal settlement areas
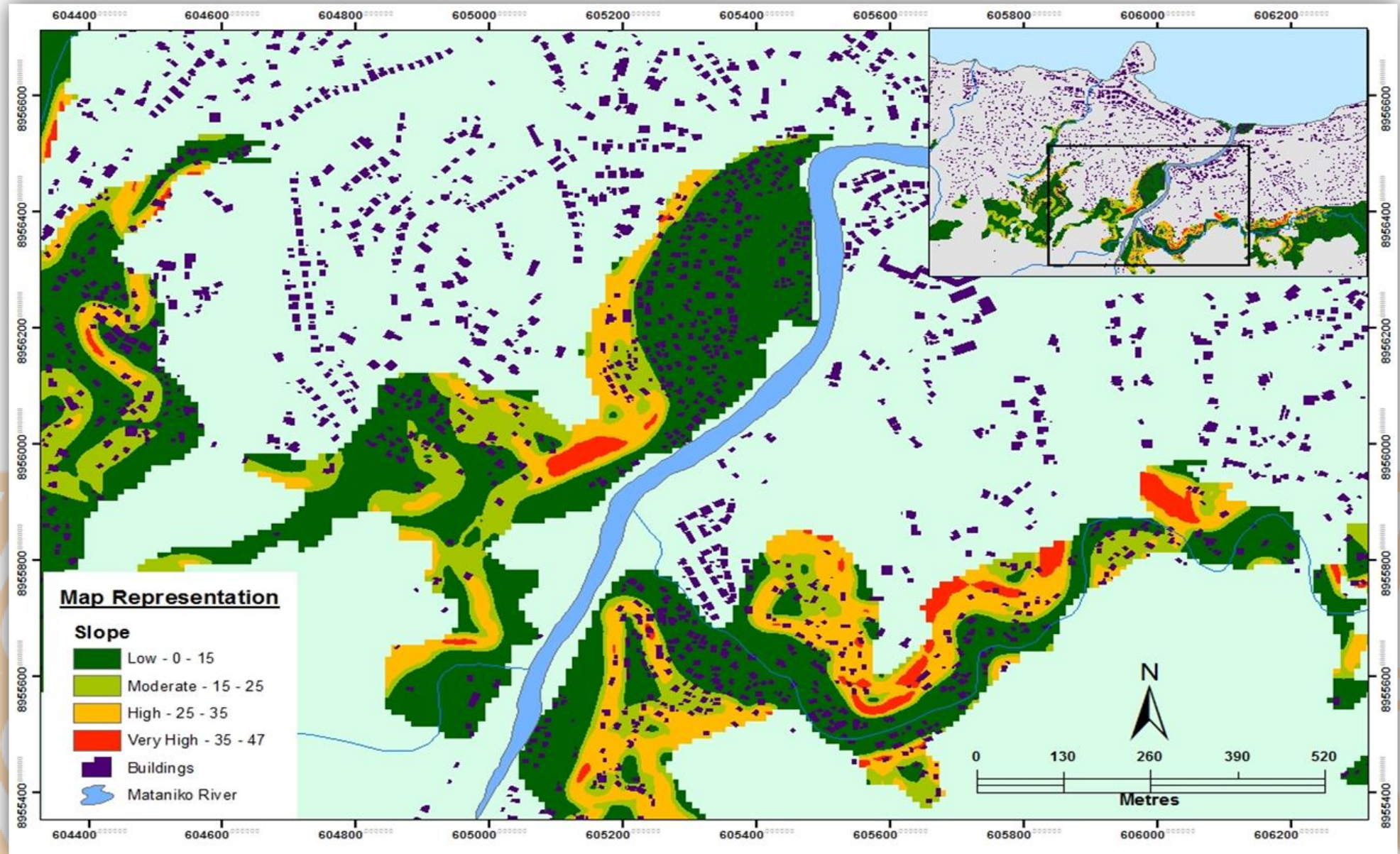
Environmental Assessment

Example: Application for a Logging Concession

i. The company need to provide area of operation

ii. Operation plan. E.g. Logged areas, skidding, Landing, log pond, bridges, tabu sites etc.

