Republic of Fiji

PROJECT for Mainstreaming of Disaster Risk Reduction Project

Guideline on Earthquake Hazard / Risk Assess-ment

-Simplified GIS based estimation-

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JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

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Chapter 1. Introduction

1.1 Introduction

Fiji is located in disaster prone area due to its geographical, geological and demographic conditions. Flood occurs almost every year due to cyclone and front. There is also a risk of tsunami due to earthquake frequently occurring in the surrounding ocean. In addition to these hazards, vulnerabilities brought about by living in small, reclusive and remote island countries increase the disaster risk in Fiji. According to the World Risk Index 2018 released by UN University, Fiji is the 10th high-risk country among 171 countries in the world.

Fiji has a certain level of capacity for disaster response based on its experience with past disasters by coordinating related agencies from national to local levels. Furthermore, some efforts have been taken already for mainstreaming DRR and promoting the pre-investment for DRR by developing the "Fiji National Disaster Risk Reduction Plan (NDRRP) 2018-2019" based on international framework such as the Sendai Framework.

However, there are several challenges in the institutional framework for the development of national and local DRR plans, and for the implementation of DRR projects, in the hazard assessment, etc.

Based on this situation, the followings from the "Sendai Framework for Disaster Risk Reduction / SFDRR" are very important in Fiji.

1) Understanding disaster risk

2) Strengthening disaster risk governance to manage disaster risk

3) Investing in disaster risk reduction for resilience

4) Enhancing disaster preparedness for effective response, and to "Build Back Better" in recovery, rehabilitation and reconstruction

As mentioned above, it is necessary to clarify the earthquake hazards in order to understand the actual situation of the disasters and to implement appropriate measures against earthquake which causes great damage.

1.2 Overview of Earthquake Hazard / Risk Assessment

When an earthquake occurs, it has a tremendous impact on many people. It can cause damage to buildings and other structures and lifelines that people use every day. In this section, we will examine how much shaking will occur and how it will affect people under the assumption of a certain earthquake. Next, we will discuss a simplified method for predicting damage to structures. We will proceed in the following major steps.

1. estimate the ground motion of a scenario earthquake using empirical methods

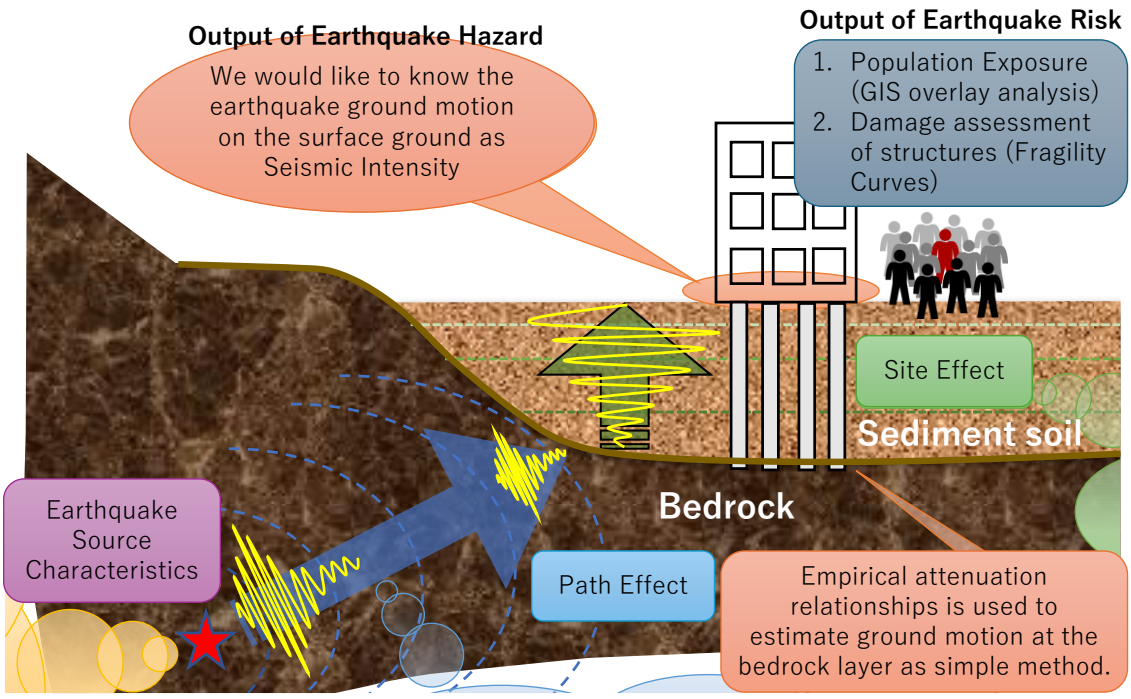
2. Identify the people who will be affected by a given earthquake ground motion

3. estimate the damage to structures in response to a given earthquake ground motion. (option in this activity)

The process of 1. consists largely of the "empirical attenuation relationship" and "ground amplification". The most difficult task is to estimate the magnitude of the earthquake, but as an item, it is treated as part of the empirical attenuation relationship.

Figure 1-1 shows an image for estimating earthquake ground motion and evaluating the population that will be affected and the structures that will be damaged due to earthquakes. The process 2 requires a population distribution to be processed. Fortunately, a detailed population distribution database in Geographic Information System (GIS) was available in Fiji, and we will use the GIS data.

On the other hand, to estimate the damage to structures in Process 3, we need to apply a damage function (Fragility Curves) that reflects the actual earthquake damage in the area. However, we were not able to obtain that information in this study. Therefore, this part is optional and only the methodology is presented in this guideline.



Source: JICA Project Team

Figure 1-1 Schematic diagram of outbreak mechanism of earthquake

1.3 Aims for Earthquake Hazard Risk Assessment

The following summarizes “How to use of "Earthquake Damage Assessment" for Earthquake Preparedness as a case in Japan” after discussion in the 1st High Level U.S. Japan Eathquake Policy Cooperation Forum.

1.3.1 Purpose of "Damage Assessment" and Status of Its Utilization

Earthquake damage estimation is carried out in response to various needs of implementers, and its policy objectives can be categorized into the following.

1. **Use for preventive measures, such as the development of earthquake-resistant facilities and urban development**
2. **Estimation and understanding of the demand for emergency measures**
3. Early estimation of damage immediately after an earthquake for the development of initial response systems, etc.
4. Setting the conditions for earthquake disaster prevention drills
5. Advance formulation of recovery and reconstruction plans
6. Education through publication of results, etc.

Of the above items, 1 and 2 are particularly important as proactive disaster prevention measures. The objectives and the status of their utilization of items 1 and 2 are outlined.

1) Use for preventive measures, such as building earthquake-resistant facilities and urban development

When promoting earthquake disaster prevention measures in the development of individual facilities and urban development, it is possible to identify areas where projects and regulations should be implemented with priority and focus by utilizing "local risk levels," etc., which assume the possibility of damage.

The effect of reducing damage by making individual buildings noncombustible and earthquake-resistant, and improving urban infrastructure such as streets and parks, can also be measured using the damage estimation method. For example, the earthquake damage to wooden buildings was reduced to 1/3 or less (at a maximum seismic velocity of 100kines) before and after the 1959 revision of the Building Standards, and the extent to which damage can be reduced by rebuilding or reinforcing can be clarified quantitatively and regionally through damage estimation.

The liquefaction map that the National Institute for Land and Infrastructure Management (NILIM) provides guidelines for is considered to be used as a reference for the construction of small-scale buildings such as residences and pipelines for lifelines, except for large-scale facilities for which detailed geological surveys are individually conducted at the time of construction.

In addition, the Tokyo Metropolitan Government is systematically promoting projects, such as the formulation of a "Disaster-Resistant City Development Promotion Plan (Development Plan)," which focuses on urban development in areas with dense wooden buildings and insufficient roads and parks, which were identified as areas with high risk of building collapse and fire in the "Regional Risk Level" survey. 2-2- Amount of demand for emergency measures

2) Estimation and understanding of the demand for emergency measures

While the regional hazard level assumption is mainly used for preventive measures, the "damage assumption" conducted by prefectures, etc., has been mainly used as the basis for the regional disaster prevention plan (a disaster prevention plan that prefectures and municipalities are legally obligated to prepare), including plans for stockpiling food, drinking water, blankets, temporary toilets, etc., and plans for securing evacuation sites, etc. The "damage assumptions" are used to calculate the demand for emergency measures as the basis for the preparation of disaster prevention plans (which prefectures, cities, towns, and villages are legally obligated to prepare).

Since the "damage assumptions" are used as the basis for measures involving financial measures, it cannot be said that there is no tendency to set the size of the assumed earthquake and the amount of damage as low as is feasible.

On the other hand, there is no validity in making assumptions that are impossible to deal with, and it is necessary to clarify the concept of damage assumptions and assumed conditions as much as possible, as well as the meaning of the measures to be implemented. If there is a disparity between the assumed results and the amount of response possible, it is also required to clarify it, thereby pointing out the need for separate measures, etc.

For example, the Tokyo Metropolitan Government estimated in its "Damage Assumption" conducted in 1997 that approximately 3.7 million people would have difficulty returning home due to transportation disruptions and other reasons. This is due to the structure of the Tokyo metropolitan area, which has an extremely large population that commutes to work, school, etc. over a wide area via the railroad network, etc. It is difficult to accommodate and protect these people who have difficulty returning home in public evacuation centers, and measures to alleviate the demand for accommodation by providing assistance at places of business and school, and by helping people return home, etc. are needed. Measures are being considered to reduce the demand for accommodating such people by providing support for them to return to their places of business, schools, etc.

Furthermore, the "damage assumptions" are used as the basis for formulating advance plans for individual disaster management organizations that will take emergency measures, such as plans for firefighting activities by fire departments and support activities by the Self-Defense Forces.

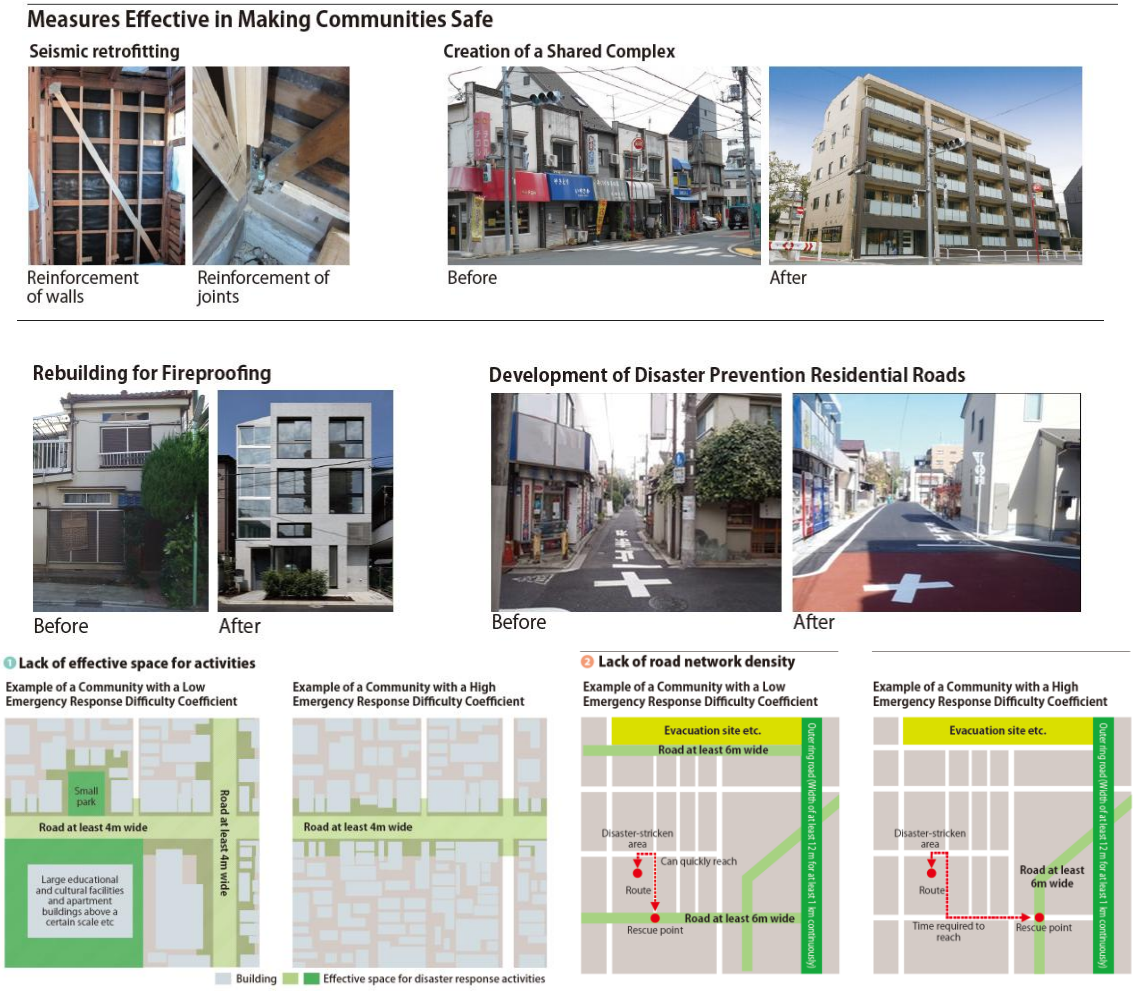


Figure 1-2 Earthquake DRR measures for individual buildings and urban planning (Your Community's Earthquake Risk of Tokyo Metropolitan Government, 2022)

1.4 Methodology of Earthquake Hazard / Risk Assessment

1.4.1 Earthquake Hazard

The hazard assessment of an earthquake is largely expressed by the following three characteristics as, "Source effects x Path effects x Site effects". Of these characteristics, the Source effects x Path effects is generally to evaluate using the attenuation equation of the distance from seismic fault to the site or base rock. And the Site effects is evaluated by the amplification factor of the maximum amplitude of the strong motion waveform record according to the ground type. Figure 1-1 shows its outline. In the figure, Earthquake Source Characteristics (in other words called “Source Effect”) is important factor to the target area. In a simplified method, attenuation relationship is applied to Source and Path effects. as, and Site correspond to the Site effects. As a simple method for evaluating the Site effects, an empirical method is generally used in which the ground model is evaluated by the average shear-wave velocity down to a depth of 30 meters (Vs30).

The following parts are main body of simple earthquake hazard assessment.

- Earthquake Source Characteristics: (longitude, latitude, depth) of hypocenter of an earthquake, magnitude
- Attenuation Relationships: source characteristics and distance from hypocenter to the target area
- Amplification factor: Vs30 (average shear-wave velocity down to a depth of 30 meters) is used as an index of ground conditions.

1.4.2 Earthquake Risk

Earthquake risk is not meant to be a probabilistic risk, but rather the damage itself. The simplest assessment is how many people will be exposed to earthquake shaking. If structures and lifelines are distributed in the area, it can be inferred that the earthquake shaking will cause damage. While the former can be evaluated by GIS through superimposed analysis, the latter requires an empirical method to evaluate the extent of damage. The latter method, called a damage function or fragility curves, is generally constructed by comparing statistics on earthquake damage in the region or country in question with information on the seismic intensity of earthquakes. (This Guideline only describes the method.)

- Population Exposure to Seismic Intensity
- Damage estimation using Fragility Curves

1.4.3 Selecting methods and Tool to calculate Earthquake Hazard and Risk

There are many hazard / risk assessment methods for earthquake hazard and risk assessment. In the project, some simplified empirical methods are applied because of limitation of scientific parameters in the field of seismology, limitation of database of soil / ground condition, and limitation of research result on past earthquake disasters / earthquake engineering field.

In another words, we introduce the simplified empirical hazard and risk assessment using limited database of natural and social environment. In an environment of limited scientific data and research results, simple empirical methods can be very effective.

In order to conduct a combination of simplified empirical methods, a standard GIS application and GIS database is applied.

The above methods are basically conducted by any standard GIS. If you understand the basic idea of methods, any kind of GIS is available. Here, in the guidelines, Arc GIS Desktop (Arc Map) is used. Recently, it is upgraded to Arc GIS Pro. But basic concept is the same as previous versions.

1.5 Methods of Earthquake Hazard Assessment

Some empirical methods for the earthquake engineering field, we will quote technical research result.

There are many hazard / risk assessment methods for each type of disaster, from simplified methods based on past disaster records to advanced methods based on simulations.

1.5.1 Case study of Attenuation Relationships

1) Si and Midorikawa (1999)

The following attenuation relationships is one of the worldwide famous research results.

- Attenuation equation to estimate PGV, PGA at the engineering bedrock [Si and Midorikawa (1999)] is popular. The parameter, relation, and fault type are shown in the following table and figures.
- What data is needed to apply this distance attenuation formula? The fault type of the scenario earthquake must be determined. You will also need to set the size and location of the fault model. For those settings, it is necessary to provide a scientific basis, and it is desirable to have observational records and research results on past earthquakes that caused damage.
- Attenuation Equation is following,

$\log A = b - \log (X + c) - kX$ or $\log A = b - \log X_{eq} - kX_{eq}$

here, A: peak value of ground motion, X: nearest distance from fault(km)、Xeq: equivalent distance from fault (km)

$b = a\,Mw + h\,D + di + e$, $c = 0.0055 \times 100.50Mw$ (PGA), $c = 0.0028 \times 100.50Mw$ (PGV)

Table 1-1 Parameters of attenuation equation by Si and Midorikawa (1999)
(left) nearest fault distance, (right)equivalent fault distance

a	h	d			e
		Crustal	Inter-plate	Intra-plate	
Peak ground acceleration					
0.50	0.0043	0.00	0.01	0.22	0.61
Peak ground velocity					
0.58	0.0038	0.00	-0.02	0.12	-1.29

a	h	d			e
		Crustal	Inter-plate	Intra-plate	
Peak ground acceleration					
0.50	0.0036	0.00	0.09	0.28	0.60
Peak ground velocity					
0.58	0.0031	0.00	0.06	0.16	-1.25

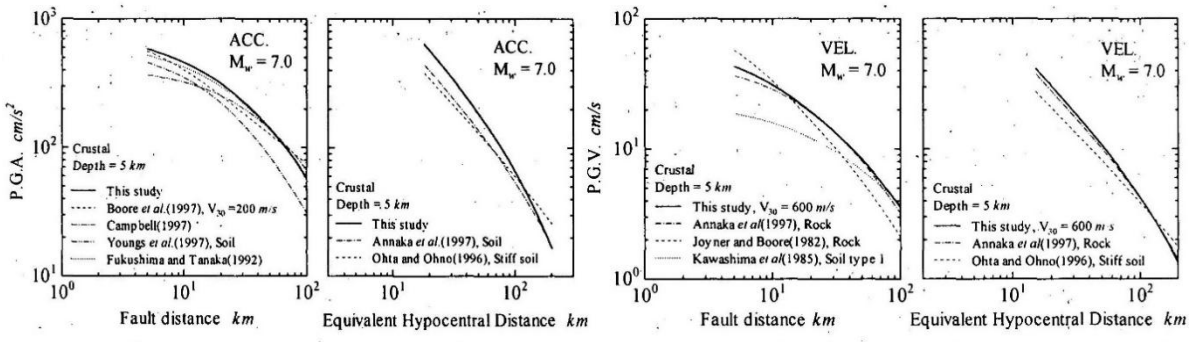


Figure 1-3 Relation of attenuation equation [Si and Midorikawa (1999)] with PGA (left) and PGV (right)

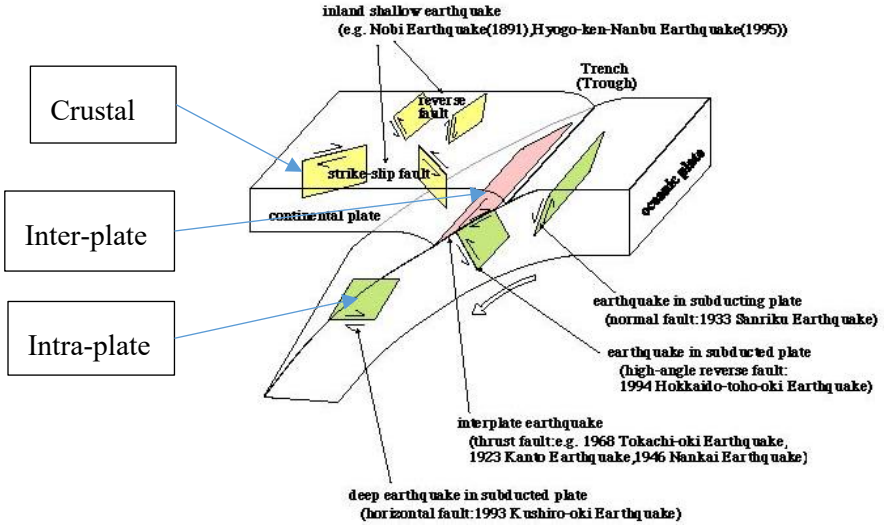


Figure 1-4 Fault type in the attenuation equation of Si and Midorikawa (1999)

2) Joyner and Boore (1982)

One of the simplest equation is proposed by Joyner and Boore (1982)[1]. A study on The equation is as follows.

$$\log y = \alpha + \beta (M - 6) + \gamma (M-6) \wedge 2 - p \log r + b\, r + c\, S$$

where M : moment magnitude, $r = (d^2 + h^2)^{1/2}$: distance from hypocentre (km)

	α	β	γ	p	b	c	S
PGV (cm/s)	2.17	0.49	0	1	-0.0026	0.17	0
PGA (g)	0.49	0.23	0	1	-0.0027	0	0

d: closest distance from the recording site to the vertical projection on the earth's surface, h: depth of hypocentre, S: 0 for a rock site and 1 for a soil site

1.5.2 Case study of Amplification Factor

1) A simple formula using Vs30

Amplification factor from bedrock to surface ground：Empirical equation to estimate ground amplification factor using the average shea wave velocity down to 30-meter depth (AVS30, Vs30)

[the following equation is popular for peak ground acceleration (PGV).]

- Midorikawa et al. (1994)[2] $\log R = 1.83 - 0.66 \log AVS30$
- Fujimoto and Midorikawa (2006)[3] $\log amp_pgv = 2.367 - 0.852 \log AVS30 \pm 0.166$

[1] Joyner W. B. and Boore D. M. (1982): Prediction of Earthquake Response Spectra, Open-file Report 82-977, 16pp, U.S.Geological Survey.

[2] Midorikawa, S., Matsuoka, M. and Sakugawa, K. (1994): Site Effects on Strong Motion Records Observed during the 1987 Chiba-ken-toho-oki, Japan Earthquake, Proc. Ninth Japan Earthquake Engineering Symposium, 3, 85-90.

[3] Fujimoto, K. and Midorikawa, S. (2006): Relationship between Average Shear-Wave Velocity and Site Amplification Inferred from Strong Motion Records at Nearby Station Pairs, Journal of JAEE, 6, 1, pp.11-22. (in Japanese)

Especially for PGA, the equation is $\log R = 1.35 - 0.47 \log V$ [Midorikawa et al.,1994][4]

An equation to estimate amplification factor for peak ground acceleration (PGA) is the following,

$$\log R = a \cdot \log V + b \pm \sigma$$

R : amplificat ion factor to Tertiary ground

V : average shear - wave velocity to a depth of 30 m (m/sec)

σ : standard deviation

Table 4.1.1 Coefficients

T (s)	a	b	σ
Absolute Acc. Response			
0.1	-0.30	0.79	0.20
0.15	-0.24	0.71	0.22
0.2	-0.35	0.98	0.22
0.3	-0.48	1.28	0.19
0.4	-0.53	1.48	0.23
0.5	-0.56	1.48	0.21
0.6	-0.62	1.68	0.21
0.7	-0.73	1.98	0.16
0.8	-0.81	2.17	0.15
1.0	-0.87	2.34	0.18
1.5	-0.54	1.48	0.18
2.0	-0.44	1.18	0.20
3.0	-0.52	1.48	0.20
Peak Ground Acc.			
-	-0.47	1.35	0.18
Peak Ground Velocity			
-	-0.66	1.83	0.16

In the guideline, the above equation is adopted as an simple method to estimate ground amplification factor to PGA.

Estimated PGV or PGA will be converted to JMA Intensity by the following equation (one example)

- Equation to estimate instrumental seismic intensity from peak ground velocity (PGV) and peak ground acceleration (PGA) [Tong and Yamazaki (1996)][5]

  $I = 2.30 + 2.01 \log PGV$

  $I = 0.59 + 1.89 \log PGA$

2) Method using Geomorphologic classification map and Vs30

Bedrock – Surface: Estimating Amplification factor by Vs30 based on geomorphological classification

It quotes Midorikawa and Matsuoka (1995)[6], where the equation to estimate ARV (amplification factor to maximum velocity) from Vs30 (AVS). Another important equation to estimate Vs30 (AVS) using parameters including elevation, distance from rivers in geomorphological classification is also described in it. Simple estimation chart for amplification factor using grid-based whole Japan geomorphological classification data[7] is proposed. It is based on combination some research results and self-study. Figure 1-5 shows flow to estimate amplification factor to each geomorphological classification.

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4 Midorikawa, S., Matsuoka, M. and Sakugawa, K. (1994): Site Effectson on Strong Motion Records Observed during the 1987 Chiba-ken-toho-oki, Japan Earthquake, Proc. Ninth Japan Earthquake Engineering Symposium, 3, 85-90.

5 Tong, H. and Yamazaki, F. (1996): Relationship between Ground Motion Indices and New JMA Seismic Intensity, Monthly journal of the Institute of Industrial Science, Vol.48, No.11, pp.31-34. (in Japanese)

6 Midorikawa, S. and Matsuoka, M. (1995): GIS-Based Integrated Seismic Hazard Evaluation using the Digital National Land Information, BUTSURI-TANSA, Vol. 48, No. 6, pp.519-529.

7 Wakamatsu, K., Matsuoka, M., Kubo, S., Hasegawa, K., and Sugiura, M. (2004): Development of GIS-Based Japan Engineering Geomorphologic Classification Map, Journal of JSCE, No. 759, pp.213-232.

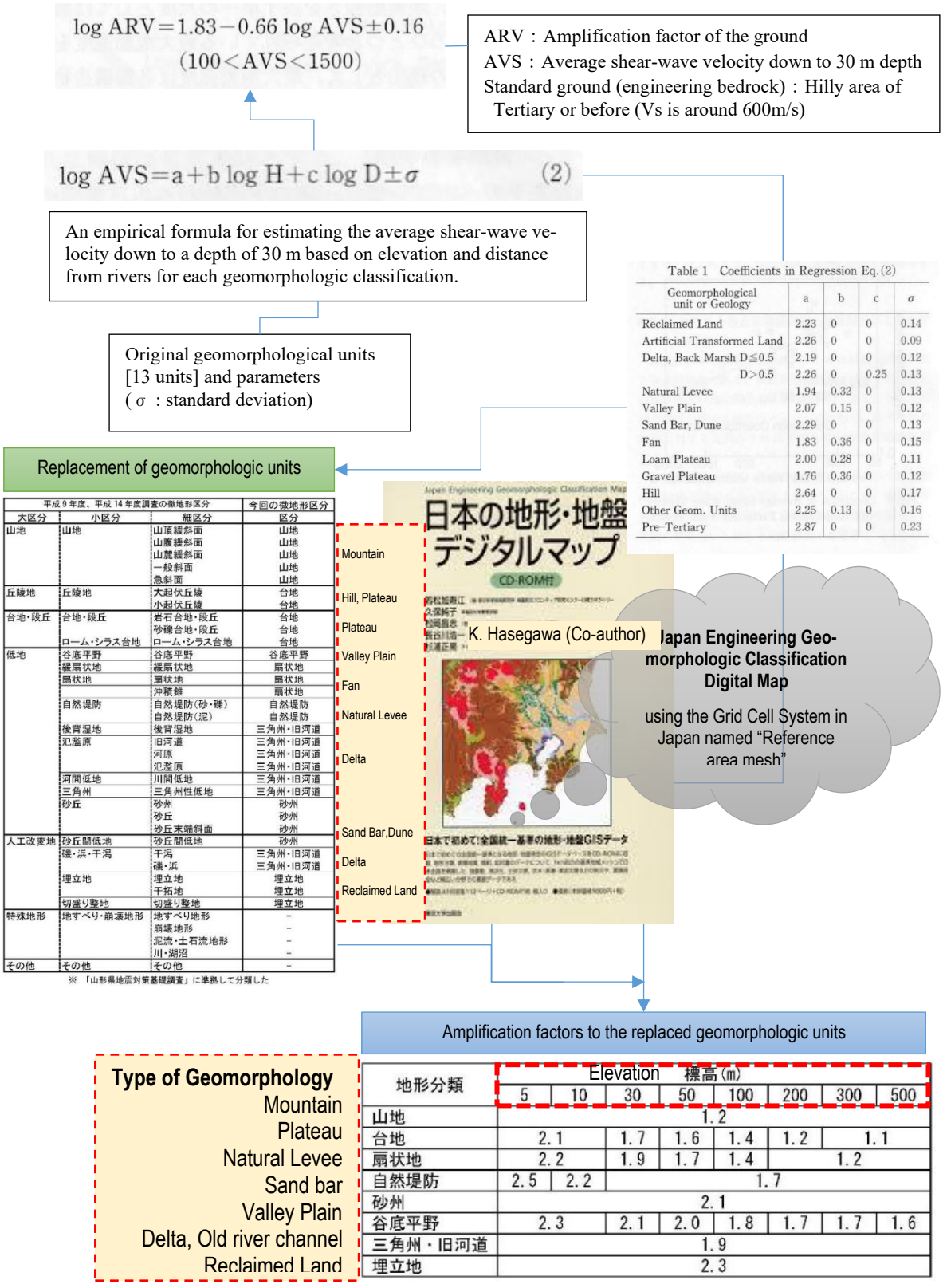

Figure 1-5 Flow for estimation of amplification factor based on geomorphologic classifications. (Japan Engineering Geomorphologic Classification Map[8])

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8 Wakamatsu, K., Matsuoka, M., Kubo, S., Hasegawa, K., and Sugiura, M. (2005): Japan Engineering Geomorphologic Classification Map (JEGM), The University of Tokyo Press, https://ndl-search.ndl.go.jp/books/R100000136-I1130282270458892672.

Chapter 2. Earthquake Hazard Assessment

2.1 Overview

Basically, a scenario earthquake is defined as an earthquake that has a large risk of occurring in a certain area. Then, using an empirical method, the attenuation relationship for earthquake ground motion is used to calculate the earthquake shaking on a relatively hard rock layer, called the engineering bedrock. This process includes earthquake source characteristics and path effect empirically.

Furthermore, we estimate the earthquake shaking at the ground surface by taking into account the soil amplification factor of the ground. It is called "Site effect". An empirical method using Vs30, an index of ground condition is used, which is popular worldwide as a simple amplification factor of the ground.

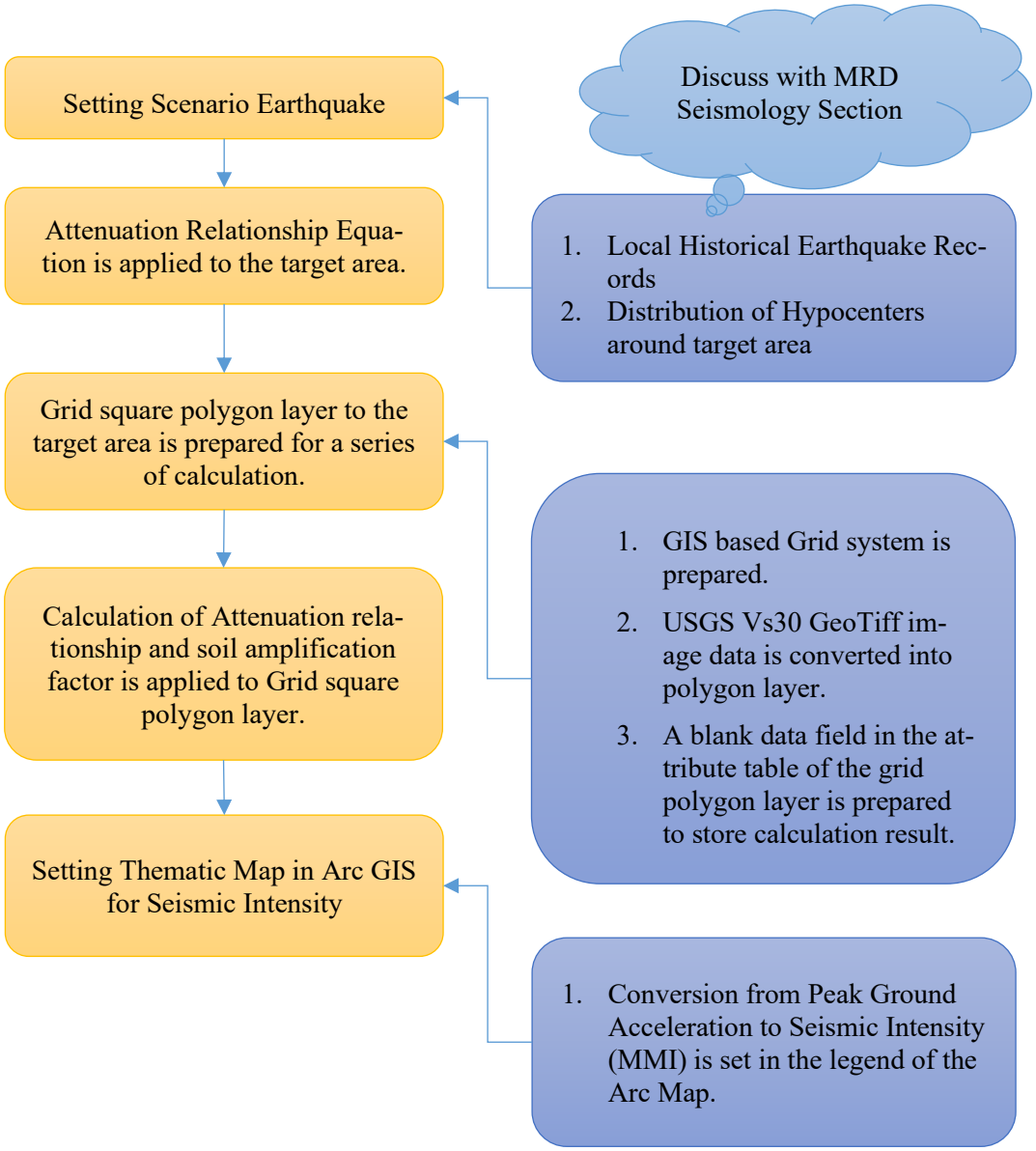


Figure 2-1 Flow of earthquake hazard assessment

2.2 Setting Scenario Earthquakes

It is usually important to identify past damaging earthquakes that have occurred for a given set area. Then, an earthquake of a level equivalent to the size of the earthquake that caused the most damage is assumed. At the same time, the location of the earthquake should be confirmed. Past earthquake records can be found, for example, by consulting the websites of global and official professional organizations such as the U.S. Geological Survey (USGS). We will not discuss in depth the magnitude and location of earthquakes here. On the other hand, probabilistic seismic motion maps provided in building codes can be considered as one of the reference cases to evaluate the likelihood of earthquake occurrence. It should be noted, however, that these maps usually do not take into account the amplification of the ground. (Advanced consideration: Building codes often set amplification factors for each simple ground type. However, in some cases, where those ground types are distributed may differ from the more detailed ground amplification. In the next section, "Ground Amplification," we will show the use of data on ground amplification provided by the USGS, a global public agency.)

2.2.1 To understand the overall seismic activity in and around Fiji

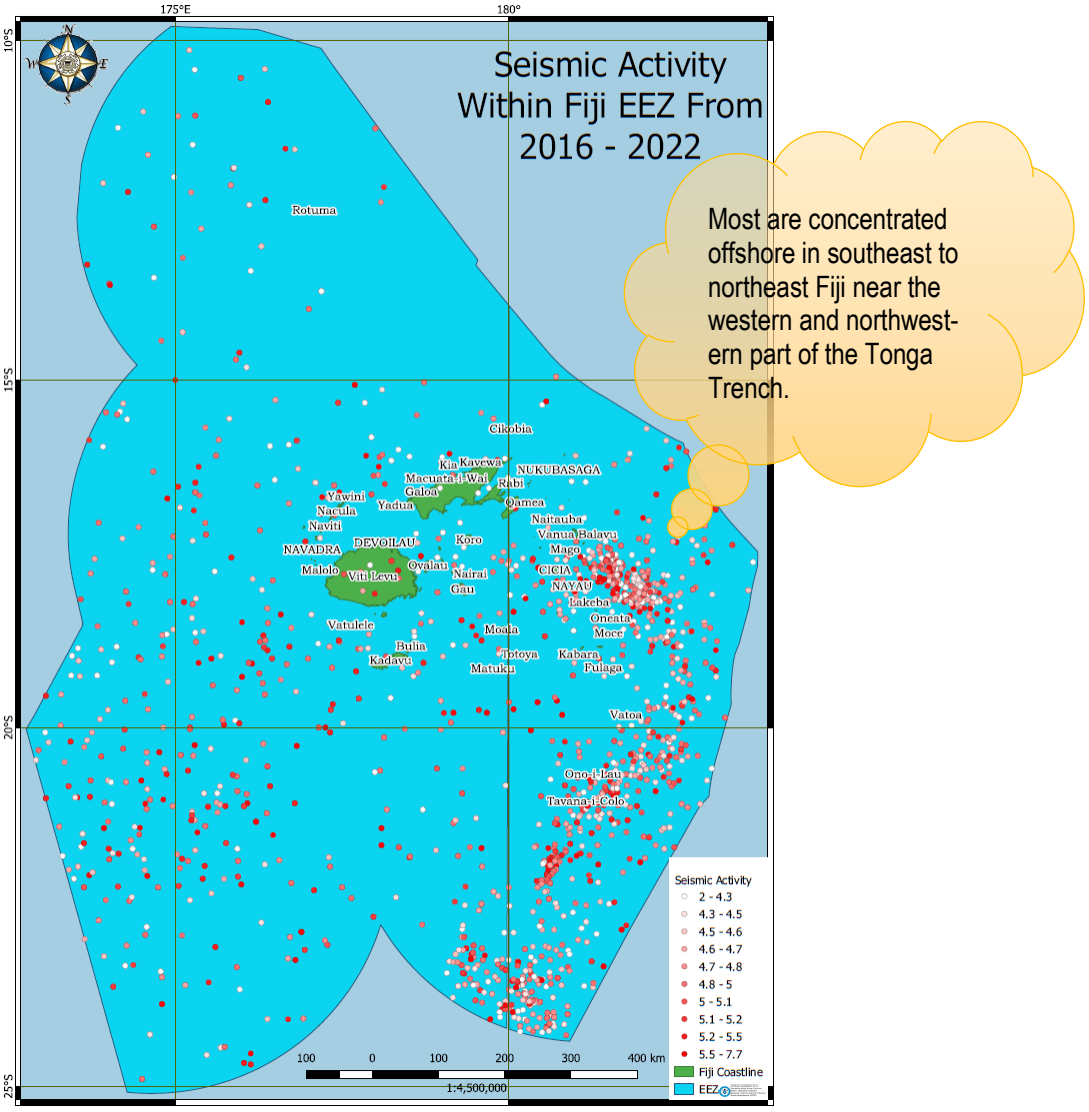


Figure 2-2 Seismic Activity in and around Fiji Islands during 2016 – 2022 (source: MRD)

The above figure shows recent seismic activity in and around Fiji Islands. From this map your will find that most are concentrated offshore in southeast to northeast Fiji near the western and

northwest-ern part of the Tonga Trench. Major ongoing movement of the plate boundary of the Fiji microplate, as well as movement along the subduction zones of Tonga and Vanuatu.

The figure below is an epicenter distribution map prepared by the U.S. Geological Survey. The period is 1900-2016, the magnitude is set above 5.5, and the symbol size of the epicenter is divided according to magnitude. In addition, the map is color-coded based on the classification of epicenter depth (0-70 km, 70-300 km, and deeper than 300 km).

As a way of looking at the figure, it is necessary to consider, for example, that even for an earthquake with a large symbol size (i.e., a large magnitude epicenter), the deeper the epicenter depth, the less significant the intensity at the ground surface.

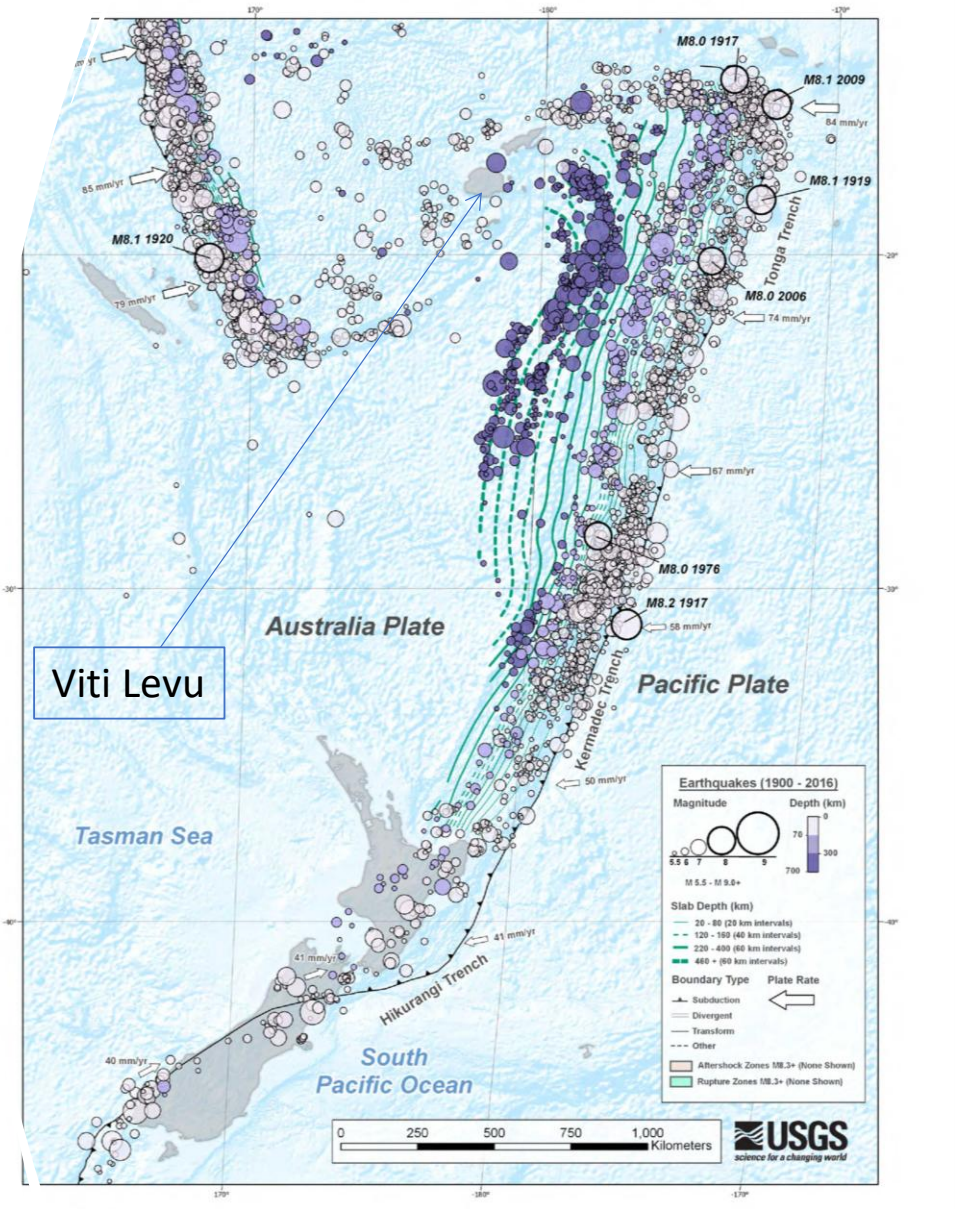


Figure 2-3 Seismic Activity (M 5.5 – 9.0) in a wide area during 1900 – 2016 (source: USGS)

2.2.2 To get an overview of seismic activity by zone

Five major epicentral zones are shown in the figure below, taking into account the major progression of the plate boundary around Fiji and the influence of subduction zones.According to the MRD Seismology Section, using Nadi as the pilot site, the scenario for considering tsunami and earthquake hazards It is recommended that the WVLZ (mainly west of Viti Levu Island) and FFZ (mainly north of Viti Levu Island) zones be established as the epicenters for earthquakes.

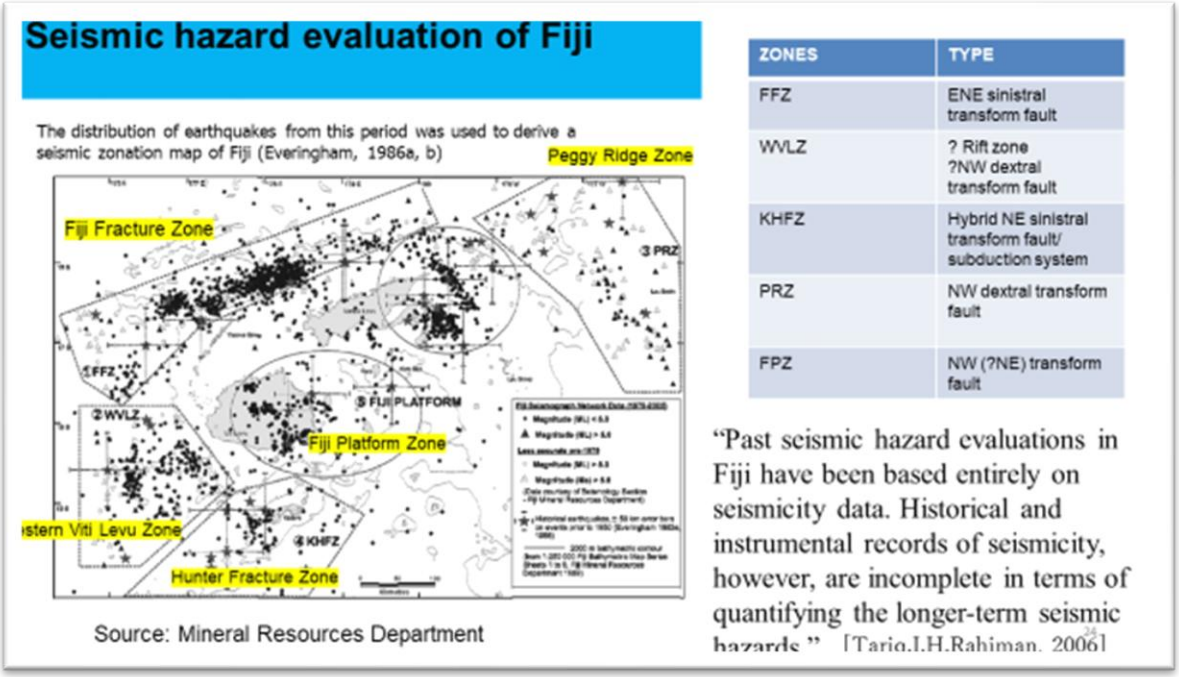
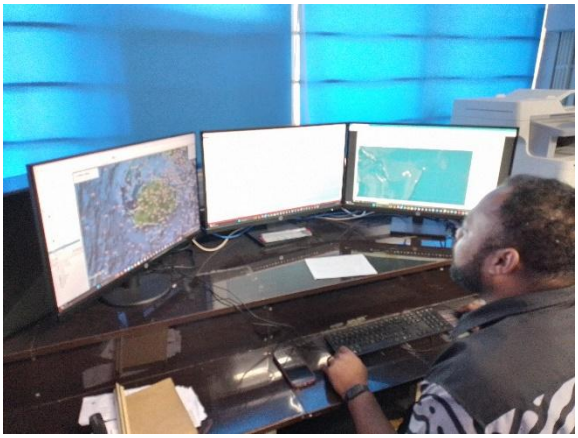


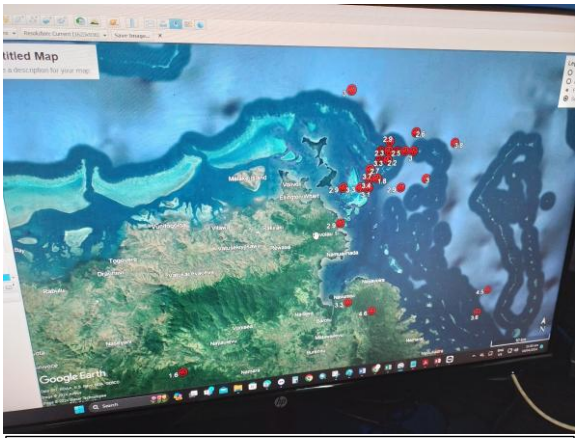
Figure 2-4 Seismic Zones in and around Fiji Islands (source: MRD)

2.2.3 Update latest information of seismic activity

MRD Seismology Section has been observing earthquake event 24 hours. They monitor the seismic waveforms that are transmitted from time to time online from the seismographs. Such observations allow us to accumulate up-to-date seismic activity data, and we can use these data to make assumptions about scenario earthquakes.



Monitoring work by MRD Seismology staff



Some earthquakes occurred around Rakiraki

Figure 2-5 Monitoring latest seismic activity in local level by MRD Seismology Section

2.2.4 Consult with experts to determine earthquake scenarios

For setting a local level earthquake scenario, such seismic hazard information might be handled as a sensitive information. It would be good for NDMO to discuss on this topic with MRD Seismology Section, as a technical partner. The staff of MRD has information of lates earthquake observation and historical records in and around Fiji. The following shows steps how to discuss setting scenarios.

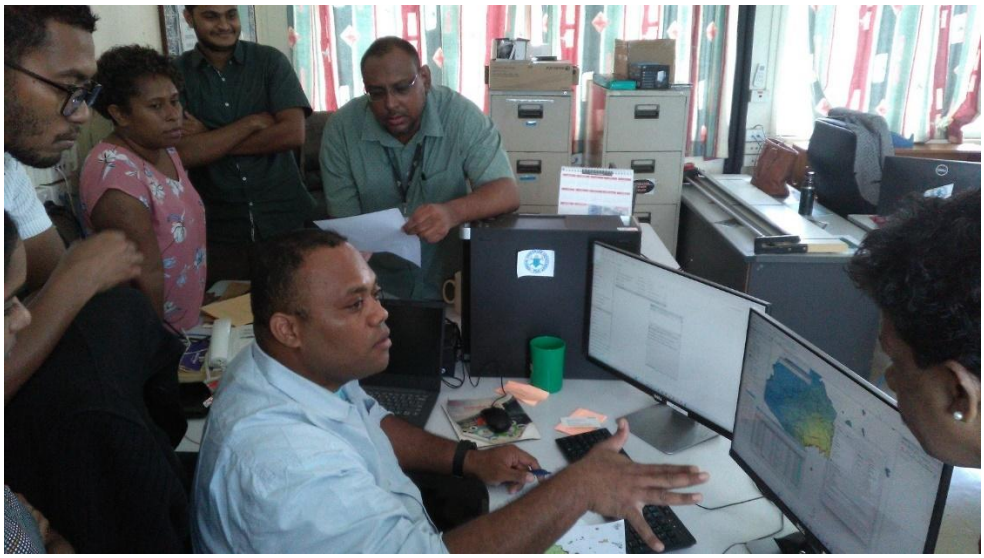


Figure 2-6 A scene of discussion using the simple GIS-based seismic hazard mapping system described in this guideline with MRD Seismology staff

2.2.5 《Option》 Confirmation of global probabilistic seismic motion

For the purpose of considering a particular scenario earthquake proposal, we will refer to a global assessment case study to identify island-wide trends.

For example, the Global Earthquake Model (GEM) maps shows a probabilistic earthquake ground motions (50-year 10% exceedance probability, PGA on an engineering bedrock layer) on the Web. (See figure below.) This map uses only one type of earthquake probability, but it is the standard probability listed in the Building Code in Fiji.

However, it does not take into account ground amplification, which needs to be evaluated separately.

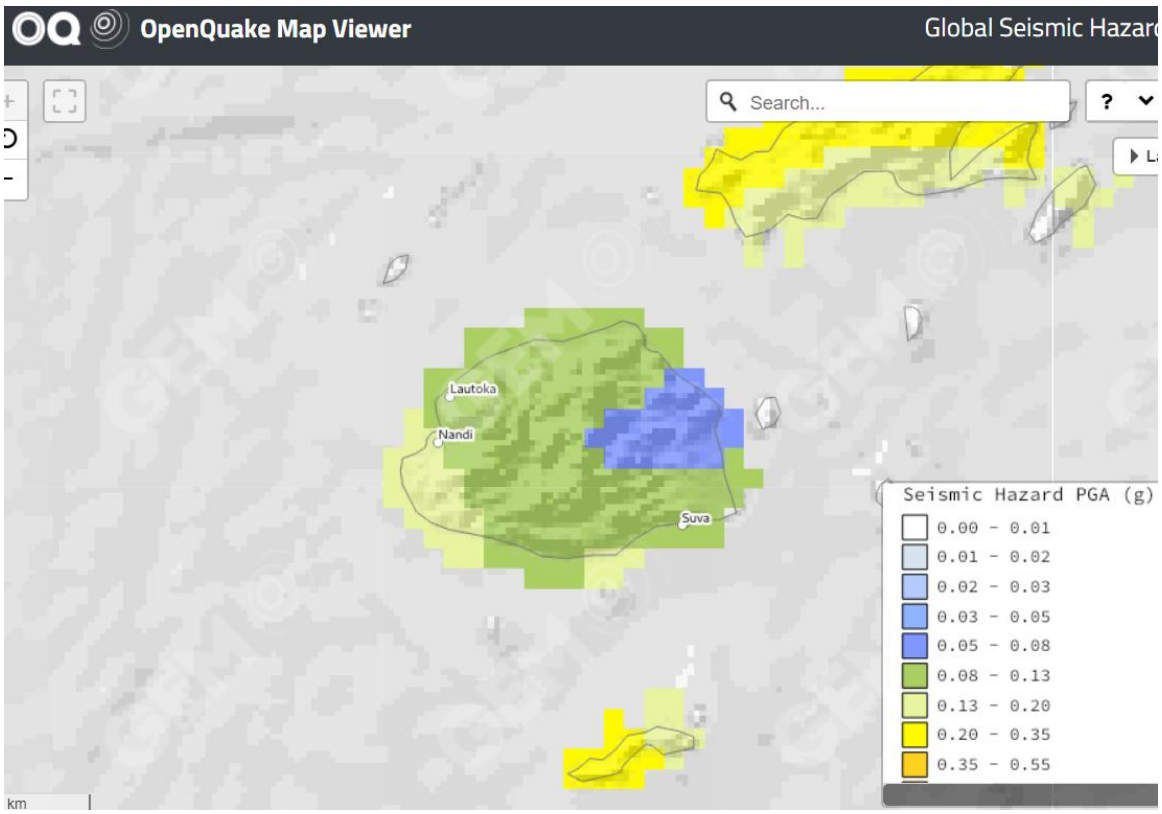
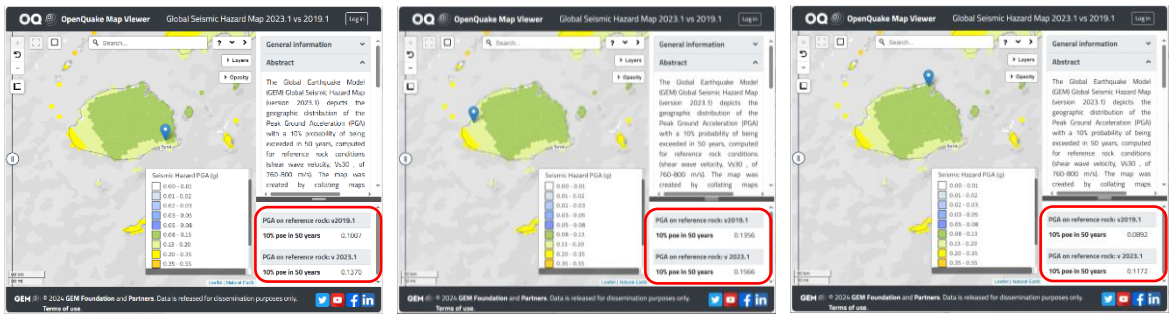


Figure 2-7 Probabilistic Seismic Hazard in and around Viti Levu Island [50-year 10% exceedance probability, PGA on an engineering bedrock layer] (source: Global Earthquake Model[9])

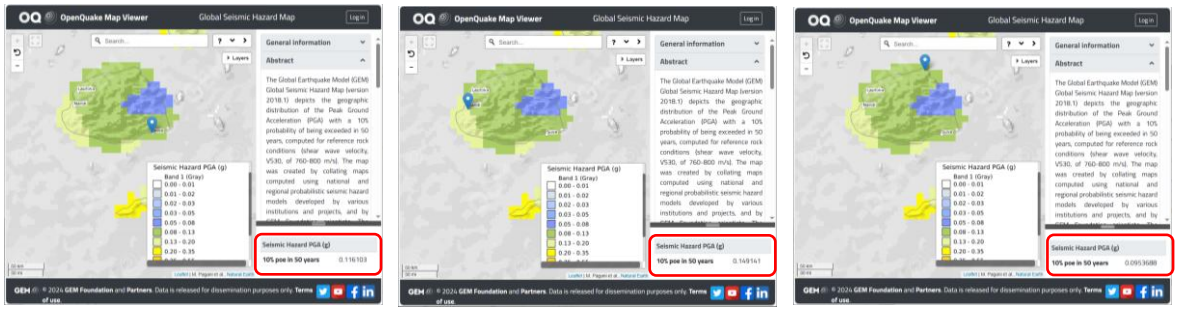
Compared to scenario earthquakes, PGA values for probabilistic seismic motions tend to be calculated relatively smaller than those based on scenarios. There is a concern that obtaining information from this value alone that the damage from an earthquake is not that great may reduce the awareness of residents. Therefore, the primary purpose of the GEM is to confirm areas of high seismic activity as a basis for setting earthquake scenarios, or to compare the effects of earthquakes in major cities.

Alternatively, as in the case of Tokyo (Regional Hazard Level of Your City), the GEM PGA could be applied to a setting where a certain level of earthquake shaking is input to an engineering bedrock, and by multiplying the amplification of the ground, it could be used to easily determine the distribution of seismic intensity on the ground surface.

[9] https://maps.openquake.org/map/global-seismic-hazard-map/#8/-17.816/177.946



Probabilistic Seismic Hazard at Suva, Nadi and Rakiraki
(Comparison of PGA between 2019 and 2023 version, see red line rectangle)



Probabilistic Seismic Hazard at Suva, Nadi and Rakiraki
(PGA in 2018 version, see red line rectangle)

Figure 2-8 Cases of Probabilistic Seismic Hazard in and around Viti Levu Island [50-year 10% exceedance probability, PGA on an engineering bedrock layer] (source: Global Earthquake Model)

As an additional note, it should be noted that probabilistic seismic motions are updated periodically, so the value of the PGA will change. For reference, in the figure above, the map screen showing the PGA values for each of the Suva, Nadi, and Rakiraki sites in the GEM OpenQuake Map and the PGA attribute information are shown side by side by version (2019 versus 2023, 2018) In comparison to 2019 and 2023, It is observed that the latter PGA is larger than the former.

2.3 Attenuation Formula for Seismic Ground Motion Estimation

In this section, the empirical distance attenuation equation is applied for the maximum acceleration (Peak Ground Acceleration, PGA).

Distance attenuation in seismic shaking refers to the phenomenon in which seismic shaking becomes weaker the further away from the location of the earthquake. For example, the reason why the intensity of an earthquake near the epicenter is large while the intensity of an earthquake far from the epicenter is small is due to this distance attenuation. The distance attenuation formula is based on an empirical method that statistically processes data from a large number of actual earthquakes that have occurred in the past.

The distance attenuation formula expresses the relationship between the intensity of earthquake shaking and the distance from the epicenter. By entering the magnitude of the earthquake and the distance from the epicenter into the formula, the shaking and intensity of the earthquake are calculated according to the distance from the epicenter. In reality, however, earthquake shaking varies greatly depending not only on the magnitude and distance from the epicenter, but also on the depth at which the earthquake occurred, the characteristics of the epicenter, and the softness of the ground at the point where the shaking is desired. For this reason, in the United States, the distance attenuation equation has recently been called the Ground Motion Prediction Equation (GMPE) instead of the distance attenuation equation.

The distance attenuation formula is used to predict earthquake shaking. For example, if an earthquake occurs on an active fault, it is used to predict the seismic intensity distribution in the surrounding area. The calculated seismic intensity distribution is used to evaluate the seismic hazard, and the seismic hazard can then be used to evaluate what kind of damage may occur at that location. This "distance attenuation formula" is also utilized for earthquake early warning.

In order to predict earthquake shaking more accurately, it is necessary to model the topography and subsurface structure, and to perform detailed calculations based on the characteristics of the epicenter fault. However, such a method requires more time and labor, so it is used differently depending on the application between the method using the "distance attenuation formula," which is relatively simple and can be calculated in a short time.

In general, the farther away from the earthquake location, the smaller the shaking becomes (distance attenuation). However, in the case of an earthquake occurring at a deep location, the shaking may be larger at a greater distance from the location of the earthquake, depending on the path taken by the earthquake waves. In order to cope with the way earthquakes shake, for example, distance attenuation formulas have been proposed for long-period seismic motions and response spectra.

2.4 Ground Amplification

Although simplified amplification factors are provided separately here, information on local ground amplification is essential for estimating seismic intensity distribution maps for a particular earthquake. In Japan, areal ground amplification data are constructed for each region using geological maps and topographic classification maps. For high-level ground amplification estimation, results of ground borehole investigations are also referenced. Vs30 refers to the time-averaged shear-wave velocity data from the USGS, the world's leading publicly available source of data on ground amplification. -The USGS estimated global Vs30 using a grid system based on topographic indices. The resolution is Grid resolution: 30 arc-seconds (0.0083333333 degrees). Here we estimate the areal distribution of ground amplification by an empirical method using Vs30.

2.5 Estimation of seismic ground motions at the surface of the earth

The earthquake shaking at the ground surface is calculated by multiplying the amplification of the ground by the result of calculating the earthquake shaking in relatively hard ground, called the engineering base, using the distance attenuation equation. It is important to use the maximum acceleration at the ground surface (PGA) in the distance attenuation equation and the ground amplification estimation equation. The data to be represented on the map will be based on the USGS VS30 grid system.

Earthquake shaking at the ground surface is fundamental information as a result of hazard assessment because it affects buildings and other structures. The figure below shows an example of how earthquake shaking is transmitted according to distance attenuation until it is input to the engineering base, but in ground shallower than the engineering base, the shaking becomes larger due to ground amplification. For the same level of input to the engineering base, the softer the ground and the thicker the layer, the greater the seismic intensity at the ground surface and the greater the impact on the building. (Right side of the figure)

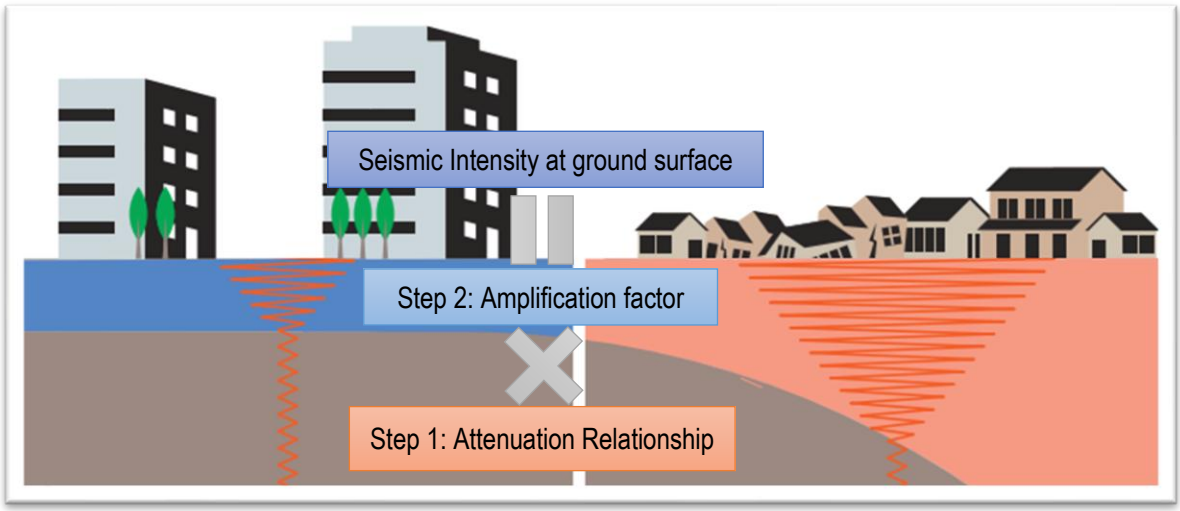


Figure 2-9 Image of calculation of seismic ground motion at surface of the earth
[including Cases of low hazard site and high hazard]
(editing Your Community's Earthquake Risk of Tokyo Metropolitan Government, 2022)

Chapter 3. Earthquake Risk Assessment

3.1 Overview

Earthquake risk assessment means to determine in advance the amount of damage to structures, such as where people live and urban areas are distributed, in an area where earthquake shaking occurs. In other words, there is no risk in an area where no people, urban areas, or anything else exists even if an earthquake tremor occurs. In Japan, it is common practice for local governments to estimate the amount of damage that could occur in a particular earthquake scenario, and this is called "earthquake damage estimation". As a simpler indicator, it is also important as basic information to indicate the population exposed to earthquake shaking. This is called Population Exposure to Seismic Intensity. By simply showing the distribution of the population in areas above a certain seismic intensity, a quantitative estimate of the affected area can be made. The amount of damage to structures is estimated by using a damage function that empirically analyses how much damage is caused for a given seismic ground motion.

3.2 Population Exposure to Seismic Intensity

The seismic intensity-exposed population refers to the population exposed to each seismic intensity when an earthquake occurs. Specifically, it is a map showing the distribution of people exposed to ground motion above a certain seismic intensity. This indicator takes into account the overlay effect of the distribution of seismic intensity and population distribution and indicates the macro seismic potential.

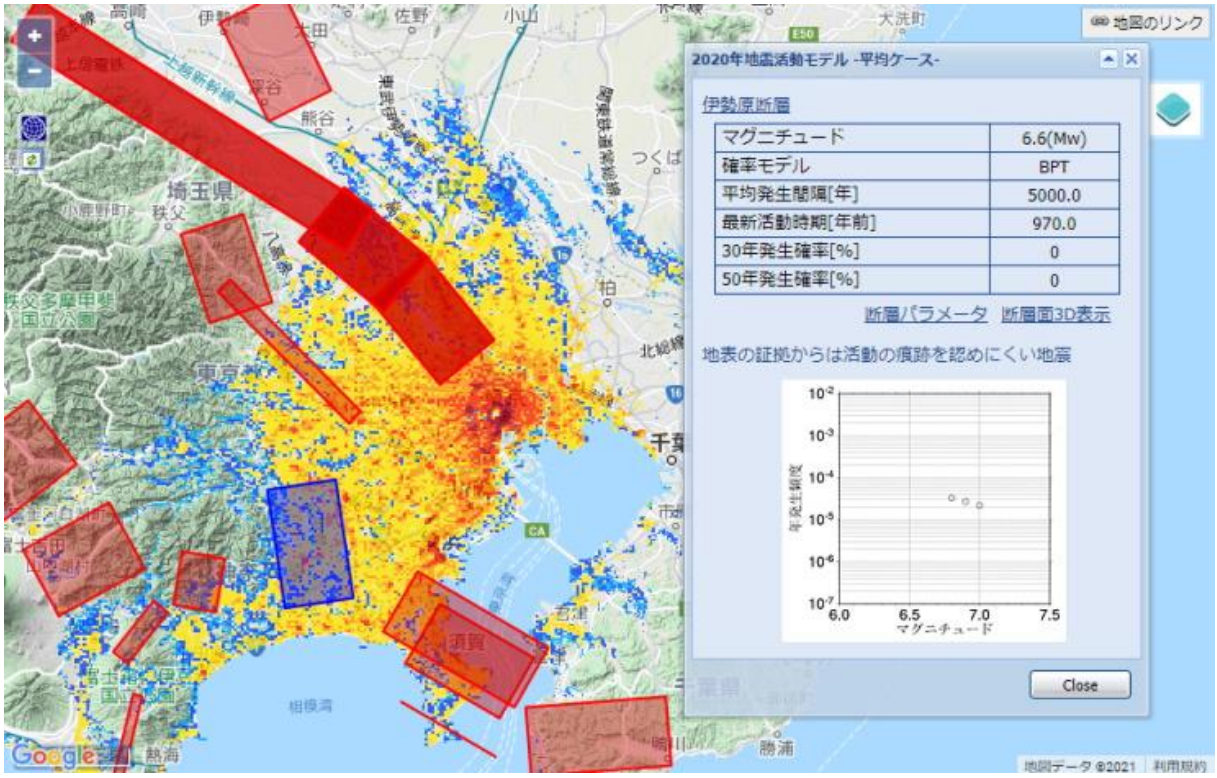


Figure 3-1 Example of Distribution of Population Exposure to Seismic Intensity[10]

[10] https://www.j-shis.bosai.go.jp/map/JSHIS2/man/man_exposure.html

3.3 (Option) Damage Estimation to Buildings

The following figures present overview of seismic risk analysis to buildings.

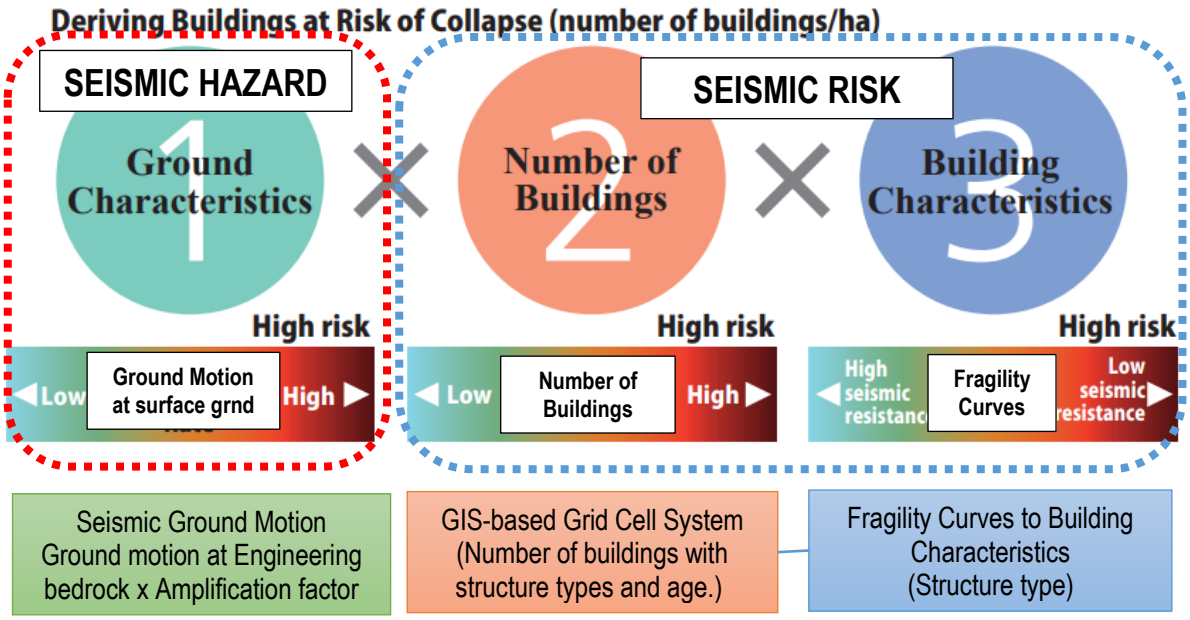


Figure 3-2 Overview of Seismic Risk process
(editing Your Community's Earthquake Risk of Tokyo Metropolitan Government, 2022)

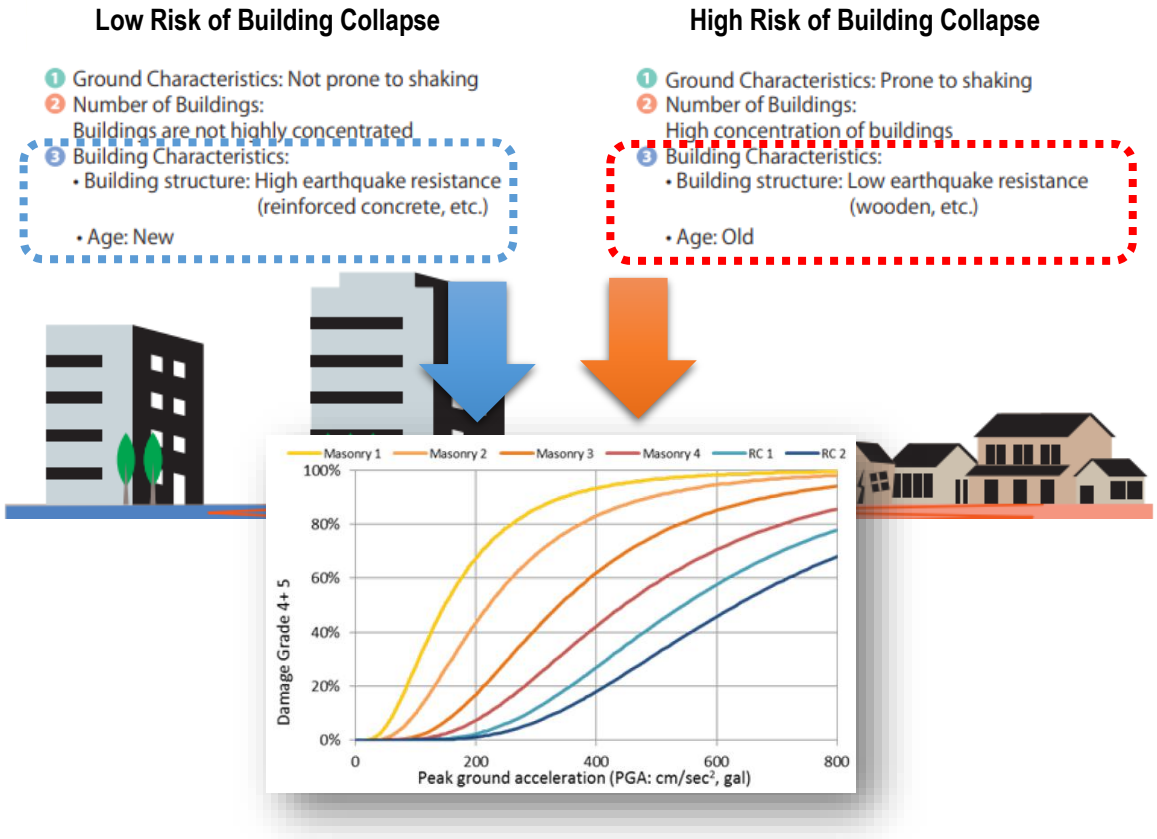
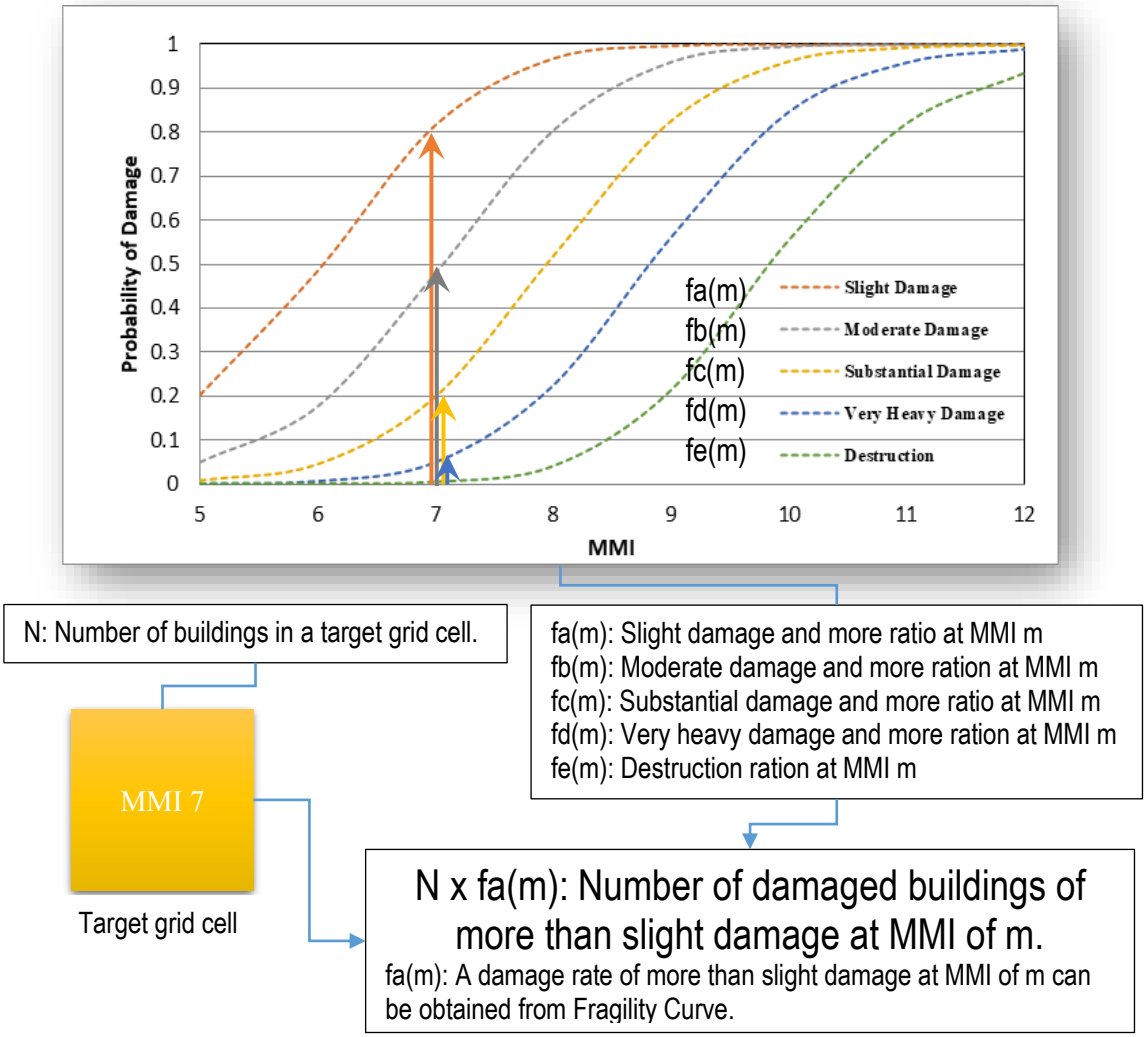


Figure 3-3 Fragility Curves based on Empirical method for Seismic Risk assessment process
(editing Your Community's Earthquake Risk of Tokyo Metropolitan Government, 2022)

The following figure presents a procedure to calculate number of damaged buildings.

A ratio of damage to each damage state is read from the fragility curves. A case study to calculate number of damaged buildings to each damage state only.

For actual calculation by computer, it would be speedy to calculate by input ratios into a database.



《Case Study》
Target grid cell: N=100, MMI:7
fa(7) = 0.8, fb(7) = 0.48, fc(7) = 0.2, fd(7) = 0.06
(We can read those numbers from the fragility curves.)
Na = 100 x 0.8 = 80, Nb = 100 x 0.48 = 48, Nc = 100 x 0.2 = 20, Nd = 100 x 0.06 = 6, Ne = 0
For example, number of Slight damage only = 80 – 48 = 32
number of Moderate damage only = 48 – 20 = 28,
number of Substantial damage only = 20 – 6 = 14, number of heavy damage only = 6 – 0 = 6

Figure 3-4 Procedure to calculate number of building damage using Fragility Curve (Fragility Curve: NED University)

Chapter 4. Earthquake Hazard & Risk Mapping using GIS

4.1 Preparation of GIS Dataset for analysis

A GIS dataset must be prepared to implement this methodology. This process is critical and still requires familiarity with GIS processing.

However, it is difficult to describe all of the processing methods here in detail. Therefore, we will outline the basic operation procedures in ArcGIS Desktop, one of the most popular GIS software.

4.1.1 Grid Cell Polygon Feature

It is one of the most important to prepare a Grid Cell polygon layer to store some dataset for the analysis of earthquake ground motion.

Since we are using a GeoTIFF file containing USGS Vs30 to estimate ground amplification factor, we prepare a polygon layer corresponding to the pixel size of this image file (i.e., 0.0083333333degree squares).

The following tool would be used to create a grid cell polygon layer in ArcGIS Desktop.

- Arc Toolbox – [Cartography Tools] – [Data Driven Pages] – [Grid Index Features]

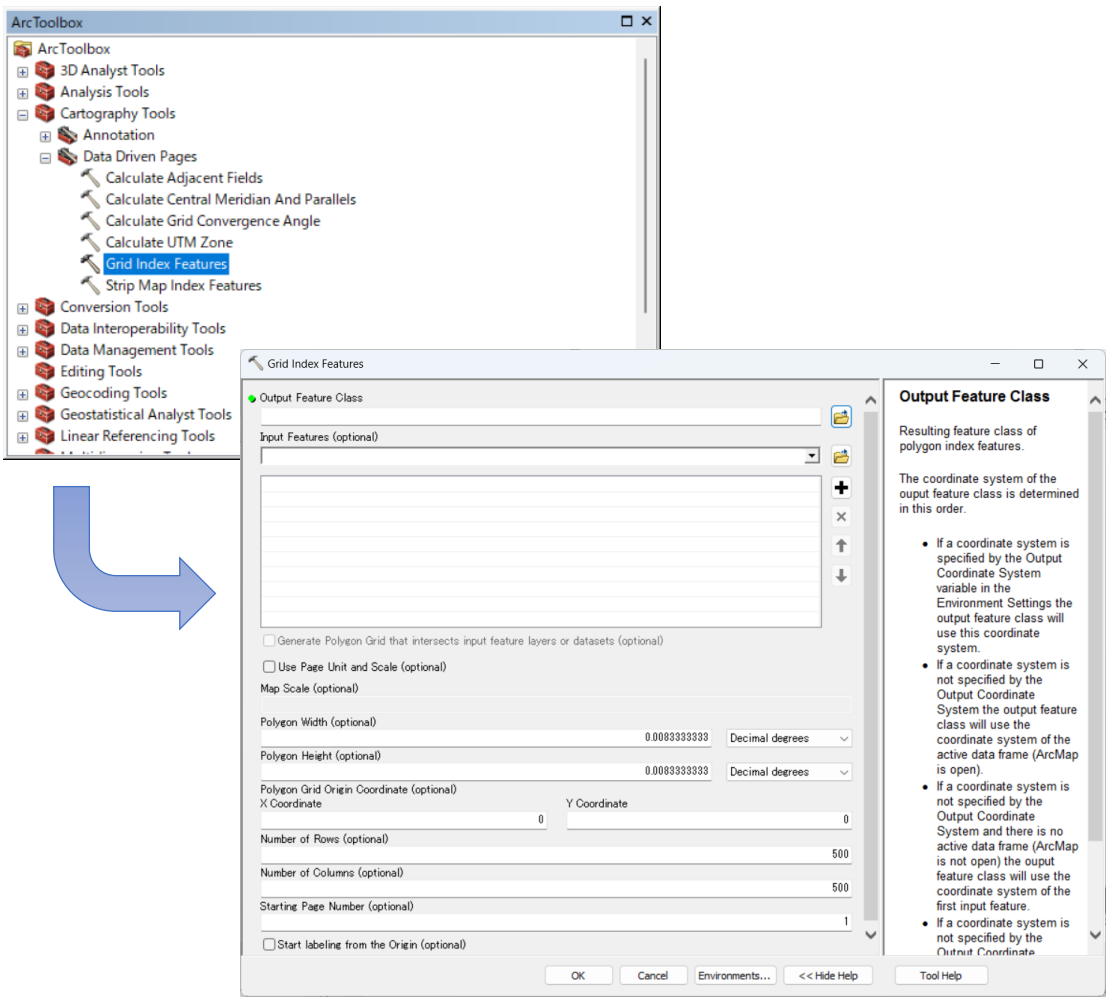


Figure 4-1 An example of tool to create grid polygon cells in ArcGIS Desktop

I believe there are other similar methods. Don't stick to one method but it would be better to learn more to use a variety of GIS tools.

4.1.2 Point Feature with Vs30

A polygon layer has been prepared with the same cell size as the USGS GeoTIFF. However, this polygon does not contain Vs30 information. Therefore, create a point layer that contains Vs30 for a preparation to insert vs30 value. and use overlay analysis to incorporate Vs30 information into each grid cell polygon.

The following tools would be used to create a grid cell polygon layer in ArcGIS Desktop. It is one process to create a grid cell polygon.

- Calculate Geometry in the attribute table of Grid Cell Polygon layer.
- X, Y coordinates are stored in the specified field.
- Export the attribute table => [Display XY Data] => Point feature layer is created.

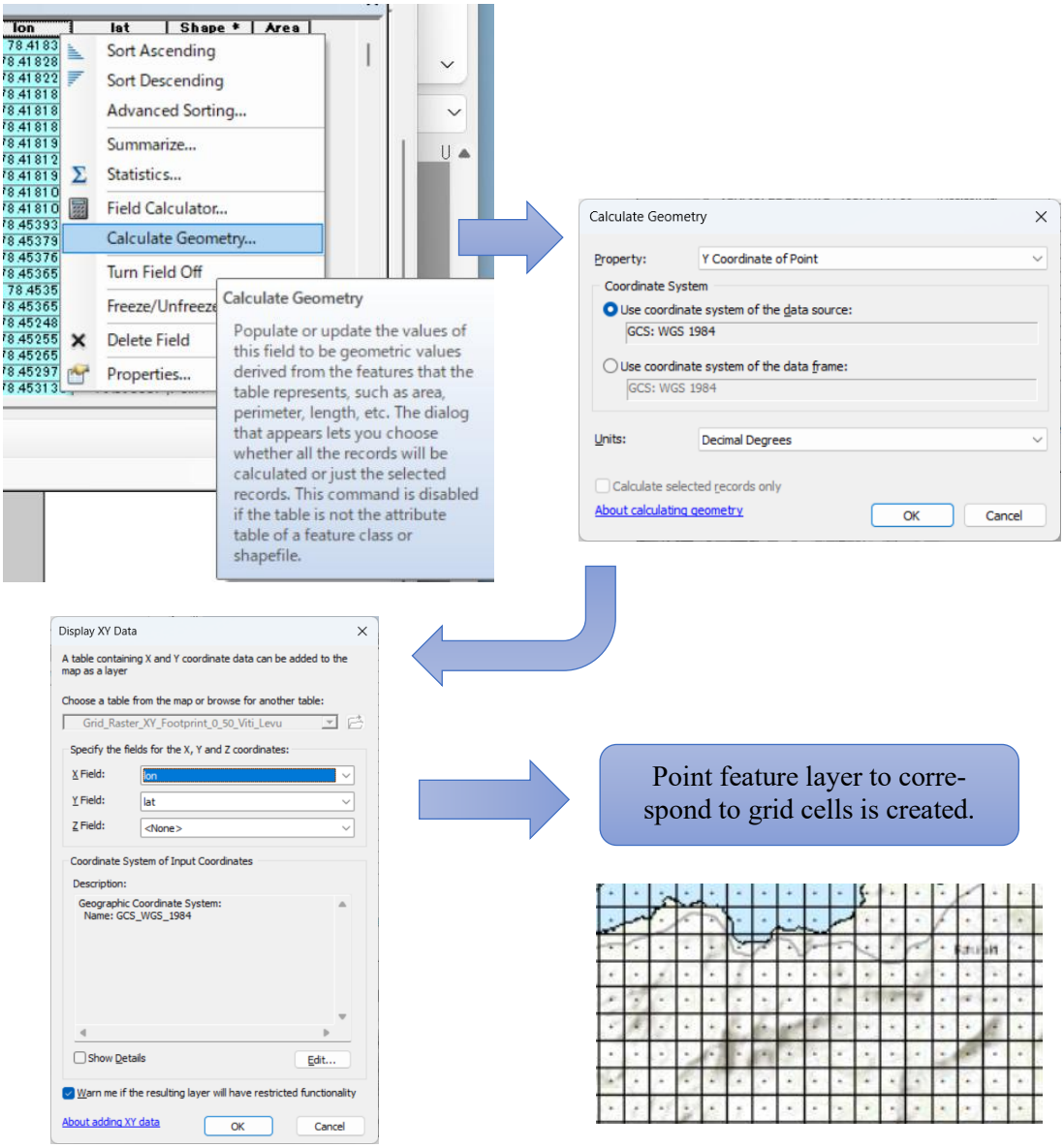


Figure 4-2 Procedure to create grid point feature to store Vs30

4.1.3 Insert Vs30 value into Grid Cell Polygon Feature

As USGS Vs30 TIFF image is used to estimate ground amplification factor, the grid cell polygon with the same size was created. Vs30 dataset was extracted from GeoTIFF to a point shapefile.

The following procedure is used in Arc GIS Desktop

- Arc Toolbox – [3D Analyst] – [Functional Surface] – [Add Surface Information] => Point feature obtain the Vs30 data
- Sub Menu (right click) at the grid cell polygon layer in Table of Contents => [Joins and Relates] => [Join Data] => [Join data from another layer based on spatial location]

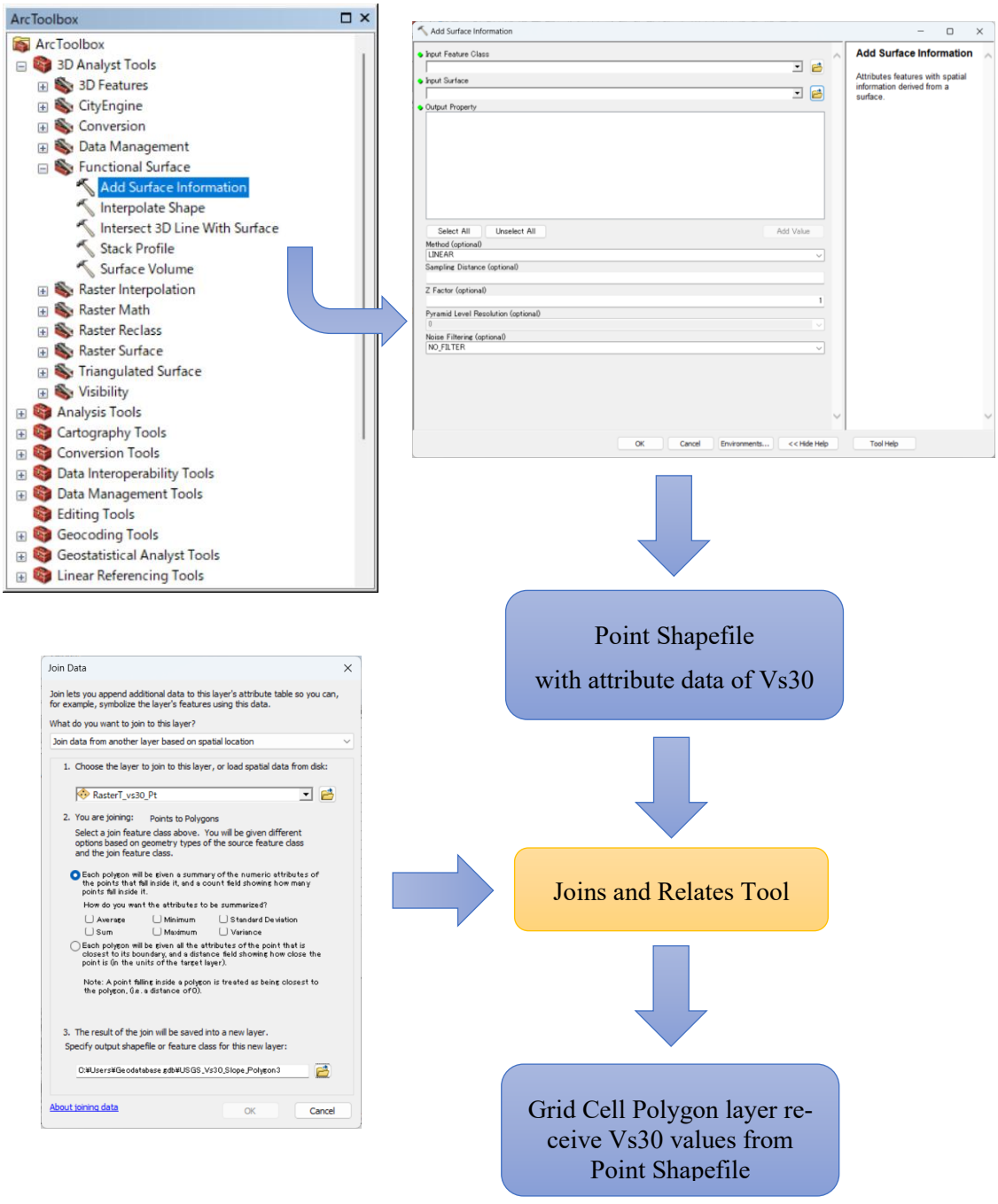


Figure 4-3 Procedure for Grid Cell Polygon layer to store Vs30 via Point feature

4.1.4 Store Population into Grid Cell Polygon

Population point feature data in Fiji was obtained through NDMO. The point feature was summarized into Grid Cell system of 0.0083333333 degree. The method to sum up population within each grid cell extent is just the same as Vs30.

- Sub Menu (right click) at the grid cell polygon layer in Table of Contents => [Joins and Relates] => [Join Data] => [Join data from another layer based on spatial location]

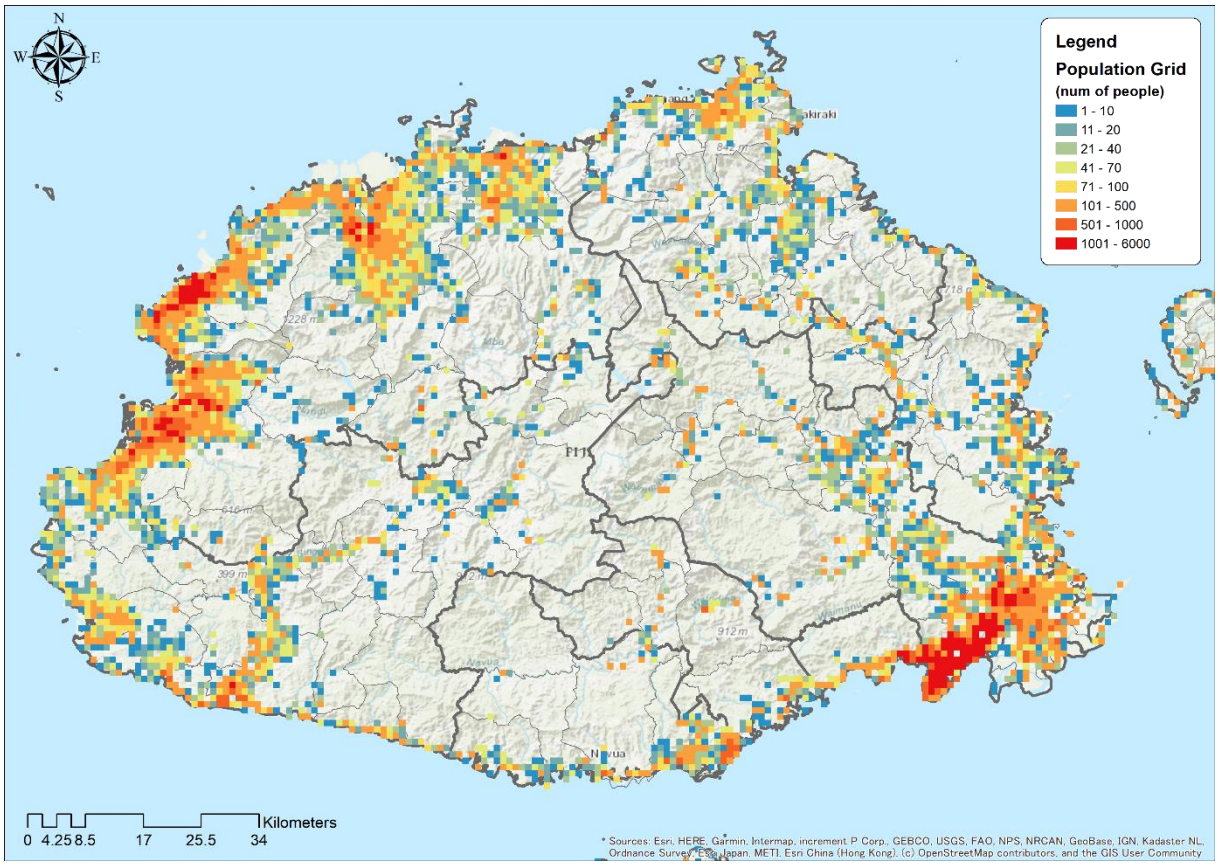


Figure 4-4 Population Grid Cell Map in Viti Levu Island

4.1.5 Execute Python Script to estimate Attenuation Relationship and Amplification Factor

The following is a method for performing empirical calculations of distance attenuation and ground amplification using Python Script running in ArcGIS Desktop (or ArcGIS Pro).

- Create a data field in the attribute table of Grid Cell Polygon to store the calculation results.
- Click "Field Calculator" in the submenu of the data field.
- In the dialog box that appears, write a calculation script. Note that Python should be selected as the Parser.
- Instead of writing, you may load a saved text file (*.cal).
- Click the OK button at the bottom of the dialog box.

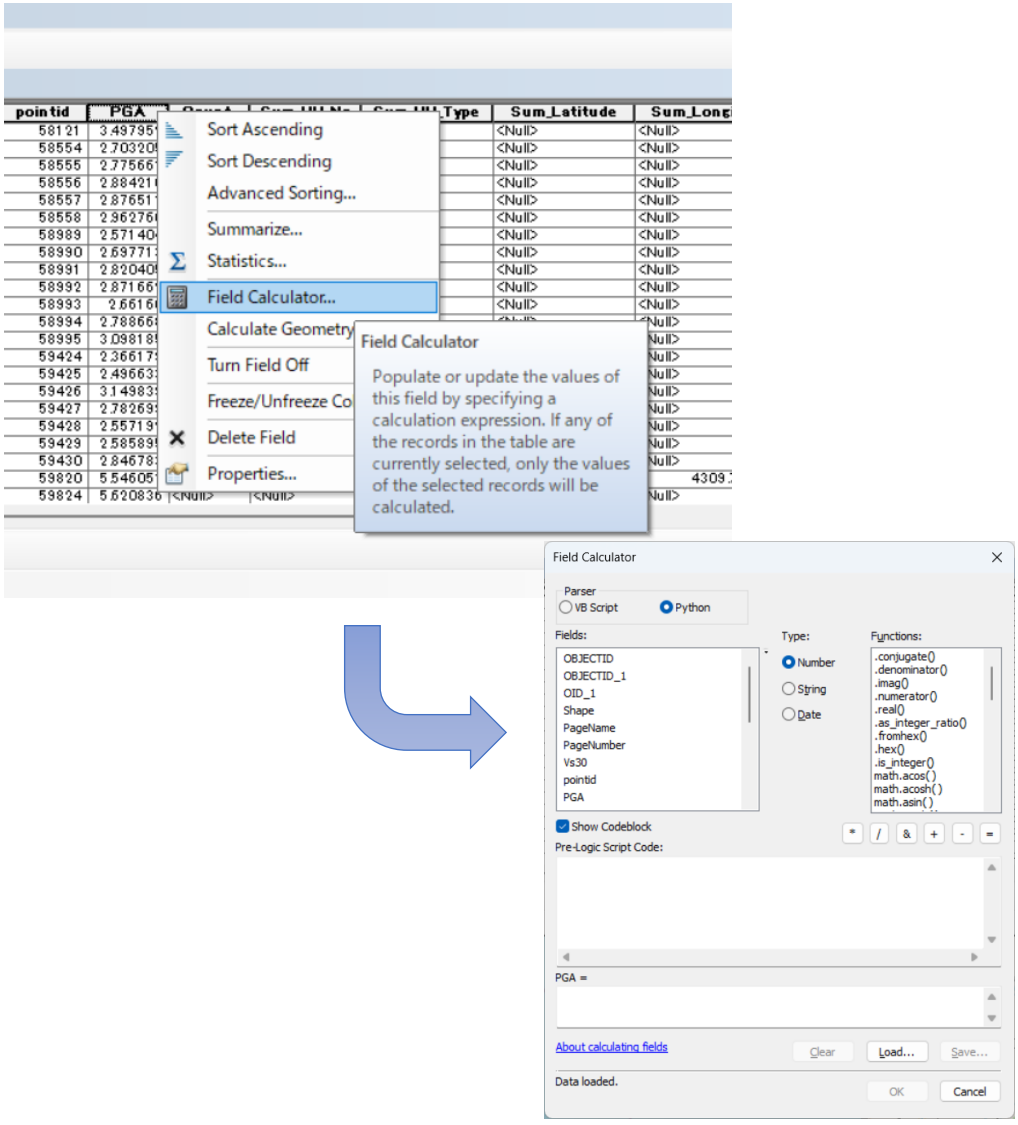


Figure 4-5 Procedure to Execute Field Calculator for Attenuation Relationship and Amplification Factor method

4.1.6 How to display Population Exposure to Seismic Intensity

It is the same procedure to

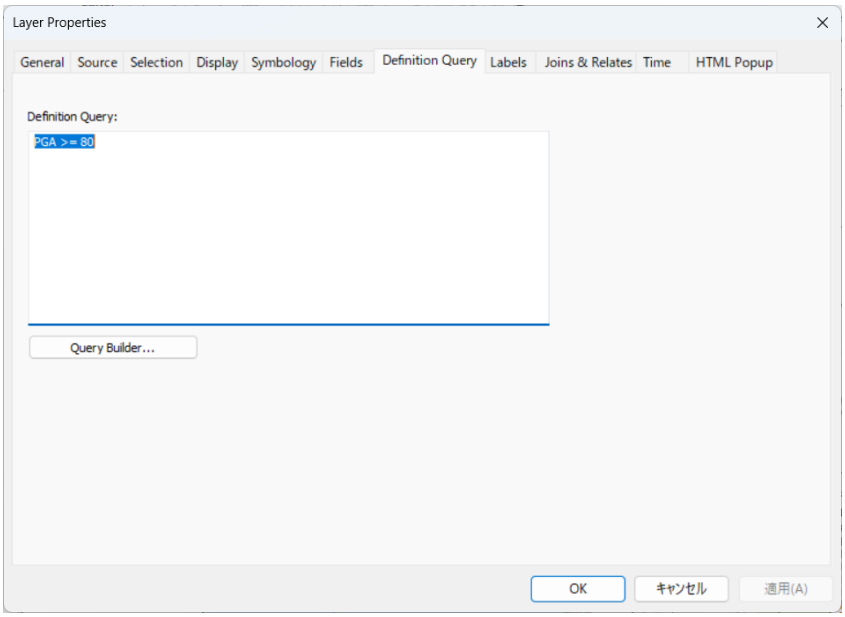


Figure 4-6 Procedure to present Population Exposure to Seismic Intensity by Definition Query in Arc GIS Desktop

4.2 Key Point of Python Script for Attenuation Relationship and Amplification Factor

A python script for Arc GIS is prepared to calculate the empirical method of earthquake hazard. How to execute calculations was described in 4.1.5. Here, key point is explained.

The Key Point consists of the following items. The following figure shows Python script to each.