Assessment:

i. Operate within 400m Above MSL

ii. Operate within 0 - 30° slope's steepness.

iii. Streams: (a). More than 10m wide – 50m buffer; (b) less than 10m wide – 25m buffer.

iv. Tabu sites – 30m buffer.

v. Protected Areas

KTEL Proposed Timber Harvesting Operation Plan

Map Legend

⊙ Settlements	▬ Old Gravel Road
● Logpond	≈ Water Source
Ⓛ Log Landing	▭ Concession Boundary
⊠ Break Down Bridges/Culvert	Contour
≈ Rivers/Streams	▨ Tabu Site
Pipe Line	▨ Protected Steep Slope
╪ Proposed Road	▨ Logged Over Area
·–·– Skiddig Roads	▨ Proposed Timber Operation

Settlements (labels on map): KOLOTTANA, GHEMOHO, BISUANA, ILILI, ULONA SCHOOL, GASINI, MALAVARI, LOLOVURO, TANAPO, LIRE, PIJAKA, TAVOZO, BATUNA, RAKATA, LUMANAMBOLO

N
W — E
S

0	250	500	750	1,000

Metres

Map prepared by MECDM Geospatial to indicate
the 2016 timber harvesting plan outlined by KTEL
for the proposed timber harvesting operation plan
on Vangunu Island, Western Province

Western Province

N

0	20	40	60	80

Kilometres

Landslide Susceptibility Assessment on Proposed Timber Operation Area

Map Legend

Settlements		Old Gravel Road	
Logpond		Water Source	
Log Landing		Concession Boundary	
Break Down Bridges/Culvert		Contour	
Rivers/Streams		Tabu Site	
Pipe Line		Proposed Timber Operation	
Proposed Road			
Skiddig Roads			

Landslide Susceptibility

- VERY HIGH
- HIGH
- MODERATE

Map prepared by MECDM Geospatial to indicate locations where slope could become instable causing landslide base on slope analysis on Vangunu Island, Western Province.

KOLOTTANA
GHEMOHO
BISUANA
ILILI
ULONA SCHOOL
GASINI
MALAVARI
LOLOVURO
TANAPO
LIRE
PINAKA TAVOZO
BATUNA
RAKATA
LUMANAMBOLO

0 250 500 750 1,000
Metres

Western Province

0 20 40 60 80
Kilometres

Slope Steepness Analysis

Slope steepness (degree)	Description	Susceptibility Scale
Above 35	Very high	4
25 – 35	high	3
15 – 25	Moderate	2
8 – 15	Low	1

KTEL Proposed Timber Harvesting Operation in Relation to Protected Areas

Map Legend

★	Marine Protected Area	▥ (pink)	Tabu Site
◉	Settlements	▥ (dark green)	Protected Steep Slope
●	Logpond	▥ (yellow)	Logged Over Area
〰	Rivers/Streams	▥ (green)	Proposed Timber Operation

Vaininoturu Island

Marovo

SABULO

KAHAINI ISLAND
CHEA

Vena Island
VARATA
CHUPIKOPI MAHORO

RANO

RUKUTU
CHOE
PATUSEGHE
MAZIPA
BULEANI
TELINA
NOGARARINGI
ARA
THANA
KOLOTTANA
CHEKE
BETHEL
GHEMOHO
BISUANA
ILILI
MALAVARI
GASINI
LOLOVURO
TANAPO
LIRE

LILIHINA
RAKE
CHEARA
GEPAE
GOLDEN SPRING CAMP
PIJAKA
TAVOLO
RAKATA
TATABIRI
LUMANAMBOL
TUPANGA TOBULU
TOVIVI TUSU
DAKOLA SIARA
INILEANA KETOKETO

HIRUHOVE

AROVO CAMP KOKETE

KELE RIVER
VORIVORI

Metres

0   1,250   2,500   3,750   5,000

Map prepared by MECDM Geospatial to indicate Protected Areas within the proposed timber harvesting operation by KTEL on Vangunu Island, Western Province