① Definition of Scenario Earthquake (Hypocenter parameters)

② Setting Geographic Coordinate (X, Y) of Target Grid Cell

③ Equation to calculate Distance from Hypocenter to Target Grid Cell

④ Equation to calculate Attenuation Relationship with adjustment due to different engineering bedrock setting

⑤ Equation to calculate Amplification Factor

①Seismic Source Parameters: Magnitude (Mw), depth, longitude and latitude of Hypocenter

```
mag = 7.0
dep = 15000
x1 = 176.871
y1 = -17.405
```

②Geographic Coordinate (X, Y) of Target Grid Cell

```
x = feat.centroid.x
y = feat.centroid.y
```

③Calculating Distance from Hypocenter to Target Grid Cell

```
ptGeometry1 = arcpy.PointGeometry(arcpy.Point(x1,y1),
arcpy.SpatialReference(4326))
ptGeometry2 = arcpy.PointGeometry(arcpy.Point(x,y),
arcpy.SpatialReference(4326))
a,d = ptGeometry1.angleAndDistanceTo(ptGeometry2, "GEODESIC")
r = math.sqrt(d**2 + dep**2 )
r = r / 1000
```

④Calculating Attenuation Relationship with adjustment due to different reference bedrock

```
pga = 10 ** (0.49 + 0.23*(mag - 6) - math.log10(r ) - 0.0027*r)
pga = 1.385 * pga * 980
```

⑤Calculating Amplification Factor

```
arv = 10 ** (1.35 - 0.47 * math.log10(vs30 ) )
pga2 = pga * arv
```

Figure 4-7 Python Script to calculate Empirical Method of Earthquake Hazard

4.3 Conversion from PGA to MMI

Modified Mercalli Intensity (MMI) is one of the popular scale of seismic intensity in the world.

USGS define MMI description as follows.

Description of The Modified Mercalli Intensity Scale[11]

Intensity	Shaking	Description/Damage
I	Not felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest,especially on upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

For the compariton among several seismic intensity with peak ground acceleration, the following figure shows an conversion table to each. PGA value is added to the table by using an empirical conversion equation[12].

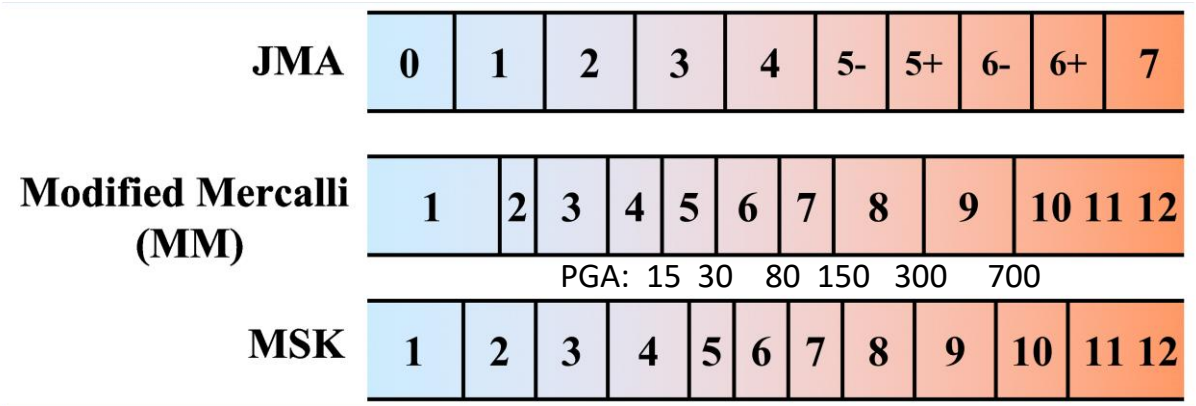


Figure 4-8 Conversion Table among Seismic Intensities with PGA (edited Grünthal (1994))

[11] https://www.usgs.gov/programs/earthquake-hazards/modified-mercalli-intensity-scale

[12] Khosrow T. Shabestari and Fumio Yamazaki (2001): A Proposal of Instrumental Seismic Intensity Scale Compatible with MMI Evaluated from Three-Component Acceleration Records

Chapter 5. Case Study for Pilot Sites

As case study to calculate earthquake hazard and risk using empirical methods including attenuation relationships and amplification factors

5.1 Nadi Area

5.1.1 Location

Nadi area is selected for pilot study area as one of the largest city in Fiji islands. The following figure shows in and around Nadi District area.

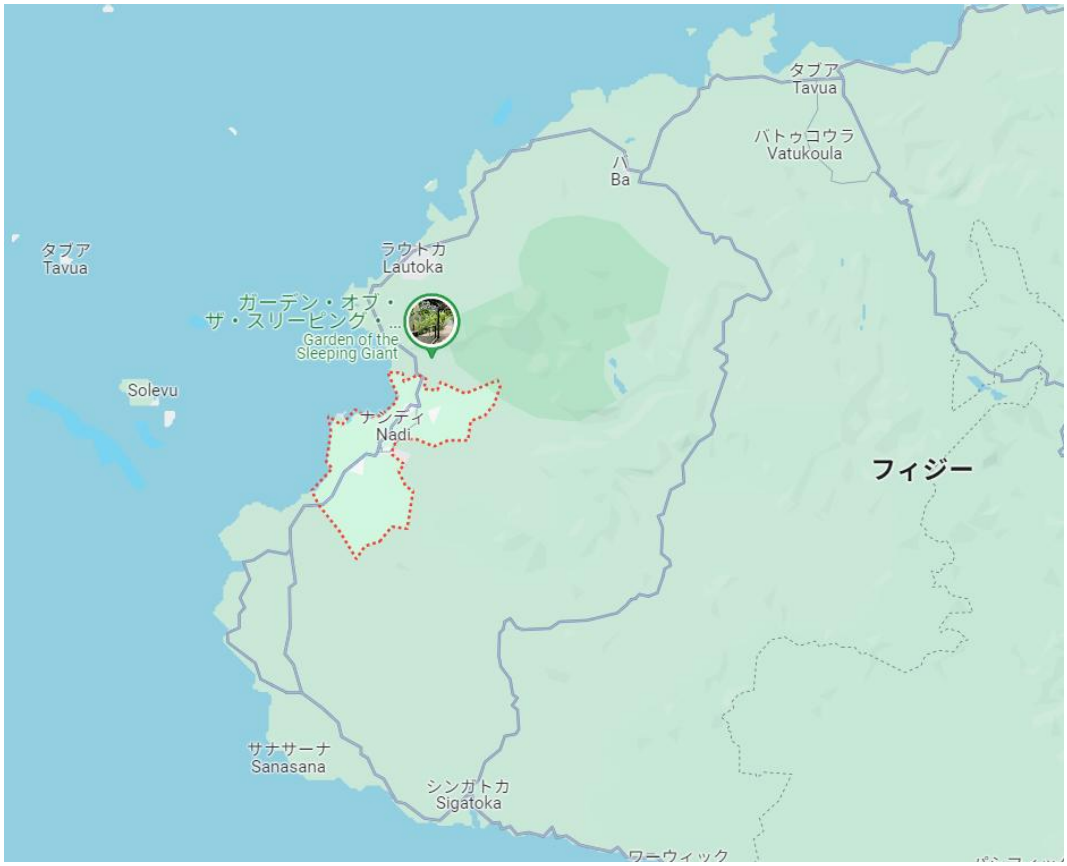


Figure 5-1 Locaton Map of Nadi District area

5.1.2 Earthquake Hazard Mapping

Based on the USGS earthquake catalog, the epicenter location of 1921-09-19 was adopted, and the magnitude and epicenter depth were adjusted as follows,

Magnitude: 7.5 (USGS: 6.56), Depth of epicenter: 10 km (USGS: 15 km)

The calculation results show that MMI intensity scale 7 (PGA: 80 to 150 (gal)) is widely distributed in the western coastal area, and some areas experience relatively strong shaking of MMI intensity scale 8 (on the map, PGA: 150 to 180 (gal)).

The MRD Seismology Section discussed the results of this calculation and commented that the distribution of Z Factor tends to be larger in the western part of NBC2023 and that, in comparison with the value of Zone Factor in Nadi, it is reasonable that the mesh of MMI8 (PGA range: 150-300 (gal)) is distributed on Viti Levu Island. ～The distribution of the mesh of MMI8 (PGA range: 150 to 300 (gal)) on Viti Levu is reasonable in comparison with the Zone Factor value on Nadi. In addition, it was also commented that there is a possibility that damage may occur on islands close to the epicenter.

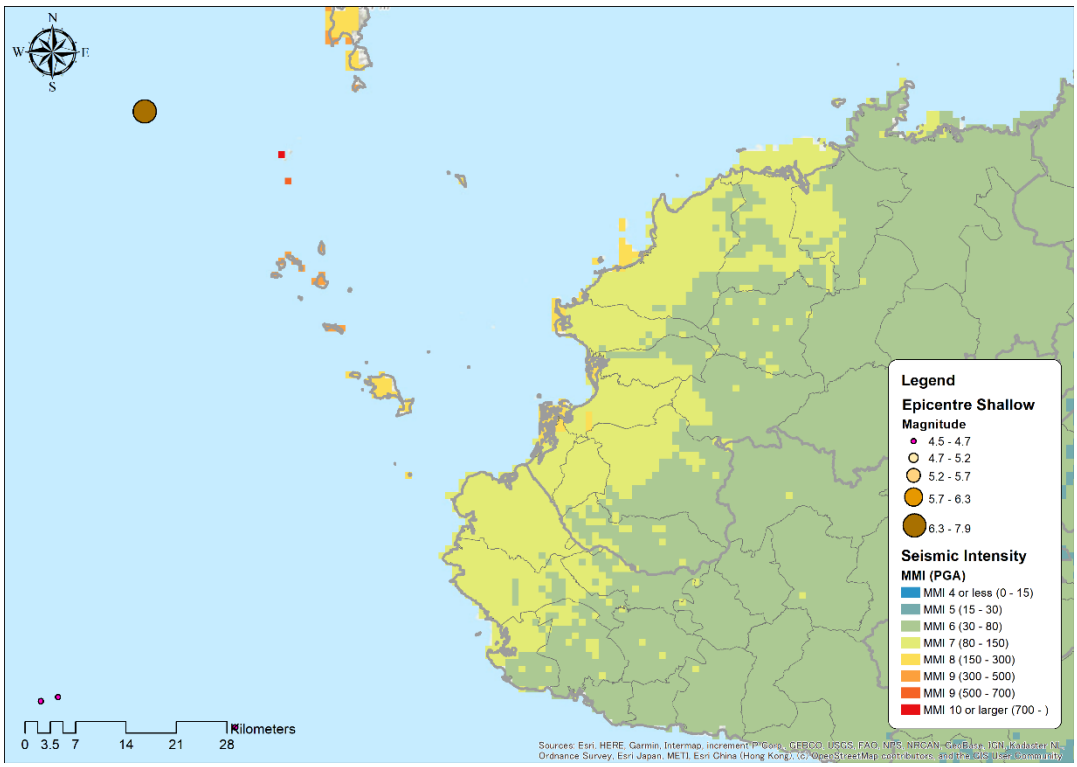


Figure 5-2 MMI seismic intensity Map in and around Nadi

5.1.3 Risk Mapping

Here, the map shows the exposed population in relation to the seismic intensity as one indicator of seismic risk. On the other hand, in order to calculate the number of buildings damaged, data on the number of buildings and structure types with relatively high accuracy are required. However, since neither of these data were available at this time, they are not included in the scope of this study. The bold black line in the following figures indicates the boundary line of Nadi District.

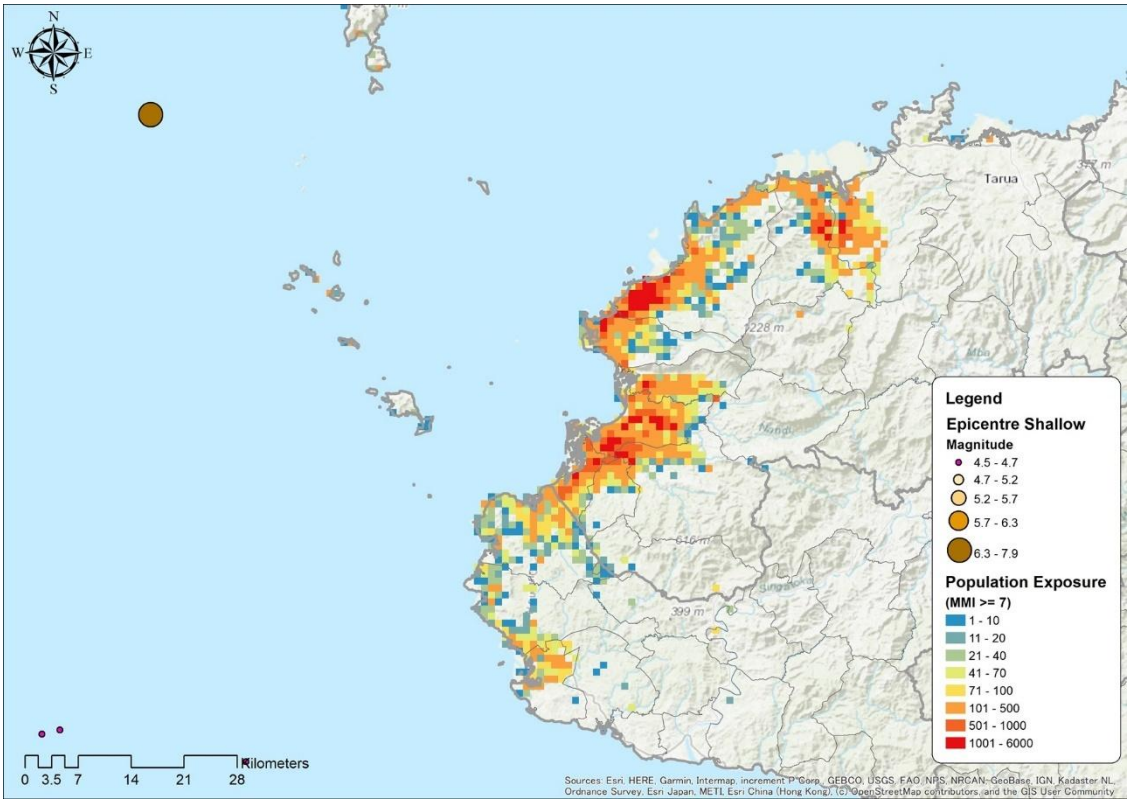


Figure 5-3 Distribution of Population exposed to MMI seismic intensity level 7 and above

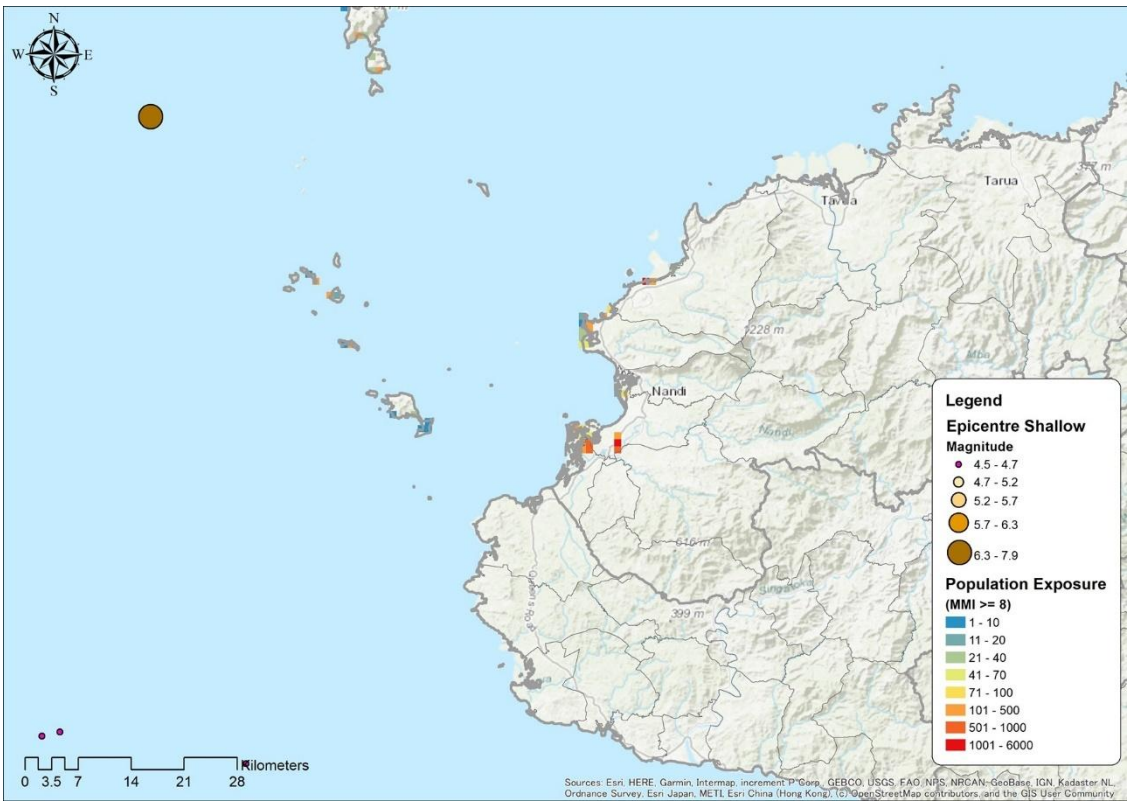


Figure 5-4 Distribution of Population exposed to MMI seismic intensity level 8 and above

5.1.4 Result Table

The following table shows the exposed population in and around the Nadi District calculated and mapped above. The number of exposed buildings is not shown because of the difference between the distribution of building footprint data and the distribution of the population, especially western Nadi urban area. The range for MMI seismic intensity level VIII (8) is converted to 150 - 300 (gal) in PGA, but the maximum value for Viti Levu Island in this hazard map is about 180 (gal).

MMI (PGA)	Exposed population (excluding islands)	Number of buildings
7 or more (PGA: 80 -)	160,000 people	-
8 or more (PGA:150 -)	7300 people	-

5.2 Rakiraki Area

5.2.1 Location

Rakiraki District locates northeast of Viti Levu Island, two-hour drive from Suva. It is a little bit local city rather than but densely populated area in and around Rakiraki City is the target for this case study training.

Figure 5-5 Locaton Map of Rakiraki area

5.2.2 Scenario Earthquake Setting

After discussing with MRD Seismology staff, the following source parameters were determined.

In setting up the scenario earthquakes, small cluster earthquakes in and around Rakiraki were considered, and the locations of past earthquakes from the USGS earthquake catalogue web database were used.

Selected past earthquake record ID in the web system was “2009-11-09T10:44:55.110Z”.

- Magnitude: 6.5
- Depth: 10 (km)
- Longitude: 178.331
- Latitude: -17.239

5.2.3 Earthquake Hazard Mapping

The sky bule point symbol in the following map is the epicentre of the scenario earthquake determined in the previous section. The assumed seismic intensity from this scenario earthquake resulted in a maximum grid cell of MMI 9 (PGA 470 cm/s^2).

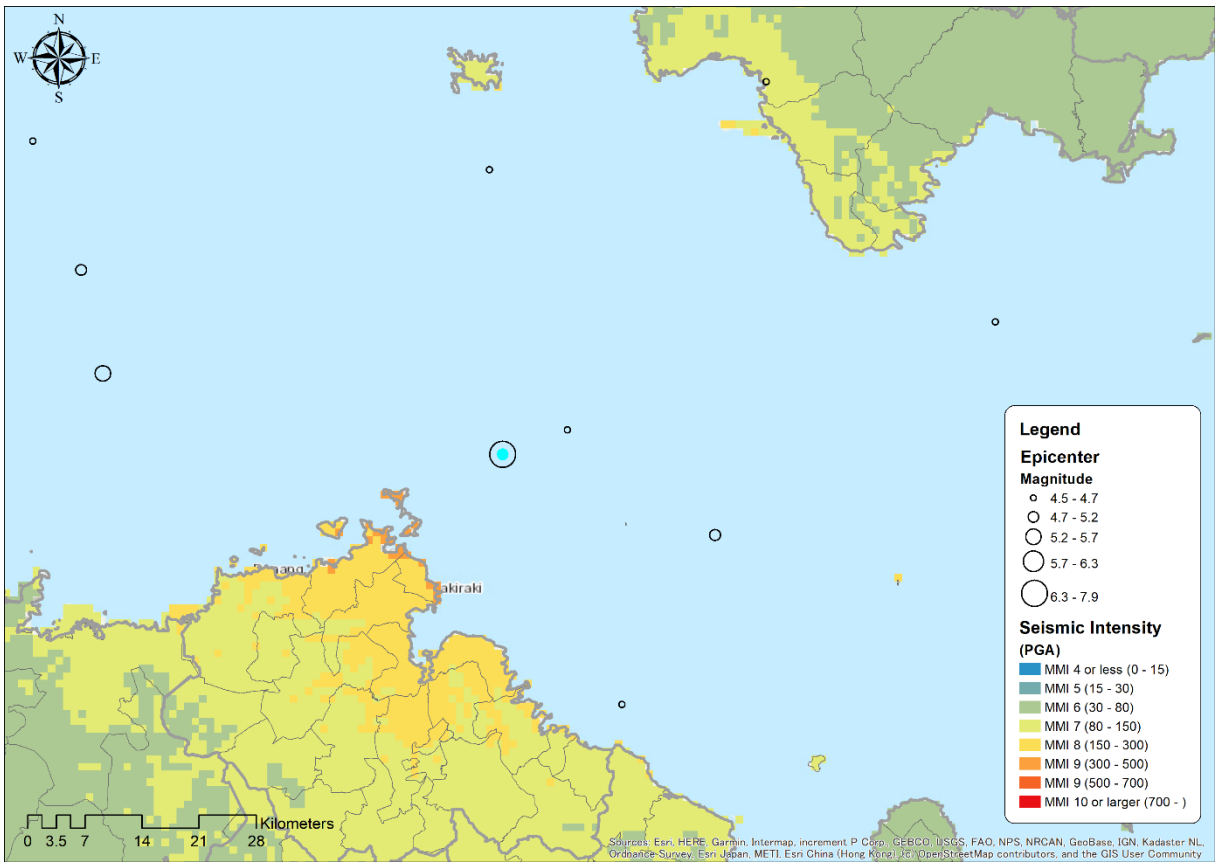


Figure 5-6 Calculation Result of Earthquake Hazard Map due to Rakiraki Scenario (M 6.5)

For your reference, here is the latest monitoring information on seismic activity around Rakiraki. The following figure shows symbols of epicenters observed recently (2024 Mar to April) including magnitude 3.7.

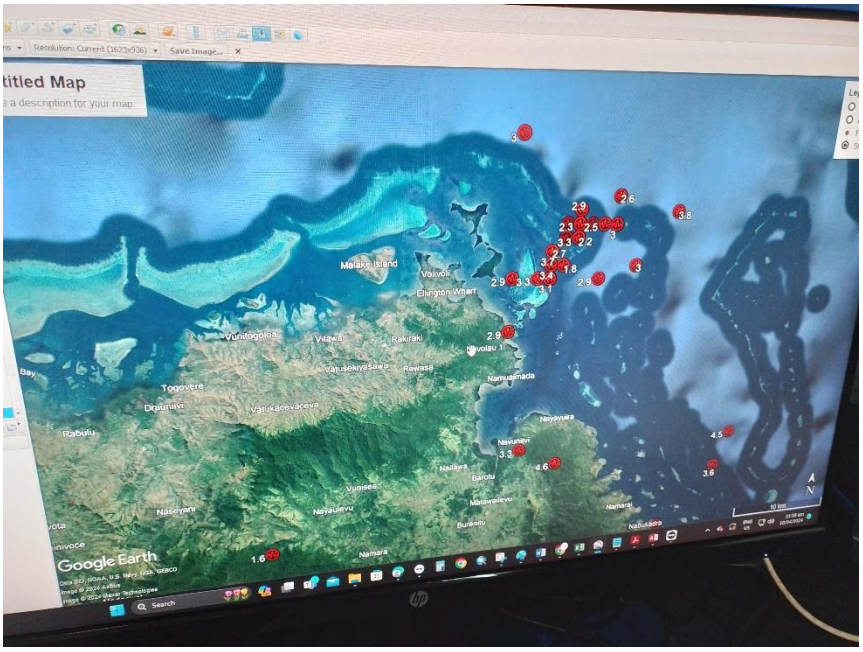


Figure 5-7 Monitoring seismic activity around Rakiraki in March and April 2024 (provided by MRD Seismology Section)

5.2.4 Earthquake Risk Mapping

As a basic risk due to the assumed seismic intensity from this scenario earthquake, the Population Exposure to Seismic Intensity was shown below; two figures were prepared for MMI 7 and above and MMI 8 and above. The results show that the total exposed population above MMI 8 is about 18,000 people. The seismic intensity of MMI 9 was estimated in the Rakiraki Scenario hazard map, which exceeds the maximum intensity of the 1953 Suva earthquake. It is expected to cause damage to structures and a large number of evacuees.

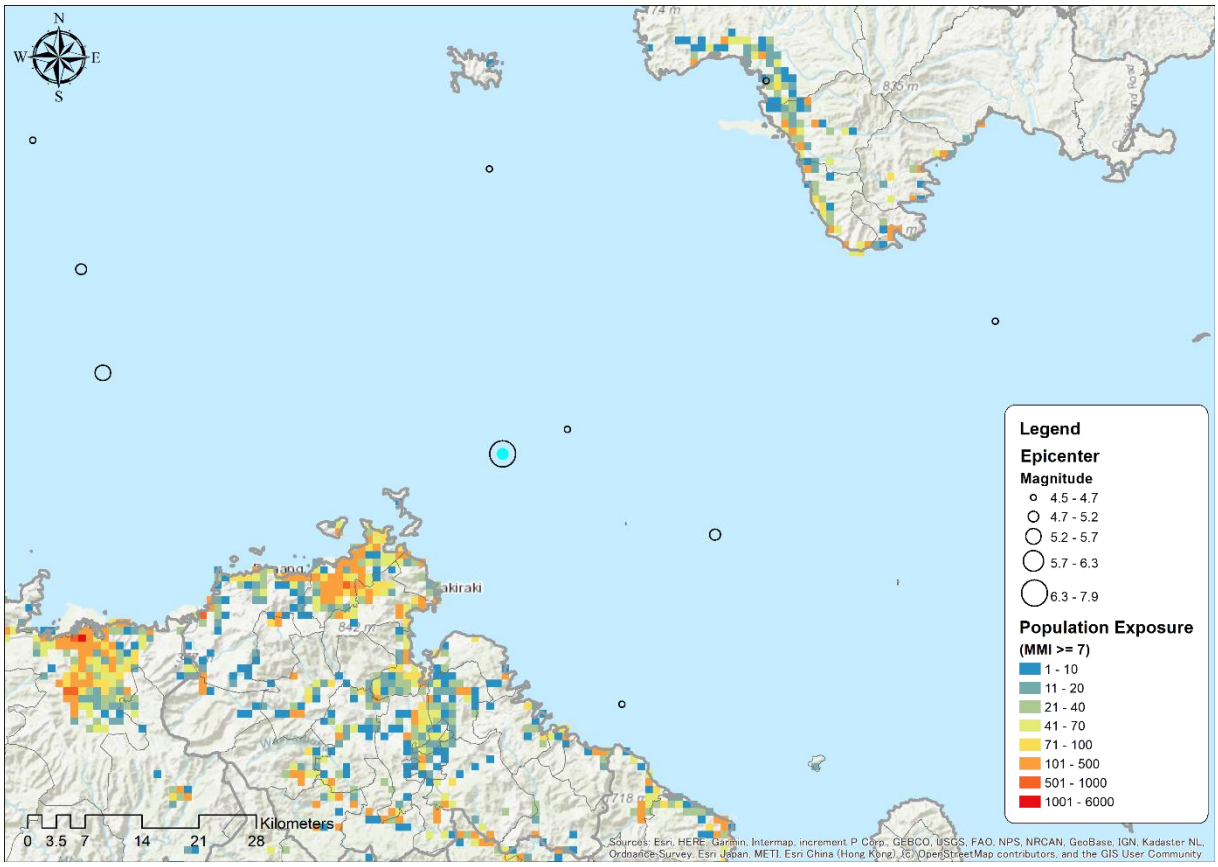


Figure 5-8 Population Exposure (larger thatn MMI 7) Map due to Rakiraki Scenario (M 6.5)

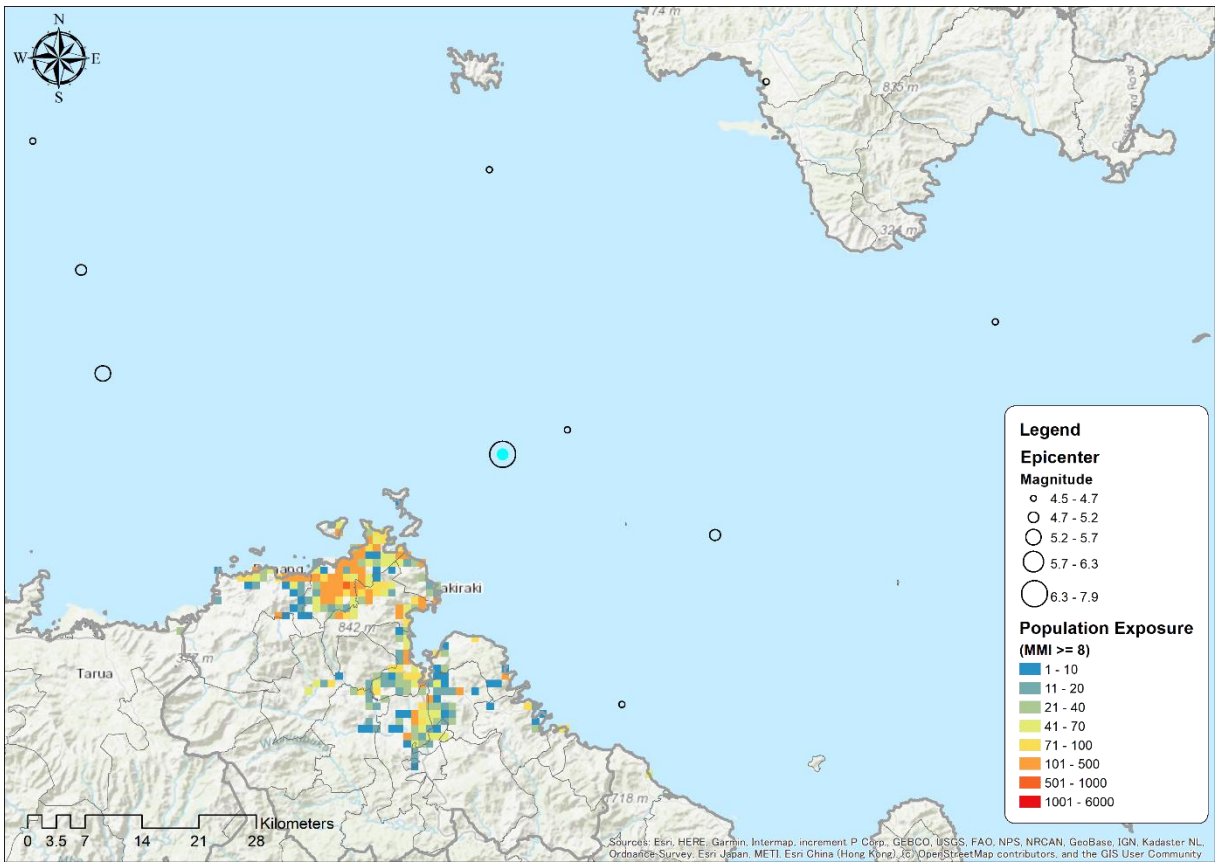


Figure 5-9 Population Exposure (larger thatn MMI 8) Map due to Rakiraki Scenario (M 6.5)

5.2.5 Suva historical scenario earthquake for Central Division

The case study of the 1953 Suva earthquake, which caused the most damage to the island of Viti Levu, should be implemented by everyone reading these guidelines. For the source parameters for the calculations, let's use the following values cited by the USGS Earthquake Catalog.

What MM seismic intensity distribution did you see on your map in ArcGIS? Compare this to the damage summary description on the next page!

Parameters of Epicenter for Suva Earthquake (USGS Earthquake Catalogu)

```
mag = 6.37
dep = 10
x1 = 178.354
y1 = -18.397
```

(Magnitude can be simplified to 6.4.)

5.4 History of Damaging Earthquakes, Suva

The epicentres of large shallow earthquakes (magnitude > 5, focal depth < 70 km) for the period 1973-1998, as well as earlier historical events, within an arbitrary 250 km radius of Suva are shown in Figure 9 and catalogued in Table 1.

Suva is located in the Southeast Viti Levu Zone of earthquake activity defined by Jones (1998). Jones' work summarised reports by others of a number of strong earthquakes which have occurred in this zone since the October 1869, Mw 6.1 event. Not all major events in the zone have been felt in Suva.

1932: In 1932, the Mw 6.6 Koro earthquake caused felt intensities in Suva of MM 4-5.

1953: Apart from several minor events, the most significant earthquake to affect Suva was the 1953 Suva earthquake of Mw 6.8, followed by a Mw 5.8 aftershock. Houtz (1962a) provided the definitive description of this event and its effects on Suva and Everingham (1987) also reported on the event. The main shock caused felt intensities of MM 7 in Suva and MM 8 in surrounding areas and caused a submarine landslide that initiated a tsunami. Two people were killed as a result of the earthquake and five more as a result of the tsunami. A large number of government buildings were damaged and many of the bridges in the region were destroyed or damaged. The main Suva wharf and the reclaimed area inshore were damaged to the extent that the wharf had to be replaced. There has been a much greater degree of development in the city area since 1953, so that an event of even similar intensity would cause far greater damage today.

1961: Other, smaller, events include the 1961, Mw 4.5 earthquake in the same zone which was described by Houtz (1962b) and Everingham (1987).

Figure 5-10 History of Damaging Earthquake in Suva[13]

5.2.6 Earthquake Hazard and Risk Mapping

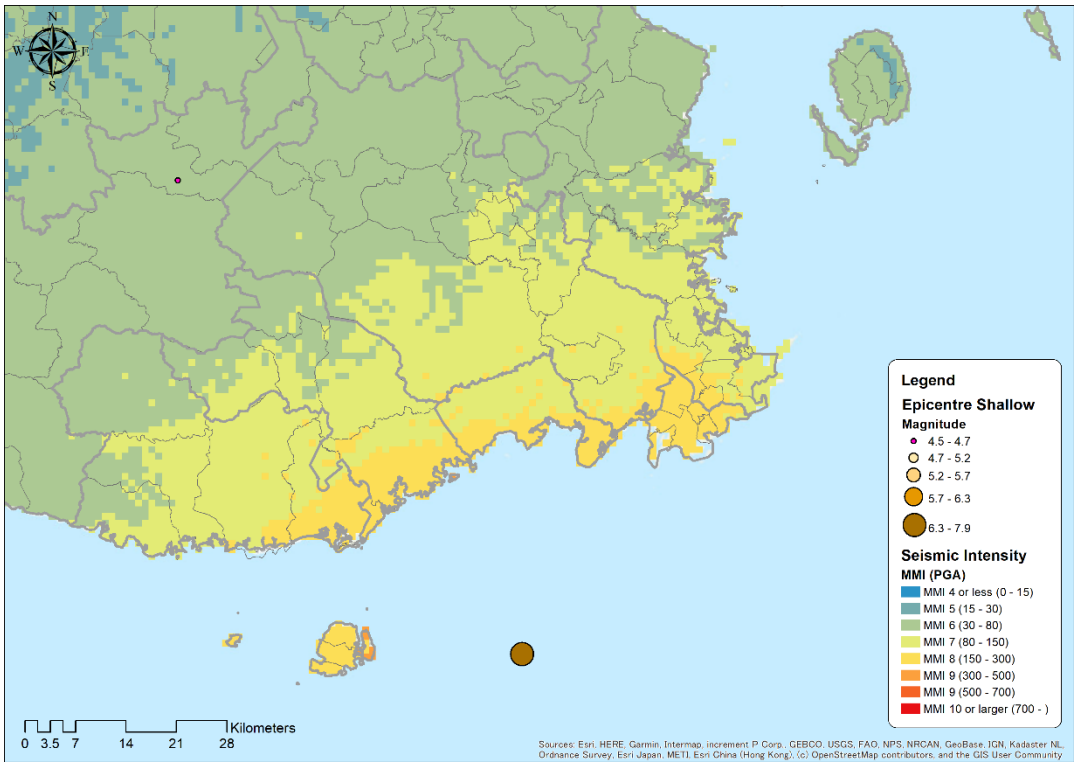


Figure 5-11 Calculation Result of Earthquake Hazard Map due to Suva Scenario (M 6.4)

[13] SOPAC (2001): Site-Specific Earthquake Hazard Determinations in Capital Cities in the South Pacific, SOPAC Technical Report 300, pp.31.

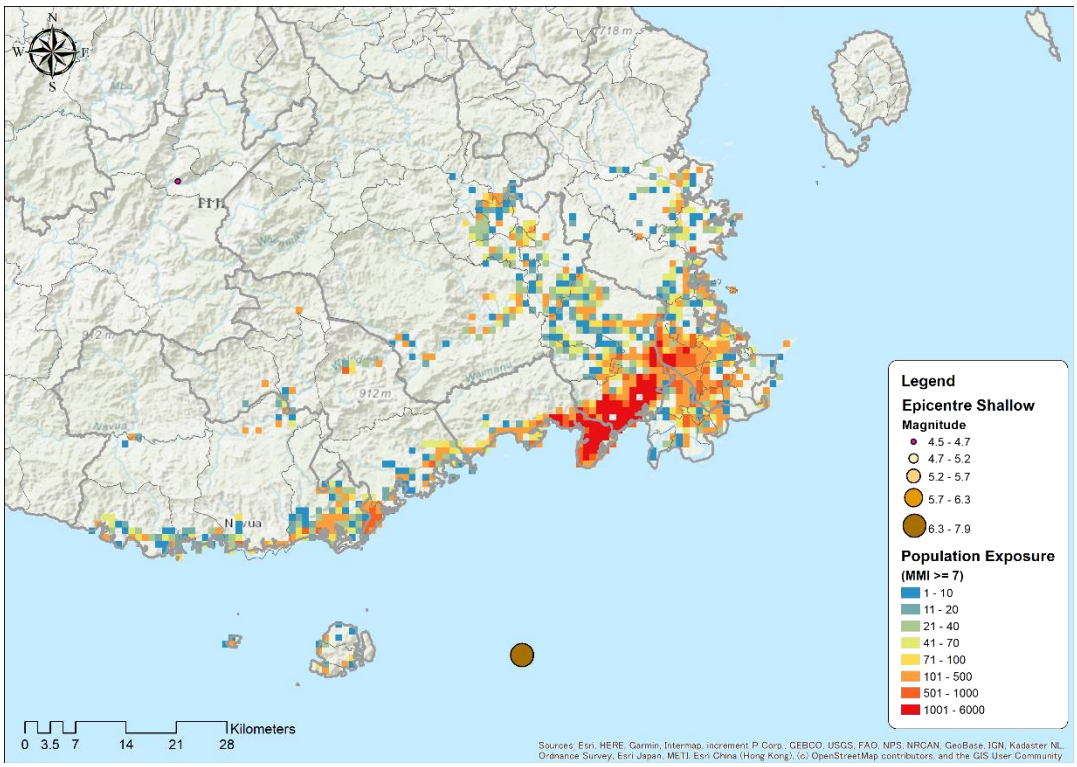


Figure 5-12 Population Exposure (larger thatn MMI 7) Map due to Suva Scenario (M 6.4)

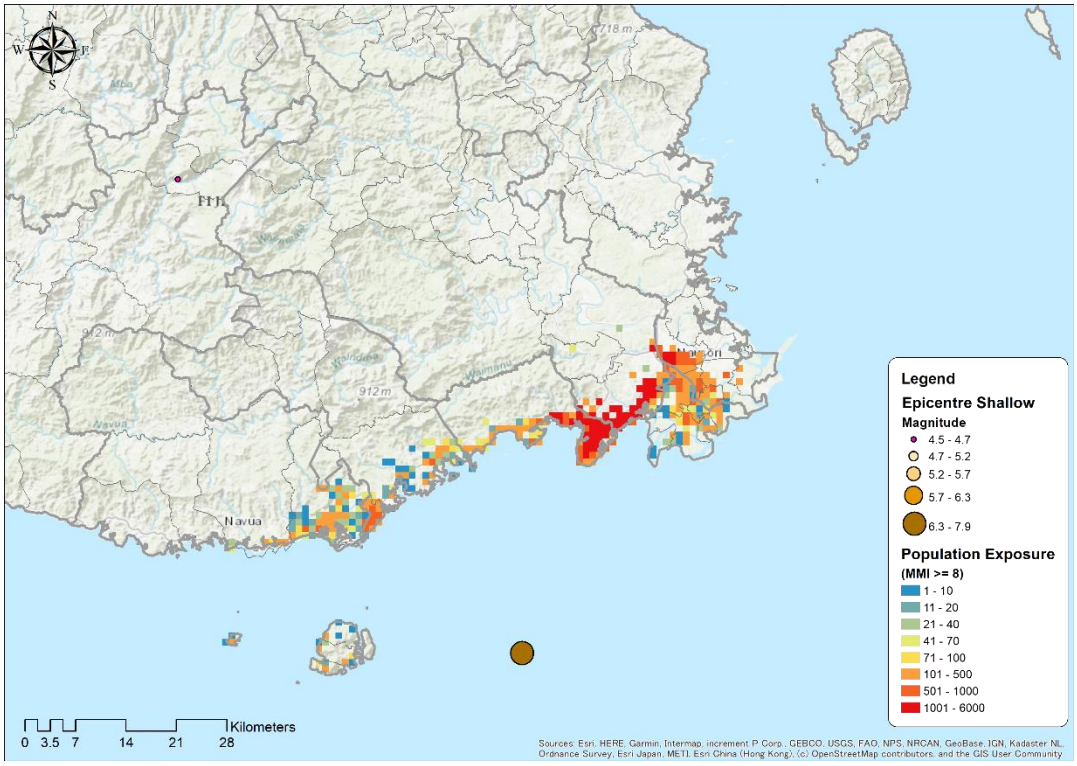


Figure 5-13 Population Exposure (larger thatn MMI 8) Map due to Suva Scenario (M 6.4)

Chapter 6. Zone Factor in National Building Code in Fiji

In this chapter, we evaluate the probabilistic seismic intensity (PGA) in the major cities of Suva and Nadi, positioning it as a probabilistic seismic map for Fiji. The Global Earthquake Model (GEM) probabilistic seismic PGA is also presented for reference.

6.1 Two types of Building Code in Fiji, old and new

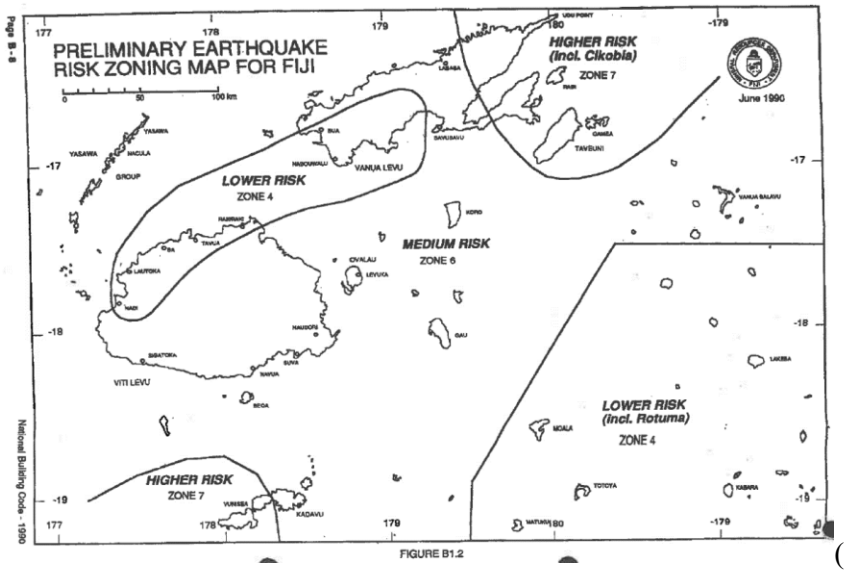
In the following two building codes, different maps are listed under different names. These technical materials contain probabilistic seismic hazard map named as “Zone Factor”.

A) National Building Code FIJI ISLANDS (1990): referred to as Zone Factor.

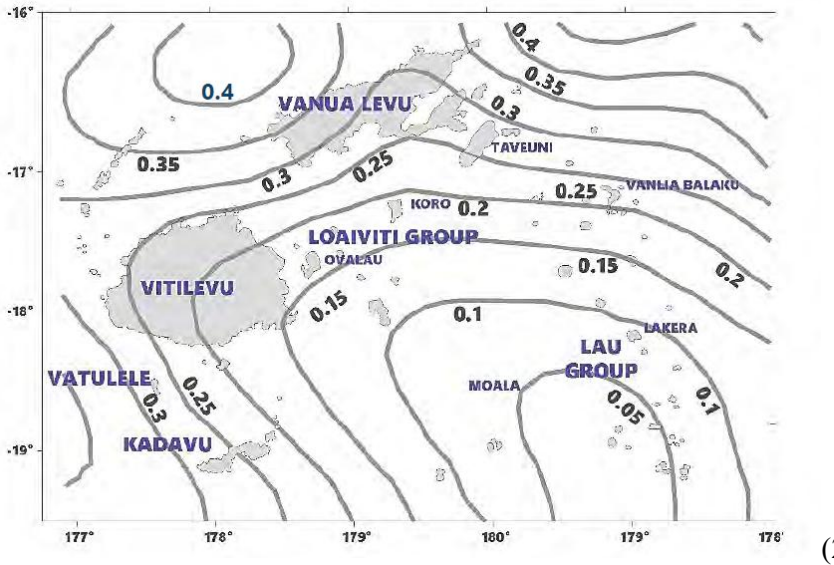
B) Seismic Hazard Z-Factor Map for Fiji in Fiji National Building Code Draft 2 (2023): referred to as the Z Factor.

6.2 Comparison of the two maps of old and new

The following figures shows two contour maps created for 1990 and 2023.



(1990)



(2023)

Figure 6-1 Comparison of Zone Factor Map between 1990 aand 2023

It was observed that both the trends of both contours and the values of the contours were different. Therefore, we investigated the literature from which each was cited.

6.3 Definition of Zone Factor and Z-Factor

The following table shows the definition of two seismic hazard map in NBCs.

NBC	Definition	Reference
1990	The 450-year 5% damped acceleration response spectral 0.2s value (g), Katayama ground condition Type 3*.	1) Probabilistic Earthquake Hazard Assessment for Fiji AGSO Record 1997/046
2023	0.5 x SA (0.5s), Horizontal response spectrum 0.5s value (g) at Class C site condition (Vs30: 450 (m/s), in return period of 500 years	2) GNS Science Consultancy Report 2014.261

* The contour map differs from the reference method, although the 1990 NBC reference material is informative in terms of numerical definitions and reference ground. The reference ground corresponds to Japanese Class 3 ground, Vs30: 100-200 (m/s).

Although the expression of probabilistic seismic motion is somewhat different, both values are the same with a 50-year 10% exceedance probability. However, the ground on which they are based differs.

6.4 Comparative study based on unification of reference ground conditions

Taking Suva and Nadi as examples, these values will be converted to engineering bedrock (equivalent to Vs=760(m/s)) and compare them with the values in the GEM employed in this project.

Conversion method: For conversion to ground amplification factor, Midorikawa et al. (1994)** is used; for conversion to SA and PGA, data and methods in the above reference materials 1) and 2) are used.

National Building Code FIJI ISLANDS (1990)

Page B-7, 8		zone		Zone Factor[1)]	PGA[1)]	***PGA at Vs760*** **
Viti Levu	Nadi.	4	Lower Risk	0.4	0.16	**0.075**
	Suva	6	Medium Risk	0.6	0.24	**0.112**

Fiji National Building Code Draft 2 (2023)

Page B-8		Z Factor	SA(0.5s)[2)]	SA(0.2s)[2)]	PGA[1)]	***PGA at Vs760*** **
Viti Levu	Nadi.	0.25	0.50	0.613	0.245	**0.192**
Z: 0.15 - 0.25	Suva	0.153	0.306	0.375	0.150	**0.117**

** S. Midorikawa, M. Matsuoka and K. Sakugawa, 1994, Site Effects on Strong-Motion Records Observed During the 1987 Chhiba-Ken-Toho-Oki, Japan Earthquake, Proc. 9th Japan Earthq. Eng. Symp.

The Global Earthquake Model (GEM)

The Global Earthquake Model (GEM) Global Seismic Hazard Map (version 2018.1) depicts the geographic distribution of the Peak Ground Acceleration (PGA) with a 10% probability of being exceeded in 50 years, computed for reference rock condition with Vs:760(m/s).

Nadi.	**0.14**
Suva	**0.11**

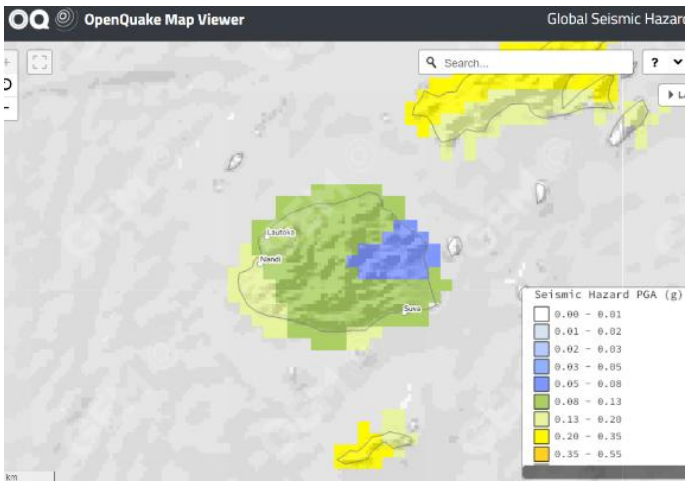


Figure 6-2 Probabilistic PGA Map in GEM

6.5 Discussion

- The Zone Factor contour plots for NBC 1990 and 2023 show very different trends, reflecting an increasing trend of shallow seismic activity on the north and west sides of Viti Levu Island since 1990.

- According to MRD Saula Mule, the active earthquakes were selected as the target of the source mechanism analysis in his master's thesis (see figure on the right). He also mentioned that the strengthening of the seismic network after 1990 may be a reason, but this does not necessarily explain the increase in earthquakes in the northwest, since the number of epicenters increases around Viti Levu Island in general.

- Following the change in trend in the contour map, the value in Nadi increased to 0.192 (g) in NBC 2023 compared to 0.075 (g) in NBC 1990. On the other hand, the Zone Factor values in Suva are almost the same, about 0.11 (g) in both cases.

- For the Zone Factor in Nadi, the seismic hazard assessment (see next page) assuming a similar strength (about 150(gal)), Engineered Buildings in urban areas such as Nadi that comply with the Building Code are designed to have this level of impact on seismic motion. In other words, the same level of seismic motion will cause the building to be damaged. In other words, it is reasonable to assume that the same level of seismic motion will not cause structural damage.

- However, there are a small number of meshes on Viti Levu Island with maximum accelerations in the 150-180 (gal) range (equivalent to 8 on the MMI seismic intensity scale) Some of the Engineered Buildings will likely suffer minor damage and many of the illegal buildings will likely experience structural damage.

- Although a survey has not yet been conducted to determine the distribution of illegal buildings, disaster prevention education is needed to inform residents that living in illegal buildings puts their lives at risk from earthquakes.

- In the current situation where illegal construction cannot be eliminated immediately, the distribution of vulnerable buildings should be determined from a humanitarian standpoint, and plans for securing appropriate shelter and supplies and dispatching rescue teams should be considered in advance.

Chapter 7. Earthquake Risk Information for Output 2 “Disaster Risk Reduction Planning” as Preliminary Assessment

7.1 Metholodogy

The population exposed to seismic intensity in the town areas identified in Output 2 is organized as follows.

- We do not know when and where an earthquake will strike. In the case of scenario earthquakes, the effects of distance attenuation from the epicentres of a specific earthquake are taken into account. In other words, the further away from the epicentres, the smaller the ground shaking.

- As scenario-based method is not considered appropriate for prioritizing facilities and infrastructure to be strengthened for earthquake resistance, constant input ground motion is adopted at the engineering bedrock. More concretely, we assume that an earthquake of the same intensity level occurred in whole area at engineering bedrock and multiply amplification factor to estimate seismic hazard at ground surface.

- We consider easy-to-use earthquake risk information in a disaster risk reduction plan for some pilot town area. According to Tokyo Metropolitan Government's “Community Earthquake Risk Assessment Study”, the input seismic motion on the engineering bedrock is kept constant. Following this approach, peak ground acceleration on the ground surface is calculated based on the effect of soil amplification factors. It is so called “Preliminary Assessment” in this project.

- Population Exposure is calculated using the PGA extent. PGA at engineering bedrock is set using open website information of probabilistic seismic ground motion. The website is described in the Section 2.2.5.

- It is possible to compare districts across the entire divisional area based on the effect of ground amplification.

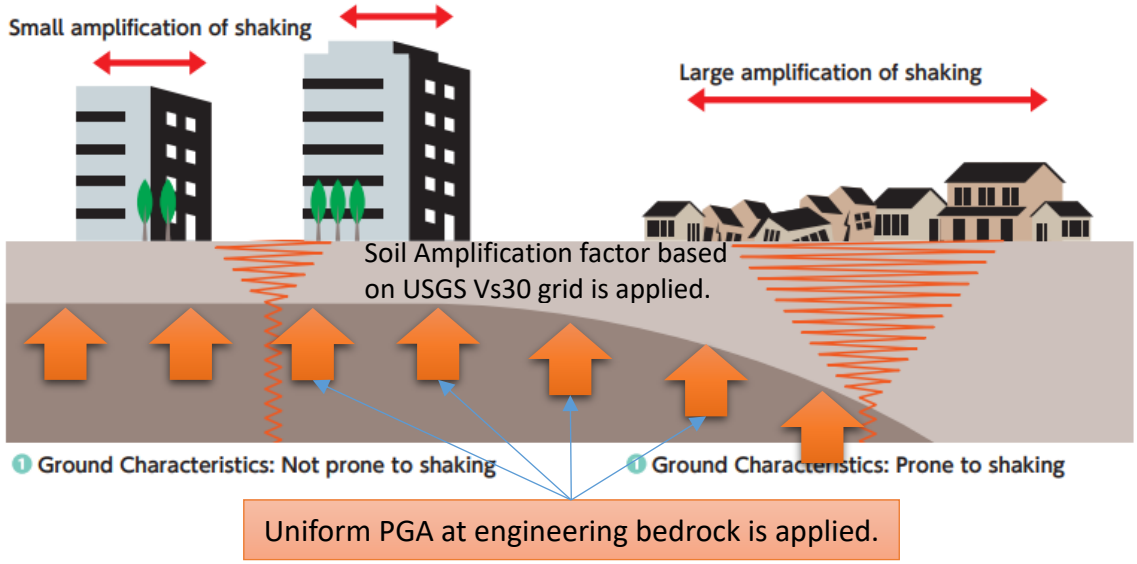


Figure 7-1 Basic Idea of setting Uniform PGA based on Tokyo Metropolitan Government
(https://www.funenka.metro.tokyo.lg.jp/2024/02/kikendo_english.pdf)
(https://www.funenka.metro.tokyo.lg.jp/assets/pdf/archive/kikendo_all.pdf)

7.2 Setting PGA at Engineering Bedrock

Using the probabilistic seismic motion introduced in Section 2.2.5, the input seismic motion for the engineering base in Fiji is calculated. The method used here is to view the PGA for the target town area in Output 2 and calculate the average of some town area candidates. Procedure is following,

- Visit the OpenQuake free website. (2023 version, https://maps.openquake.org/map/gshm-2023-1/#8/-17.273/178.526) This website shows a geographic distribution of probabilistic PGA with a 10% probability of being exceeded in 50 years, computed for reference engineering bedrock conditions (shear wave velocity of 760-800 m/s)

- Click on the center of the Town Area to obtain the PGA information on the web map.

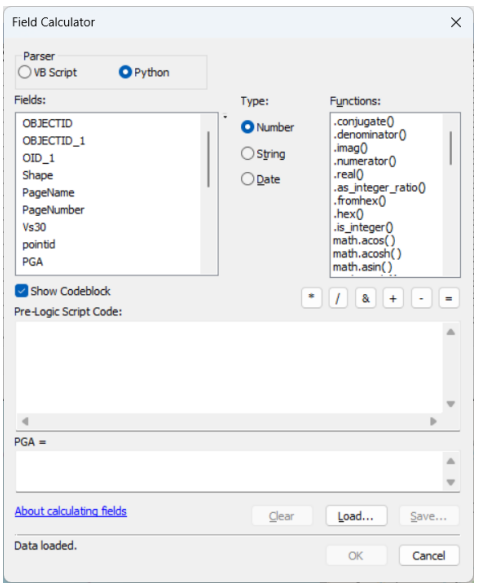
- Calculate the average of the probabilistic PGA for the Priority Areas. Candidate towns are currently listed for Western and Central Divisions as follows. PGA is attached to the list.

Western Division		Central Division	
Rakiraki	0.11	Navua, Pacific Harbour	6,901
Ba	0.12	Lami	1,397
Lautoka	0.14	Suva, Nasinu	39,780
Tavua	0.11	Nausori	50,137
Sigatoka	0.14	Korovou	—
Nadi	0.17		

The average value was calculated as 0.14 (g) from the above table on the condition that the third decimal place and below were rounded down. We set this value as a constant PGA at the engineering bedrock.

7.3 Calculation of PGA on the ground surface

Using the grid cell Vs30 database, PGA on the ground surface is calculated in ArcGIS. The following figure shows the procedure.



Procedure

1. On the Attribute Table, create a new field "PGA2" for the calculation of PGA using a constant/uniform PGA.
2. At the "PGA2" data field, Field Calculator is executed. (see the left figure)
3. Checking Python as Parser and describe the following equation in the box for Script Code.
   10 ** (1.35 - 0.47 * math.log10(!Vs30!)) * 0.12
4. In the above equation, 0.12 means the constant value for PGA (g) at the engineering bedrock.
5. The unit of the calculation result is expressed in g, the acceleration of gravity.
6. Be careful that this equation uses Vs30 field in the attribute table. You need to prepare in advance.

Figure 7-2 Field Calculator and equation to calculate PGA using constant/uniform PGA on the engineering bedrock

7.4 Population Exposure Calculation

The following figure shows overlay of Population exposure with a case of criterion: PGA> 0.2 (g), which approximately corresponds to JMA Intensity 5+ or higher overlaying town area polygon layer which are candidates for Output 2. This intensity level includes MMI 8 or higher.

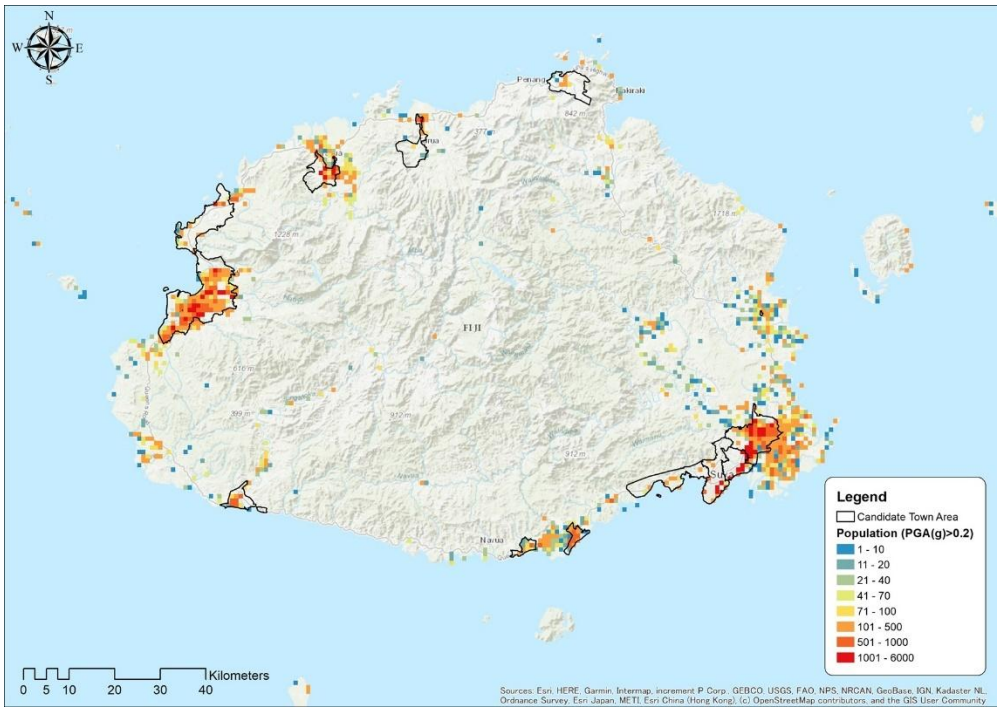


Figure 7-3 Population Exposure (PGA > 0.2(g)) and candidate Town Area

The following figure shows a reason why a criterion of JMA Seismic Intensity 5 was chosen for Population Exposure calculation. The figure of a fragility curve for wooden houses in Japan after Kobe earthquake 1995 shows a tendency that partial collapse occurs from JMA Intensity 5 or larger. [14] So, JMA Seismic Intensity 5 is adopted as a criterion for population exposure in general.

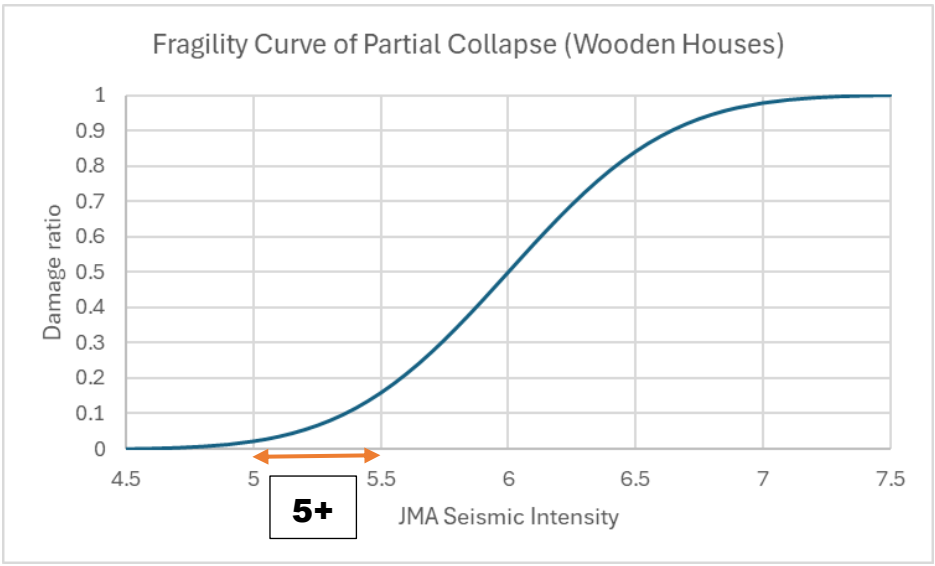


Figure 7-4 A Fragility Curve for wooden houses after the 1995 Kobe earathquake (Yamaguchi and Yamazaki (2000))

[14] Yamaguchi, Naoya, and Fumio Yamazaki. "Fragility curves for buildings in Japan based on damage surveys after the 1995 Kobe earthquake." Proceedings of the 12th World Conference on Earthquake Engineering. No. 2541. 2000.

A simple conversion method from PGA to JMA Seismic Intensity is introduced at Section 1.5.2 as following figure.

As conversion equation includes standard error (σ), one criterion of 0.2 (g) was set for JMA Seismic Intensity 5+ or larger.

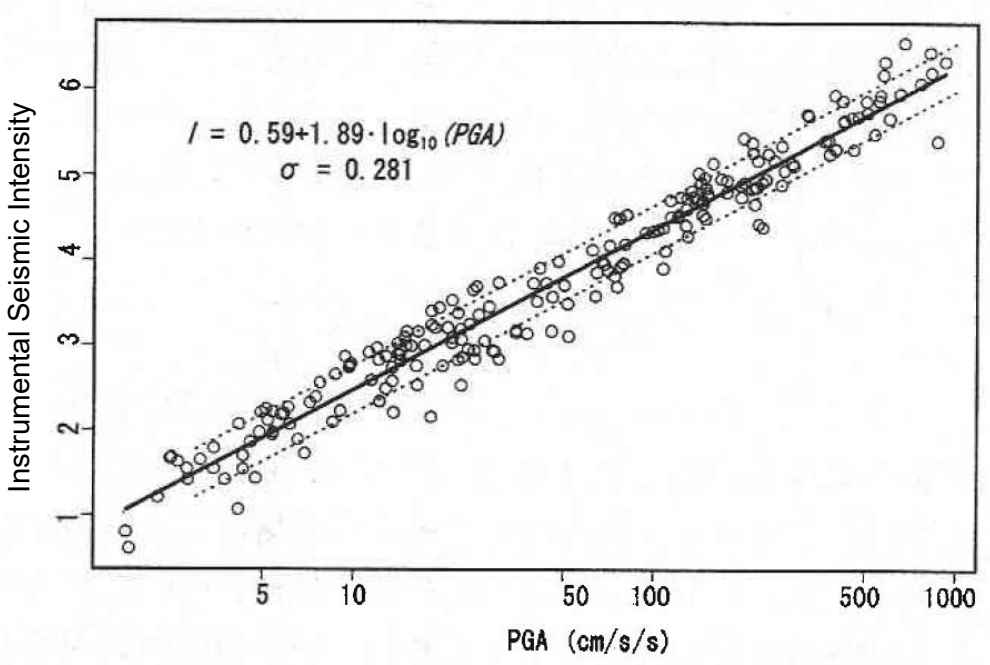


Figure 7-5 Comparison method between PGA and JMA Seismic Intensity (Ton and Yamazaki (1996))

The following is a method for summing up population exposure within the target priority town area polygons. The procedure is described for ArcGIS Desktop (or ArcGIS Pro).

- Prepare longitude and latitude data field in the attribute table of Grid raster polygon layer. For this purpose, [Add field] and [Calculating Geometry] is executed. X, Y coordinate is stored in the attribute table of Grid raster polygon. (See 4.1.2 for details)
- Export the attribute table => [Display XY Data] => Point feature layer including population exposure to sum up is created.
-
- In the dialog box that appears, write a calculation script. Note that Python should be selected as the Parser.
- Instead of writing, you may load a saved text file (*.cal).
- Click the OK button at the bottom of the dialog box.

Chapter 8. Damaging Earthquakes in and around Fiji Islands

Fiji is divided into northern, southern, eastern, and western regions, and a Nationwide Expansion Plan of Hazard and Risk Assessments has been created to conduct earthquake hazard risk assessments in each region. The following table shows damaging earthquakes in and around Fiji, which can be used as a draft of the scenario earthquakes to be used in the Enhanced Assessment.

When damaging earthquakes occur in the vicinity of Fiji in the future, this table should be updated. It should be utilized as a new scenario earthquake for regional earthquake disaster prevention and mitigation. In its application, please utilize the fundamental hazard and risk assessment methodologies outlined in this guideline.

Table 8-1 Damage Earthquakes in and around Fiji Islands

Year	Magnitude	Intensity (MMI)	Description
1869	-	7	Viti levu
1877	-	---	Tsunami from Northern Chile earthquake
1919	6.9	7-8	Minor damage to buildings, landslides
1932	6.2	7-8	Major Landslide on neighboring islands tilting and major damage to the reef lighthouse
1953	6.8	7	Major damage to the wharf and buildings in Suva, Tsunami caused 3 fatalities in Suva and 12 reports of drowning in Kadavu and Koro, deaths 8, Injuries 50
1979	6.9	7-8	Major damage to buildings on neighboring islands. Landslide to island of Qamea.
1993	6.4	---	Futuna Island, Deaths 5, Injuries 201, limited damage
1998	6.5	---	Major damage to concrete buildings, major landslide to mount Washington, massive damage to plantations
2018-8	8.2	4	Viti Levu region is affected. No damage is reported.
2018-9	7.9	4	Viti Levu region is affected. No damage is reported.
2019	5.7	5	Minor damage, Landslides, 17.5 km depth, 94 km SSW from Suva

Sources: JICA report 2008, BRI (Japan), USGS, and NGDC

Republic of Fiji

PROJECT for Mainstreaming of Disaster Risk Reduction Project

Nationwide Expansion Plan of Hazard and Risk Assessments

October 2025

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

ORIENTAL CONSULTANTS GLOBAL
YACHIYO ENGINEERING CO., LTD
PACIFIC CONSULTANTS CO., LTD

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1. Purpose of the Assessments

The major purpose of disaster hazard and risk assessment is to enable agencies / organizations and personnel involved in disaster prevention, as well as local residents and stakeholders, **to understand the risks of disasters in the country / region and the actual conditions of challenges and measures against them, in order to eliminate / reduce risks leading to disasters as much as possible and minimize disaster damage**.

It enables to consider disaster measures in regional / local DRR plans as a “proactive disaster prevention measure” by conducting disaster hazard and risk assessments. It is expected that the prevention and mitigation of disasters will be further promoted. Additionally, each agency / organization responsible for preventive and emergency measures against disasters can consider their respective strategies by organizing hazard / risk information through visualizations of items such as "flood-prone areas / tsunami or storm-serge hazard areas and expected inundation depths", "landslide warning areas and dangerous spots", "earthquake risks and susceptibility", and "other necessary matters". Furthermore, local residents can promote disaster awareness and education, advance inundation prevention measures and seismic retrofitting for buildings, and facilitate smooth evacuations, which will help prevent human casualties by providing clear information on "disaster risks".

There are various definitions of disaster risk, such as the disaster risk is determined by the “interaction of hazards, vulnerabilities, and exposures”, but disaster hazard / risk assessments in the project is defined as follows.

Disaster Hazard Assessment	: Assessment of potentially harmful natural phenomena that may cause damage to human life, assets, society, economy, etc.
Disaster Risk Assessment	: Assessment of damage to human life, assets, etc. that disaster hazards can cause

2. The Effectiveness and Utilization of the Simplified Hazard/Risk Assessments to be conducted in this Project

The following effects / outcomes can be expected in addition to the aforementioned objectives by effectively conducting risk assessments.

- ✧ **The disaster risk in the region becomes clear**
- ✧ **Awareness of the disaster risk in the region can be shared throughout the community, including administrators**
- ✧ **Priorities for safety measures can be determined in a rational manner**
- ✧ **The reasons for the "rules to protect" against remaining risks become clear**
- ✧ **Sensitivity to the disasters risk increases by involving all the stakeholders**

Regarding 1) and 2), although there are accuracy constraints in the simplified hazard / risk assessments as shown in the following sections, it is possible to visually indicate hazard areas on maps, especially in regions where past disaster information is limited. As a result, disaster risks become clear, and awareness of disaster risks can be deepened. For example, it is possible to roughly understand the impact of each cyclone / heavy rain on the region by conducting multiple simplified hazard / risk assessments of flood / inundation situations caused by past cyclones / heavy rain. Although the accuracy is not high, a simplified hazard / risk assessments can provide an understanding of “which areas (including specific roads and bridges) will be affected to what extent (such as inundation depth)” by the external forces inputted. Furthermore it is possible to roughly grasp the potential impact of flood / inundation that could occur from future cyclone and rainfall predictions by organizing the impact of each cyclone in a visual or comparable manner. Since the damage caused by the cyclone is easy for people to remember, it can also be used to provide disaster information in a form that is easy for residents to understand, such as "there is a concern that flooding will be on the same level as past cyclones.", and it can be utilized for impact-based forecasting (especially for floods and coastal disasters).

Regarding 3) and 4), not only the above-mentioned flood / inundation but also landslides (sediment disasters) and earthquakes can be spatially / map-wise indicated as hazard areas, allowing for a rough understanding of which regions will require disaster countermeasures. As a result, it enables to logically determine the areas that need protection based on their social and economic importance and so on, and to consider necessary measures, even if only roughly. Of course, more accurate hazard / risk assessments are required for the consideration of specific countermeasures, the calculation of their effectiveness, and for outline / detailed design of structural measures. Even if appropriate risk mitigation measures cannot be implemented immediately due to technical, economic, or time constraints, it is possible to understand the necessary considerations and rules to follow (such as restraining development in areas with remaining risks) by taking into account the risks and residual risks in the area.

By sharing hazard and risk information from 1) to 4), everyone's awareness of disaster hazards and risks, including those who are not familiar with the local situation, will deepen and the sensitivity to the disasters risk will increase as mention on 5).

In relation to the nationwide expansion and utilization of simplified hazard / risk assessments, this project conducted hazard and risk assessments through the following division of roles. A similar division of roles is expected for future activities for other regions of Fiji.

Table 1 Demarcation of duties towards hazard and risk assessments

(in parentheses: proposed responsible agency)

	Major Steps	Flood	Sediment Disaster	Tsunami	Storm Surge	Earthquake
Hazard Assessment	Preparation of basic data	Preparation of topographic data (NDRMO) and hydrological data (FMS)	Preparation of topographic data (MRD, NDRMO)	Using existing models (MRD)	Using existing models (FMS)	Seismic Data (MRD) Building Data (NDRMO)
	Set of pre-assumption, boundary conditions	Rainfall intensity estimation / Statistical analysis of the past floods (FMS)	Various processing of DEM data on GIS (MRD, NDRMO)	Assumed earthquake by using ComMIT model (MRD)	Assumed storm surge by using the SSFM-JMA model (FMS)	A scenario earthquake (MRD)
	Conduct the simulation	Inundation simulation by using RRI Model (FMS, NDRMO, MoAW)	Visual & Manual judgement of hazard areas (MRD, NDRMO)	Inundation simulation by Fill Level Method (MRD, NDRMO)	Inundation simulation by Fill Level Method (MRD, NDRMO)	Seismic attenuation formula and site amplification (MRD)
	Model validation/re-calibration	Actually, difficult because of the lack of past disaster records (area, damage, water level, rainfall etc.) Actual inundation survey (NDRMO)	On-site validation survey (MRD)	Actually, difficult because of the lack of past disaster records (area, damage, water level etc.)	Actually, difficult because of the lack of past disaster records (area, damage, water level etc.)	MRD and NDRMO will work together on GIS mapping work. Seismic parameters may be revised according to the damage estimation.
Risk Assessment	Preparation of exposure data	Preparation of GIS data on household / population / infrastructure etc. (NDRMO)				Building vulnerability survey (NDRMO)
	Analysis of loss and damage	Estimation of affected household, population, infrastructures (NDRMO)				Vulnerability function of buildings (NDRMO)
	Risk Mapping	Organizing the GIS information (NDRMO)				Population exposure to seismic intensity (MRD and NDRMO)

* NDRMO: National Disaster Risk Management Office, FMS: Fiji Meteorological Service, MRD: Mineral Resource Department - Ministry of Lands and Mineral Resources, MoAW: Ministry of Agriculture and Waterways (As of February 2025)

3. Limitations of Simplified Hazard / Risk Assessments, Limitations of Accuracy and Constraints

The methods for simplified hazard / risk assessment are explained in the separate booklets, "Guidelines for each disaster type" which should be referred to; however, the methods used in this project, as well as the evaluation items and the major necessary data required for the assessment, are as shown in the table below.

Table 2 Methods of the simplified hazard assessment and major necessary data

Hazard Assessment	Flood	Sediment Disaster	Coastal Disaster (Storm Surge & Tsunami)		Earthquake
Method	**Simplified runoff / flood analyses (RRI model)**	**Simplified topographical debris flow & steep slope collapse assessments**	**Storm surge simulation model (SSFM-JMA) + Fill level method using seaside evaluation method**	**Simplified tsunami simulation model (ComMIT) + Fill level method using seaside evaluation method**	**Attenuation equation and soil amplification factor**
Items can be assessed	➢ Inundation area ➢ Inundation depth ➢ Inundation duration time	➢ Debris flow hazard area ➢ A slope at risk of collapse	➢ Storm surges at coasts ➢ Inundated area ➢ Inundation depth	➢ Tsunami heights at coast ➢ Inundation area ➢ Inundation depth	➢ Seismic Intensity (PGA)
Major Necessary Input Data ***Data (in blue): Essential data**	➢ **Elevation (DEM)** ➢ **Rainfall data** ➢ Land use ➢ River longitudinal and cross-section data (simple) etc. ➢ **Past inundation area and its inundation depth**	➢ **Elevation (DEM)** ➢ **Location of house, household, building (Building footprint)** ➢ Location of infrastructure such as road & etc. ➢ Rivers / streams GIS information	➢ **Elevation (DEM)** ➢ **Past cyclone information (tracks, pressure, etc.)** ➢ Datum of tide gauges	➢ **Elevation (DEM)** ➢ **Past earthquake information to set scenario earthquake** ➢ Datum of tide gauges	➢ Epicenter parameters (longitude, latitude, depth, magnitude) for attenuation equation ➢ Vs30 (shear wave velocity to 30 meters depth) grid database for amplification factor

The specific limitations of the simplified hazard assessment will be introduced in each disaster section, but broadly speaking, the following can be mentioned.

- ✧ **It is expected that the evaluation results will change when more detailed analyses are conducted since this simplified analyses are based only on the limited input data shown above.**
- ✧ **There are challenges in validating the reliability of the developed analysis models, due to limited information on past disaster data such as past inundation data.**
- ✧ **The available historical disaster information is limited, and the assumed scenarios in the simulations do not necessarily reflect reality. Additionally, they do not consider all disaster occurrence mechanisms (especially tsunamis, etc.).**
- ✧ **As mentioned above, the results of the simplified hazard / risk assessments are utilized to roughly consider countermeasures in local disaster prevention plans and so on, however detailed hazard analysis is necessary to examine specific countermeasures.**

The hazard / risk assessments in this Project are consist of two assessments, “Preliminary Assessment” and “Enhanced Assessment” (for more details, refer to the separate booklets, "Guidelines for each disaster type"). Preliminary assessment is conducted in order to select the priority area to conduct the enhanced assessment in the division. Enhanced assessment (with the simplified hazard / risk assessments) is conducted in order to grasp and understand the hazard / risk areas in the priority areas as mentioned in the previous chapters.

Inundation area, affected household & population and infrastructures based on the Global Flood Map (GFM, 1-in-50 year Flood)[1)]

Basin	Assumed			
	Inundation Area[2)] (km^2)	Affected Household[3)]	Affected Population[3)]	Affected Business[3)]
Navua	44.7	1,484	6,599	122
Coastal Neighbor Navua	92.7	1,420	6,285	56
Rewa	99.3	4,678	21,732	433
Namalata Neighbor	116.5	1,463	6,873	76
Suva & Lami Coast	22.0	4,378	18,885	1,350

Basin	Actual Damage		
	Frequency of Flood damage[4)]	Year[4)]	Damaged infrastructures in GFM inundation area[4)]
Navua	1	2016	10
Coastal Neighbor Navua	1	2012	6
Rewa	3	2012Jan&Mar, 2016	10
Namalata Neighbor	-	Unknown	4
Suva & Lami Coast	-	Unknown	2

1) inunriver_historical_000000000WATCH_1980_rp00050.tif, (source: https://www.kvfi.org/data/aqueduct-floods-hazard-maps),
2) Difference of inundation depth is not considered, 3) Based on the 2017 Census (Household & Population) & the 2018 Census, "Fiji_BR_2018.shp" (Business),
4) Based on the "Infrastructures Affected by Flood" prepared by NDRMO,

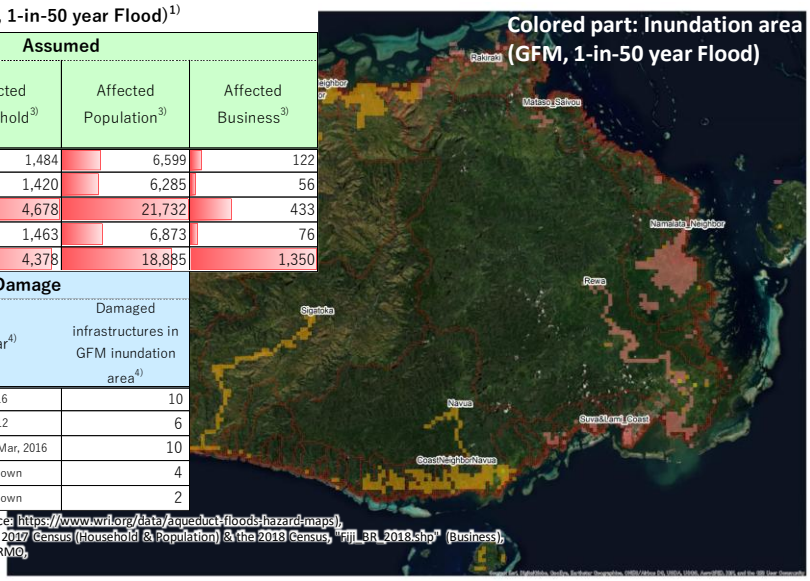


Figure 1 Example of the preliminary assessment

The nationwide expansion plans for each disaster type will be described in the following chapters. It contains the following contents.

- ✧ Implementing organizations / agencies
- ✧ Expected areas to expand
- ✧ Expected implementation schedule
- ✧ Limitations of simplified hazard / risk assessments, limitations of accuracy and constraints
- ✧ Expected improvements of hazard / risk assessments in the future
- ✧ Expected budgeting
- ✧ Other Related Projects to be Collaborated

4. Flood

4.1 Activities / Responsibilities

Expected implementing organizations / agencies are as follows. FMS and NDRMO are expected to take a leading role. Input data preparation such as creating watersheds and so on for the enhanced hazard assessment might be conducted by NDRMO, while FMS prepare the input rainfall data. Also NDRMO is expected to play a leading role in an actual inundation survey. Moreover, NDRMO will enhance interaction among MRD and FMS to build the network with them. Currently, NDRMO plays an administrative role, but aims to take on more technical, scientific, and specialized responsibilities as a governmental agency.

Items	Organization	Activities
Preliminary Assessment	FMS Hydrology Section, NDRMO	• NDRMO can perform this assessment due to simplified evaluation by GIS. • The assessments for the Western & Central Divisions have already been conducted in the project. • After that, the Northern and Eastern Divisions will be expanded.
Enhanced Hazard Assessment for Whole Islands	FMS Hydrology Section, NDRMO	• RRI models have been developed for several watersheds in the Western & the Central divisions (refer to エラー! 参照元が見つかりません。). • There are no or very limited actual inundation information that contributes to model validation. Therefore, it is considered of conducting actual inundation survey under the leadership of NDRMO. • More detailed flood hazard assessments have been conducted or will be conducted with the support of other donors in some watersheds (e.g., the Nadi River Basin, etc.). Therefore, demarcation of hazard assessment should be confirm considering other donor support. • As mentioned above, based on the results of the Preliminary Assessment, the relevant C/P organizations will discuss the setting of the Priority Area, the division of roles, the timeline, etc., and finalize the plan.
Enhanced Risk Assessment of for Whole Islands	NDRMO	• Since asset data is managed by the NDRMO, risk assessments are conducted based on the results of FMS hazard assessment.

4.2 Expected Areas to Expand and Timeline / Milestones

Assumed expected areas (divisions) to expand and its timeline are as shown below (refer to Table 3). Preliminary assessments for the Western and Central divisions are implemented in the Project. And the enhanced assessments for the Ba River and the Lami, the Wailoku, the Samabula and the Laqere Rivers are implemented as well. For the Nadi River, more detailed flood model was developed and the assessments was conducted by other projects.

Items	Western Div.	Central Div.	Northern Div.	Eastern Div.
Preliminary Assessment	~2024	~2025	~2026	~2027
Enhanced Hazard Assessment	~2026	~2027	~2028	~2029
Enhanced Risk Assessment	~2026	~2027	~2028	~2029

According to the preliminary assessment, Lautoka, Sigatoka, and Tavua, which have a large affected population and area, are considered Priority Areas after Ba in the Western Division. However, there are not specific big rivers run through Lautoka. Nausori (The Rewa River) and Navua are similarly regarded as Priority Areas in the Central Division. It was determined that the Northern division has a higher priority than the Eastern division considering the affected population, socio-economics, the size of the cities, the size of the river / river basins and the topographical conditions.

4.3 Limitations of simplified hazard / risk assessments, limitations of accuracy and constraints

Detailed limitations of the simplified hazard / risk assessments are as follows, even though the major limitations were mentioned in the chapter 3.

Data used in the model → The accuracy of the analytical model is not high

- ✧ The available observational rainfall data is limited both spatially and temporally, and this project utilizes daily rainfall data.
- ✧ Due to the low quality of the observed rainfall data, quality control of the data is necessary.
- ✧ Data such as the width and depth of rivers should be set based on survey data, but currently, the river width is set based on readings from satellite images.
- ✧ 30m-resolutions DEM is used for the model.
- ✧ Calculation grids of the model can be rough depending on the watershed area. And Conditions that affect the spread of flood flows, such as road embankments and waterways, are not modelled.

Model validation → No validation was conducted since there is no / lack of data for validation

- ✧ As mentioned above, there are challenges in validating the reliability of the developed analysis models, due to limited information on past disaster data such as the inundation area / extent and its inundation depth in the floodplains, and observed water level data during the floods.

Constraints on usage → The use of evaluation results is limited to understanding the general range and extent of disaster impact

- ✧ As mentioned above, the results of the simplified hazard / risk assessments are utilized to roughly consider countermeasures in local disaster prevention plans and so on. More detailed hazard analyses are necessary to calculate a more accurate disaster impact, examine countermeasures and estimate their effectiveness, and outline and detail the design of countermeasures.

4.4 Expected improvements of hazard / risk assessments in the future

The following matters are expected to require or improve in the future regarding the above mentioned constraints / limitations on the simplified hazard / risk assessments.

Constraints1: The accuracy of the analytical model is not high

- ✧ Long-term and spatially denser observations are needed.
- ✧ Proper rainfall inventory, such as the inventories prepared in this project, shall be organized. FMS will try to arrange rainfall inventories for other river basins (including the quality control) following the guideline. Then, FMS will do statistical analysis, starting from the Western division, Central, Northern then Eastern Divisions.
- ✧ Since there are a lot of missing data and suspicious data, quality control of observation is needed.
- ✧ Regular cross-section survey especially at the water level gauges should be conducted.

Constraints2: No validation was conducted since there is no / lack of data for validation

- ✧ Actual inundation survey and accumulation of survey results on flood damage caused by river flooding. In this regard, NDRMO should take a leading role in collaboration with other related local organizations.

Constraints3: The use of evaluation results is limited to understanding the general range and extent of disaster impact

- ✧ Advancement of hazard assessment methods tailored to specific purposes, such as detailed examination of countermeasures and more accurate disaster warning systems.
- ✧ As for the utilization of the simplified hazard / risk assessments, publication of flood hazard maps shall be implemented. Moreover, putting a flood hazard map on a big signboard in the specific flood prone area shall be taken in collaboration with NDRMO. NDRMO will take a leading role for public awareness activity using the signboard (Due to the limit of validation information, simulation model validation will not be implemented).
- ✧ Assessment results and the maps to be updated / revised periodically, such as every 3-5 years (Tsunami ready response plan is updated every 3 years).

4.5 Expected budgeting

The simplified hazard / risk assessments generally involves "organizing terrain data, organizing input rainfall data, developing analytical models, and organizing the result as GIS data". The number of days and manpower required for the work depends on the size of the watershed, however it will likely take several days per watershed. As mentioned in 4.1, the organization of terrain data was handled by NDRMO, while the organization of observed hydrological data, the development of the RRI model, and the organization of evaluation results on GIS were managed by FMS in the Project. Therefore, it is expected that a similar division of roles will occur when expanding nationwide, with the approximate number of manpower outlined above being borne by each respective organizations.

Besides, the expansion of hydrological observation equipment depends on the annual budget related to the FMS. And the actual inundation survey and the surveyed data compilation will primarily be carried out at the expense of the NDRMO.

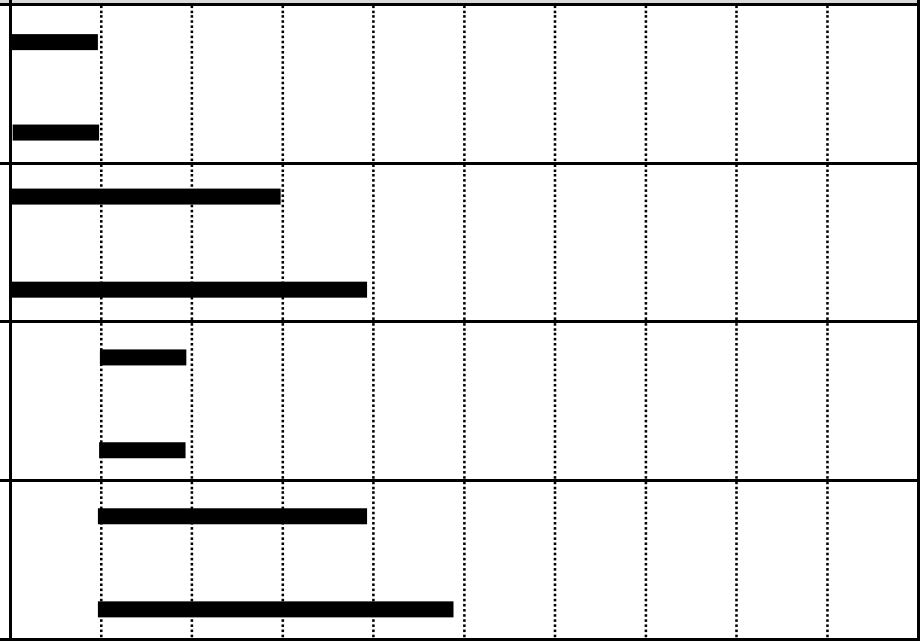
Publication of flood hazard maps and notice signboards of the flood hazard will contribute to justify the budget for the hazard / risk assessments. The numbers of RRI modeling (flood hazard mapping) accomplished in the year will be included as an output in the work report for the year.

Human resource planning is also essential relating to budgeting. In regard to scientific officer, the hydrology section of the FMS considers increasing the number of scientific officers from three to four. One senior scientific officer looks after flood forecasting (including the hydrological analysis and modelling) and another senior scientific officer looks after hydrology product (Intensity-Duration-Frequency curve and so on). Regarding the human resource of NDRMO, two more GIS officers shall be recruited so that each officer can look after each division and the chief GIS officer will look after entire Fiji (this is not only for flood, but also for other types of disaster). Also increasing the salary to retain the officers will be considered. However, funding support (project base) to secure GIS officers is required.

4.6 Other Related Projects to be Collaborated

No.	Projects	Related Activities
1	Hydrology support for flash flood early warning systems (The project supported by the SPC)	• Rakiraki is the target area of the project. FMS Hydrology Section is involved in this project. 2 water level gauges were installed and the thresholds of warning water levels were set.
2	Nadi Flood Protection Project	• Detailed flood analyses have been conducted through the passed JICA project, the ADB project and the Australian Infrastructure Financing Facility for the Pacific (AIFFP).
3	Pacific project enhances early warning systems for island resilience (Solomon Islands, Fiji) by WMO (SPC and NIWA are part of the project)	• The project supported 14 Pacific Island Countries and Territories (PICTs) in enhancing their multi-hazard early warning systems (MHEWS) by addressing gaps in institutional governance, technical capacity, risk information systems, and community-based preparedness.
4	Pacific Flash Flood Guidance System (FFGS) by WMO	• The project is executed by the FMS with the Hydrologic Research Centre (HRC), USA, providing technical assistance for the system implementation and training, and WMO providing technical backstopping and supervisory services including monitoring and evaluation of the project.

Table 3 Assumed timeline / milestone for expansion (Flood)

No.	Div.	Place	HZ.	Activity	Responsible Organizations	2024 2028 2032
1	W	Entire Area	Flood	Preliminary Analysis	NDRMO / FMS	
				Division DRR Planning	W. Division	
2	W	Priority Area	Flood	Enhanced Analysis	FMS	
				Priority Area Planning	W. Division	
3	C	Entire Area	Flood	Preliminary Analysis	NDRMO / FMS	
				Division DRR Planning	C. Division	
4	C	Priority Area	Flood	Enhanced Analysis	FMS	
				Priority Area Planning	C. Division	

No.	Div.	Place	HZ.	Activity	Responsible Organizations	2024	2028	2032
5	N	Entire Area	Flood	Preliminary Analysis	NDRMO / FMS			
				Division DRR Planning	N. Division			
6	N	Priority Area	Flood	Enhanced Analysis	FMS			
				Priority Area Planning	N. Division			
7	E	Entire Area	Flood	Preliminary Analysis	NDRMO / FMS			
				Division DRR Planning	E. Division			
8	E	Priority Area	Flood	Enhanced Analysis	FMS			
				Priority Area Planning	E. Division			

5. Sediment Disaster (Debris flow and Steep slope collapse)

5.1 Activities/ Responsibilities

Expected implementing organizations / agencies are as follows. MRD and NDRMO are expected to take a leading role. Both MRD and NDRMO are able to conduct debris flow and steep slope collapse assessments using the GIS. Even though, the assessment results should be finalised by MRD. Also MRD is expected to play a leading role in on-site validation survey. NDRMO will enhance interaction among MRD and FMS to build the network with them. Currently, NDRMO plays an administrative role, but aims to take on more technical, scientific, and specialized responsibilities as a governmental agency.

Items	Organization	Activities
(Past landslide records / inventory)	MRD	• MRD is developing a GIS database of past landslides.
Enhanced Hazard / Risk Assessment for Whole Islands	MRD Geology Section, NDRMO	• Enhanced debris flow assessments have been conducted in the Ba and Nadi river basins in the Western Division. • In consultation with the MRD and NDRMO, the MRD is considering the development of debris flow hazard assessments in other watersheds of the Western Division. At this stage, we are considering the evaluation in the Sigatoka basin following the above basin. • The MRD is the main organization for conducting the hazard assessment for sediment disaster, but both organizations have agreed to provide on-the-job training or lectures to NDRMOs. • Enhanced assessment of steep slope collapse has already been carried out on Viti Levu Island (Western Division, Central Division). Expansion to Vanua Levu Island will also be considered in the future. • However, since there is room for further improvement in the evaluation results, such as the extraction of dangerous areas taking into account geological information, it is necessary to discuss and elaborate the details of future developments with the MRD. • Discuss and confirm the use of the evaluation results among the relevant organizations.

5.2 Expected Areas to Expand and Timeline / Milestones

Assumed expected areas (divisions) to expand and its timeline are as shown below (refer to Table 5). Preliminary assessments for the Western and Central divisions are implemented in the Project. Especially for the enhanced assessment of the steep slope collapse has been completed across the entire western and central regions to conduct analytical processing for the whole island. It was determined that the Northern division has a higher priority than the Eastern division considering the affected population, socio-economics, the size of the cities, and the topographical conditions.

Items	Western Div.	Central Div.	Northern Div.	Eastern Div.
Enhanced Hazard / Risk Assessment of Debris Flow (List areas to be covered, refer to the Table 4)	~2026	~2027	~2028	~2029
Enhanced Hazard / Risk Assessment of Steep Slope Collapse	~2024	~2024	~2025	~2026

Table 4 Expected Areas to Expand

Divisions	Province	Major Catchment
Western*	Nadroga/Navosa	Sigatoka River
	Ba	Ba River Nadi River Vitogo River Tavua River
	Ra	Wainibuka River Yaqara River
Central	Tailevu	Rewa River
	Rewa	Rewa River
	Naitasiri	Rewa River
	Namosi	Navua River
	Serua	Navua River
Northern	Macuata	Labasa/Korotasere River
	Bua	Dreketi/Sea Qaqa River
	Cakaudrove	Drekeniwai River Wairiki River Nakura River Na Qereqere River
Eastern	Kadavu	
	Lomaiviti	Lovoni River-Ovalau
	Lau	

*Only the Nadi and the Ba River catchments in the Western Division have been assessed regarding the debris flow analysis.

5.3 Limitations of simplified hazard / risk assessments, limitations of accuracy and constraints

Detailed limitations of the simplified hazard / risk assessments are as follows, even though the major limitations were mentioned in the chapter 3.

Judgement condition / Data used for the assessment → Accuracy of the assessments is not high

- ✧ Assessments of both debris flow and steep slope collapse are mainly based on the DEM. Therefore the resolution of the DEM is important.
- ✧ As mentioned above, the major conditions considered in the assessments are slope gradient, streams / creeks, and relative elevation, all of which are generated from the DEM. Geological conditions are not used.
- ✧ 30m-resolutions DEM is used for the model, except for some parts of Rakiraki and Suva.
- ✧ In the case of a debris flow, the flow direction of the debris flow will form a fan-shaped area with an angle of approximately 30 degrees centered on the valley exit. However, this project does not take that into consideration.
- ✧ Especially for the debris flow assessment, it requires some experience / expertise and assessment result depends on interpretation / judgement skill.
- ✧ In the case of steep slope collapses, the impact range is set based on the distance from the slope such as 50m below the steep slope and 10m above the steep slope and so. However, the impact area in the project is uniformly determined to be within a 50m range from households / population and major roads.

Verification of evaluation results → Field investigation is required for accurate evaluation / setting of impact range

✧ As mentioned above, geological conditions are not considered and impact ranges are set simplistically.

Constraints on usage → The use of evaluation results is limited to understanding the general range and extent of disaster impact

✧ As mentioned above, the results of the assessments are utilized to roughly consider countermeasures in local disaster prevention plans and so on. More detailed hazard analyses are necessary to evaluate a more accurate disaster impact, examine countermeasures and estimate their effectiveness, and outline and detail the design of countermeasures.

5.4 Expected improvements of hazard / risk assessments in the future

The following matters are expected to require or improve in the future regarding the above mentioned constraints / limitations on the simplified hazard / risk assessments.

Constraints1: The accuracy of the assessments is not high

✧ As mentioned below, on-site verification is required.

✧ Higher resolution of the DEM is better. The higher priority areas shall be selected after the nationwide simplified hazard / risk assessments and the Fiji government (refer to 7.4) will attempt to secure a budget for a high resolution DEM.

Constraints2: Field investigation is required for accurate evaluation / setting of impact range

✧ Since the assessment results are simply evaluated, on-site verification is important.

✧ As well as geological condition, ground surface conditions, thickness of surface soil and so on can be considered especially for steep slope collapse assessment. Also, width of the streams, relative height of the adjacent buildings and son on can be considered for debris flow assessment.

Constraints3: The use of evaluation results is limited to understanding the general range and extent of disaster impact

✧ Advancement of hazard assessment methods tailored to specific purposes, such as detailed examination of countermeasures and more accurate disaster warning systems.

✧ The assessed result can be utilized for the landslide hazard map. Therefore, NDRMO might take a leading role in public awareness utilizing the assessed results in collaboration with MRD.

5.5 Expected budgeting

The number of days and manpower required for the in-house work, especially for debris flow hazard assessment, depends on the size of the watershed / the target area, however it will likely take several days per watershed / area. As mentioned in 5.1, both MRD (geology section) and NDRMO are able to conduct debris flow and steep slope collapse (sediment disaster) assessments using the GIS. Therefore, NDRMO and MRD might share the burden. However, especially the debris flow hazard / risk assessments require “local-scale visual judgment” and “some experience / expertise” since the assessment result depends on interpretation / judgement skill. MRD should review and finalize the assessment result, and consolidate the data. In the case of onsite verification, budgets will need to consider the following.

(1) Consultation and Awareness Phase

Prior to any site verification, team will need to visit targeted land-owning units or communities where the hazards are identified especially within village and settlement to seek traditional approval for access and to inform of the project and purpose of the site visit to allow for the verification to be carried out.

(2) On site Verification Phase

During this phase, funding is required to cater for the team's meal allowances, transport, accommodation and other logistics.

Publication of landslide (sediment disaster) hazard maps will contribute to justify the budget for the hazard / risk assessments. The numbers of RRI modeling (flood hazard mapping) accomplished in the year will be included as an output in the work report for the year.

Human resource planning is also essential relating to budgeting. In regard to scientific officer, the hydrology section of the FMS considers increasing the number of scientific officers from three to four. One senior scientific officer looks after flood forecasting (including the hydrological analysis and modelling) and another senior scientific officer looks after hydrology product (Intensity-Duration-Frequency curve and so on).

5.6 Other Related Projects to be Collaborated

No.	Projects	Related Activities
1	Landslide inventory by MRD	• This refers to the ad hoc updating of the Landslide database that is usually updated by the Engineering Geology team of all past and recent landslide points that are either reported to or identified by the Department.
2	Landslide mapping training by the USGS (2024)	• This is a capacity building inhouse training on basic landslide hazard mapping between the Department and USGS
3	Landslide Susceptibility GIS training (2022)	• This is an in-house training between the Department and the United Nations Institute for Training and Research (UNITAR) regarding simple weight-based rainfall triggered landslide susceptibility modelling

Table 5 Assumed timeline / milestone for expansion (Sediment Disaster)

No.	Div.	Place	HZ.	Activity	Responsible Organizations	2024 2028 2032
1	Entire Fiji	Entire Area	Sediment Disaster	Preliminary Analysis	MRD	
2	W, C, N, E	Entire Area	Debris Flow	Enhanced Analysis	MRD/ NDRMO	W C N E
				Division DRR Planning	Each Division	
3	Viti Vanua Other	Entire Area	Steep Slope Collapse	Enhanced Analysis	MRD/ NDRMO	Viti Levu Vanua Levu Other
				Division DRR Planning	Each Area	
4	Entire Fiji	Entire Area	Sediment Disaster	Further Improvement	MRD	

6. Storm Surge (SS)

6.1 Activities/ Responsibilities

Expected implementing organizations / agencies are as follows. FMS and NDRMO are expected to take a leading role. FMS will use the JMA storm surge model to evaluate the storm surge at target coast. Using the results of storm surge by simulation, NDRMO will conduct risk analysis with GIS data such as topography, population and assets.

Items	Organization	Activities
Preliminary Assessment	NDRMO	• NDRMO can perform this assessment due to simplified evaluation by GIS. • The assessment in the Western Division has already been conducted in Phase 1 of this project. • The Central Division has also been assessed in Phase 2. • After that, the Northern and Eastern Divisions will be expanded.
Enhanced Hazard Assessment of Storm Surge for Whole Islands	FMS Forecast	• Storm surge analysis for the Western Division was already conducted in Phase 1. • Storm surge analysis was conducted for Viti Levu Island in the Central Division in Phase 2. • For the other islands in the Central Division and other Divisions, representative cyclones will be selected, parallel shift courses will be established from east to west and from north to south, and storm surge analysis will be conducted to identify the cyclone that will have the greatest impact on each region.
Enhanced Risk Assessment of Storm Surge for Whole Islands	NDRMO	• Based on the results of the hazard analysis by FMS (storm surge deviation in coastal areas), inundation areas and depths will be estimated using the Fill Level Method and then risk assessment will be conducted using exposure data such as population and assets. • In Phase 1, risk analysis was conducted for Nadi town in the Western Division. • In Phase 2, risk analysis was conducted for major areas near Suva in the Central Division.

6.2 Expected Areas to Expand and Timeline / Milestones

Assumed expected areas (divisions) to expand and its timeline are as shown below (refer to Table 6). Preliminary assessments for the Western and Central divisions are implemented in the Project. It was determined that the Northern division has a higher priority than the Eastern division considering the affected population, socio-economics and the size of the cities. In the Western division, Lautoka, Sigatoka, and Tavua, which have large populations and areas affected following Nadi and Ba, are designated as priority areas.

Items	Western Div.	Central Div.	Northern Div.	Eastern Div.
Preliminary Assessment	~2024	~2025	~2027	~2028
Enhanced Hazard Assessment	~2026	~2027	~2029	~2031
Enhanced Risk Assessment	~2026	~2027	~2029	~2031

6.3 Limitations of simplified hazard / risk assessments, limitations of accuracy and constraints

Detailed limitations of the simplified hazard / risk assessments are as follows, even though the major limitations were mentioned in the chapter 3.