Western Province

0   20   40   60   80
Kilometres

Landslide Susceptibility
Assessment

143-001-0011

Map Legend

Concession Area

Rivers

400m and AMSL

Streams

Landslide Susceptibility

VERY HIGH

HIGH

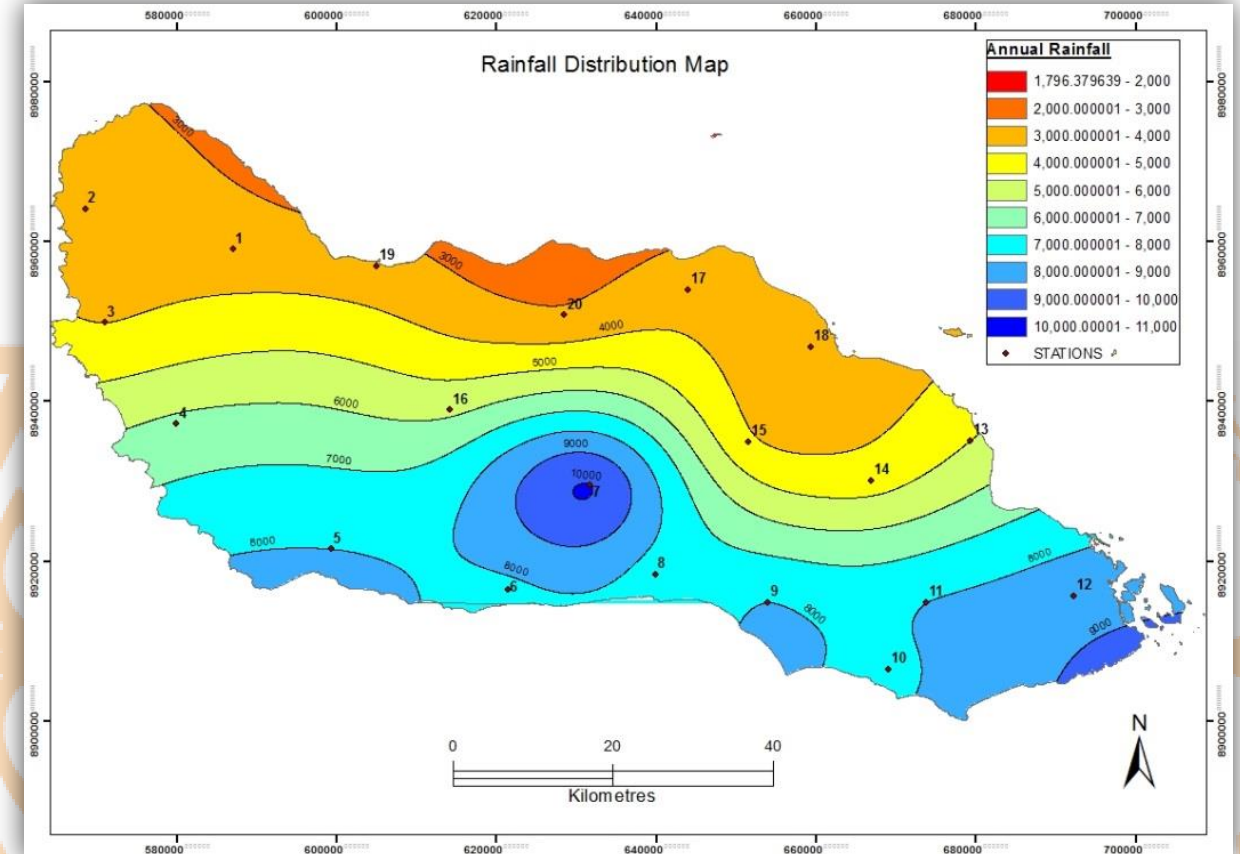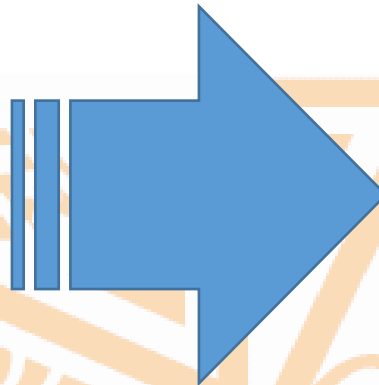MODERATE

LOW

N

0   1   2   3   4
Kilometres

**Vangunu Logging Concession
Area 143-001-0011**

What can be done in the future

Rainfall data from 20 stations

Spline interpolation applied to rainfall data

Summary

- Most of our activities centered around Hazards, Exposures, vulnerability and Risk Assessments.

- GIS contributes a lot to decision-making processes.

- GIS Services and products are available to Government Ministries, Partner Organizations and Stakeholders.

- Lack of data, limits GIS applications & analysis.

Thank You

Questions??