Data used in the model → The accuracy of the analytical model is not high

- ✧ 30m-resolutions DEM is used for the model.
- ✧ Freely available bathymetric data is used for the model.

Model validation → No validation was conducted since there is no / lack of data for validation

- ✧ It is significantly challenging in validating the reliability of the analysis results, due to limited information on past disaster data such as the storm surge height at coastal area and inundation area / extent and its inundation depth in the target coasts, and observed tide during the storm surge.

Constraints of calculation model → The model is limited to evaluation points of major places and does not consider wave impact

- ✧ The evaluation points of calculated results by the model are very limited so that the representative results may not capture the maximum storm surge deviation.
- ✧ The model does not cover wave effect such as the inundation due to wave overtopping.

Constraints of inundation method → The method can consider only maximum inundation depth and extent due to the highest storm surge value at coastline.

- ✧ For inundation analysis, the results of the model show only maximum inundation depth and extent due to the highest storm surge value at coastline due to the constraints of Fill Level Method. The model either considers time dependent inundation and the effectiveness of countermeasures.

6.4 Expected improvements of hazard / risk assessments in the future

The following matters are expected to require or improve in the future regarding the above-mentioned constraints / limitations on the simplified hazard / risk assessments.

Constraints 1: The accuracy of the analytical model is not high

- ✧ Highly accurate topographic and bathymetric data, instead of freely available data (i.e., global data) are needed for more accurate analysis.

Constraints 2: No validation was conducted since there is no / lack of data for validation

- ✧ Actual inundation survey and accumulation of survey results on flood damage caused by storm surge.
- ✧ Increase of numbers of tide observation stations and accumulation of observed data are necessary.

Constraints 3: Model Limitation

- ✧ Model should be expanded to various points to be evaluated and to consider the wave effect for inundation due to overtopping.

Constraints 4: Limitation of Fill Level Method

- ✧ Advancement of inundation model should be introduced for more accurate inundation results such as time dependent inundation area and depth. This advanced model can clarify the effect of countermeasures in case of with and without cases of calculations.

6.5 Expected budgeting

The simplified hazard / risk assessments generally require only GIS-related data such as topographic data (DEM), coastline data, population and asset data from CENSUS to be analysed. However, the enhanced assessments will use the storm surge model for evaluation of storm surge height at target coasts with several parallelly shifted cyclones. Although the number of days and manpower required for the work depends on the target area of coast, it will likely take several days per target coast that consists of several tens' km stretch. The enhanced risk analysis needs data like the simplified one, which takes a few days per target coast if the necessary data is easily available.

6.6 Other Related Projects to be Collaborated

No.	Projects	Related Activities
1	Adaptation Fund Project "Enhancing Climate Adaptation through Scaling up Fiji's Coastal Inundation Forecasting Early Warning System"	• Since topographic data for all of Fiji will be developed as part of the project mainly conducted by WMO, the data will be used to calculate the extent and depth of inundation. • The inundation calculations will be performed in conjunction with the progress of the project, and analysis will begin as soon as the data is available. • This project seems to have been canceled. More information is necessary.
2	Weather-Ready Nation	• The main objective of this project is Impact-base-Forecasting, which requires hazard maps and risk analysis information. • It is necessary that this information, which will be created in this project, be used effectively to improve the accuracy of the Impact base forecast.
3	Weather Ready Pacific	• Over a decade, comprehensively strengthen the full hydro-meteorological system: with enhanced data, underpinning global-standard modelling, enabling strengthened forecasts and warning, translated and communicated to clearly convey impacts, reaching target communities in a timely way, managed by technically skilled staff in effective organizations. • The project will contribute the knowledge building of FMS officers.
4	JICA: The Project for Capacity Development for Improvement of Meteorological Forecasting and Warning and for Establishment of Regional Centers for the Pacific	• Storm surge and wave models of FMS will be upgraded in the project. • The project will enhance the capability of forecasting marine phenomena such as storm surge and wave.

7. Tsunami (TNM)

7.1 Activities/ Responsibilities

Expected implementing organizations / agencies are as follows. MRD and NDRMO are expected to take a leading role. MRD will use the ComMIT tsunami model to evaluate the tsunami height at target coasts. Using the results of tsunami simulation, NDRMO will conduct risk analysis with GIS data such as topography, population and assets. NDRMO will enhance interaction among MRD and FMS to build the network with them. Currently, NDRMO plays an administrative role, but aims to take on more technical, scientific, and specialized responsibilities as a governmental agency.

Items	Organization	Activities
Preliminary Assessment	NDRMO	• NDRMO can perform this assessment due to simplified evaluation by GIS. • The assessment in the Western Division has already been conducted in Phase 1 of this project. The Central Division has also been assessed in Phase 2. • After that, the Northern and Eastern Divisions will be expanded.
Enhanced Hazard Assessment of Tsunami for Whole Islands	MRD Seismology	• Cuvu in the Western Division and Suba in the Central Division have already been implemented in the Tsunami Ready project. • Nadi has been implemented as a pilot area in Phase 1 of this project. • MRD with the Project team has conducted hazard analysis in major areas near Suva in the Central Division in Phase 2. • The enhanced hazard assessment will be gradually expanded to other cities/ areas while sharing the status of Tsunami Ready and progress with other projects.
Enhanced Risk Assessment of Tsunami for Whole Islands	NDRMO	• Based on the results of the hazard analysis by MRD (tsunami height in coastal areas), inundation areas and depths will be estimated using the Fill Level Method and then risk assessment will be conducted using exposure data. • In Phase 2, risk analysis was conducted for major areas near Suva in the Central Division.

7.2 Expected Areas to Expand and Timeline / Milestones

Assumed expected areas (divisions) to expand and its timeline are as shown below (refer to Table 6). Preliminary assessments for the Western and Central divisions are implemented in the Project. It was determined that the Northern division has a higher priority than the Eastern division considering the affected population, socio-economics and the size of the cities. NDRMO should set the priority division for tsunami hazard assessment. In the Western division, Lautoka, Sigatoka, and Tavua—which have large populations and areas affected, following Nadi and Ba—are designated as priority areas.

Items	Western Div.	Central Div.	Northern Div.	Eastern Div.
Preliminary Assessment	~2024	~2025	~2027	~2028
Enhanced Hazard Assessment	~2026	~2027	~2029	~2031
Enhanced Risk Assessment	~2026	~2027	~2029	~2031

7.3 Limitations of simplified hazard / risk assessments, limitations of accuracy and constraints

Detailed limitations of the simplified hazard / risk assessments are as follows, even though the major limitations were mentioned in the chapter 3.

Data used in the model → The accuracy of the analytical model is not high

- ✧ 30m-resolutions DEM is used for the model.
- ✧ Freely available bathymetric data is used for the model.

Model validation → No validation was conducted since there is no / lack of data for validation

- ✧ It is significantly challenging in validating the reliability of the analysis results, due to limited information on past disaster data such as the tsunami height at coastal area and inundation area / extent and its inundation depth in the target coasts, and observed tide during tsunami.

Constraints of calculation model / inundation method→ The model is limited to mean sea level for initial calculation condition. Unique water level is assumed for inundation.

- ✧ The ComMIT model can consider the mean sea level for initial calculation condition so that the results at high tide may not be obtained for the maximum tsunami inundation.
- ✧ For inundation analysis, the model assumes that the water level at coastline would continue and be kept to landward until enough high elevation due to the constraints of Fill Level Method. The model either considers time dependent inundation and the effectiveness of countermeasures.

7.4 Expected improvements of hazard / risk assessments in the future

The following matters are expected to require or improve in the future regarding the above-mentioned constraints / limitations on the simplified hazard / risk assessments.

Constraints 1: The accuracy of the analytical model is not high

- ✧ Highly accurate topographic and bathymetric data, instead of freely available data (i.e., global data) are needed for more accurate analysis.
- ✧ Procuring and sharing the LiDAR data in collaboration with the whole Fiji government (cross-cutting) such as NDRMO, FMS, MRD, Road Authority and so on.
- ✧ A cloud server to run the real-time simulation models are required especially for earthquake and tsunami.

Constraints 2: No validation was conducted since there is no / lack of data for validation

- ✧ Actual inundation survey and accumulation of survey results on flood damage caused by tsunami.
- ✧ Increase of numbers of tide observation stations and accumulation of observed data are necessary.
- ✧ NDRMO and MRD obtain tsunami gauges buoy. Bathymetric survey is periodically conducted by the Fiji Navy. Therefore, NDRMO and MRD need to enhance the collaboration with Fiji Navy and FMS in order to merge the bathymetric data and DEM data for validation and for more enhanced assessment.

Constraints 3: Limitation of Model and Fill Level Method

- ✧ Other sophisticated model should be introduced to consider various initial water level in the tsunami analysis.
- ✧ Advancement of inundation model should be introduced for more accurate inundation results such as time dependent inundation area and depth. This advanced model can clarify the effect of countermeasures in case of with and without cases of calculations.

7.5 Expected budgeting

The simplified hazard / risk assessments generally require only GIS-related data such as topographic data (DEM), coastline data, population and asset data from CENSUS to be analysed. However, the enhanced assessments will use the ComMIT model for evaluation of tsunami height at target coasts with several assumable earthquake sources. Although the number of days and manpower required for the work depends on the target area of coast, it will likely take several days per target coast that consists of several tens' km stretch. The enhanced risk analysis needs data like the simplified one, which takes a few days per target coast if the necessary data is easily available.

Publication of Tsunami hazard maps in collaboration with NDRMO will contribute to justify the budget for the hazard / risk assessments. At least the Tsunami hazard map for Cuve has already published under the Tsunami Ready project. MRD can utilize the results of this project for Suva and Nadi. The activities related to the Tsunami modelling and mapping will be included in the yearly work report as an output for particular officers in order to justify the budget for the hazard / risk assessments.

Human resource planning is also essential relating to budgeting. In regard to scientific officer, the seismology section of the MRD considers increasing the number of scientific officers so that each scientific officer can look after each division (North, West, East and Central). Also, one senior scientific officer shall look after Tsunami and another senior scientific officer looks after earthquake.

7.6 Other Related Projects to be Collaborated

Even for the other donor's activity, this priority division will be considered

No.	Projects	Related Activities
1	Adaptation Fund Project "Enhancing Climate Adaptation through Scaling up Fiji's Coastal Inundation Forecasting Early Warning System"	• Since topographic data for all of Fiji will be developed as part of the project mainly conducted by WMO, the data will be used to calculate the extent and depth of inundation. • The inundation calculations will be performed in conjunction with the progress of the project, and analysis will begin as soon as the data is available. • This project seems to have been canceled. More information is necessary.
2	Tsunami Ready	• The project conducted hazard analysis, evacuation planning, and guideline development in Cuvu, Western Division as its first pilot site. • The project also conducted such activities at Suva area in the Central Division in December 2024. • The project should also be linked with this project for hazard analysis in other areas as well as the guideline development.

Table 6 Assumed timeline / milestone for expansion (Coastal Disaster)

No.	Div.	Place	HZ.	Activity	Responsible Organizations	2024 2028 2032
1	W	Entire Area	SS	Preliminary Analysis	NDRMO	
			TNM	Preliminary Analysis	NDRMO	
			All	Division DRR Planning	W. Division	
2	W	Priority Area	SS	Enhanced Analysis	FMS/ NDRMO	
			TNM	Enhanced Analysis	MRD/ NDRMO	
			All	Priority Area Planning	W. Division	
3	C	Entire Area	SS	Preliminary Analysis	NDRMO	
			TNM	Preliminary Analysis	NDRMO	
			All	Division DRR Planning	C. Division	
4	C	Priority Area	SS	Enhanced Analysis	FMS/ NDRMO	
			TNM	Enhanced Analysis	MRD/ NDRMO	
			All	Priority Area Planning	C. Division	

No.	Div.	Place	HZ.	Activity	Responsible Organizations	2024 2028 2032
5	N	Entire Area	SS	Preliminary Analysis	NDRMO	
			TNM	Preliminary Analysis	NDRMO	
			All	Division DRR Planning	N. Division	
6	N	Priority Area	SS	Enhanced Analysis	FMS/ NDRMO	
			TNM	Enhanced Analysis	MRD/ NDRMO	
			All	Priority Area Planning	N. Division	
7	E	Entire Area	SS	Preliminary Analysis	NDRMO	
			TNM	Preliminary Analysis	NDRMO	
			All	Division DRR Planning	E. Division	
8	E	Priority Area	SS	Enhanced Analysis	FMS/ NDRMO	
			TNM	Enhanced Analysis	MRD/ NDRMO	
			All	Priority Area Planning	E. Division	

8. Earthquake

8.1 Activities / Responsibilities

Expected implementing organizations / agencies are as follows. Especially, GIS experts in NDRMO will conduct seismic hazard and risk assessment using GIS. MRD Seismology Section will support their activities in technical part. NDRMO will enhance interaction among MRD Seismology Section to build the network with them. Currently, NDRMO plays an administrative role, but aims to take on more technical, scientific, and specialized responsibilities as a governmental agency.

Special field	Organizations involved	Summary
Social Sciences, Engineering, and Information and Communication (buildings, population, etc., use of GIS)	NDRMO	• Obtain census maintenance information and update GIS population data • Perform calculations for seismic hazard and risk assessment using GIS • Disseminate the results of the seismic hazard risk assessment to residents nationwide during the Fiji National Disaster Awareness Week and other events. • Collaborate with MRD to calculate seismic hazards and risk assessments in GIS for nationwide deployment. • (For the future) Estimate building damage by developing building information (footprint, structure type, etc.) and setting up damage functions.
Natural sciences (fields related to earthquakes and geotechnical engineering)	MRD Seismology Section	• Implement scenario earthquakes as requested by local governments in the National Deployment Plan • Collect basic data on ground amplification (Vs30, borehole data, etc.) from the USGS and other publicly available information on the web or in the field and update the information as appropriate. • Explain the methodology for seismic hazard and risk assessment with reference to the guidelines for nationwide deployment
No specific expertise	Local Government	• Play a role in the nationwide development of seismic hazard and risk assessment in collaboration with NDRMO and MRD • Collaborate in the actual hazard and risk assessment with technical guidance from NDRMO and MRD • Disseminate hazard information to residents of the municipality

8.2 Expected Areas to Expand and Timeline / Milestones

(a) Preliminary Assessment for DRR planning

According to the NDRMO, within the Western Division, Lautoka, Sigatoka, and Tavua are designated as Priority Areas, following Nadi and Ba, due to their large affected populations, areas, and other factors. Once the polygons for these areas are finalized using GIS, the seismic intensity exposure population from the Preliminary Assessment will be extracted through GIS processing and utilized in the process of formulating the regional DRR plan (Output 2). NDRMO's GIS staff can handle this series of GIS tasks.

Figure 7 shows the GIS map of the Preliminary Assessment results (covering Viti Levu Island, including the Western and Central Divisions).

(b) Enhanced Assessment

Enhanced Assessment requires the setting of a deterministic earthquake for seismic hazard analysis. The Fiji Islands region does not have an extensive historical record of damaging earthquakes. Therefore, utmost care is necessary when sharing risk assessment results based on scenario earthquake settings and applying those results to DRR planning.

NDRMO and MRD Seismology staff understand this point, and it is a matter that will be passed on should the responsible staff change in the future. It may be acceptable to use some earthquakes listed in the table of catalogue of damaging earthquakes in Fiji (Table 7).

Figure 2 shows the proposed epicentre locations based on USGS earthquake catalogue for the Deterministic scenario earthquakes in the Enhanced Assessment. USGS provides one of the most reliable earthquake catalogues.

For Central Division, we have selected Suva Earthquake (1953-09) which is also shown in the damaging earthquake catalogue. It is very important to discussion with staff of NDRMO and MRD Seismology Section for the decision making.

If you cannot find any damaging earthquakes for other Divisions, it is recommended to choose the earthquakes from USGS earthquake catalogue, with relatively large magnitude, shallow and nearer to the Islands. Nadi Scenario (1924-09) and the Rakiraki Scenario (2009-11) for the Western Division are case studies.

Note that the green epicenters on the map in Figure 2 represent tentatively proposed scenario earthquakes based on discussions with MRD staff and are not yet finalized.

(c) Timeline

Assumed timeline to expected areas (divisions) to expand are as shown below.

《Assumed implementation schedule for earthquake disaster》

Items	Western Div.	Central Div.	Northern Div.	Eastern Div.
Preliminary Assessment	~2024	~2025	~2027	~2028
Enhanced Hazard Assessment	~2026	~2027	~2029	~2030
Enhanced Risk Assessment	~2026	~2027	~2029	~2030

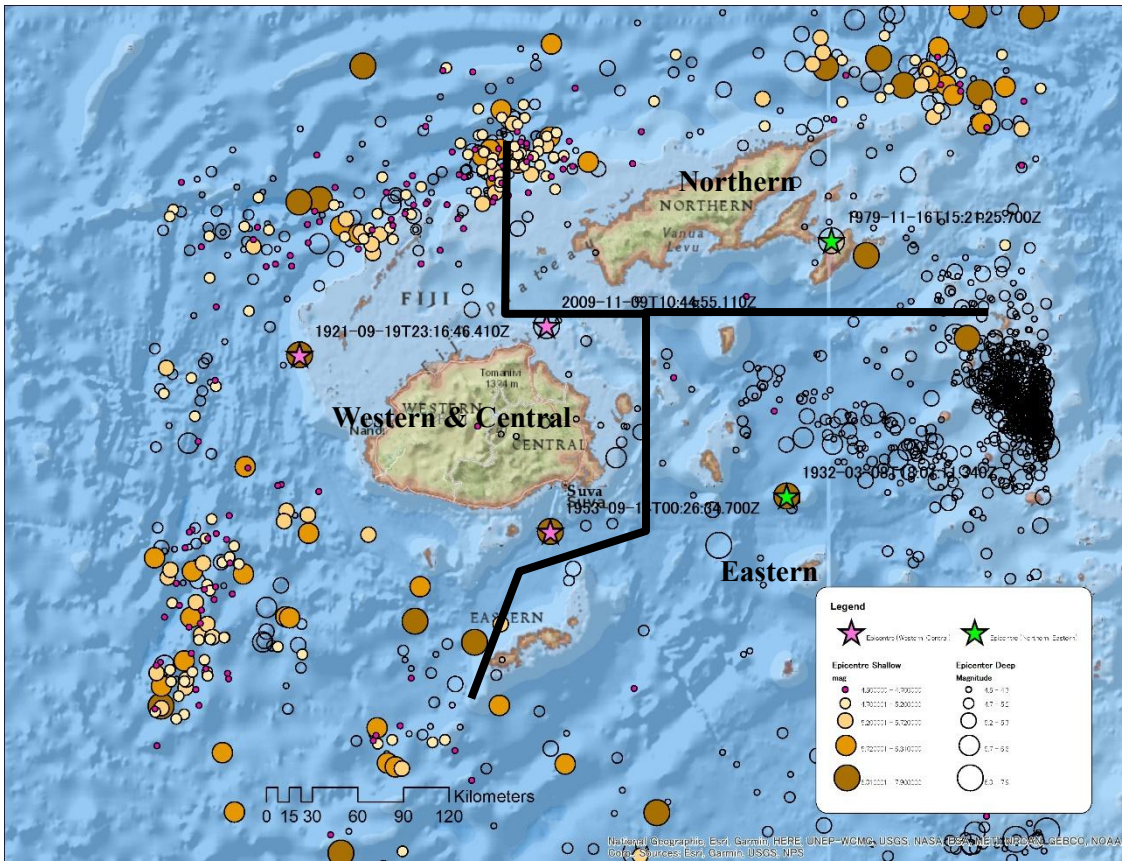


Figure 2　Scenario Epicentres for Enhanced Assessment (Source: USGS)

(Pink★: Already Done for Western / Central Divisions, Green★: To be done for Northern / Eastern Divisions)

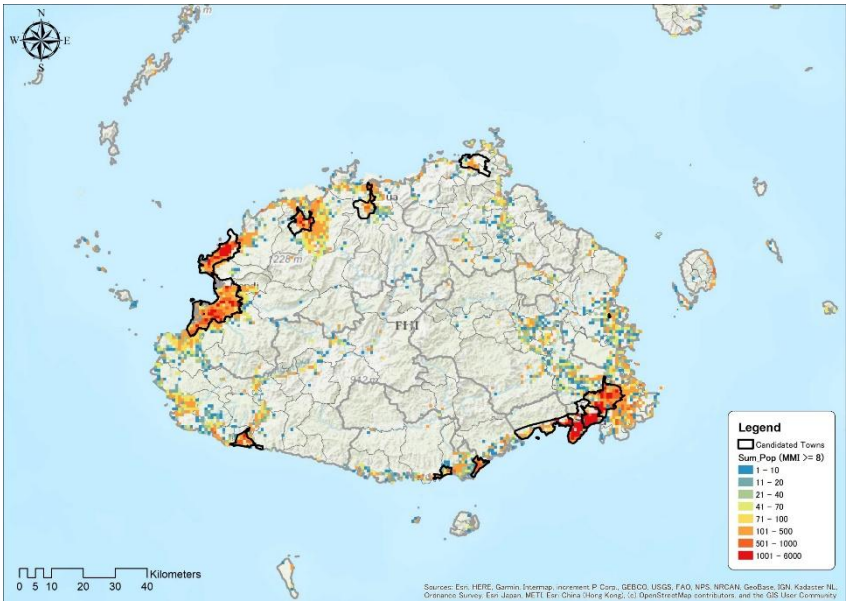


Figure 3　Preliminary Risk Assessment for Earthquake Disaster

(Population Exposure Table to each pilot area: see Final Report)

Table 7 Earthquake Catalogue in and around Fiji (1850 – up to now)

Year	Magnitude	Intensity (MMI)	Description
1869	-	7	Viti levu
1877	-	---	Tsunami from Northern Chile earthquake
1919	6.9	7-8	Minor damage to buildings, landslides
1932 Scenario for Eastern (tentative)	6.2	7-8	Major Landslide on neighboring islands tilting and major damage to the reef lighthouse
1953 Scenario for Central Division	6.8	7	Major damage to the wharf and buildings in Suva, Tsunami caused 3 fatalities in Suva and 12 reports of drowning in Kadavu and Koro, deaths 8, Injuries 50
1979 Scenario for Northern (tentative)	6.9	7-8	Major damage to buildings on neighboring islands. Landslide to island of Qamea.
1993	6.4	---	Futuna Island, Deaths 5, Injuries 201, limited damage
1998	6.5	---	Major damage to concrete buildings, major landslide to mount Washington, massive damage to plantations
2018-8	8.2	4	Viti Levu region is affected. No damage is reported.
2018-9	7.9	4	Viti Levu region is affected. No damage is reported.
2019	5.7	5	Minor damage, Landslides, 17.5 km depth, 94 km SSW from Suva

*Source: JICA report 2008, BRI (Japan), USGS, and NGDC)
The above table data has already examined to set scenarios for Eastern and Northern Divisions. As historical damage earthquakes are very limited, additional assessment in Western and Central Divisions will not be expected.

8.3 Limitations of available data / methods

Detailed limitations of the simplified hazard / risk assessments are as follows.

Hazard assessment data & method → Open data is available but not of high quality

- ✧ Improve accuracy of ground amplification: Although this project used Vs30 (average S-wave velocity to a depth of 30 m) based on USGS open data, the accuracy is generally low.
- ✧ In the study of scenario earthquakes, improving the accuracy of the assumption of past damaging earthquakes is needed.
- ✧ Regarding method to calculate earthquake hazard, in the activities of technology transfer of seismic motion prediction methods, we have focused on understanding the basic contents of the attenuation equation and ground amplification (GMPE, Ground Motion Prediction Equation).

Risk assessment for Buildings → Lack of database of buildings, necessity of vulnerability assessment of buildings

- ✧ In order to assess the risk of a building, it is necessary to assess the vulnerability of the building. To assess the vulnerability of a building, it is necessary to establish a Fragility Curve.
- ✧ Building inventory database needs to be added structure type, number of story, and so on to estimate number of damaged buildings.

8.4 Expected improvements of hazard / risk assessments in the future

The following matters are expected to require or improve in the future regarding the above-mentioned constraints / limitations on the simplified hazard / risk assessments.

Constraints1: Earthquake hazard assessment

- ✧ Development of accurate spatial ground amplification data based on actual measurements of average S-wave velocity (Vs30) to evaluate ground amplification.
- ✧ It is desirable to develop spatial ground amplification database by conducting geophysical surveys and its analysis, including array microtremor method.
- ✧ For improving the scenario earthquake, evaluation of unknown earthquakes including active faults needs to be developed.
- ✧ Establishment of an optimal seismic motion prediction method (GMPE) such as distance attenuation equation in Fiji based on the development of strong-motion observation network.
- ✧ Utilization of AI, machine learning, establishment of automatic calculation processing shall be considered in the future.

Constraints2: Building Database and Vulnerability Assessment in Seismic Risk Assessment

- ✧ It is necessary to establish a GIS-based building database with information on attributes such as structure type, etc., and to transfer technology such as updating methods. All the building data to be sent to NDRMO. NDRMO will aggregate the data into a database and manage it centrally. NDRMO shall request the relevant Ministry to update the building data.
- ✧ This requires technical study based on actual damage information, technical data on buildings, and research papers.
- ✧ Apart from the revision of the Building Code, this is an area where technology transfer by Japanese experts is still needed to estimate earthquake damage in a wide area.

8.5 Expected budgeting

The simplified hazard / risk assessments for earthquake disaster generally require the following data,

1) standard earthquake ground motion at engineering bedrock layer, 2) global ground amplification data, and 3) population data in Fiji. This work is estimated to take from a few days to two weeks. 3) Information will need to be up-to-date within Fiji, and will require conversion to a GIS database, which may take weeks or months in some cases. As a prerequisite for these tasks, basic engineering seismology knowledge and skills are essential. An overview is provided in the guidelines, and an understanding of their contents is essential.

Regarding Enhanced assessment, it is necessary to set scenario earthquake for deterministic hazard / risk assessment. Next, regarding Enhanced Hazard Risk Assessment, the major difference is that in part 1), scenario earthquakes need to be set. In Fiji, technical consultation with the MRD Seismology Section is required, and is expected to take from one to several weeks. 2) and 3) are the same as simplified one.

Note that Enhanced Risk Assessment often includes building damage assumptions. The work for 4) requires the construction of GIS data on the number of buildings per structure type, and 5) the setting of damage functions. Regarding the work for 4), NDRMO shall request the relevant Ministry to update the building data.

4) is based on the area of the region, so it is difficult to say how long it will take to create the GIS database. 5) requires knowledge and skills in engineering seismology, and should be considered in the study. The work for 5) requires knowledge and skills in engineering seismology and is expected to take several months, including the collection of papers and other information.

Moreover, a microtremor survey and a seismic survey shall be implemented. Both surveys will take approximately one month for one specific area. Procuring the machines will cost roughly 5,000 - 6,000FJD for the microtremor survey and 20,000FJD for the seismic survey. Only the main rock formation for the microtremor and he seismic survey will be covered in the 14 provinces for the first 2 years. Members from the NDRMO need to participate in the survey / technical team to ensure smooth local coordination and administrative tasks.

Earthquake engineer in MRD will continue the work on earthquake hazard assessment and the output shall be included in the yearly work report in order to justify the budget for the hazard / risk assessments.

8.6 Other Related Projects to be Collaborated

No.	Projects	Related Activities
1	National Building Code revision project (including probabilistic seismic ground motion prediction)	• Other donors have been implemented to develop a probabilistic seismic ground motion prediction for National Building Code (NBC) in the past. If revision of the NBC is conducted, counterparts are expected to actively learn those techniques. • In particular, MRD Seismology Section is expected to have a quick understanding of these techniques because of its basic expertise in acquiring them.
2	FIJI NATIONAL DEVELOPMENT PLAN 2025-2029 AND VISION 2050 5.8: Construction Industry	• Strengthen multi-hazard early warning systems: Real-time earthquake damage estimation system will also be included. • Establish resilient multipurpose evacuation centres

Table 8 Assumed timeline / milestone for expansion (Earthquake)

No.	Div.	Place	HZ.	Activity	Responsible Organizations	2024 2028 2032
1	W	Entire Area	EQ All	Preliminary Analysis Division DRR Planning	MRD/ NDMO W. Division	
2	W	Priority Area	EQ All	Enhanced Analysis Priority Area Planning	MRD/ NDMO W. Division	
3	C	Entire Area	EQ All	Preliminary Analysis Division DRR Planning	MRD/ NDMO C. Division	
4	C	Priority Area	EQ All	Enhanced Analysis Priority Area Planning	MRD/ NDMO C. Division	
5	N	Entire Area	EQ All	Preliminary Analysis Division DRR Planning	MRD/ NDMO N. Division	
6	N	Priority Area	EQ All	Enhanced Analysis Priority Area Planning	MRD/ NDMO N. Division	
7	E	Entire Area	EQ All	Preliminary Analysis Division DRR Planning	MRD/ NDMO E. Division	
8	E	Priority Area	EQ All	Enhanced Analysis Priority Area Planning	MRD/ NDMO E. Division	

GUIDE on the DRR PLAN FORMULATION in FIJI

DRAFT

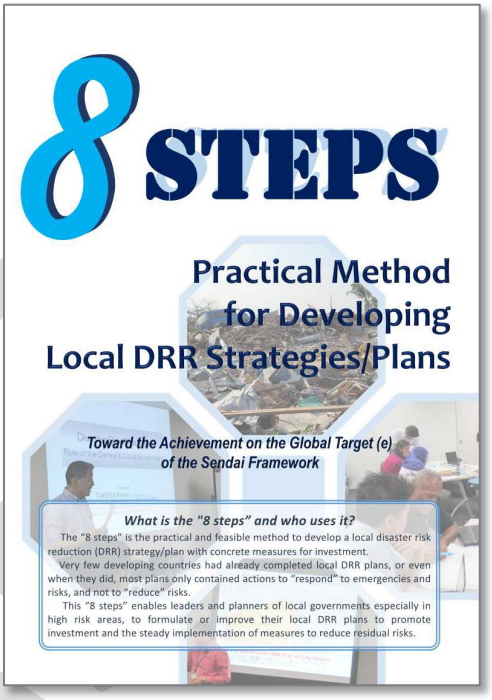
JANUARY 2024

UPDATED OCTOBER 2025

Introduction

Purpose of the Guide on the DRR Plan Formulation in FIJI

A local Disaster Risk Reduction (hereinafter referred to as "DRR") plan is developed by local stakeholders together with national governments in line with the global and national legal framework, in order to prevent new and reduce existing disaster risks through investment, specific measures against disasters, along with goals in time-series, as well as budget arrangements.



In order to support the formulation of Local DRR plans, the Japan International Cooperation Agency (hereinafter referred to as "JICA") published the "8 Steps – Practical Method for developing Local DRR Strategies/Plans (hereinafter referred to as "8 steps")" which is a practical and feasible method to develop a DRR plans with concrete measures for investment.

This "8 steps" aim to enable leaders and planners especially in risk-prone areas to formulate or improve their local DRR plans to promote investment and the steady implementation of measures to reduce residual risks.

The purpose of the "Guide on the DRR Plan Formulation in FIJI (hereinafter referred to as "Guide") is to propose a methodology to develop Local DRR plan in Fiji, by customizing the "8 steps" to the Fijian context.

Definition of Local DRR Plan in FIJI

The Government of Fiji adopted its National Disaster Risk Reduction Policy 2018-2030 (hereinafter referred to as "NDRRM") in 2019. The NDRRP aims to enable Fiji to deliver on its priority of preventing new and reducing existing disaster risks in line with relevant regional and global frameworks.

With the implementation of the NDRRP, efforts to mainstream DRR into various sectors were generated by each line ministry at the National level.

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However, regarding the sub-national levels, there is not any DRR policy or strategy to implement DRR.

Therefore, under the Project for Mainstreaming Disaster Risk Reduction (hereinafter referred to as the "Project"), the definition of Local DRR plans was proposed as follows.

- Divisional DRR Plan: The DRR Plan at the Divisional Level aims to contextualize the NDRRP at the sub-national level by setting the fundamental DRR directions and priorities. Due to the extent of the locality, detailed hazard analysis covering the entire division is difficult to conduct. Consequently, the identification and planning of concrete DRR measures are challenging. Therefore, it is recommended to use the results from "global" hazard analysis as a first step to identify the priority areas and set the DRR fundamental directions when more accurate data are not available.
- Priority Area DRR Plan: Once the priority areas or locations are identified at the Divisional level, the conduct of more detailed hazard analysis or simulation by using more accurate data can be conducted. Therefore, more concrete DRR measures and implementation schemes can be considered.

Note 1: The conduct of detailed hazard analysis or simulation usually requires additional human resources, funds, materials such as computers and others. Therefore, the conduct of such type of hazard analysis is usually challenging when the target areas are large. That is the reason why the conduct of detailed hazard analysis is limited to smaller target areas or "priority areas" under this Project.

Note 2: Guidelines on the conduct of hazard analysis and disaster risk assessment for flood, landslides, storm surge, tsunami and earthquake were drafted under the Project.

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Table 1. Differences between DRR plans at the Divisional and Priority Area levels

	Divisional DRR Plan	Priority Area DRR Plan
Purpose	To set the fundamental strategies or directions on DRR.	To consider concrete DRR measures to be implemented.
Target Areas	Entire division	Town areas include urban and peri-urban areas.
Involved Agencies	National headquarters and divisional offices of line ministries, and all Town Councils	Target Town Area's Council, divisional offices of line ministries, private sector.
Secretary	Commissioner	Commissioner
Hazard Analysis	Review of past disasters, and preliminary hazard analysis covering the entire division. ✓ Flood Hazard: Global Flood Map (50-year flood), ✓ Coastal Hazard: Extraction of the areas where the elevation is below 10 meters (Mean Sea Level) and 3 kilometers from the coastline.	Review of past disasters, and enhanced hazard analysis based on more detailed simulation models. ✓ Flood Hazard: Rainfall-Runoff-Inundation Model, ✓ Storm surge Hazard: ComMIT Model, ✓ Tsunami: Simulation Model used by FMS, ✓ Earthquake: Global Earthquake Model.

Source: JICA Project Team

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List of Abbreviations

ABBREVIATION	DEFINITION
BoS	Bureau of Statistics
DRR	Disaster Risk Reduction
DoH	Department of Housing
EFL	Energy Fiji Limited
FJD	Fijian Dollars
FRA	Fiji Road Authority
HA	Housing Authority
JICA	Japan International Cooperation Agency
MCTTT	Ministry of Trade, Co-operatives, Small and Medium Enterprises, former Ministry for Commerce, Trade, Tourism and Transport
MHMS	Ministry of Health and Medical Services
MLG	Ministry of Local Government
MLMR	Ministry of Lands and Mineral Resources
MoE	Ministry of Finance (former Ministry of Economy)
MoEnv.	Ministry of Environment
MoHMS	Ministry of Health and Medical Services
MoWa	Ministry of Waterways
MPW	Direction for Public Works of the Ministry of Public Works, Transport and Meteorological Services
MRMDDM	Ministry of Rural and Maritime Development and Disaster Management
NDRRP	National Disaster Risk Reduction Policy
NDMO	National Disaster Management Office
NDP	National Development Plan
NIIP	National Infrastructure Investment Plan
TC	Tropical Cyclone
WAF	Water Authority of Fiji
WDDP	Western Divisional Development Plan

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1 Data and documents to collect and review

1.1 Data and documents collection

The DRR Plan is a comprehensive plan involving various sectors and aiming to the achievement of the NDRRP and contributing to the establishment of sustainable development. Therefore, the review and understanding on various data and documents covering disaster profile, development policies of each sector, on-going and planned DRR initiatives and others.

The following table proposes the minimal basic data and documents to collect for DRR planning.

Table 2. Data and documents to collect and review

Category	Details	Data Source
Development Policies	5, 20 National Development Plan	-
	Divisional Development Plan	Division
Sectoral Development Policies	Annual Reports	Ministries
	Corporate Reports	
DRR Policies and Initiatives	Sendai Framework for DRR	-
	National DRR Policy	-
	Fiji National Adaptation Plan	-
	Outline of planned and on-going DRR projects	Ministries, Donors
Past Disaster Records	Disaster database (GIS)	NDMO
	Situational reports	NDMO
	Post-disaster needs assessment reports	NDMO, Ministries, Donors
Hazard Simulation and Disaster Risk Assessment Results	Past Studies	Universities, Donors, Ministries
	Hazard Simulation and Disaster Risk Assessment results	Please refer to the Guidelines on Hazard Analysis and Disaster Risk Assessment
	Topographic Data	Ministry of Land
	Rivers and Waterways	Ministry of Waterways
Elements	Town Planning Schemes (Land use)	Town Council
	Population and Housing Census	Bureau of Statistics
	Registered businesses	Bureau of Statistics
	Evacuation Centres (Health Facilities, Community Halls, Schools, Religious Sites)	NDMO
	Road Network and Bridges	Fiji Road Authority
	Airports	Airports Fiji Limited
	Power Stations, High Voltage Lines	Fiji Energy Authority
	Water Main Pipes, Wastewater Pipes	Water Authority of Fiji

Source: JICA Project Team

Based on the experience of the Central Division, to enhance the data collection process it is useful to conduct a consultive meeting led by the NDRMO under the presence of the Divisional Commissioner and call for cooperation on the data collection.

In addition, individual consultation with relevant institutions is essential to gather relevant information in detail. The overall process of data collection conducted in the Central Division is shown in Figure 1. The relevant institutions and organization are listed in Table 1.

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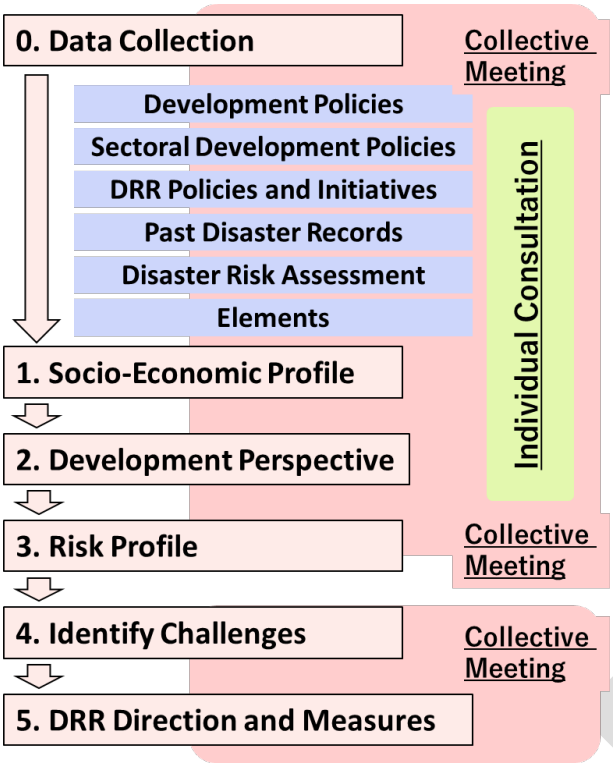

Figure 1 Flow of Data Collection

Table 3 Institution to Conduct Interviews

1	Ministry of Finance (Department of Strategic Planning, National Development and Statistics)
2	Direction for Public Works and Meteorological Services
3	Fiji Road Authority
4	Ministry of Waterways and Environment
5	Ministry of Education
6	Ministry of Health and Medical Services
7	Ministry of Communications
8	Water Authority of Fiji
9	Energy Fiji Limited (urban)
10	Rural Electrification Unit (rural)
11	Ministry of Lands and Mineral Resources
12	Mineral Resources Department
13	Ministry of Trade, Co-operatives, Small and Medium Enterprises
14	Ministry of Commerce, Trade, Tourism and Transport
15	Ministry of Housing and Local Government
16	Department of Town & Country Planning
17	Housing Authority
18	Public Rental Board
19	Provincial Administrator in Each Provinces
20	Town Councils

In the interviews to the relevant institution, basic questions as shown below can be asked.

[For the Relevant Institutions by Sector]

[Data Request]

- Strategy Plan or Reports
- Latest Annual Reports
- Corporate Reports, Operation Report
- Other Master Plans for Specific Items
- **Existing or Planned Programs and Projects in the Central Division** Important

[Question Items]

- What are the challenges in socio-economic perspective and what are the strategy to overcome with the challenges?
- What are the elements or areas which are vulnerable to disaster?
- What was the major damage caused by disaster in the past?
- Were some DRR measures implemented after disaster?

[For the Provincial Administrators or Officers in the City or Town Council Office]

[Data Request]

- **Existing or Planned Programs and Projects facilitated in your Provinces, Cities or Towns** Important

[Question Items]

- What are the challenges in socio-economic perspective and what are the strategy to overcome with the challenges?
- Where are the areas which are vulnerable to disaster?
- What was the major damage caused by disaster in the past?
- Were some DRR measures implemented after disaster?

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1.2 How the data and documents will be used

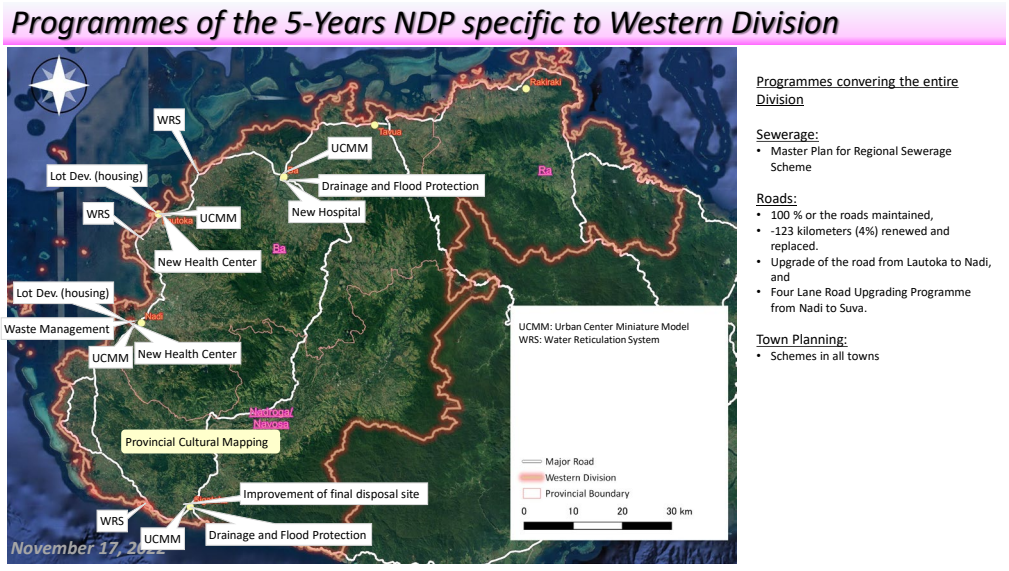
1.2.1 Development Policies

The purpose of reviewing higher development policies adopted by the Country is to understand how the locality is expected to be developed in the future.

The 5, 20 years National Development Plan (hereinafter referred to as "NDP") is published by the Ministry of Finance (former Ministry of Economy, hereinafter referred to as "MoE"). Especially, the 5-Year Development Plan translates the long-term NDP into sectoral development plans. The major programmes and projects are based on the development needs gathered from the nationwide consultations. Emphasis is placed on access to basic services for all Fijians such as water, electricity, housing, medical services, and education.

Figure 1 shows a sample on how the NDP was reviewed to draft the Western Divisional DRR Plan. The projects listed in the NDP that are anticipated to be implemented in the Division were extracted and plotted in order to understand and anticipate the future changes in the Division.

	Sector	Location / Scheme	Programme and Project	Lead Agency
1.	Rural Economy	Entire Division	Formulation of the Divisional Development Plan	MoE and Divisional Commissioner
2.	Rural Economy	Entire Division	Development of hazard maps and models for all potential hazards (sea level rise, storm surge, flood and tsunami) for the entire Division	MoE and Development Partners
3.	Rural Economy	Entire Division	Conduct of an integrated vulnerability assessment for all communities	MoE and Development Partners
4.	Housing Development	Entire Division	Upgrading and Resettlement of Squatters (Lots)	Department of Housing
5.	Land Transport	Entire Division	Maintenance of the 3,083 kilometers of roads in the Western Division	FRA
6.	Land Transport	Entire Division	Renewals and replacement programme for 486 kilometers of roads	FRA
7.	Land Transport	Entire Division	Implementation of the Climate Resilience projects	FRA
8.	Land Transport	Entire Division	Implementation of 15 projects under the rural road programme	FRA
9.	Agriculture / Waterways	Ba Province	Implementation of the Land Drainage and Flood Protection Programme (Dredging of Ba River) to reduce the frequency of flash flo	MoWa. MoE
10.	Rural Economy	Ba Province	Mapping of resource-based sectors to i activities	



Source: JICA Project Team

Figure 2. Sample image on the review of the NDP

The National Development Plan (NDP) was updated in September 2024. In the new NDP not as same with the previous plan, the plan does not mention a specific program for infrastructure intervention of DRR actions. However, it sets some Key Performance Indicators which all relevant plan shall follow. The key performance indicators related to DRR is show in Table 4.

Table 4 List of Key Performance indicators related to DRR

Indicators	Baseline	3 Years (2025-2027)	5 Years (2025-2029)
Multi Hazard Early Warning System for Fiji (%)	NA	50	100
Joint National Action Plan for Climate Change and Disaster Risk Reduction (%)	NA	50	100
Multipurpose evacuation centers (number)	NA	5	4
DRR Divisional Plan developed (number)	NA	2	4
Disaster Risk Finance Policy (%)	NA	50	100

In the formulation of the Central Divisional DPP plan, since the latest NDP did not include any activities list, Fiji National Infrastructure Investment Plan (NIIP) 2023-2024 was also reviewed as a reference which was prepared under the auspices of Fiji Government was confirmed. NIIP is an initiative to summarize and monitor the major development activities in Fiji.

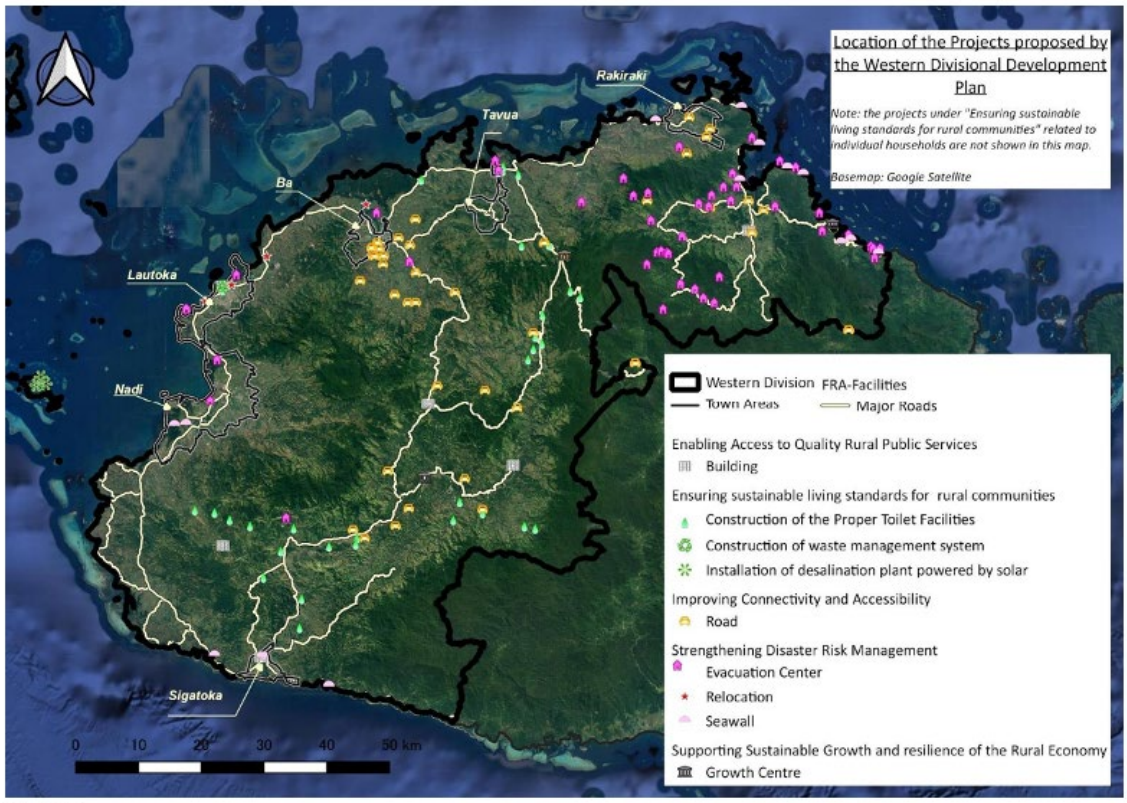
As the plan includes some major infrastructure investment planned in the whole nation, the program considered in division can be listed and provide reference information. In the central division DRR plan the DRR related programs were highlighted to bring attention to it as shown in Table 5.

Table 5 Example List of Programs Located in Central Division in the NIIP

	Sector	Program Name	Description	Lead Agency
1.	Air	Upgrade of Met Equipment	Upgrade of Nausori Radar	FMS
2.	Air	Installation of AWOS	Installation of Automated Weather Observing System (AWOS) at Nausori Airport	FMS
3.	Air	Weather data stations (blackspots)	Not Mentioned	FMS
4.	Air	Outer Islands Connectivity	Apron expansions and river encroachment in Bureta Airport (Located in Eastern Division but related)	Fiji Airports
5.	Air	Suva Nausori Connectivity	Upgrade in the terminal and related airport facility in Nausori airport	Fiji Airports
6.	Air	Aviation Safety and Security	Equipment for security check and biometric access control	Fiji Airports
7.	Buildings	N/A	Construction of New Maternity Unit Extension (CWM)	AMU
8.	Buildings	N/A	Construction of New Rehabilitation Unit (Tamavua)	AMU
9.	Buildings	N/A	New Medical Waste Incineartor (Naboro Landfill)	AMU
10.	Buildings	N/A	Construction of New National Wellness Center	AMU
11.	Buildings	N/A	Construction of FPBS Warehouse Extension - Suva	AMU
12.	Buildings	Sub-divisional Hospital Refurbishment	Sub-Divisional Hospital of Korovou / Wainibokasi / Vunidawa / Navua, Nausori Health Center and Maternity Hospital, Valelevu Health Center	AMU
13.	Buildings	N/A	Construction of New Hospital or Health Center in Nasinu	AMU
14.	Buildings	LTA (Land Transport Authority) Complex Valelevu	LTA Complex Valelevu	LTA
15.	Buildings	Museum Refurbishment	Museum Refurbishment	AMU
16.	Buildings	Classroom and Ablution Renovations	Renovation and Construction of Ablution Blocks, Classrooms & Staff Quarters	AMU
17.	Buildings	Upgrade of Driveways and Walkways	Upgrade and maintenance of Driveways and Walkways	AMU
18.	Buildings	N/A	New Nasinu Court House	JD
19.	Buildings	Police Station Construction Programme	Nakasi Police Station and Design and Build of Dog Kennel at Navosa Police Barrack	FPF
20.	Buildings	N/A	New Nakasi Market	DLG
21.	Buildings	N/A	Construction of Sub-Urban Shuttle Station- Valelevu	N/A
22.	Buildings	Upkeep of Facilities	Nausori Radar Building upgrade	FMS
23.	Buildings	Public Buildings Refurbishment	N/A	DBGA
24.	Buildings	N/A	Construction of MSAF Head Office	Transport
25.	ICT	Upgrade and Maintenance of ICT in Schools	Upgrade and Maintenance of ICT facilities in schools (Central)	Elearning
26.	Marine	Government Wharf Upgrade (Suva)	Phase 1 Government Wharf Upgrade (Suva Port)	GSS
27.	Marine	Supply of Boat & Engine to Schools	Connectivity and Transportation of Maritime Schools (Central)	AMU

The Divisional Development Plan (hereinafter referred to as “DDP”) is a consultative document which intends to spell out and address the development needs in the Division. As a sample, Figure 2 shows the locations of the projects proposed under the Western Division’s DDP. By reflecting

the disaster risk profile of the locality, DRR Plan can contribute to the achievement of the DDP by identifying the priority areas such as locations frequently affected by disasters, locations where assets and population are concentrated as where the impacts from disasters are anticipated to be high and others.



Source: JICA Project Team

Figure 5. Location of the projects proposed by the Western Divisional Development Plan

Source: JICA Project Team

Figure 3. Sample image on the review of the DDP

However, besides the Western Division, the Divisional Development Plan is underdeveloped. Therefore, in the DRR Plan formulation in the Central Division, an approach to collect the development policies from sector was conducted. The data collection was done as shown in Figure 1. As the needs and challenges in each section or in the Province and City/Towns are not summarized, some major documents were reviewed, and interview was conducted.

This process will contribute to the development of the Divisional Development Plan in the future, as the plan is collecting the needs and challenges in the division from the DRR point of view. The relationship among the sector wise or area wise plans is shown in Figure 4.

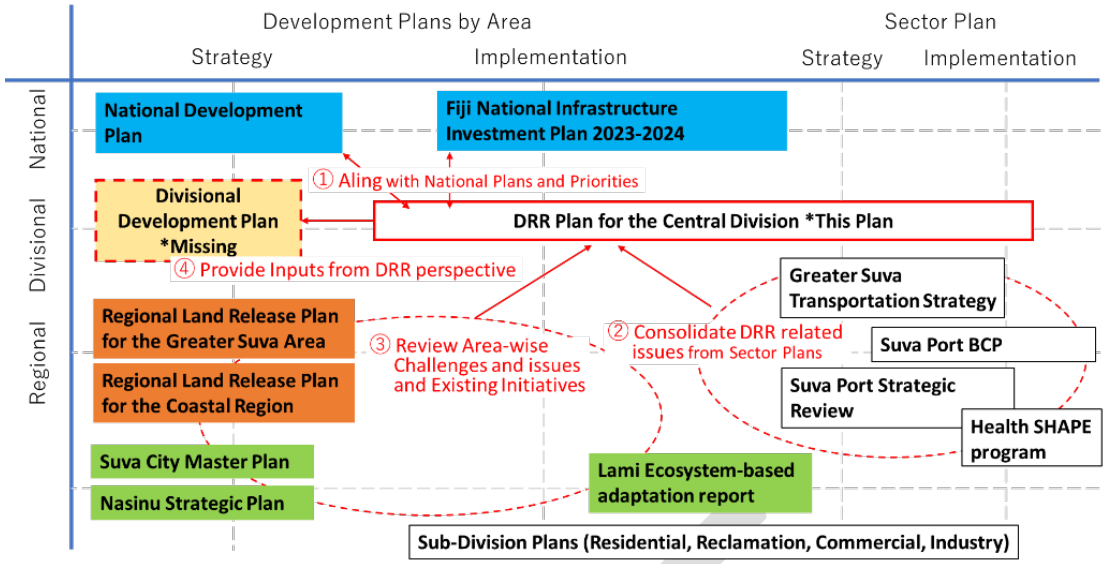


Figure 4 Linkages Among Related Plans in the Central Division

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1.2.2 Sectoral Development Policies

By reducing the existing and avoiding the creation of new disaster risks, the implementation of DRR plan will contribute to the sustainability and development of each sector.

For example, as shown in Table 3, the Tropical Cyclone Winston of February 2016 affected the entire Country and all sectors. Therefore, the reduction of disaster risk is fundamental to avoid the direct and indirect impact of disasters to each sector and ensure sustainable development.

In addition, some development projects may change the risk profile of locality. For example, urbanization may affect the extent of flooding due to the change in land coverage.

Therefore, the review of sectoral development policies based on the dialogue within ministries and stakeholders has two major purposes. The first one is to understand the challenges faced by each sector during disasters. The second one is to make a consensus on how each sector is anticipating implementing their programmes in the locality, harmonize each sector's strategies and consider the way to optimize each ministry's resources.

Table 6. Damage caused by Tropical Cyclone Winston

		West	Central	North	East	Total
Casualties		22	6	3	13	**44**
Affected Population		230,821	167,975	103,716	37,902	**540,821**
Economic Damage (At least)		686.43	110.82	238.55	171.30	**1,517.5 M**
BREAKDOW	Agriculture	43.8	12.2	17.4	7.9	81.3 M
	Commerce and Manufacturing	60.2	NA	NA	NA	72.9 M
	Tourism	55.8	0.8	13.0	6.6	76.1 M
	Mining	11.5	-	-	-	11.5 M
	Education	34.8	13.0	7.7	13.6	69.2 M
	Health	2.1	2.6	0.4	2.6	7.7 M
	Housing	439.3	64.7	163.1	83.9	751.0 M
	Transport	29.9	14.4	32.9	49.9	127.1 M
	Water and Sanitation	7.6	2.9	4.5	1.9	16.9 M
	Electricity	NA	NA	NA	NA	33.0 M
	Communications	NA	NA	NA	NA	31.2 M
	Environment	NA	NA	NA	NA	232.5 M
	Culture and Heritage	0.53	0.02	0.25	4.30	5.1 M
	Disaster Risk Management	0.9	0.2	0.3	0.6	2.0 M

Source: Direct Damage Amount from the PDNA published by the Government of Fiji in May 2016

1.2.3 DRR Policies and Initiatives

The purpose of reviewing DRR Policies such as the Sendai Framework for DRR, NDRRP, Fiji National Adaption Plan is to consider how the implementation of the DRR plan will contribute to the achievement of those policies.

In addition to the implementation of national policies, various initiatives were, are and will be implemented by each ministry, communities, external donors and other stakeholders.

For example, according to the budget estimates from 2016, an amount of 880,000 to 15 million, with an annual average of 5 million was requested from 2016 to 2024 under the Drainage and

Flood Protection programme of the Ministry of Waterways. In terms of hydrological observation, an annual average of 300,000 FJD was allocated from 2016 to 2020 for the installation of water level and rainfall telemetry instruments and 250,000 FJD from 2022 to 2024 for the supply and installation of water level and rainfall equipment under Fiji Meteorological Services. In addition, DRR activities to reduce impacts from disasters are also implemented under the health, energy, telecommunication, and agricultural sectors.

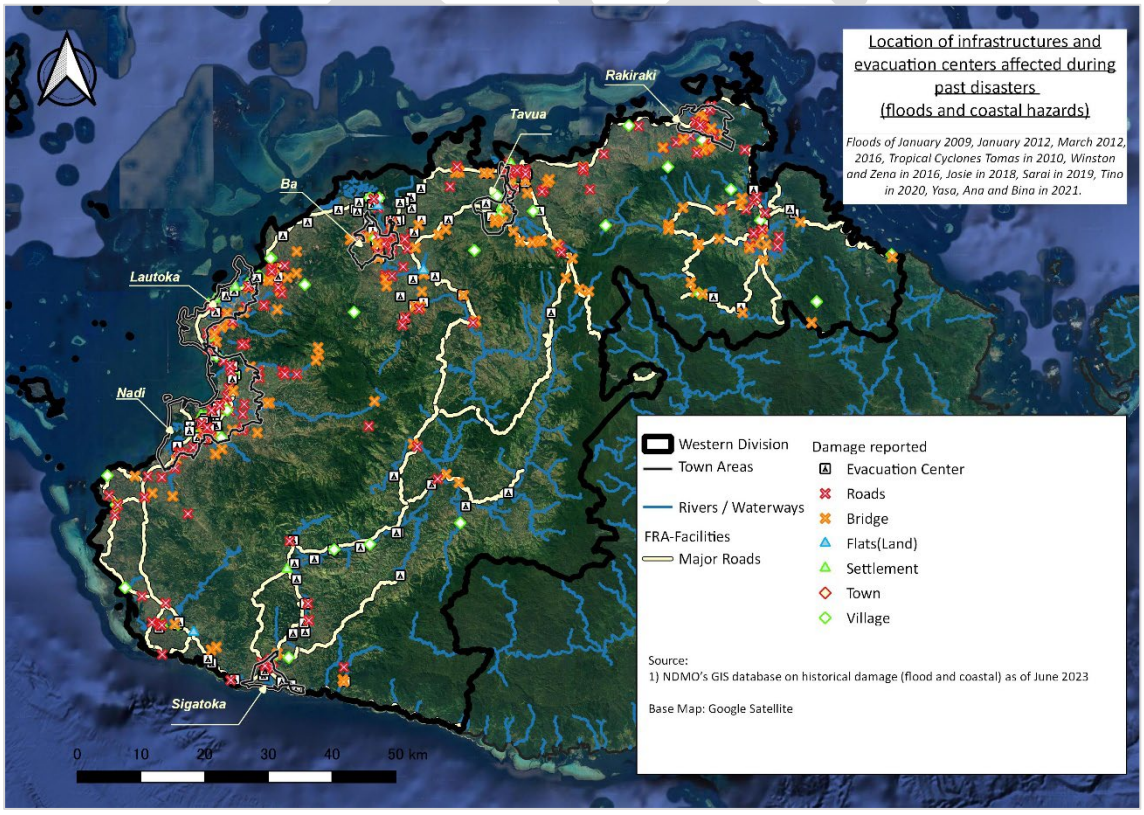
The review of DRR policies and initiatives implemented by each ministry will help the understanding of how disaster risk is expected to be reduced in the locality.

1.2.4 Past Disaster Records

The review of past disaster records is the basis to deepen the understanding on the hazard-prone areas, impacts and challenges faced by each sector and others.

Regarding major disasters, the Post-Disaster Needs Assessment reports published by the Government and Situational reports provide comprehensive information and analysis on the impacts, weaknesses and challenges faced by each ministry.

In addition to those reports, NDMO's GIS database can be used to visualize the locations of past disaster damage. Please note that this database is under improvement and that data for all sectors and hazards is not yet available.



Source: JICA Project Team by using NDMO's GIS database on historical disasters (as of June 2023)

Figure 5. Location of the reported damage in the Western Division

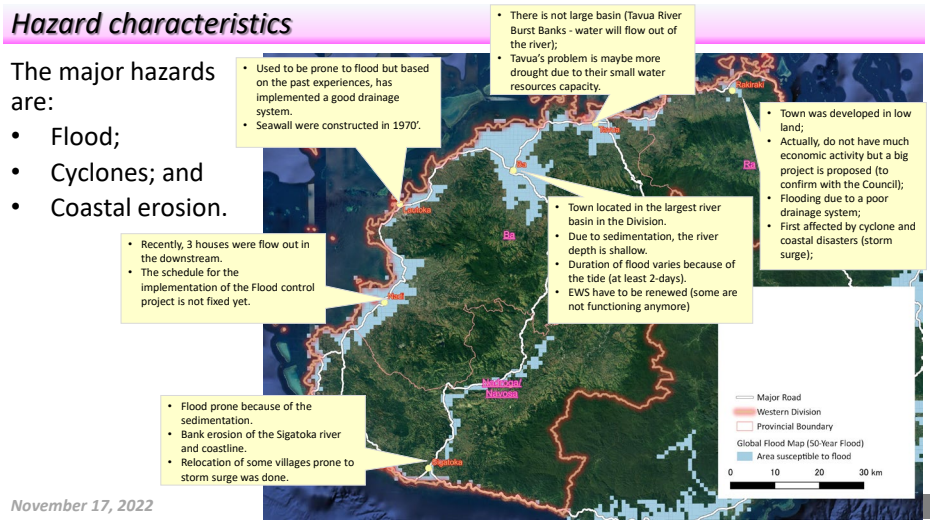
1.2.5 Hazard Simulation and Disaster Risk Assessment Results

Guidelines on the conduct of hazard analysis and disaster risk assessment for flood, landslides, storm surge, tsunami and earthquake were drafted under the Project. By using these guidelines, hazard simulations can be conducted to provide basic data for risk profiling.

The conduct of detailed hazard analysis or simulation usually requires additional human resources, funds, materials such as computers and others. Concretely, hazard simulations include (1) the collection and processing of basic data such as topography, land coverage, waterways and others, (2) data checking and calibration, (3) the setting of external force, (4) the conduct of the simulation, (5) the validation of the results, and (6) the visualization of the results. Consequently, to obtain more detailed or accurate simulation data, additional resources including time are usually needed.

That is the reason why under this Project, the use of "global" hazard analysis results is recommended at the Divisional level due to the extent of the Division, and more detailed "enhanced" hazard analysis results are recommended at the Priority Area level.

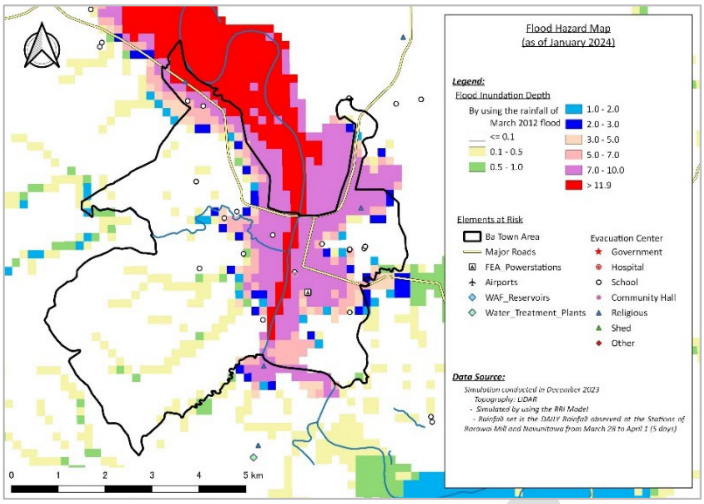
"Global" hazard analysis results can be used to grasp roughly the hazard prone areas in a large area such as the Division. However, the accuracy of such type of analysis is not so high, and information such as anticipated flood inundation depth is not available. Therefore, consultations with local stakeholders are important to confirm and understand the hazard characteristics.



Source: JICA Project Team

Figure 6. Global Flood Map

"Enhanced" hazard analysis resulting from hazard simulations provide more detailed information such as hazard extend and intensity (such as flood inundation depth, ground motion).



Source: JICA Project Team

Figure 7. Flood Hazard Map prepared based on simulation results

1.2.6 Elements

As defined by UNDRR, "hazard, exposure, vulnerabilities, and capacities are dynamic and constantly changing because of changes, for instance, in land use and landcover, rapidly growing urbanization, construction practice and regulations, and technological innovations. Other processes further impact on the dynamics of hazard, exposure, vulnerability, capacity, and their interactions, including underlying root causes such as climate change, population growth or changing demographic structures, and changing levels of inequality gaps and poverty. Therefore, understanding and addressing the root causes of all dimensions of risk is an essential consideration."

By overlaying the hazard analysis results and elements such as population, businesses, government buildings and others, impacts can be anticipated (Please refer to the Guidelines on the conduct of hazard analysis and disaster risk assessment).

Table 2 only provides a basic list of the minimal data to collect. However, according to the characteristics and major economic activities of the locality, additional data on the elements to protect through the implementation of DRR measures can be needed. For example, in tourism sites, the information on hotels and resorts is important to understand where the tourists who may not be so familiar with the locality may be affected during disasters.

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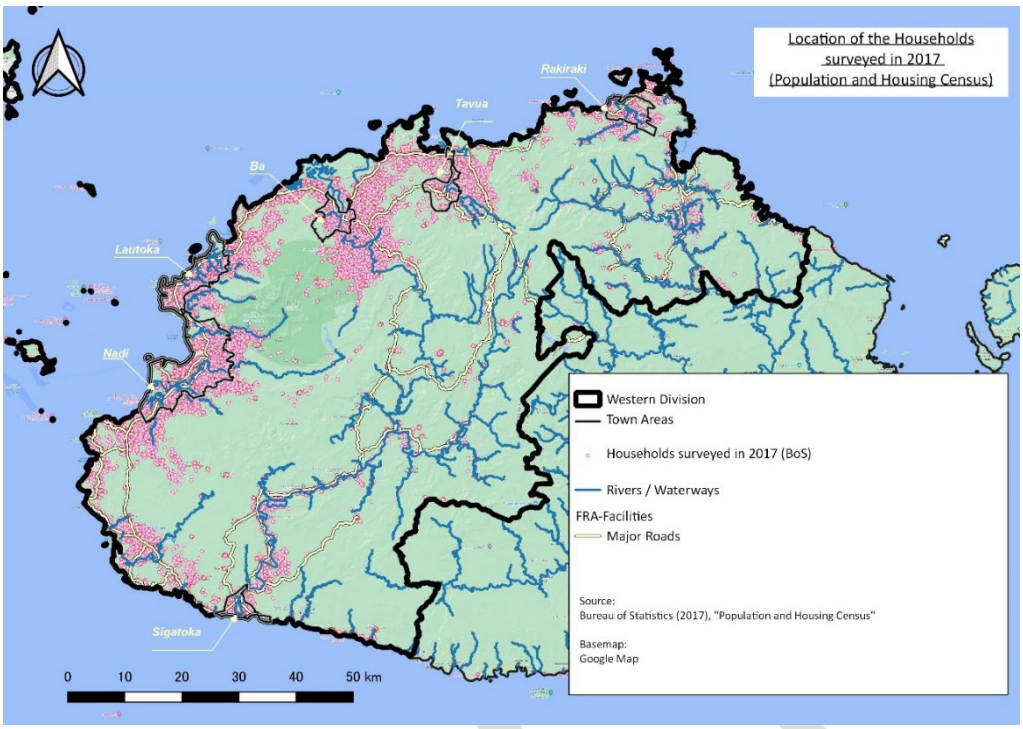

Source: JICA Project Team by using BoS' data

Figure 8. Location of the households surveyed for the Census 2017

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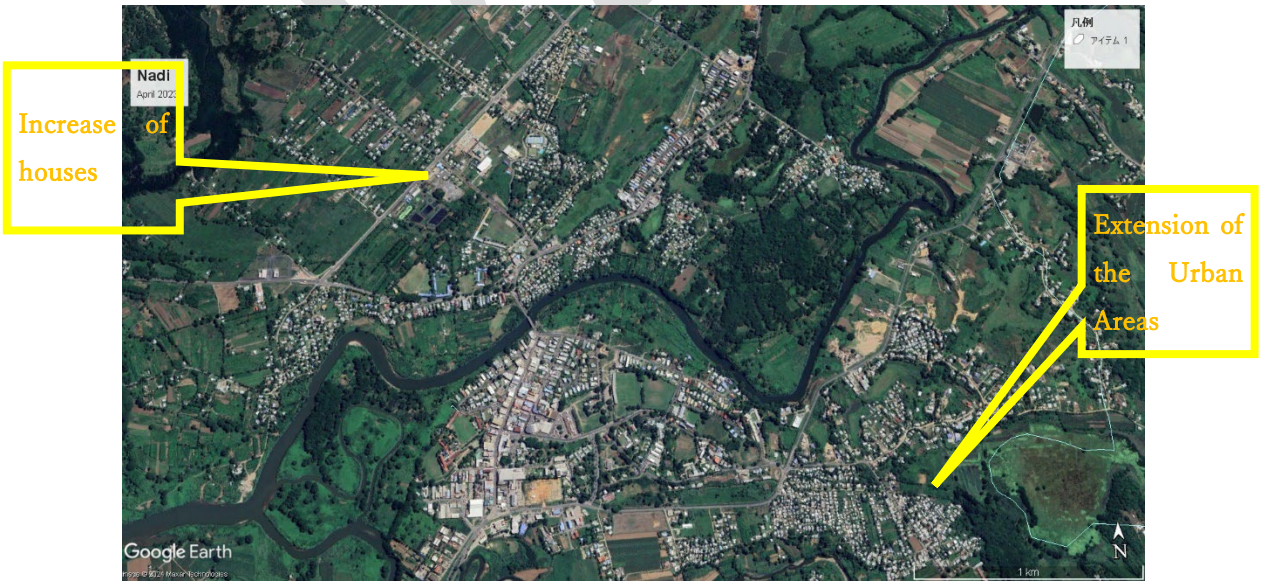
2 Update the socio-economic profile of the locality

If available, the socio-economic profile of the locality is already included in the DDP. The purpose of reviewing or updating the socio-economic profile is to deepen the understanding on how the locality has changed in the past and may change in the future.

In addition to the basic data listed in Table 2. online tools such as Google Earth can be used to understand how the urban areas were extended in the past.

March 2013

April 2023



Source: JICA Project Team by using Google Earth Pro (as of January 2024)

Figure 9. Understand how the locality changed by using Google Earth tools

As explained in the Session 1.2.1 and 1.2.2, each ministry has their development strategy and are implementing projects. Therefore, in addition to the actual socio-economic profile, it is fundamental to understand how each ministry are willing to develop the locality and make a consensus among sectors.

3 Update the Risk Profile of the locality

In the past, various studies were conducted to understand the Risk Profile of Fiji. For example, regarding the Nadi River Basin, the JICA has conducted a comprehensive study on flood risk to develop the river master plan. If such studies were conducted, they can be used as a basis to analyze the risk profile of the locality.

3.1.1 Review the past disaster records

As explained in 1.2.4, the review of past disaster records is the basis to deepen the understanding on the hazard-prone areas, impacts and challenges faced by each sector and others.

The following guide questions can help the process to review past disaster records.

- What types of hazards affected the locality in the past?
- How frequently the locality is affected?
- Where were the most affected areas and businesses?
- Where did roads closure occur?
- Were the government buildings affected?
- Were the evacuation centres affected?
- How long was the duration of the event?
- How long was the evacuation duration?
- How long did the businesses suspend their activities?
- Were some DRR measures implemented after the disaster?

3.1.2 Confirm the results of hazard simulation

As explained in Session 1.2.5, hazard simulations provide important information. Especially, by adjusting the pre-condition factors such as external forces, land-use coverage, topographic data, waterways and others, different hazard scenario can be anticipated (Please refer to the Guidelines on the conduct of hazard analysis and disaster risk assessment for flood, landslides, storm surge, tsunami and earthquake).

Therefore, the conduct of hazard simulations enables the considerations on the “worst” scenario which is anticipated to occur in the future.

Since different hazard scenario can be set, the confirmation of the pre-condition factors is crucial to review the results of hazard simulations. For example, if DRR plan has to focus first on the frequent floods, it may not be proper to refer to the hazard map of high intensity flood.

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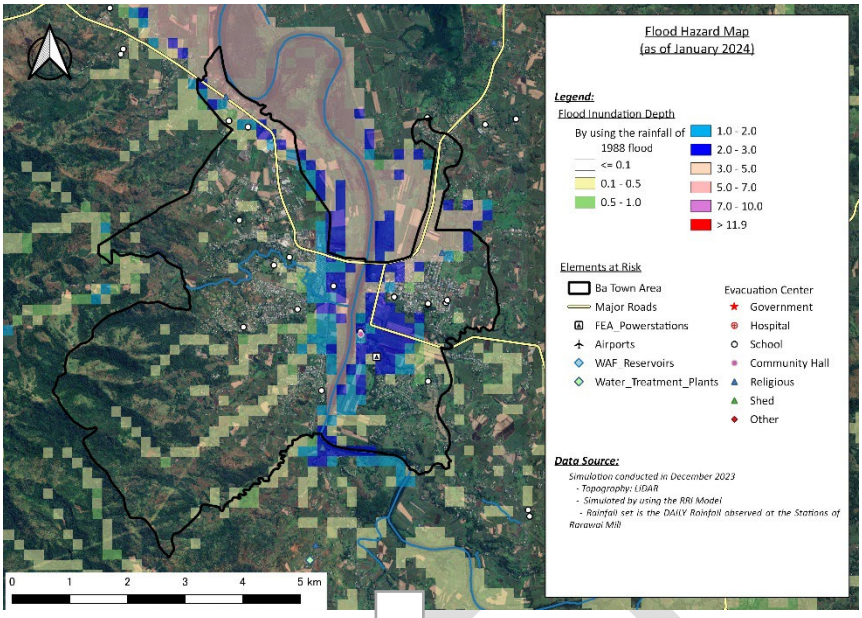
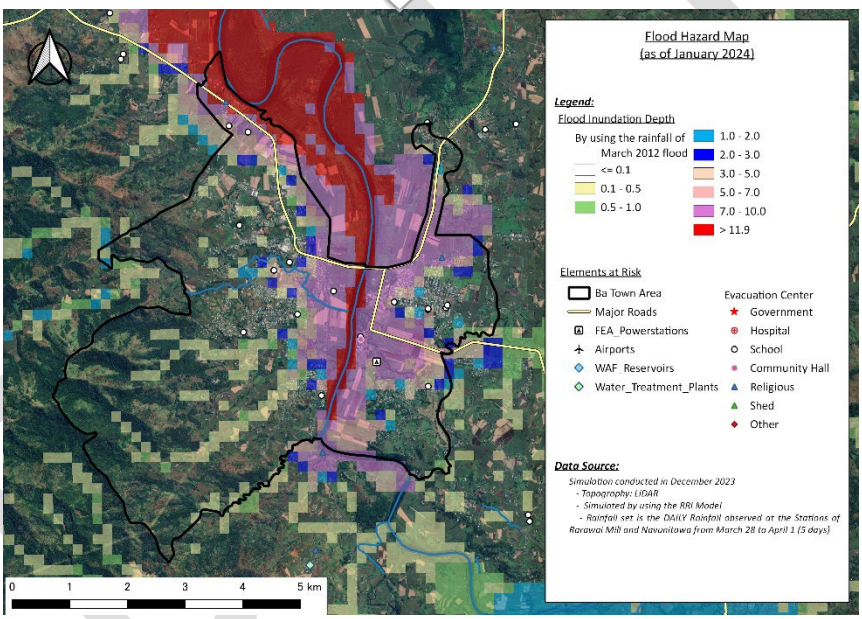
Low rainfall intensity



High rainfall intensity



Source: JICA Project Team (as of January 2024)

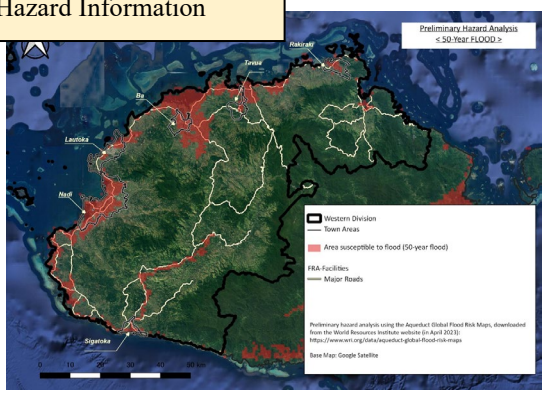
Figure 10. Simulation conducted under different external forces conditions

In addition, the tools to conduct hazard simulations are improving. For example, more accurate topographic data is now available in some areas. Furthermore, due to land development or urbanization, implementation of drainage systems and other factors, the extent of hazards may have changed in some areas. Therefore, it is fundamental to confirm the validity of the hazard maps and if needed update them.

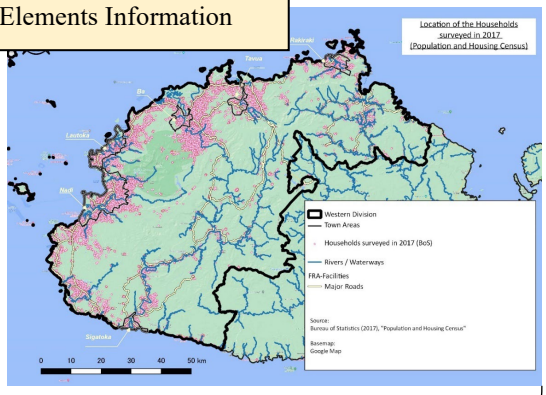
3.1.3 Estimate the elements-at-risk

The estimation or determination of exposed elements can be conducted by computing the area or number of elements located within the hazard prone areas (The detailed methodology is explained in the Guidelines on the conduct of hazard analysis and disaster risk assessment for flood, landslides, storm surge, tsunami and earthquake).

Hazard Information



Elements Information



By overlaying the hazard and elements information, the number or area of elements exposed to disaster risk can be computed.

Table 11. Summary of the elements-at-risk

	Entire Division	Town Areas (Urban + Peri-Urban Areas)						Rural Areas
		Lautoka	Nadi	Ba	Sigatoka	Tavua	Rakiraki	
Actual Situation								
Land Area	6,377 km²	64 km²	143 km²	32 km²	21 km²	30 km²	35 km²	6,052 km²
Population	337,041	71,595	70,575	15,832	10,509	8,805	5,964	153,761
Number of EC*	605	43	57	19	12	14	20	440
Number of elements exposed to flood								
Land Area	1,282 km²	14 km²	103 km²	21 km²	8 km²	10 km²	11 km²	1,115 km²
Population	152,130	14,870	54,154	15,168	5,077	5,829	2,685	54,347
Number of EC	209	10	47	19	8	10	11	104
Number of elements exposed to coastal hazard								
Land Area	147 km²	4 km²	15 km²	1 km²	4 km²	1 km²	8 km²	114 km²
Population	35,899	3,071	5,461	328	2,748	1,028	1,210	22,053
Number of EC	75	2	6	1	3	4	5	54
Number of elements exposed to earthquake *1								
Population	109,324	5,749	63,617	7,351	3,407	2,229	1,428	25,543

*EC: Facilities (Governmental Buildings, Community Hall, Schools, Hospitals, Hotel, Recreation Hall, Shop Compound, Churches, and Temples) registered as evacuation centres in NDMO's database
*1: Regarding earthquake, since the building information (such as building material, number of floors, year of construction) are not complete or available, only the population who may be highly affected in locations where the seismic intensity is supposed to be bigger than JMA5+ was computed.

Source: JICA Project Team

Source: JICA Project Team

Figure 11. Image of the estimation of elements-at-risk

As explained in Session 1.2.6, the elements to protect from disasters may vary depending on the major economic activities of the locality. In addition, by conducting hazard simulations, more detailed estimation can be done. For example, the elements-at-risk can be classified per flood depth (flood, storm surge and tsunami) or ground motion (earthquake).

4 Identify the challenges of the locality

4.1.1 Identify vulnerabilities and capacities

New and recurring vulnerabilities and capacities of each stakeholder have to be identified. The review of past disasters (Session 3.1.1) helps the identification of vulnerabilities. However, various DRR initiatives were generated based on the lessons learned from the devastative Tropical Cyclone Winston. Therefore, the capacities related to DRR are enhancing and the impact from "similar" disasters may have changed.

The identification of strengths and weaknesses toward disasters is fundamental to consider what are the challenges to be solved in priority.

The following guide questions can be used to identify the vulnerabilities and capacities.

- What are the strengths, good characteristics and potentials of the locality in protecting the elements at risk?
- What are the strengths, good characteristics and potentials of the locality in managing the common features that increase exposure, and reduce the negative impacts of hazards?
- What are the weaknesses or limitations of the locality in protecting the elements-at-risk, managing the common features that increase exposure, and reducing the negative impacts of hazards?
- What are the opportunities external to the locality that can be explored, seized, or maximized to effectively protect the elements-at-risk, manage the common features that increase exposure, and reduce the negative impacts of hazards?
- What are the challenges external to the locality that hinder the protection of the elements-at-risk, management of the common features that increase exposure, and reduction of the negative impacts of hazards?

4.1.2 Confirm the on-going and planned DRR initiatives

According to the Programmes List of Budget Estimates, line ministries including the Ministry of Health and Medical Services, Ministry of Education, Heritage and Arts, Ministry of Communication are requesting budget to implement DRR.

Fiji Meteorological Services and the Ministry of Land are allocating a certain amount for the installation, maintenance and upgrade of their hazard observation system, and the Ministry of Waterways for the continuous maintenance and improvement of their drainage network.

In addition, various Aid-in-kind projects supported by international donors are implemented.

These DRR initiatives have to be reviewed to understand the weaknesses which can be solved and how disaster risk may be reduced in the future.

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5 DRR Measures Planning

5.1.1 Consider the DRR directions

The review on the socio-economic profile (Chapter 2), disaster risk profile (Chapter 3), vulnerabilities and capacities and ongoing and planned DRR initiatives (Chapter 4) are the basis to consider the followings.

- Target time frame of the DRR Plan: Will the DRR plan be a short- or mid- or long-term plan?
- Target hazards: What are the types of hazards to consider?
- Intensity of the hazards: Will the DRR plan propose measures for small but frequent hazard or large but rare hazard or both?
- Elements-at-risk to protect with the implementation of DRR infrastructure: Where are the strategic areas or buildings that should not be physically damaged?
- Target DRR targets: How does the number of elements-at-risk are expected to be reduced with the implementation of the DRR plan?

Divisional Level

At the Divisional Level, the collection of hazard information covering the entire locality may be challenging. Therefore, only "global" hazard information may be available and consequently the identification of elements-at-risk may not be so accurate.

Regarding the Western Division, the target timeframe of the DRR Plan was adjusted to the DDP and the target hazards were flood and coastal hazards based on the availability of global hazard information and past disaster records.

Due to the roughness of hazard information, only general directions on the elements-at-risk to protect in priority were considered and the DRR plan provides initial materials to discuss among line ministries.

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5.1 DRR Directions

- Implementation of structural DRR measures in Urban Areas: As explained in the previous chapters, almost half of the Divisional population are living in the 5% of the land designated as urban areas. Therefore, the implementation of DRR preventive measures which will mitigate the impacts and reduce physical damage from disasters is a high priority.
- Enhancement of DRR awareness in Rural Areas: Due to the dispersion of settlements and limitation of ministries' resources, the enhancement of the understanding on disaster risk of the communities will be required in order to enable communities to implement measures by their own (For example, consideration of hazard information before the installation of water tank, health facilities, schools and others).
- Formulation of Sectoral DRR Strategies: Almost all sectors, especially those which were affected by past disasters, are considering how to promote DRR. More information sharing (for example on hazard information) and discussion will be needed to promote the synergy within each sector and set efficient DRR strategies.
- Contribution to Development: DRR plan will contribute to the implementation of the Divisional Development Plan by identifying strategies and priorities.

Source: JICA Project Team

Figure 12. DRR Directions of the Western Divisional DRR Plan (as of January 2024)

Priority Area Level

At the priority area level, since more accurate hazard information and disaster risk assessments results are available, more concrete directions to consider the elements-at-risk to protect and DRR targets can be conducted.

For example, as shown in Figure 10, more concrete considerations can be conducted by using more accurate "enhanced" hazard information. Based on these considerations, more feasible DRR targets can be set. For example, reduction of 25% of flood prone area (XX-year intensity) within 10 years or ensure that all critical infrastructures located within the flood prone area (XX-year intensity) will be inspected within 2 years and improved within 5 years.

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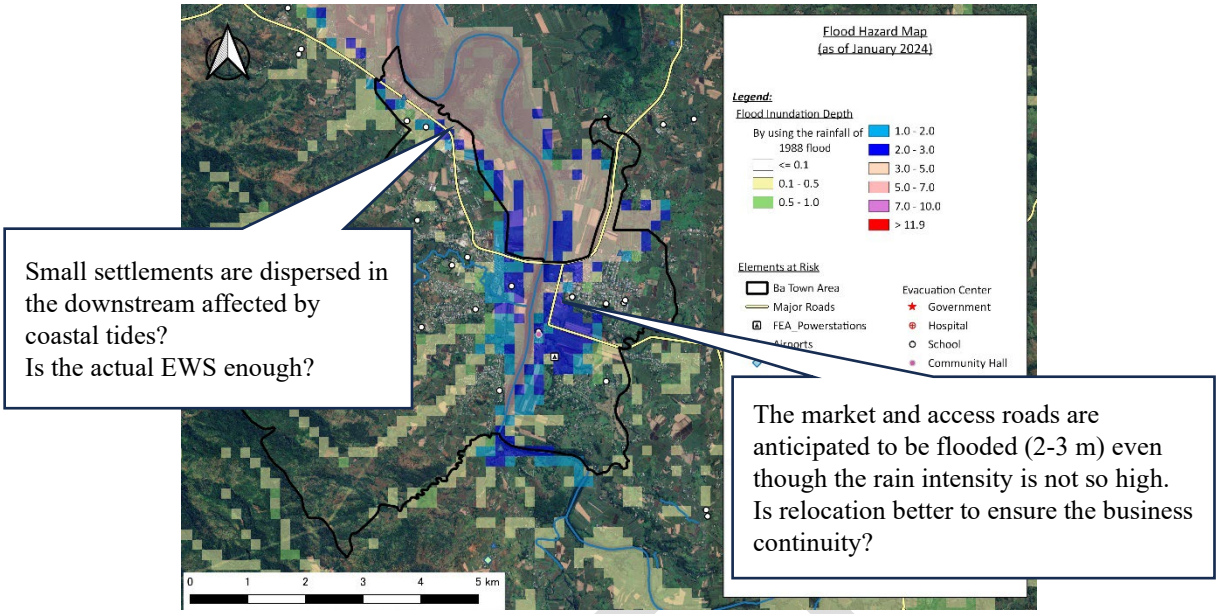
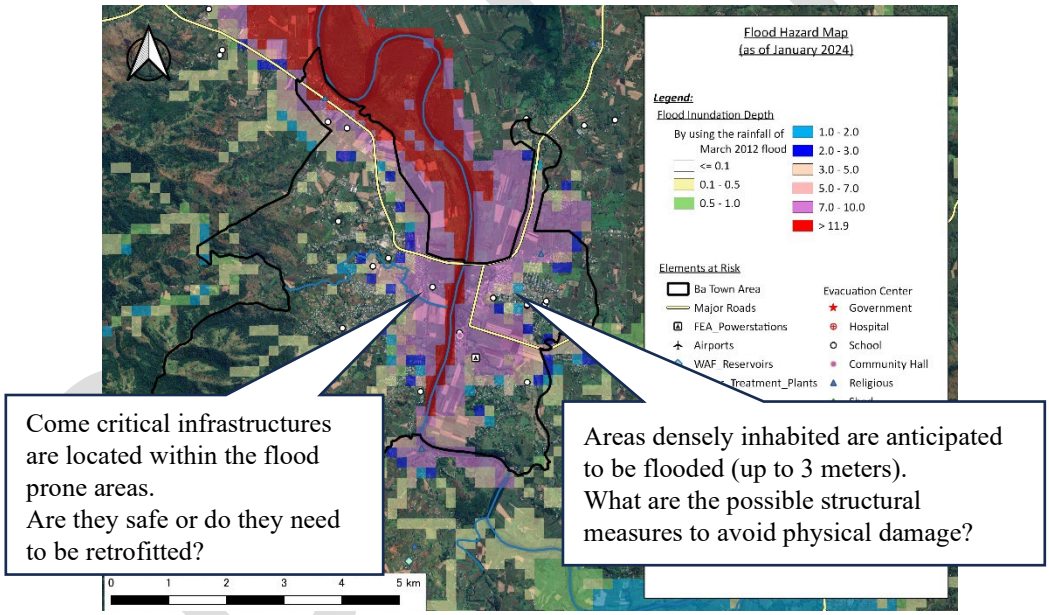
Low rainfall intensity



High rainfall intensity



Source: JICA Project Team (as of January 2024)

Figure 13. Example of considerations

5.1.2 Consider DRR measures

DRR is a part of sustainable development which must involve all sectors of society: government, non-government organizations, and the professional and private sectors. Hence, it requires a people-centered and multi-sector approach that builds resilience to multiple, cascading, and interacting hazards and create a culture of prevention and resilience. (UNISDR, 2015a).

Therefore, DRR measures are not limited to what line ministries can or will implement. The involvement of Civil Society Organizations and Communities may be crucial to implement and

ensure the continuity of DRR efforts in the locality.

In addition, there are “structural” and “non-structural” DRR measures, and it is important to understand their functions properly. Structural measures aim to reduce physical disaster risks through the construction, strengthening, retrofitting, and maintenance of infrastructures, design of new buildings, roads, canals, dams, and others. Non-structural measures aim to reduce the damage, through the improvement of information transfer or EWS, DRR education, land-use regulation, and others.

Both structural and non-structural measures have some merits (advantages) and demerits (disadvantages). A well-balanced combination of both structural and non-structural measures should be considered to reduce actual risk and avoid the creation of new risks.

At the Divisional Level

As the same as the DRR directions, since the priorities of each ministry differ, a series of consultations among ministries is needed to concretize the DRR plan. In other words, the Secretariat can propose initial idea on the DRR measures, but it will be the roles and responsibilities of each ministry to consider how to strategize the implementation of DRR in their own sector.

As a sample, Figure 10 shows the DRR measures proposed for the Western Divisional DRR Plan. Please note that as of January 2024, this list is a draft that should be discussed and concretized among line ministries.

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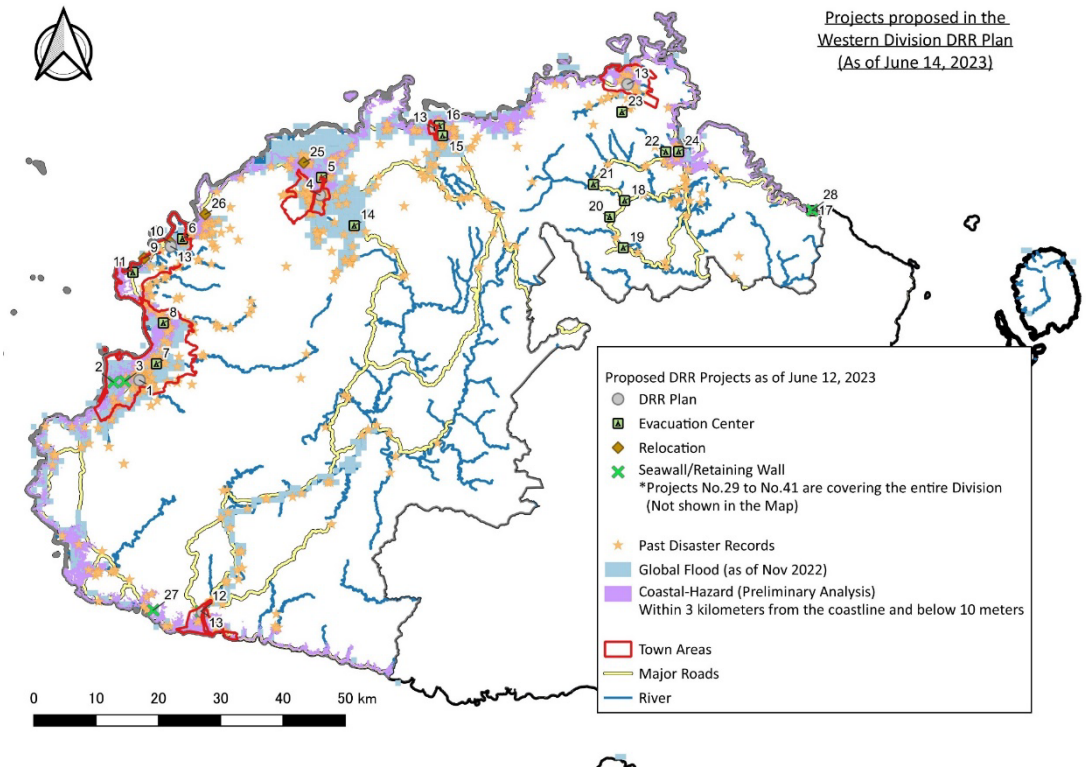
5.2 Proposed DRR Measures

DRR measures were considered by reflecting the socio-economic profile, development perspectives, disaster risk profile, challenges and initiatives related to DRR.

- **Promotion of DRR structural measures in urban areas (Project Number 1, 4, 13):** in addition to the existing DRR measures such as the rivers and creeks desilting, the planning and implementation of DRR structural measures is a priority in order to reduce the impacts of disasters. Especially, all Towns are exposed to flood and coastal hazards. However the hazard maps are not always updated. Therefore, the conduct of hazard analysis and disaster risk assessment should be conducted to consider concrete and efficient DRR measures.
- **Implementation of seawall projects identified in the DDP (Project Number 2, 3, 12, 27, 28):** Under the DDP, six seawall projects aiming to protect Sigatoka Town Area, two villages within Nadi Town Area, one in Cuvu District and another one in Nakorotubu District are listed. Those areas were affected by recent disasters. To implement these projects, consultations with the Ministry of Waterways will be needed.
- **Relocation of informal settlements identified in the DDP (Project Number 9, 10, 25, 26):** Under the DDP, four (two in Ba Town Area, one in Ba District and one in Vuda District) relocation projects are proposed. The targeted settlements are located in the coastal areas and were affected by recent disasters. In addition, challenges occurred in terms of information dissemination during disasters. To relocate these settlements, investigation of the settlement and consultation for the relocation among stakeholders will be needed.
- **Identification of priorities and consideration of DRR strategies per sector (Project Number 32 - 41):** As explained in the Session 4.2, line ministries are requesting budget for the implementation of DRR. However, the number or lengths of assets to be managed by each ministry is large. In addition, all assets may not need to be upgraded. For example, some schools and health facilities which were rehabilitated after past disasters are compliant with the revised Building Code and were upgraded.

  Therefore, it will fundamental that each line ministry identify which facilities have to be upgraded or constructed in priority. Since DRR strategies need to reflect the disaster risk profile, disaster risk assessment is needed per sector. In addition, the investigation on the actual status of each asset or site is needed to confirm the needs. Then, to promote the alignment or harmonization of activities, consultations and agreements will be needed among ministries and non-governmental stakeholders.
- **Construction, rehabilitation, upgrade of evacuation centers identified in the DDP (Project Number 5-8, 11, 14-24):** In the DPP, 40 projects related to the construction, rehabilitation or upgrade of evacuation centres are proposed. Out of the 40, 26 which were recently affected or are located within the flood or coastal hazard areas identified through the preliminary hazard analysis are prioritized.

Promotion of Public Awareness in the entire Division (Project Number 29 - 31): due to large number of communities dispersed in the entire division, strategies to enhance DRR awareness in both urban and rural areas need to be considered. In other words, the communities which are highly prone to disaster risks need to be identified based on hazard analysis, disaster risk assessment and community profiling.



Source: JICA Project Team (as of January 2024)

Figure 14. DRR measures proposed for the Western Divisional DRR Plan

6 Implementation, Monitoring and Evaluation

The purpose of DRR plan is not the formulation itself, but rather the implementation of the DRR measures. Therefore, in compiling the list of DRR measures, format was adopted that would be linked to the monitoring activities under Output 3. Particular attention was paid to the following points:

- For each DRR measure, the responsible agency and the implementing agency were separately identified. The responsible agency was defined as the institution accountable for recognizing the importance of implementing the DRR measure—based on hazard analysis and other results—and for ensuring its realization, including budget allocation. The implementing agency was defined as the institution technically responsible for carrying out the project.
- To indicate the priority of projects, the implementation timeline was classified into three categories: short-term (to be realized within 2–3 years), medium-term (to be implemented within approximately 5 years), and long-term (to be realized over a timeframe of more than 10 years). In particular, short-term goals included feasibility studies and detailed priority assessments for implementation, and progress in these studies was expected to promote medium- and long-term risk reduction measures.
- As items directly related to monitoring, project status was divided into two aspects: budget and implementation. For budget, five stages were defined: before commencement, cost estimated, cost secured, under implementation, and completed. For implementation, five stages were defined: before commencement, implementation site determined, year of completion confirmed, under implementation, and completed. These classifications enabled project status to be clearly identified.

With respect to the above points, in the Central Division, the Commissioner's Office is taking the lead to promoting the use of this framework for monitoring sectoral implementation status, as well as to consider the establishment of a forum to discuss the progress of DRR-related projects.

DRR Direction (2) : Measures to Reduce the Impact of Hazard

DRR Measures	Program	Activity	Responsible Agency	Proposed Implementing Agency	Location	Timeline	Monitoring: Financial Status		Monitoring: Physical Status	Remarks
River Management	Develop Comprehensive River Management Plan	Update of the Strategic Plan 2020-2024 for the Waterways	Ministry of Waterways and Environment?	Ministry of Waterways and Environment	Entire Division	Short (2-3 years)	2025	Not Started	Not Started	
		Update the priority list for river management in the Divisional level	Ministry of Waterways and Environment?	Ministry of Waterways and Environment		Short (2-3 years)	2025	Not Started	Not Started	
River Management	River Management for the Rewa River (including the tributaries such as Waimanu River)	Formulation of river management Master Plan for Rewa River	Central Division, Ministry of Waterways and Environment?	Ministry of Waterways and Environment	Rewa River	Short (2-3 years)	2025	Not Started	Not Started	
		Planning for dredging and riverbank protection in the Rewa River	Central Division, Ministry of Waterways and Environment?	Ministry of Waterways and Environment		Mid (5 years)	2025	Not Started	Not Started	
		Enhance capacity on managing and regulating commercial dredging	Central Division, Ministry of Waterways and Environment?	Ministry of Waterways and Environment		Long (10 years)	2025	Not Started	Not Started	
		Implementation of the considered measures (dredging, riverbank protection)	Central Division, Ministry of Waterways and Environment?	Ministry of Waterways and Environment		Long (10 years)	2025	Not Started	Not Started	
River Management	River Management for the Nabua River	Formulation of river management Master Plan for Nabua River	Central Division, Ministry of Waterways and Environment?	Ministry of Waterways and Environment	Nabua River	Mid (5 years)	2025	Not Started	Not Started	*Dredging of the Deuba river is mentioned in the Strategic Plan 2020-2024 for the waterways
		Planning for dredging and riverbank protection in the Rewa River	Central Division, Ministry of Waterways and Environment?	Ministry of Waterways and Environment		Long (10 years)	2025	Not Started	Not Started	
		Implementation of the considered measures (dredging, riverbank protection)	Central Division, Ministry of Waterways and Environment?	Ministry of Waterways and Environment		Long (10 years)	2025	Not Started	Not Started	
River Management	River Management in other priority Rivers in Serua Province	Identification of Priorities among the rivers with	PA Serua, Central Division, Ministry of Local Government	Ministry of Waterways and Environment	Raiwaqa/ALTA, Waivunu, Wainivilase Settlement, Nakoba, Galoa, Yarawa Flat are areas raised by PA Serua	Short (2-3 years)	2025	Budget Estimated	Target Area/Facility Identified	
		Planning for dredging and riverbank protection in the priority rivers	PA Serua, Central Division, Ministry of Local Government	Ministry of Waterways and Environment		Mid (5 years)	2025	Budget Estimated	Not Started	
		Implementation of the considered measures (dredging, riverbank protection)	PA Serua, Central Division, Ministry of Local Government	Ministry of Waterways and Environment		Long (10 years)	2025	Budget Estimated	Not Started	

Timeline	Financial Status	Physical Status
Short (2-3 years)	Not Started	Not Started
Mid (5 years)	Budget Estimated	Target Area / Facility Identified
Long (10 years)	Budget Allocated	Goal Set
	In Progress	In Progress
	Completed	Completed

Figure 15 List of DRR Measures with Items for Facilitating the Implementation

Guidelines
for Priority Area DRR Plan
in FIJI

JUNE 2024

Updated in October 2025

1. Introduction

The guidelines in this chapter provide procedures and key points for the development of Priority Area DRR Plans, which aim to reduce disaster risk.

Here, we restate the difference between a "Divisional DRR plan" and a "Priority area DRR plan" as defined in the Local DRR Plan.

Divisional DRR plans.

Divisional DRR planning is intended to contextualize the NDRRP at the local level and set basic disaster management directions and priorities. The size of the region makes a detailed hazard analysis covering the entire district difficult. Therefore, identifying and planning specific disaster reduction measures is difficult, and it is recommended that the results of a "global" hazard analysis be used first to identify priority areas and set basic disaster reduction directions if more accurate data are not available.

Priority Area DRR Plan.

Once priority areas and locations have been identified at the district level, more accurate data can be used to conduct detailed hazard analysis and simulations. Thus, more specific disaster prevention measures and implementation plans can be considered.

Table 1: Differences between DRR plans at the Divisional and Priority Area levels

	Divisional DRR Plan	Priority Area DRR Plan
Purpose	To set the fundamental strategies or directions on DRR.	To consider concrete DRR measures to be implemented.
Target Areas	Entire division	Town areas include urban and peri-urban areas.
Involved Agencies	National headquarters and divisional offices of line ministries, and all Town Councils	Target Town Area's Council, divisional offices of line ministries, private sector.
Secretary	Commissioner	Commissioner
Hazard Analysis	Review of past disasters, and preliminary hazard analysis covering the entire division. ✓ Flood Hazard: Global Flood Map (50-year flood), ✓ Coastal Hazard: Extraction of the areas where the elevation is below 10 meters (Mean Sea Level) and 3 kilometers from the coastline.	Review of past disasters, and enhanced hazard analysis based on more detailed simulation models. ✓ Flood Hazard: Rainfall-Runoff-Inundation Model, ✓ Storm surge Hazard: ComMIT Model, ✓ Tsunami: Simulation Model used by FMS, ✓ Earthquake: Global Earthquake Model.

Source: JICA Project Team

The DRR will be oriented toward the following three points.

- Urban areas need to plan and implement DRR prevention measures.
- In rural areas, there is a need to improve community understanding of disaster risks and promote mainstreaming of DRR and implementation of preventive measures (e.g., review hazard information before installing water tanks, health facilities, schools, etc. in communities).
- Almost all sectors, especially those affected by disasters in the past, are considering ways to promote DRR. More information sharing (e.g., hazard information) and discussions are needed to promote synergies within each sector.

The DRR Plan contributes to the implementation of the Division's Development Plan by setting strategies and priorities.

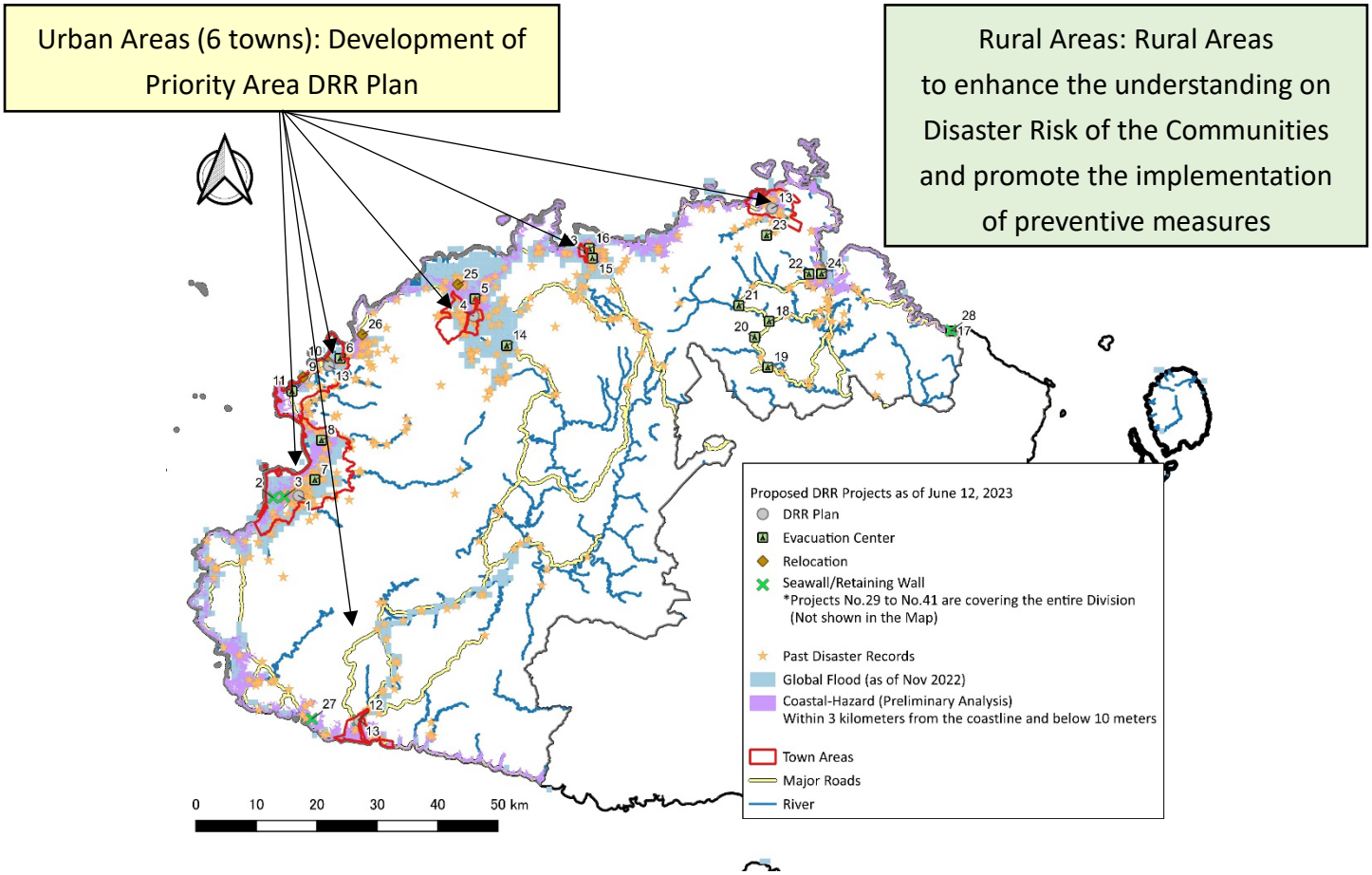


Figure 1: Urban (6 towns) and rural areas in the Western DRR plan

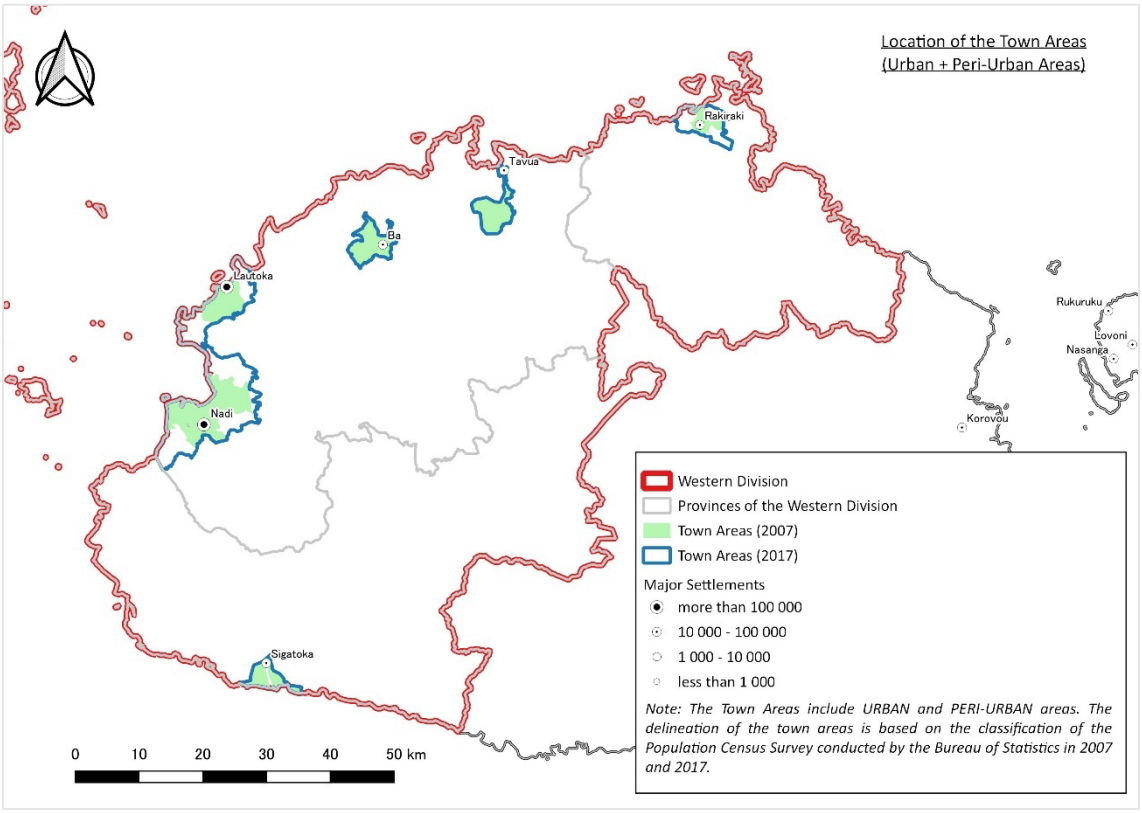


Figure 2: Cities (6 towns) in the Western Region DRR Plan

One of the objectives of DRR planning is to consider specific and feasible DRR measures that contribute to disaster risk reduction.

Therefore, in order to select priority areas, they will be evaluated according to the following criteria

- Actual socioeconomic profile (population, firms),
- Perspectives from higher-level national and provincial development plans and policies,
- Results of a "preliminary" hazard analysis and risk assessment,
- Past Disaster Records
- Others

The table below evaluates the six urban areas according to the aforementioned evaluation criteria.

Among the six urban areas, the Nadi area shows the highest degree of impact from coastal and flood disasters. The Ba Area has the next highest level of damage from flood disasters. Therefore, Nadi Area was selected for coastal disasters and Ba Area for flood disasters as proposed pilot areas for priority areas.

Table 2: Evaluation Table for Selecting Priority Areas

	Lautoka Area (63.6 km²)	**Nadi Area (143.1 km²)**	**Ba Area (31.6 km²)**	**Sigatoka Area (20.5 km²)**	**Rakiraki Area (34.8 km²)**	**Tavua Area (29.9 km²)**
Major economic activities	Governmental Center, Sugar Industry, Tourism	Tourism, Sugar Industry, Agriculture	Sugar Industry, Agriculture, Construction	Tourism Agriculture	Sugar Industry, Agriculture, Tourism	Sugar Industry, Agriculture, Mining
Population	69,616	69,834	15,575	10,231	8,901	5,942
Number of Businesses	1,318	1,633	673	278	196	272
Susceptibility to Flood • Land Area • Population • Number of Businesses	 14.3 14,970 100	 103.4 54,154 1,406	 21.0 15,168 672	 7.8 5,077 63	 10.5 2,685 247	 9.7 5,829 189
Susceptibility to Coastal Hazard • Land Area • Population • Number of Businesses	 4.5 3,071 43	 15.2 5,461 76	 0.9 328 4	 4.6 2,748 21	 7.6 1,210 85	 1.0 1,028 26
Susceptibility to Earthquake • Population highly affected	5,749	63,617	7,351	3,407	1,428	2,229
Major Challenges to deal with disasters identified during consultation meetings with each Town Council in November 2022	• Post-disaster waste management • Strict compliance of the Town-Planning Scheme and Building regulations	• Post-disaster waste management • Tourism protocol	• EWS not functioning • Post-disaster waste management • Lack of funding and resources for recovery	• No updated hazard map • Basic data difficult to find (challenges on the sharing of data within agencies)	• Weather forecast error • Workers resides in flood-prone areas • Collection of garbage	• Prone to drought and flood. • Weather forecast error • Telecommunication (weak signal)

June 12, 2024

In addition, in the priority area plan DRR plan formulation, since the greater Suva area, the population distribution is connected through the Lami Town, Nasinu Town and Nausori Town the approach to consider the target area based on the population distribution was done.

Although the other areas in Fiji may not have the same situation, the image of selection of the priority area based on the population distribution is shown in

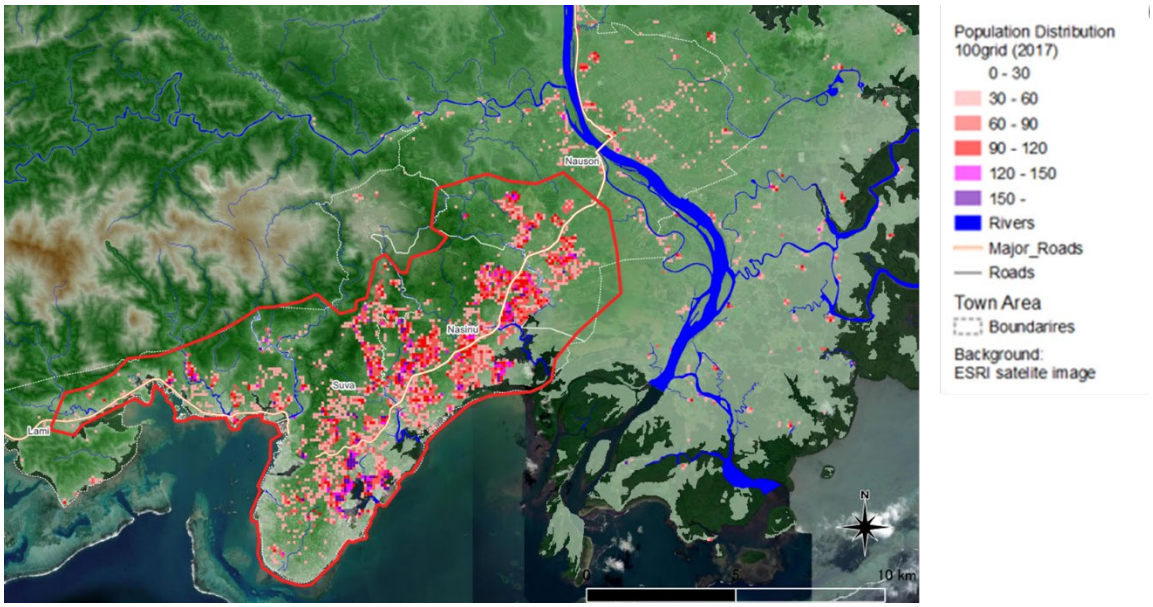


Figure 3: Image of Selection of Priority Areas (Red) based on the population distribution

Based on the aforementioned differences between divisional-level and priority area DRR plans, the following steps should be followed to develop a Priority Area DRR Plan according to the characteristics of the area.

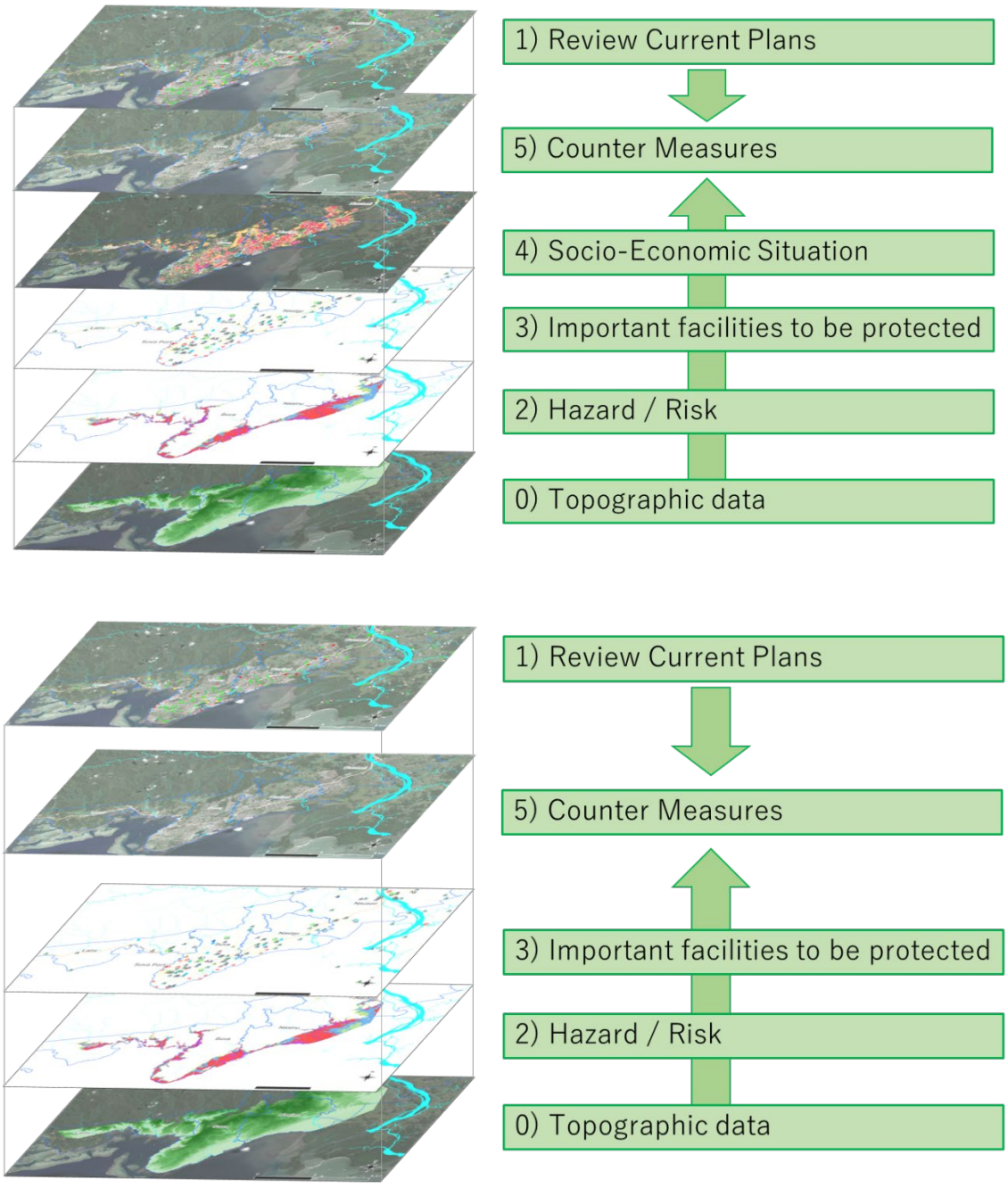


Figure 4: Flow of creating a Priority Area DRR Plan
(Top: With Major Socio Economic Issues. Bottom: With Minor Socio Economic Issues)

2. STEP1: Understand the position of the relevant plans.

2.1. Review of Current Plan

- The current plans being collected in the Divisional DRR Plan will again be reviewed in detail for priority areas.
- Review current land use plans, disaster prevention related plans, infrastructure plans, etc.
- Understanding of local development plans and existing master disaster management plans.

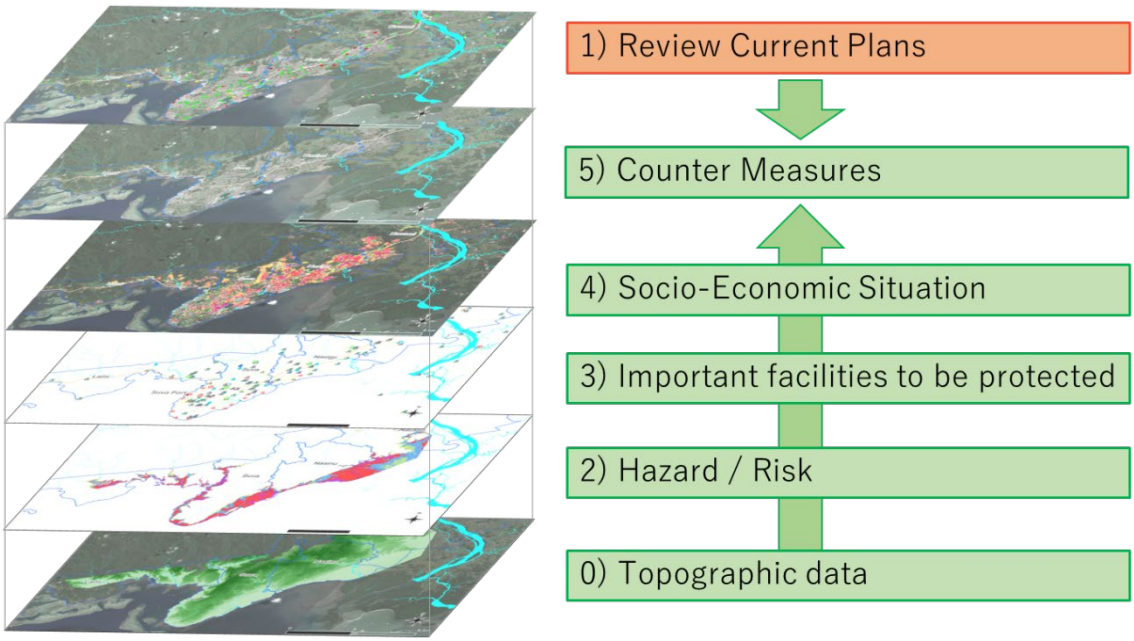


Figure 5: Flow of creating a Priority Area DRR Plan (Step 1)

2.2. Consultations with relevant organizations

- Consultations with relevant agencies involved in regional planning (councils in the target urban areas, district offices of line ministries, departments in charge of disaster management, and the private sector) to ensure consistency of the plan.
- The plan's appropriateness was confirmed by consolidating findings from a wide range of perspectives through sector-specific hearings and other exchanges of views with stakeholders.

3. STEP2: Identify hazard risks

3.1. Risk Assessment

- It is assumed that data collection for assessing natural disaster risk (flood, tsunami, storm surge, earthquake, landslide, etc.) has already been collected in the district-level disaster management plan. However, disaster types to be treated as priority areas should be established and their risks reassessed.
- Risk areas are identified using topographic maps, LiDAR data, past disaster records, and relevant hazard maps.
- The probability of occurrence of various disaster events is determined based on historical data and scientific projections in the priority areas again, which have already been considered at the district level. Both high frequency/low impact events and low frequency/high impact events are considered.

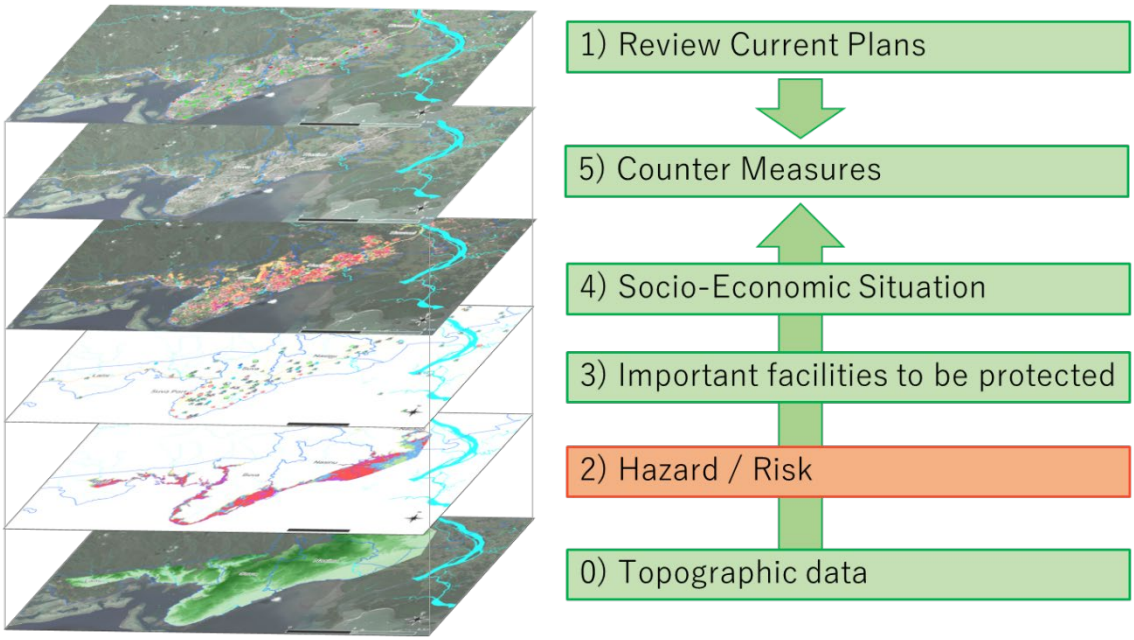
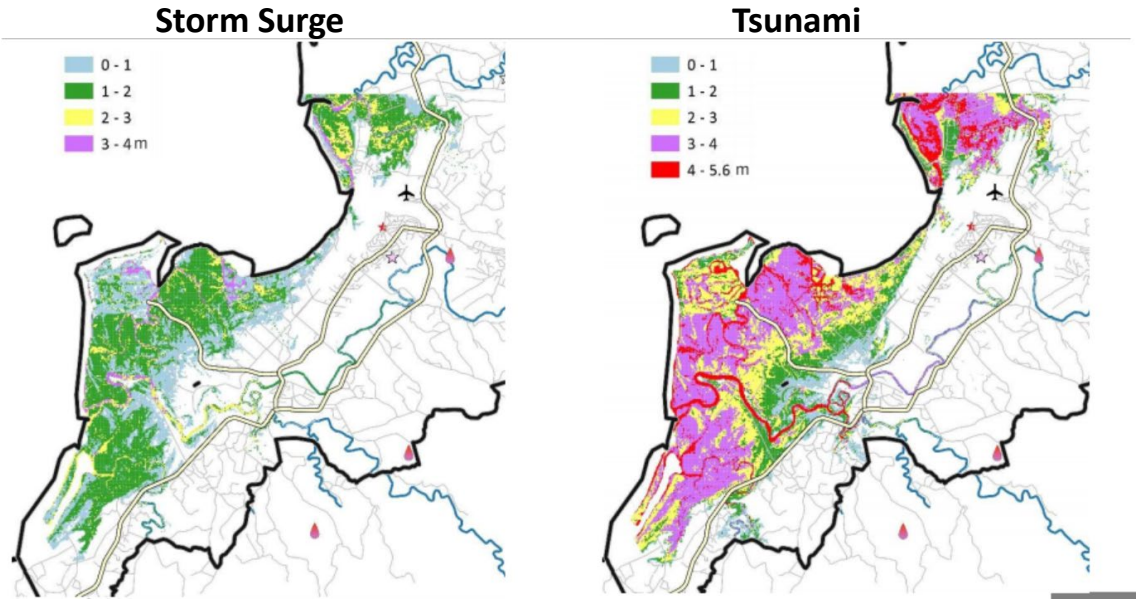


Figure 6: Flow of creating a Priority Area DRR Plan (Step 2)

3.2. Simulation

- Even if the study is being conducted at the district level, disaster simulations (e.g., flood simulations, tsunami simulations, earthquake impact analysis) should be conducted again for the identified risks in the priority areas.
- Ideally, advanced simulation tools and models should be used to predict the extent of impact, depth of inundation, and population affected; however, simulation tools and models should be selected while considering the limitations of available data.
- Simulation results are checked against past disaster records, and field surveys are conducted to verify the accuracy of assumptions.
- Since the simulation is a theoretical model, it is important to use it in combination with field surveys and expert opinions.
- An example simulation is shown below.



Storm Surge
-Topography: LiDAR
-Storm Surge Height: MSL+3.0 m
By considering the Highest Astronomical Height (HAT) and simulation calculation of the highest storm surge in Nadi
-Inundation Area determined based on the Fill Level Method
-Inundation Area determined based on the Fill Level Method

Tsunami
Data Source:.
Simulation conducted in September 2023
-Topography: LiDAR
-Tsunami Source: Trench Earthquake (Magnitude 9.0)
-Tsunami Height calculated by using CoMMIT Simulation
-Inundation Area determined based on the Fill Level Method (Tsunami Height + HWL)

Figure 7: Hazard Risk Simulation Example

3.3. Verification (reiterated but important)

- Simulation results are compared with historical disaster data to confirm the accuracy and reliability of the simulations.
- Conduct field surveys and site checks to ensure that simulation assumptions are consistent with actual local conditions.
- Continuously update and improve simulations based on new data and technological developments.

4. STEP3: Identify important public facilities to be protected, etc.

4.1. Identification of Critical Facilities

List of important public facilities including

- Medical facilities: Hospitals, clinics, urgent care centers, etc.
- Educational facilities: Schools (elementary, junior high, high school), kindergartens, universities, etc.
- Shelters and community centers: Designated shelters, community halls, etc.
- Administrative facilities: City Hall, police stations, fire stations, etc.
- Infrastructure: major roads, bridges, water treatment facilities, substations, etc.
- The current status, capacity, and location of these facilities.

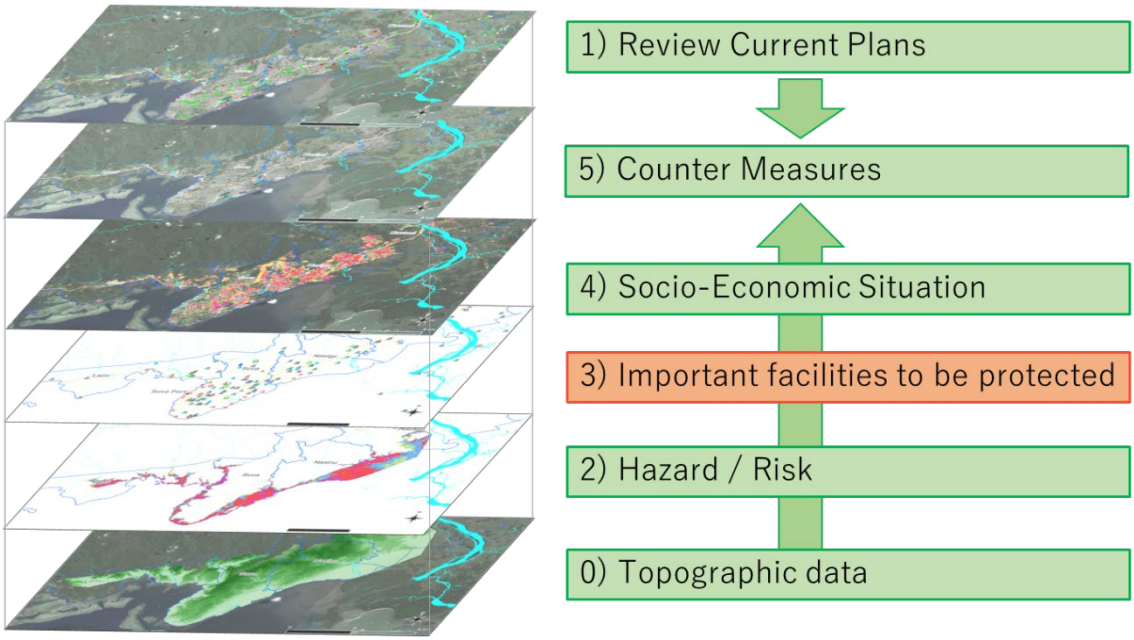


Figure 8: Priority Area DRR Plan Creation Flow (Step 3)

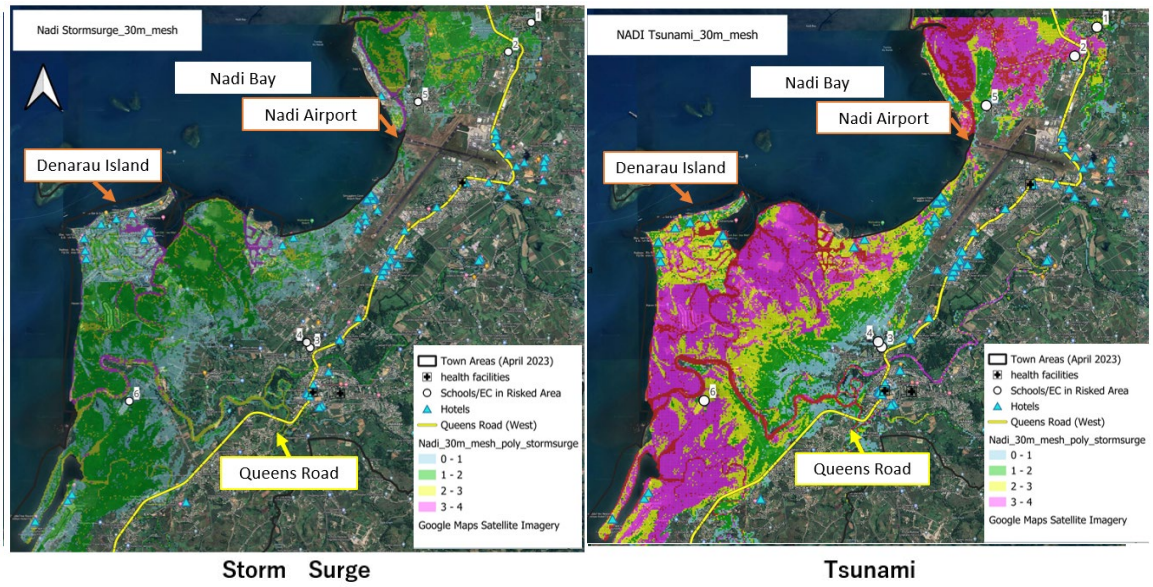
4.2. Facility vulnerability assessment

- Vulnerability of critical public facilities is assessed by considering the following
- Structural integrity and compliance with building codes (e.g., seismic design).
- Proximity to high-risk areas (e.g., flood zones, landslide hazard areas).
- Performance during past disasters.
- Create and maintain a comprehensive facility ledger that includes facility details (e.g., year built, type of structure, current maintenance status, existing protective measures).
- The following facility ledgers can be used as a reference

Building Information			
Building Name	Votua Catholic School	No.	3
Address	Votua Village, Ba		
Building Structure	CB	Number of floors	3 double storey building and 1 single storey
Building area	4 building	Total Building area	70,113.74m
Age of building		Date of completion	
Hazard Information			
Depth of flooding	3-5M	Depth of Tsunami	
Earthquake			
Remarks			
Photos			

Figure 9: Example of building ledger

- A vulnerability assessment matrix may be prepared to prioritize the development of facilities based on risk and criticality. This may involve a separate study of prioritizing the development of shelter facilities, etc., and coordination and consistency with these studies should be ensured.



Storm Surge Tsunami

Figure 10: Example of understanding the location of critical public facilities within the hazard risk

5. Step 4: Socio-Economic Situation

- Based on the fact that in urban areas there are many Socio-Economic Situation with challenges in the urban area, in the priority area plan for the greater Suva area, an approach to consider the Socio-Economic Situation was considered.

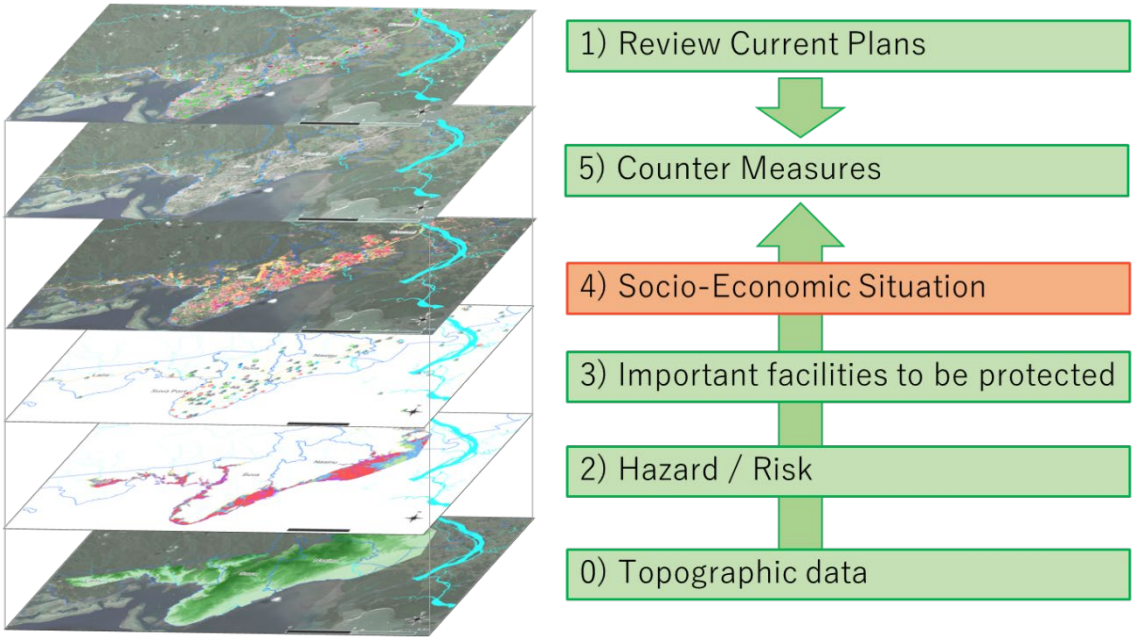


Figure 11: Flow of creating a Priority Area DRR Plan (Step 4)

- To consider the Socio-Economic status of the area, population, new-development areas, location of informal settlements was considered
- In addition, to well understand the Socio-Economic challenges due to rapid urbanization, a matrix to identify challenges in different urbanization / development situations to different hazards was considered.
- As shown in Figure 12, when considering the development phase of the development can be divided into several categories such as Urban (Central Area, Informal Settlement Area), Sub-urban (Already Developed Area, Future Development Area) and Hilly Terrain (Divisional Connection, Provincial Connection and Village Area).
- It is important to consider the different approach for different development Situations which can be summarized as the table below. Based on this table the approach for different measures such as Drainage and Measures in Steep Slopes, Coastal Hazard area, Strong wind and Earthquake can be identified.

Figure 12: Summary of the Challenges based on Socio-Economic Perspectives (Example in the greater Suva Area)

	Urban		Sub-Urban	
	Central Area	Informal	Already Developed	Future Development Area
Urban Flooding	Urban Flooding caused by insufficient drainage network	Insufficient drainage facility and high risk of inundation (Wailea)	Insufficient drainage facility causing increase in damage caused at the downstream	Drainage facility shall be incorporated in the new development plans
River Flooding	Industrial or Commercial zone in river flood areas (Lami river, Samabul river)	Located in high-risk area requiring relocation or river management measures (Qauia, Marayu)	Housing development in the flood plain area	Development plan in the flood plain area
Steep Slope Measures	Steep Slope Failure occurring in housing development areas	Located in high-risk areas requiring relocation or steep slope management measures (Jittu)	Steep Slope Failure occurring in new housing development areas, and causing traffic disruption (Princes Road, Dikusha)	Development near steep slope shall be regulated or to be developed with appropriate slope stabilization measures
Coastal Hazard Measures	Rehabilitation and construction of coastal protection is necessary to prevent coastal erosion	Located in high-risk areas requiring relocation, coastal protection measures of evacuation plans (Wailea, Nanuku)	Development in the Low-line flood plain areas (in Suva)	Some plan in a low-line areas with high risk to coastal hazard (Storm surge, flooding in the Delta area)
Strong Wind Measures	Evacuation Centers lacking in some areas (areas with no evacuation center in 500m distance)	Evacuation Centers for Informal Settlement is not sufficient	Capacity of Evacuation Centers shall be confirmed	Capacity of Evacuation Centers shall be confirmed
Earthquake/ Tsunami Measures	Necessity of retrofitting of critical facilities to be evaluated Business Continuity Plan (BCP) to be considered in critical facilities (Ports etc.)	Evacuation Planning and Training to be conducted in coastal settlement (Wailea, Nanuku)	Evacuation Planning and Training to be conducted in coastal settlement	Evacuation Planning and Training to be conducted in coastal settlement
Road Resilience	Road drainage of urban areas insufficient and not connected to drainage channel	Unpaved road getting unpassable during rain/storm	Lack in coordinated drainage facility of roads, drainage channel and natural water bodies	Coastal road in the east coastline between Suva and Nasinu proposed need to be resilient

6. STEP5: Prepare a Priority Area DRR Plan

- The information from STEP 1-3 is integrated to create a DRR plan for the priority areas.
- The following flow chart shows the integration of the plans.

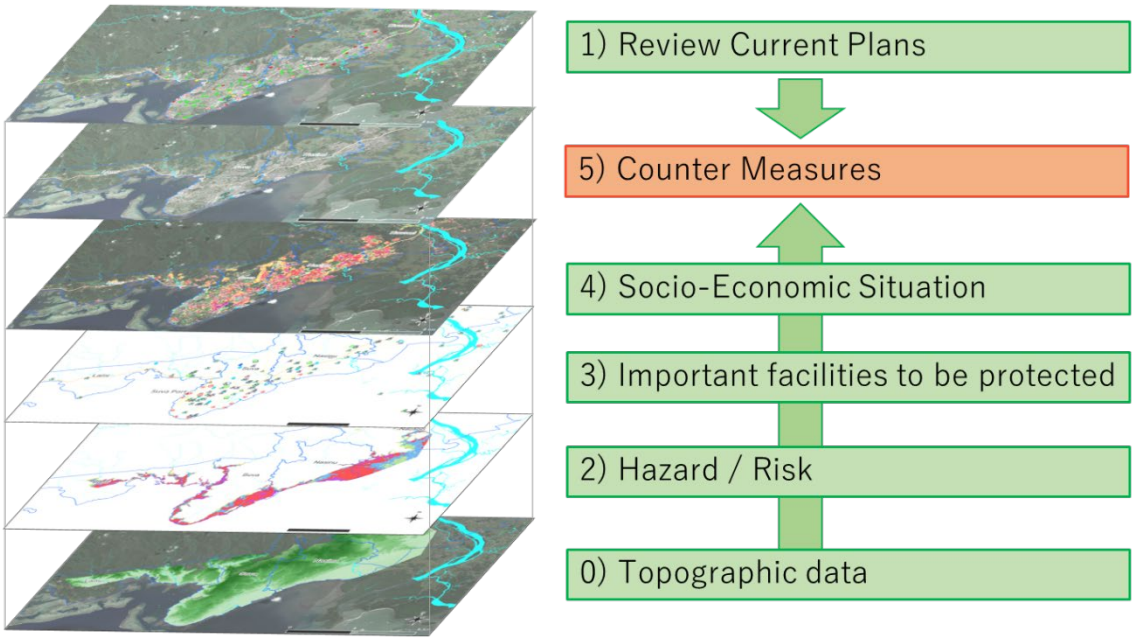


Figure 13: Flow of creating a Priority Area DRR Plan (Step 5)

■ In addition, it is envisioned that 3D maps will be used in the planning process to overlay the topographical conditions and hazard risks of the area, and to identify important public facilities that should be protected based on these conditions.

≪Reference≫ The advantages of 3D mapping are as follows

1. Improved visual understanding

The intuitive understanding of the topographical ups and downs and the layout of buildings allows for a clearer understanding of the topographical conditions and disaster risks in the area. This makes it easier for all parties involved to share a common understanding.

2. Detailed risk assessment

The system can provide a detailed analysis of what hazards a particular area is likely to be exposed to by assessing the risks of floods, earthquakes, landslides, and other disasters in a three-dimensional superimposed manner. This enables more effective disaster prevention planning

3. Simulation function

The ability to simulate disaster scenarios in 3D makes it easier to predict the progress of a disaster and the extent of damage. It is useful for confirming evacuation routes and verifying disaster prevention measures.

4. Maintenance plans for critical facilities

The location and surrounding environment of important public facilities such as schools, hospitals, and government agencies can be grasped three-dimensionally, which is useful in developing measures to effectively protect them. For example, the placement of evacuation centers and evacuation routes can be optimized.

5. Data integration and analysis

By integrating and analyzing various data sets in a 3D space, including topographic data, population distribution, and infrastructure information, a more comprehensive disaster prevention plan can be developed. Multiple data sets can be overlaid to optimize risk and resource allocation.

6. Provision of information to residents

When explaining the contents of disaster prevention plans to residents, 3D maps can be

used to provide visual and easy-to-understand information. This will make it easier to gain the understanding and cooperation of residents.

7. Decision-making support

It is also useful as a tool to support the decision-making process of the parties involved in the formulation and implementation of disaster prevention plans. A bird's-eye view of the situation of the entire community from a three-dimensional perspective will enable more accurate and prompt decision-making.

The above advantages make 3D mapping an extremely effective tool in the study of priority area disaster management plans. This allows for concrete and effective measures to be taken to enhance community safety and minimize damage in the event of a disaster.

The following is an example of a 3D map superposition diagram

When creating a superimposed map with a 3D topographic map, if the urban area has a lot of flat terrain, it is possible to enlarge the height direction of the topographic map by several times to emphasize the topographic features. In the following topographic map, the height direction is magnified by about 3 times. The yellow line extending horizontally is Queen's Road, the main artery in the area. It can be seen that the ground is higher on the mountain side of Queen's Road. Since the ground on Queen's Road is slightly higher than the seaward side, it can be seen that the inundation area by the storm surge and tsunami is confined to the seaward side of Queen's Road.

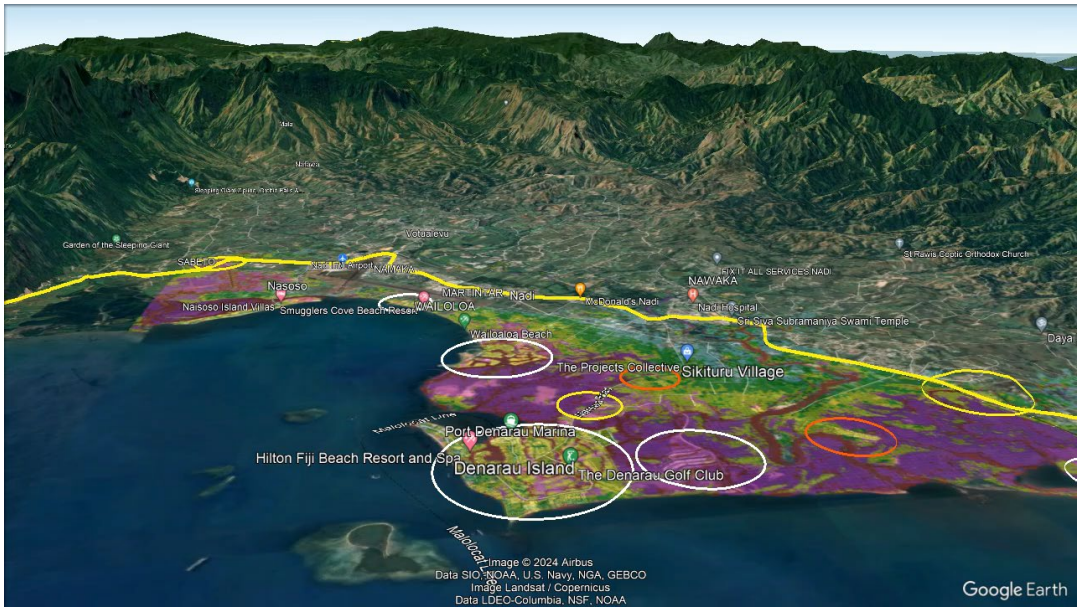


Figure 14: Example of overlaid 3D topographic map and hazard risk (Nadi)

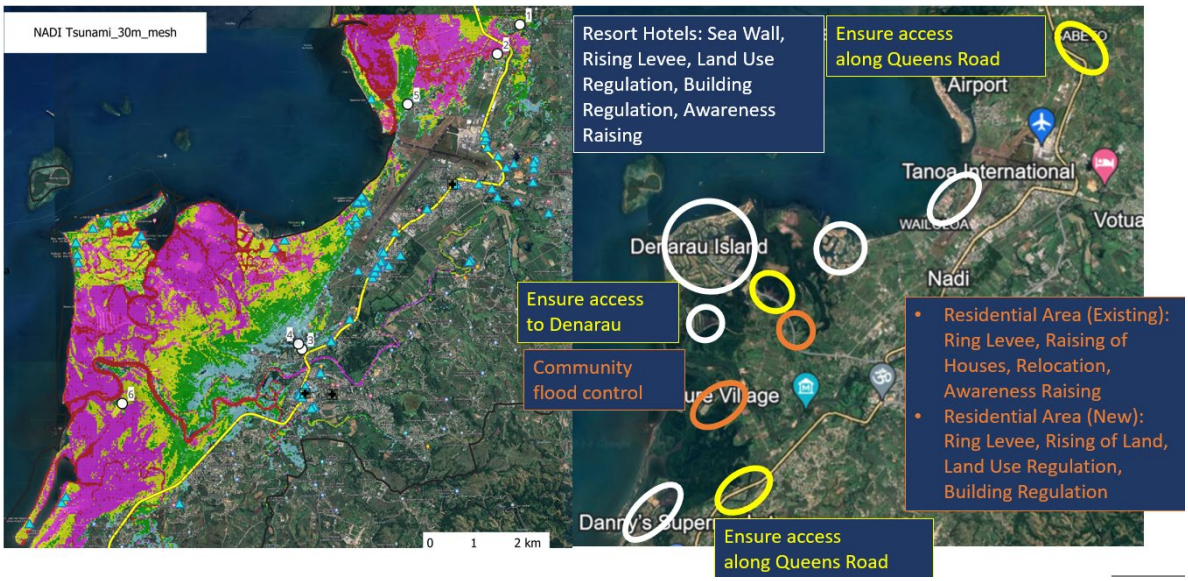


Figure 15: Examples of specific Priority Area Plans

Nadi is given as an example of a specific Priority Area Plan. The area circled by the white oval is an example of a resort area. The areas circled by orange ovals show examples of measures in settlements and communities. The yellow ones show examples of measures to improve the Queen's Road and the access road to the resort area. Specific details are shown in the Activity settings below.

7. STEP5: Set up specific activities (Activities)

- Specific activities are set up to implement the plan.
- Including specific actions/activities for disaster risk reduction (e.g., infrastructure strengthening, land use regulations, upgrading of critical facilities, strengthening disaster response capacity, etc.) in the plan.
- The Activity should indicate who (Responsible Organization), when (TimeLine), and specifically what (Activities) will be done. The relationship with the NDRRP should also be clarified.
- In considering the timeline, the feasible timing of project implementation should be set from the short, medium, and long term perspectives.
  - ■Short-term projects: Projects that are urgent and for which budget and resources have already been secured. For example, maintenance and redevelopment of shelters can be started within a few months to a year, etc. Perspective.
  - ■Medium-term projects: Projects that require planning and budget adjustments. For example, strengthening of disaster prevention infrastructure and seismic retrofitting of critical public facilities are assumed to be implemented within one to three years, etc.
  - ■Long-term projects: Projects that span multiple years, such as major infrastructure improvements or a review of the region's overall disaster management plan. These are planned for a span of 3-5 years or more.

Through these processes, it is important to clarify the feasible timing of implementation and promote phased and efficient disaster reduction measures.

- As a reminder, ensure that the plan is consistent with ongoing disaster risk reduction initiatives and planned projects, and that it is aligned with national disaster risk reduction policies and international best practices.
- In particular, due consideration will be given to consistency with NDRRP action items.

The following are examples of specific activities.

Table 3: List of activities 1

No.	Div.	Place	HZ.	Ensure Access	Responsible Organization	Target Year
1-1	W	Nadi	C	Ensure access along Queens Road (2 locations)	FRA	2030
1-2	W	Nadi	C	Ensure access to Denarau	FRA	2035
1-3	W	Nadi	C	Construction of bypass road to Denarau	FRA	2035
2	W	Nadi	C	Community flood control (2 locations)	Rural	2030
3	W	Nadi	C	BCP for resort hotels (8 locations)	Hotel	2030
4	W	Nadi	C	Flood control for schools (2 out of 6 locations)	MOE	2025
5	W	Nadi	C	Flood control for health facilities (2 locations)	MHMS	2030
6	W	Nadi	C	Land use regulations	Nadi Town	2030

Table 4: List of activities 2

No.	Div.	Place	HZ.	Activity	Outline
1-1	W	Nadi	C	Ensure access along Queens Road (2 locations)	The Queen's Road, a major arterial route in the region, must not be allowed to rupture due to flooding. Measures such as road elevation and bridge maintenance should be taken, especially for these two locations prone to flooding.
1-2	W	Nadi	C	Ensure access to Denarau	Nadi, ensuring access to Denarau, the most important tourist destination, is the utmost priority. Measures such as road elevation or circuit maintenance should be implemented to prevent access roads from flooding caused by Floods, Storm surge, or Tsunamis.
1-3	W	Nadi	C	Construction of bypass road to Denarau	Nadi, ensuring access to Denarau, the most important tourist destination, is the utmost priority. A separate new road to the Denarau resort area would also be effective from a redundancy perspective.
2	W	Nadi	C	Community flood control (2 locations)	For existing communities with high hazard risks, measures such as relocation incentives, as well as implementing solutions like embankments or regional elevation, should be taken.
3	W	Nadi	C	BCP for resort hotels (8 locations)	In the resort hotel area primarily centered around Denarau, it is essential not only for individual hotels but also for the entire region to develop Business Continuity Plans (BCPs) and conduct regular practical training exercises.
4	W	Nadi	C	Flood control for schools (2 out of 6 locations)	School facilities, as important public institutions, also serve as community evacuation centers. Therefore, it is desirable to renovate these facilities to have structures and stories capable of withstanding flooding and earthquakes.
5	W	Nadi	C	Flood control for health facilities (2 locations)	Medical facilities are critical public institutions in both normal times and during disasters. Therefore, it is desirable for them to be located in areas accessible even during flooding. Furthermore, renovating or constructing facilities with structures and storeys capable of withstanding flooding and earthquakes is desirable.
6	W	Nadi	C	Land use regulations	Nadi is the most important hub in Fiji, housing the major tourist destination and connecting Nadi International Airport. Therefore, it is crucial to implement measures to ensure its functionality both in normal times and during disasters. As part of important defense areas, efforts are needed to ensure that critical public facilities, major infrastructure, and road networks within it remain intact. To achieve this, it is important to implement land use regulations that eliminate disaster risks and promote proper location of facilities.

6 important public facilities (schools and shelters) located within the hazard risk area.

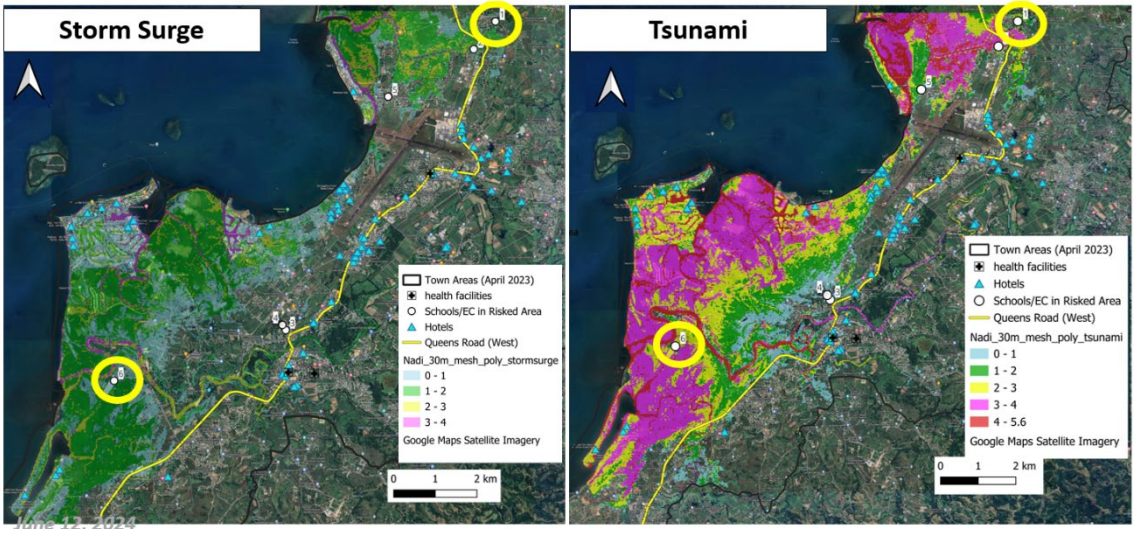
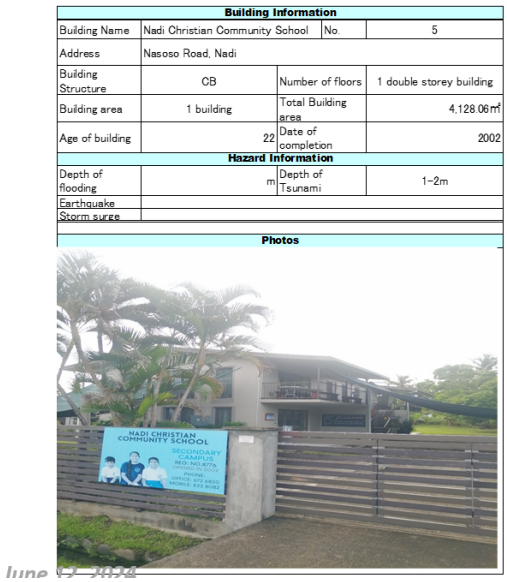


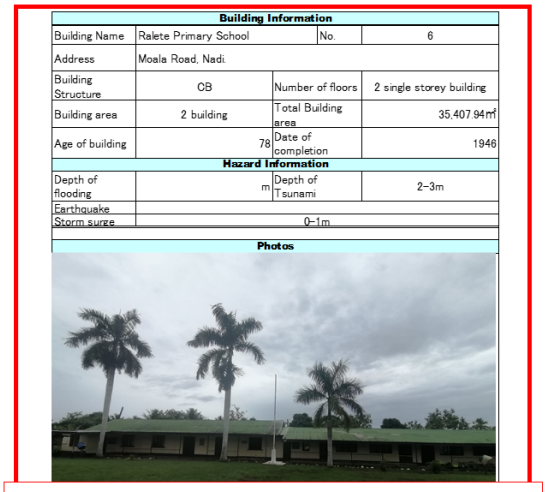
Figure 16: Example of extraction of important public facilities that need to be addressed (superimposed diagram) (Nadi)

6 important public facilities (schools and shelters) located within the hazard risk area.



Building Information			
Building Name	Nadi Christian Community School	No.	5
Address	Nasoso Road, Nadi		
Building Structure	CB	Number of floors	1 double storey building
Building area	1 building	Total Building area	4,128.06㎡
Age of building	22	Date of completion	2002
Hazard Information			
Depth of flooding	m	Depth of Tsunami	1~2m
Earthquake			
Storm surge			

Photos



Building Information			
Building Name	Ralete Primary School	No.	6
Address	Moala Road, Nadi		
Building Structure	CB	Number of floors	2 single storey building
Building area	2 building	Total Building area	35,407.94㎡
Age of building	78	Date of completion	1946
Hazard Information			
Depth of flooding	m	Depth of Tsunami	2~3m
Earthquake			
Storm surge			0~1m

Photos

Ralete Primary School(#6) is one-story building
though flooding depths of 2~3m are anticipated,
it is desirable to replace it with two-story building, etc.

Figure 17: Example of extraction of critical public facilities that need to be addressed (building ledger) (Nadi)

8. Plan implementation and monitoring

8.1. Implementation of Activities

- Activities set in accordance with the plan are carried out.
- Regularly monitor the progress of activities using project management tools and techniques.
- Adjust plans based on progress reports, stakeholder feedback, and emerging risks.

8.2. Monitoring and evaluation

- Clear indicators and benchmarks to evaluate the effectiveness of the plan.
- Regularly monitor the implementation of the plan and its effectiveness and reflect the evaluation results in the next plan.
- Conduct post-execution reviews and continuously improve the plan based on lessons learned and best practices.

9. Finally.

These guidelines can be used to develop effective priority area disaster management plans that are tailored to local characteristics and reduce disaster risk. It is also important for national deployment plans. In each step of the process, it is important to cooperate with relevant agencies and incorporate the opinions of diverse stakeholders such as local residents.

IMPLEMENTATION PLAN
FOR
THE NATION WIDE ROLLOUT OF
LOCAL DRR PLANS

DRAFT

OCTOBER 2025

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DRAFT

1 Introduction

1.1 Background

This report aims to summarize the implementation plan and monitoring procedures for the nationwide rollout of local DRR plans in Fiji. The report is intended to:

- Present the current status and challenges of local DRR planning in Fiji,
- Outline the strategy and roadmap for expanding practical DRR planning and implementation systems nationwide,
- Propose a framework for monitoring and evaluating the progress and effectiveness of DRR plans,

The findings and recommendations in this report are expected to contribute to the sustainable and effective promotion of DRR at both local and national levels, in line with Fiji's national policies and international frameworks such as the Sendai Framework for Disaster Risk Reduction.

The Local DRR Process was promoted through the discussion of the NDRMO and Divisional office supported by the JICA project on The Project for Mainstreaming Disaster Risk Reduction in Fiji. To promote the nationwide rollout of local DRR plans, a draft National Rollout Plan was prepared in Phase 1 of the JICA project. In Phase 2, for the Western Division, consultations were held with NDMO staff to confirm the planned formulation of Priority Area Plans for towns other than Rakiraki, and this was reflected in the National Rollout Plan.

1.2 Current Status and Challenges of Local DRR Plans in Fiji

During the duration of the JICA project 2 divisional plans and total 3 Priority area plans were formulated as shown in the figure below.

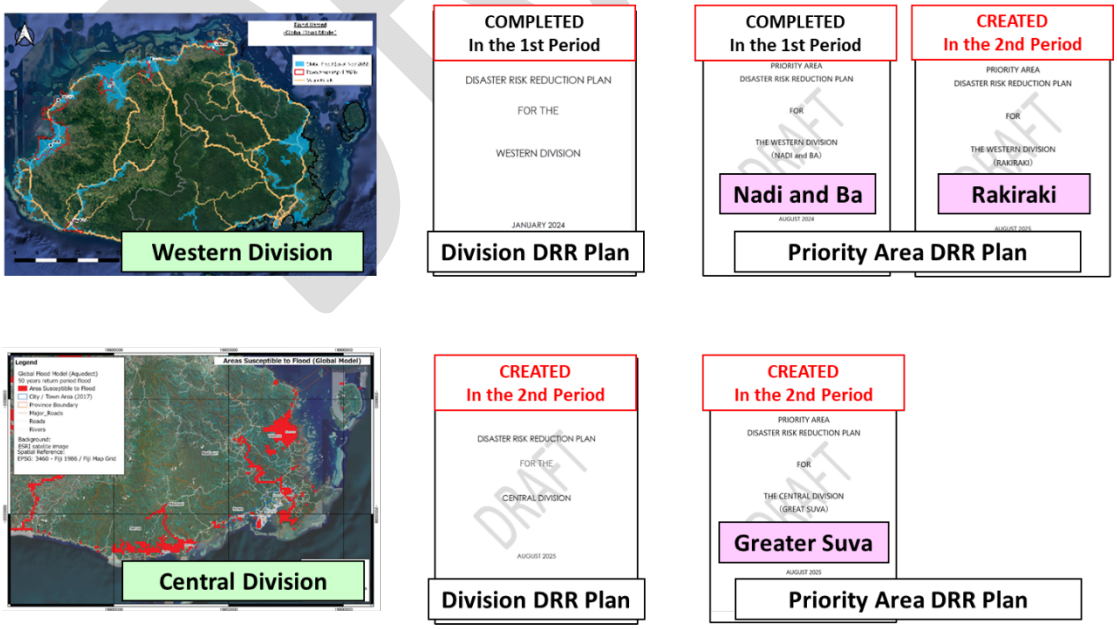
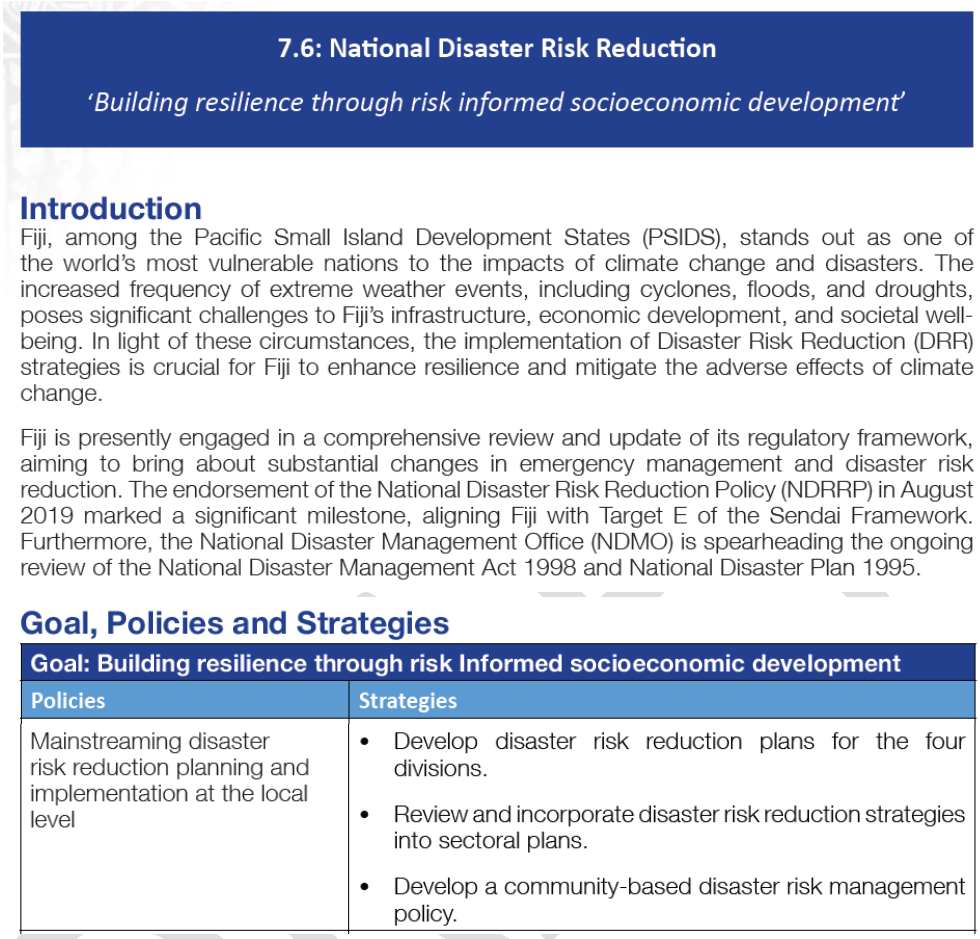


Figure 1 DRR Plans Developed by 2025 November

In addition, as a policy background of local DRR plan, although it is not obligatory for any entity under law, the target to formulate the DRR plan covering all 4 division in the country was clearly mentioned in the Fiji National Development Plan 2025-2029 and vision 2050 which was adopted in September 2024.



7.6: National Disaster Risk Reduction

'Building resilience through risk informed socioeconomic development'

Introduction

Fiji, among the Pacific Small Island Development States (PSIDS), stands out as one of the world's most vulnerable nations to the impacts of climate change and disasters. The increased frequency of extreme weather events, including cyclones, floods, and droughts, poses significant challenges to Fiji's infrastructure, economic development, and societal well-being. In light of these circumstances, the implementation of Disaster Risk Reduction (DRR) strategies is crucial for Fiji to enhance resilience and mitigate the adverse effects of climate change.

Fiji is presently engaged in a comprehensive review and update of its regulatory framework, aiming to bring about substantial changes in emergency management and disaster risk reduction. The endorsement of the National Disaster Risk Reduction Policy (NDRRP) in August 2019 marked a significant milestone, aligning Fiji with Target E of the Sendai Framework. Furthermore, the National Disaster Management Office (NDMO) is spearheading the ongoing review of the National Disaster Management Act 1998 and National Disaster Plan 1995.

Goal, Policies and Strategies

Goal: Building resilience through risk Informed socioeconomic development	
Policies	**Strategies**
Mainstreaming disaster risk reduction planning and implementation at the local level	• Develop disaster risk reduction plans for the four divisions. • Review and incorporate disaster risk reduction strategies into sectoral plans. • Develop a community-based disaster risk management policy.

Figure 2 Point Related to DRR Plan in the National Development Plan

The development plan also has a Key Performance Indicator (KPI) to formulate 2 DRR Divisional Plan plans by 2027 and 4 DRR Divisional Plan by 2029. As Divisional DRR plan has already been developed in the Western and Central Division, the target is to cover the other 2 divisions by 2029.

Table 1 List of Key Performance Indicators Related to DRR

Indicators	Baseline	3 Years (2025-2027)	5 Years (2025-2029)
Multi Hazard Early Warning System for Fiji (%)	NA	50	100
Joint National Action Plan for Climate Change and Disaster Risk Reduction (%)	NA	50	100
Multipurpose evacuation centers (number)	NA	5	4
DRR Divisional Plan developed (number)	NA	2	4
Disaster Risk Finance Policy (%)	NA	50	100

2 Implementation Plan for Nationwide Rollout

2.1 Implementation Schedule

Based on the discussion with NDRMO, a tentative implementation schedule for the Nationwide Rollout has been formulated as shown below. In the figure the plans which were formulated in cooperation with the JICA project team and the NDRMO are described in light green by 2024, in the year 2025 NDRMO led the planning process supported by the JICA project team which is mentioned in pink. After the completion of the JICA project team, according to the KPI of the National Development Plan the Divisional DRR plan for the Northern and Eastern Division is targeted to be developed.

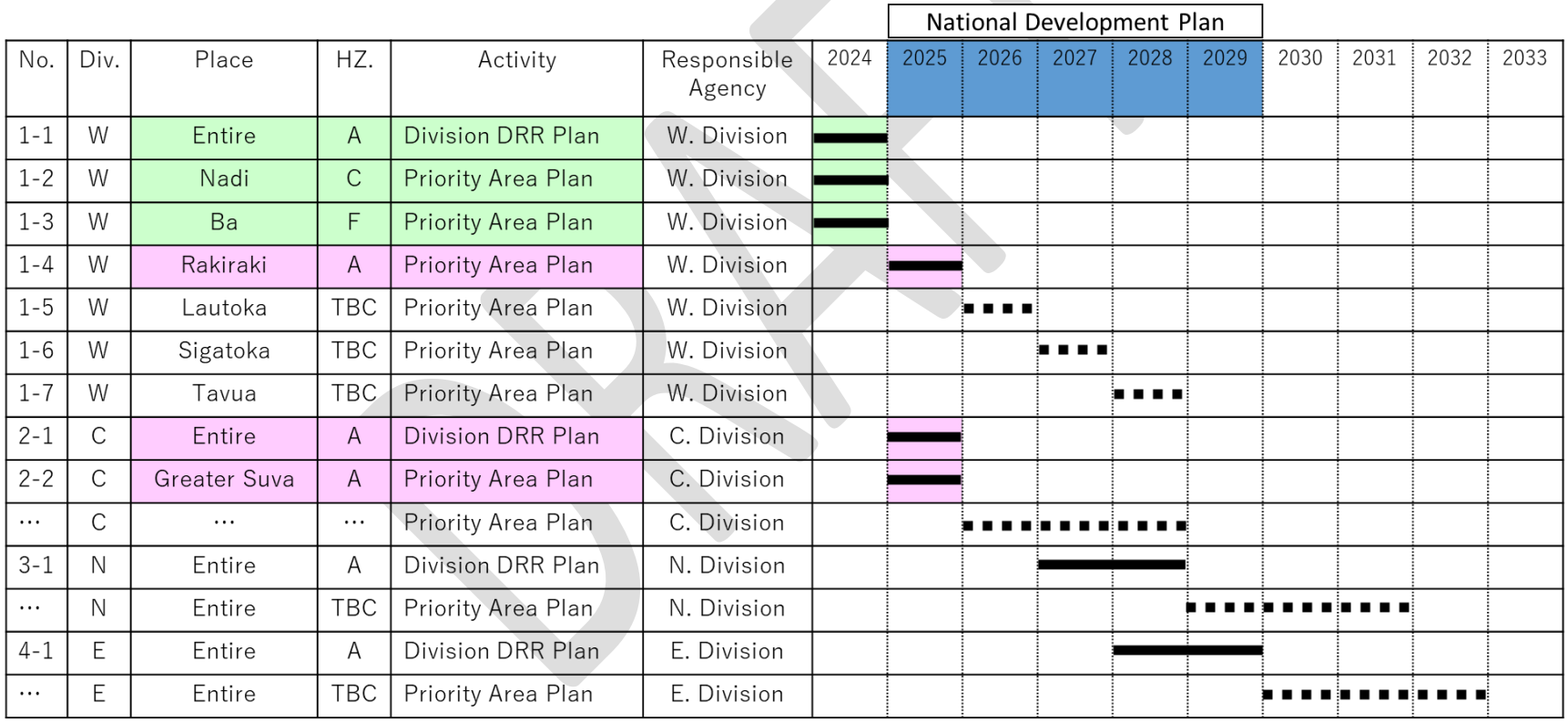


Figure 3 Proposed Implementation Plan for Nationwide Rollout

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2.2 Procedure of the DRR planning

In the JICA project the procedure for the Divisional DRR plan and the Priority Area plan has been formulated. The process will be a combination of hazard assessment, data collection, consensus building and a documentation process. Guidelines for the formulation have been formulated, and the detailed process can be referred to.

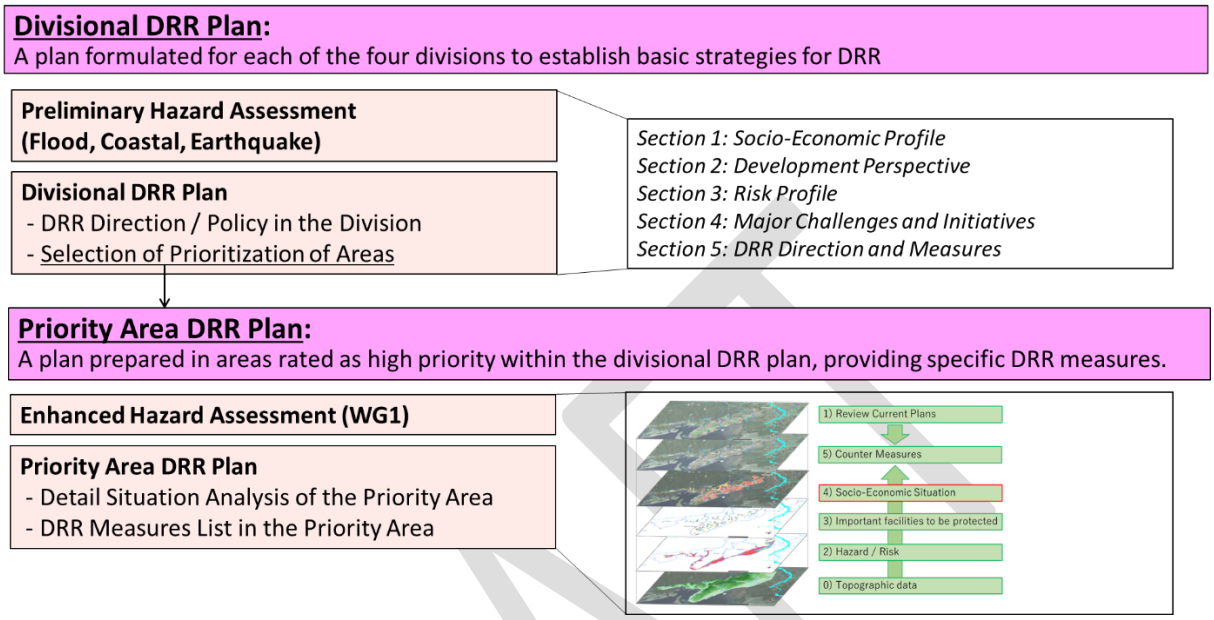

Figure 4 Overall Procedure on the DRR Planning

2.3 Criteria for Selecting Priority Areas

The selection of priority areas for local DRR planning in Fiji is based on a combination of scientific, social, and practical considerations. The following criteria have been established to ensure that DRR efforts are focused on regions with the highest risk and the greatest need for targeted interventions:

The basic approach of the selection is as mentioned in the guideline for the Divisional DRR plan, it is to estimate the elements at risk based on a simple risk assessment and based on the level of risk in different City and Towns to identify the priority and formulate the priority area plan for the priority City and Towns. In addition, in the Central division, additional approach was considered to cover the issue in the urban areas. And also, the connectivity between the different area was considered.

For example, in the Central Division, the Greater Suva area was identified based on the population distribution covering the whole Suva City, Nasinu town, almost the whole population in Lami town and some portion on the Nausori town. And since the greater Suva plan covered only some portion of the exposed population in Nausori town, especially the central town area, this area can be identified as the next priority areas.

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Table 2 Example list of Assessment of Elements at Risk

Table 8 Summary of the elements at risk

Contents	City and Town Areas						
	Suva	Lami	Nasinu	Nausori	Navua	Deuba	Korovou
Actual Situation							
Land Area	66.14 km²	45.93 km²	28.66 km²	66.14 km²	12.26 km²	9.69 km²	0.38 km²
Population	93,874	24,637	92,046	57,866	5,812	1,963	329
Number of Business	2,860	159	549	790	131	74	36
Number of elements exposed to flood							
Population	12,074	6,151	20	12,069	4,909	1,726	388
Number of Business	1,318	26	0	410	115	38	34
Number of EC	18	4	0	17	8	2	1
Number of elements exposed to coastal hazard							
Population	18,677	3,265	8,251	2,342	3,990	819	331
Number of Business	1,409	117	35	9	38	13	33
Number of EC	70	24	61	10	8	2	1
Number of elements exposed to earthquake *1							
Population	20,395	1,397	19,385	50,137	5,111	1,790	0

*EC: Facilities (Governmental Buildings, Community Hall, Schools, Hospitals, Hotel, Recreation Hall, Shop Compound, Churches, and Temples) registered as evacuation centers in NDMO's database
*1: Regarding earthquake, since the building information (such as building material, number of floors, year of construction) are not complete or available, only the population who may be highly affected in locations where the MMI 8 (more than 150(cm/s2)) was computed.
Source: JICA Project Team

In addition, in the Central Division the area was divided by the characteristic based on the region with different approach for DRR. This way of categorizing the area can also be a guide for the selection of the priority area plan.

In the divisional DRR plan to be developed in the future in the Northern and Eastern divisions the categorization and the priority area identification shall be considered.

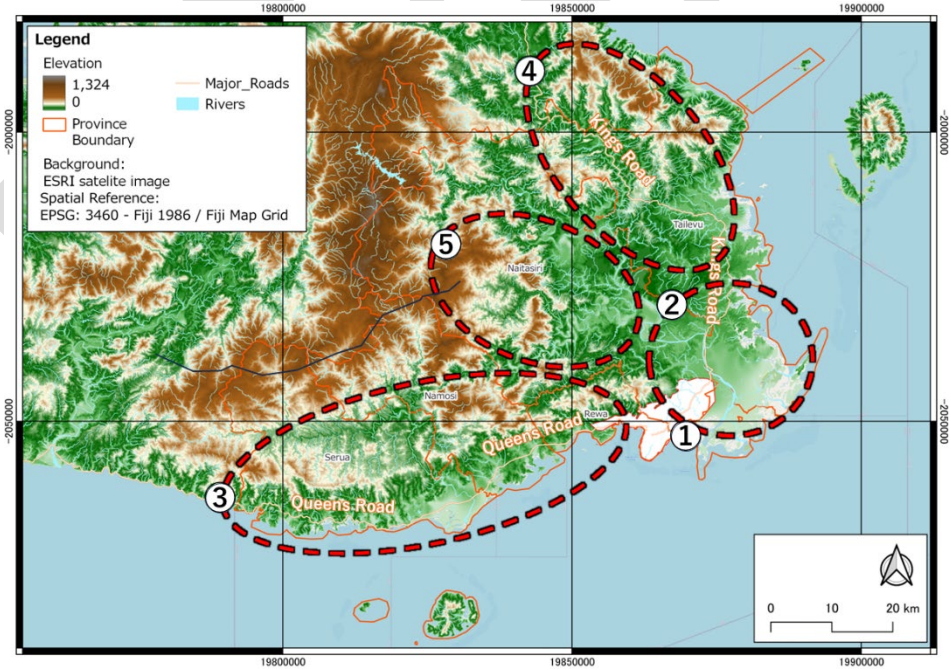

Figure 5 Example of Identification of Areas with Different Characteristics

2.4 Monitoring Process

To enhance the implementation of the DRR action identified in the planning process the items bellow were integrated into the list of DRR measures. This was designed to be fit with the progress for project implementation progress monitoring process.

- Responsible agency and the implementing agency were separately identified. The responsible agency was defined as the institution accountable for recognizing the importance of implementing the DRR measure—based on hazard analysis and other results—and for ensuring its realization, including budget allocation. The implementing agency was defined as the institution technically responsible for carrying out the project.
- To indicate the priority of projects, the implementation timeline was classified into three categories: short-term (to be realized within 2–3 years), medium-term (to be implemented within approximately 5 years), and long-term (to be realized over a timeframe of more than 10 years). In particular, short-term goals included feasibility studies and detailed priority assessments for implementation, and progress in these studies was expected to promote medium- and long-term risk reduction measures.
- Project status was divided into two aspects: budget and implementation. For budget, five stages were defined: before commencement, cost estimated, cost secured, under implementation, and completed. For implementation, five stages were defined: before commencement, implementation site determined, year of completion confirmed, under implementation, and completed. These classifications enabled project status to be clearly identified.

DRR Direction (2) : Measures to Reduce the Impact of Hazard

DRR Measures	Program	Activity	Responsible Agency	Proposed Implementing Agency	Location	Timeline	Monitoring: Financial Status		Monitoring: Physical Status	Remarks
River Management	Develop Comprehensive River Management Plan	Update of the Strategic Plan 2020-2024 for the Waterways	Ministry of Waterways and Environment?	Ministry of Waterways and Environment	Entire Division	Short (2-3 years)		Not Started		
		Update the priority list for river management in the Divisional level	Ministry of Waterways and Environment?	Ministry of Waterways and Environment		Short (2-3 years)	2025	Not Started	Not Started	
River Management	River Management for the Rewa River (including the tributaries such as Waimanu River)	Formulation of river management Master Plan for Rewa River	Central Division, Ministry of Waterways and Environment?	Ministry of Waterways and Environment	Rewa River	Short (2-3 years)	2025	Not Started	Not Started	
		Planning for dredging and riverbank protection in the Rewa River	Central Division, Ministry of Waterways and Environment?	Ministry of Waterways and Environment		Mid (5 years)	2025	Not Started	Not Started	
		Enhance capacity on managing and regulating commercial dredging	Central Division, Ministry of Waterways and Environment?	Ministry of Waterways and Environment		Long (10 years)	2025	Not Started	Not Started	
		Implementation of the considered measures (dredging, riverbank protection)	Central Division, Ministry of Waterways and Environment?	Ministry of Waterways and Environment		Long (10 years)	2025	Not Started	Not Started	
River Management	River Management for the Nabua River	Formulation of river management Master Plan for Nabua River	Central Division, Ministry of Waterways and Environment?	Ministry of Waterways and Environment	Nabua River	Mid (5 years)	2025	Not Started	Not Started	*Dredging of the Deuba river is mentioned in the Strategic Plan 2020-2024 for the waterways
		Planning for dredging and riverbank protection in the Rewa River	Central Division, Ministry of Waterways and Environment?	Ministry of Waterways and Environment		Long (10 years)	2025	Not Started	Not Started	
		Implementation of the considered measures (dredging, riverbank protection)	Central Division, Ministry of Waterways and Environment?	Ministry of Waterways and Environment		Long (10 years)	2025	Not Started	Not Started	
River Management	River Management in other priority Rivers in Serua Province	Identification of Priorities among the rivers with	PA Serua, Central Division, Ministry of Local Government	Ministry of Waterways and Environment	Raiwaqa/ALTA, Waivunu, Wainiviliase Settlement, Nakoba, Galoa, Yarawa Flat are areas raised by PA Serua	Short (2-3 years)	2025	Budget Estimated	Target Area/Facility Identified	
		Planning for dredging and riverbank protection in the priority rivers	PA Serua, Central Division, Ministry of Local Government	Ministry of Waterways and Environment		Mid (5 years)	2025	Budget Estimated	Not Started	
		Implementation of the considered measures (dredging, riverbank protection)	PA Serua, Central Division, Ministry of Local Government	Ministry of Waterways and Environment		Long (10 years)	2025	Budget Estimated	Not Started	

Short (2-3 years) / Mid (5 years) / Long (10 years)

Not Started / Budget Estimated / Budget Allocated / In Progress / Completed

Not Started / Target Area / Facility Identified / Goal Set / In Progress / Completed

Figure 6 List of DRR Measures with Items for Facilitating the Implementation

Regarding the update plan for the DRR plan, it shall be discussed in line with the National Development Plan and the future divisional development plan to be discussed in the future. As a reference, the National Development Plan's target period is until 2029. The divisional DRR plan shall also be considered to be updated after the 2029 period.

In 2030, update in the global agenda such as the Sustainable Development Goals and the Sendai Framework for Disaster Risk Reduction is planned to be updated. The concept described in these global agenda shall also be considered in updating the divisional DRR plan.

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3 Future Recommendations

3.1 Good Practice to be Referred to in the Future Activities

Institutionalization and Expansion of Local DRR Planning

- Lack of the framework for DRR plans was identified as a challenge from the start of the project
- Positioning the Divisional DRR plan formulation to the National Development Plan was a major success in promoting the DRR plan formulation
- In the Central Division, close coordination among NDMO, the Divisional Commissioner, and municipalities ensured practical and feasible DRR plans.
- This planning and decision-making process will be shared with other division as a good example
- NDRMO and the Divisional Offices shall take the leadership to fully utilize the guideline for DRR Planning Process

Alignment with Divisional Development Plans

- In the Western Division, the DRR plan was developed alongside the Divisional Development Plan 2023–2032, integrating with 377 projects under five development pillars.
- In the Central Division, where no such plan existed, consistency was ensured through sectoral consultations and alignment with urban strategies and visions for the Greater Suva metropolitan area.
- This approach can be utilized as a model of DRR mainstreaming, connecting disaster risk management with broader development and infrastructure policies.

3.2 Challenges and Ways Forward for the Future

Challenges Faces in the Implementation Stage

- Policy, Regulation and Master Plans for arising issues (Land-use and Building Regulation, Urban Drainage Issue etc.)
- Technical Capacity Enhancement (Urban Flood Analysis, Measures against Steep Slope Failure etc.)
- Customizing to align with the challenges faced in different division. (In the Central division, the issue on urban development was identified as an arising issue which was not fully discussed in the Western division. The consideration of this direction may require support from a DRR planning expert internationally)
- Enhancement of Fund Allocation Capacity to secure the funding for the planned activity

Ways Forward

- Utilize the standardized methodologies and lessons from the Western and Central Divisions in the guidelines
- Enhancement of planning capacity in the NDRMO and divisional, provincial and municipality counterpart officers including Trainer of Trainers (ToT) programs
- Position legal and institutional support as a future cooperation area for formalizing city/town-level DRR plans

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Roadmap for NDRRP Implementation [Ver. 2]

National Disaster Risk Management Office

Republic of Fiji

December 2024

(Revised in December 2025)

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Acronyms and Abbreviations

ACRONYM	ABBREVIATION
COC	Commissioner Office Central
COE	Commissioner Office Eastern
CON	Commissioner Office Northern
COW	Commissioner Office Western
DRR	Disaster Risk Reduction
DTCP	Department of Town and Country Planning
FPCL	Fiji Port Corporation Limited
FRA	Fiji Roads Authority
FSC	Fiji Sugar Corporation
FY	Fiscal Year
JICA	Japan International Cooperation Agency
LDP	Local Disaster Risk Reduction Plan
MRMDDM	Ministry of Rural and Maritime Development and Disaster Management
MRD	Mineral Resources Department
MHMS	Ministry of Health and Medical Services
NDRMC	National Disaster Risk Management Council
NDRMO	National Disaster Risk Management Office
NDRRP	National Disaster Risk Reduction Policy
TBC	To Be Confirmed

Update Information

The following updates were made in December 2025:

Table 1 Update Information [Ver. 2]

Chapter and Section	Update
2.2	Updated *Table 2 Roadmap for Promoting the Formulation of LDPs*
3.1	Added the Central Division DRR Plan, Priority Area DRR Plan for Rakiraki and Priority Area Plan for the Greater Suva Area as target DRR plans.
3.1 and 3.2	Added action items for the Western Area Plan to *Table 4 Roadmap for the Implementation of LDPs*.
General	Standardized the name notation by changing all instances of "Priority Area Plan" to "Priority Area DRR Plan".
General	Standardized the name notation by changing all instances of "National Disaster Management Council (NDMC)" to "National Disaster Risk Management Council (NDRMC)".

1. Overview and Background of the Roadmap

1.1 Overview

1. The government of Fiji formulated the National Disaster Risk Reduction Policy (NDRRP) in October 2018, which is part of a national strategy to reduce disaster risks across the country. The effective implementation of the NDRRP requires the active participation and cooperation of all Fiji government agencies. The National Disaster Risk Management Office (NDRMO) has played a central role in promoting this Policy, as it is the government agency responsible for coordinating disaster response and disaster risk reduction in Fiji. The NDRMO also monitors the implementation of the NDRRP and ensures collaboration among government agencies.

2. The Roadmap outlines technical guidelines and commitments to support the implementation of the NDRRP, led by the NDRMO and the Ministry of Rural and Maritime Development and Disaster Management (MRMDDM). It will be regularly reviewed and updated with progress reports submitted to the National Disaster Risk Management Council (NDRMC).

1.2 Purpose of the Roadmap

3. The main purposes of the Roadmap are as follows:

4. **Promote Disaster Risk Reduction Activities:** The Roadmap serves a tool for government agencies in Fiji to actively engage in Disaster Risk Reduction (DRR) by formulating and implementing Local Disaster Risk Reduction Plan (LDP), thereby contributing to the overall implementation of the NDRRP. Meanwhile, the NDRMO leads Monitoring & Evaluation (M&E) process to track and assess the progress of the NDRRP's action items

5. **Raise Awareness:** The Roadmap aims to raise awareness among government agencies in Fiji about the importance of the NDRRP and enhance their understanding of disaster risk reduction, which will make disaster risk reduction efforts more effective.

6. **Support the Formulation and Implementation of Local Disaster Risk Reduction Plans:** Another vital role of the Roadmap is to support the formulation and implementation of LDPs in each division. It provides a timeline for creating the LDPs and monitors the progress of the risk reduction activities listed in them, making adjustments to ensure effective implementation

7. **Organize and Promote Action Items:** The Roadmap selects and organizes action items from the NDRRP that are closely related to the activities in the LDPs and prioritizes them.

8. **Clarify Additional Action Items:** The Roadmap identifies additional action items

that may be necessary for implementing the LDPs but are not included in the NDRRP, ensuring steady progress in their implementation

1.3. Structure of the Roadmap

1) Structure of the Roadmap

9. The Roadmap is structured in two parts to achieve its purpose: one for developing the Local Disaster Risk Reduction Plans (LDPs) and the other for their implementation. It clarifies and prioritizes the issues to be considered during the LDPs planning process, the activities to be carried out to reduce disaster risks as outlined in the plans, and the specific action items in the NDRRP that will be achieved by promoting these activities.

2) Local Disaster Risk Reduction Plan

10. LDPs are developed by MRMDDM, presenting strategies and activities for specific areas based on hazard/risk assessment. The LDP consists of the following two plans:

11. **Division DRR Plan:** A DRR plan formulated for each division (Western, Central, Northern, and Eastern) outlining basic strategies and policies.

12. **Priority Area DRR Plans:** A detailed plan focused on areas within each division that are particularly vulnerable to disasters and have high risks. These plans provide specific activities for particular disasters (floods, earthquakes, landslides, etc.) in areas with high population density and concentrated economic resources.

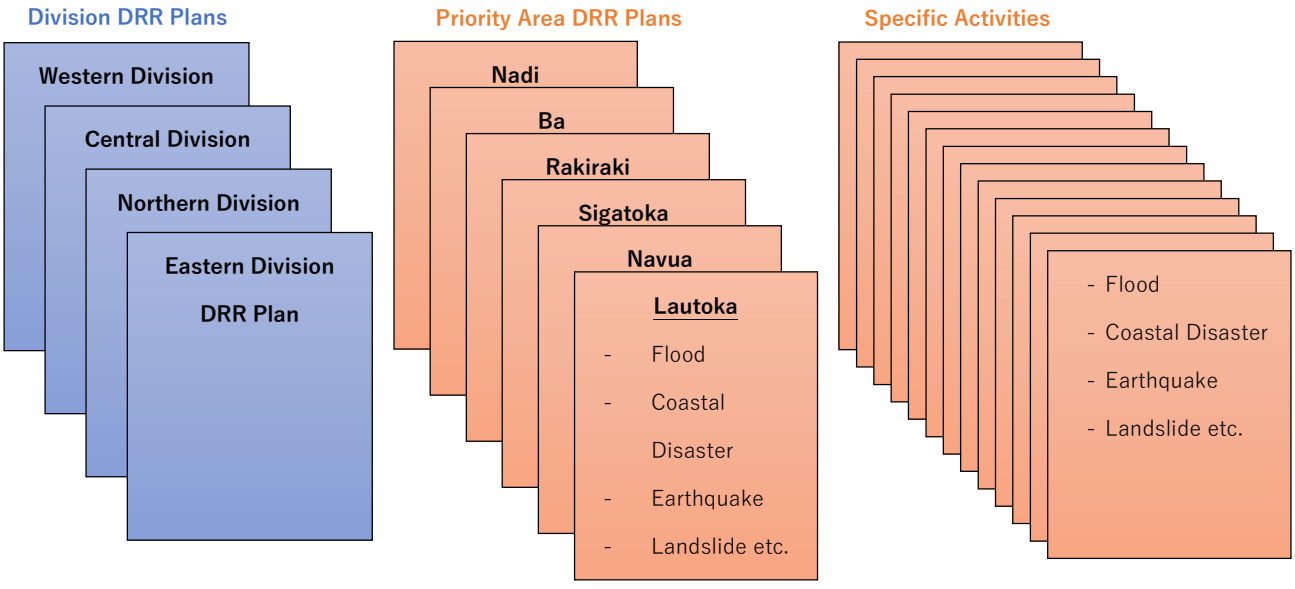


Fig. 1 Structure of Local Disaster Risk Reduction Plans

Example: Priority Area DRR Plan for Western Division

13. Priority areas such as Nadi, Ba, Rakiraki, Sigatoka, Navua, and Lautoka have been

designated for the Western Division. Specific activities for reducing risks like floods, coastal disasters, earthquakes, and landslides are presented for each area.

3) Study Flow of LDPs

14. The NDRMO outlines the details of the LDP formulation process in the Local DRR Plan Development Guideline; however, this document provides the main framework.

15. **Data Collection:** The first step in formulating a Division DRR Plan in each division is to collect necessary data and information, such as topographical maps, building inventories, meteorological observation data, and geological surveys. These data and information form the foundation for risk assessments.

16. **Hazard and Risk Assessment:** Based on the collected data and information, a preliminary hazard assessment is conducted, following by a risk assessment that considers socioeconomic data. This process identifies areas within each division with high risks (Priority Areas).

17. **Development of Basic Strategies:** Based on the results of hazard and risk assessments, basic strategies and policies are developed for the Division DRR Plan. These strategies include specific activities and measures for risk reduction.

18. **Development of Priority Area DRR Plans:** During the formulation of Priority Area DRR Plans, more detailed topographic data is collected, and detailed hazard and risk assessments are conducted. Specific activities necessary for each priority area are proposed, and their implementation plans are formulated.

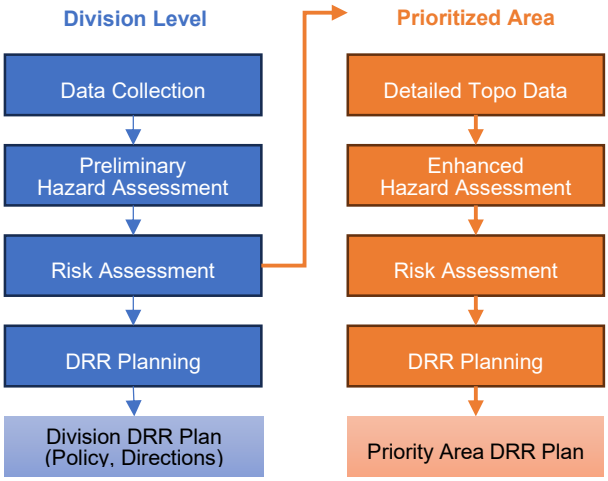


Fig. 2 Study Flow of LDPs Development

2. Roadmap for Promoting the Formulation of LDPs

2.1 Roadmap for Promoting the Formulation of LDPs

19. The Roadmap for Promoting the Formulation of LDPs is shown in Table 2.

2.2 Structure of the Roadmap for Promoting the Formulation of LDPs

20. The Roadmap provides a specific schedule for developing the LDPs in each division, including necessary activities and responsible agencies.

21. **Schedule for the Formulation of Four LDPs:** The formulation of the Division DRR Plans and the Priority Area DRR Plans for each division will be between 2024 and 2033. For instance, Division DRR Plan and some of the Priority Area DRR Plans for the Western Division are underway. These will be completed between 2024 and 2025 in collaboration with the JICA project for mainstreaming Disaster Risk Reduction. Following this, the formulation of plans for the Central, Northern, and Eastern Divisions will proceed to achieve a goals outlined in the National Development Plan 2025-2029*.

22. **Responsible Agencies:** Each division's Division DRR Plan and Priority Area DRR Plans have designated responsible agencies that manage the progress of their formulation.

23. **Monitoring and Evaluation:** The responsible agencies will monitor and evaluate the formulation of the LDPs, making adjustments and amendments to the Roadmap as needed to ensure practical support for the LDP formulation.

Reference: National Development Plan 2025-2029 and Vision 2025

Development of disaster risk reduction plans for the four divisions is identified as one of the strategies to achieve a resilient developing country in the Fiji National Development Plan 2025-2029.

Chapter 7

Focus area 6: Developing public Infrastructure, protecting Environment and addressing Climate change

7.6: National Disaster Risk Reduction

Goal: Building resilience through risk informed socioeconomic development	
Policies	**Strategies**
Mainstreaming disaster risk reduction planning and implementation at the local level	· Develop disaster risk reduction plans for the four divisions. · Review and incorporate disaster risk reduction strategies into sectoral plans. · Develop a community-based disaster risk management policy.

Indicators	**Baseline**	**3 Years (2025-2027)**	**5 Years (2025-2029)**
DRR Divisional Plan developed (number)	None	2	4

Table 2 Roadmap for Promoting the Formulation of LDPs (UPDATED in 2025)

No.	Division.	Place	Hazard	Activity	Responsible Agency	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
1-1	Western	Entire	All	Division DRR Plan	COW										
1-2	Western	Nadi	Coastal	Priority Area Plan	COW										
1-3	Western	Ba	Flood	Priority Area Plan	COW										
1-4	Western	Rakiraki	Flood	Priority Area Plan	COW										
1-5	Western	Lautoka	TBC	Priority Area Plan	COW										
1-6	Western	Sigatoka	TBC	Priority Area Plan	COW										
1-7	Western	Tavua	TBC	Priority Area Plan	COW										
2-1	Central	Entire	All	Division DRR Plan	COC										
2-2	Central	Suva Area	Coastal, Sediment	Priority Area Plan	COC										
2-3	Central	Nausori	TBC	Priority Area Plan	COC										
2-4	Central	Nabua	TBC	Priority Area Plan	COC										
…	Central	Mountain Area	TBC	Priority Area Plan	COC										
3-1	Northen	Entire	A	Division DRR Plan	CON										
…	Northen	Entire	TBC	Priority Area Plan	CON										
4-1	Eastern	Entire	A	Division DRR Plan	COE										
…	Eastern	Entire	TBC	Priority Area Plan	COE										

Target year on NDP* 2025-2029

Supported by JICA in 2020-2024 (1st Period) and in 2024-2025 (2nd Period)

Hazard - All: Storm Surge, Tsunami, River Flood, Sediment Disaster, and Earthquake; Coastal: Storm Surge and Tsunami; Flood: River Flood

———: Approved by the stakeholders - - - -: To be confirmed

2.3 Organizing and Prioritizing Action Items by the Roadmap for Promoting Formulating LDPs

24. The relevant NDRRP Action Items for each stage of the planning process, as outlined in the study flow, are shown in the table below. In other words, they will be implemented as the planning stages progress. It can also be stated that these Action Items must be prioritized to develop the LDPs.

25. However, some activities are essential to develop the LDPs excluded in the 122 NDRRP Action Items. These activities include tasks such as preparing higher-resolution topographic maps, conducting geological surveys, and performing building survey, as indicated in the data collection steps.

26. Additionally, discussing the scale of the targeted disaster (probabilistic annual frequency) at each stage of the planning process with the involvement of all government agencies is important.

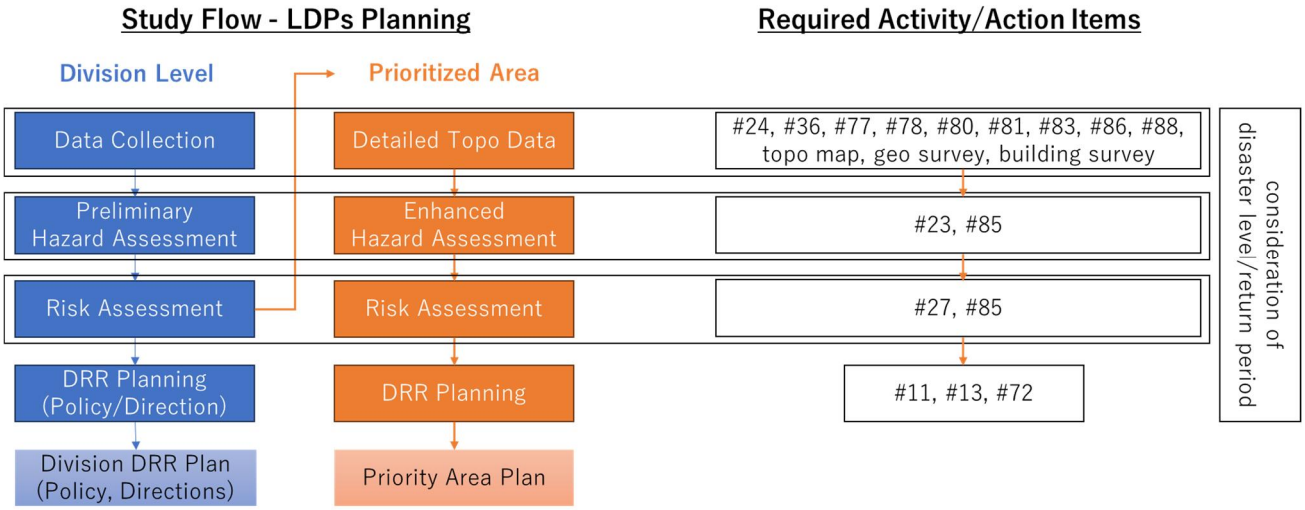


Fig. 3 Study Flow and Related Activities on LDPs Development

Table 3 Priority NDRRP Action Items for Formulation of LDPs

・ Priority Action Items for Data Collection

No.	Action Items	Responsible Agencies	Summary
24	Building Codes	Health, Public Works, Housing	Establish building codes by considering the effects of updated disaster impacts and climate change impacts. Building codes are critical for risk assessment, especially for important facilities, and for facilitating building resilience.
36	Experts in Hydrology	FMS, Waterways	Engage experts in hydrology who can manage observations and analyze hydro-meteorological data for DRR plans and/or measures
77	Storm Surge and Coastal Inundation Prediction System	FMS, MRD	Observe waves, tidal levels, and inundations at sufficient locations and frequency as basic data/information for hazard assessment.
78	Catchment Monitoring/Management and Flood Prediction Systems	Waterways, NDRMO, FMS	Make hydrology and river observations at sufficient locations and frequency in major rivers as basic data/information for hazard assessment.
80	Survey, Observation and Gauging of Hazards	FMS	Facilitate installation of weather observation facilities and equipment
81	Consignment Observation System for Hydro-Meteorological Observation	FMS	Make weather observations at sufficient locations and frequency as basic data/information for hazard assessment.
83	Disaster Loss and Damage Assessment	NDRMO	Re-examine damage survey items to establish a system for collecting necessary data/information for hazard assessment. Establish a system to efficiently manage, store, and easily access the collected data/information.

85	Multi-Hazard Risk Mapping	NDRMO	Develop multi-hazard risk maps including fundamental public facilities.
86	Inspection on Infrastructure and DRR Facilities	FRA, Local, Waterways	Strengthen liaison with the department in charge of inspection on infrastructure and DRR facilities which are deeply involved in the O&M, together with training systems for inspectors on them
88	Consolidation of DRR Database Systems	NDRMO	Consolidate DRR database systems managed by DRR-related agencies and become activated the sharing and usage of data and information, creating an integrated database on disaster victims, damage, lessons learnt, DRR measures and facilities, the design data of infrastructure, the operation and maintenance (O&M) data, meteor-hydrological and earthquake data, etc.
N/A	Creating topographic maps	Land	Develop accurate topographic maps for hazard assessment, land-use planning, and construction planning.
N/A	Geological survey & ground investigation	MRD	Conduct geological surveys and ground investigations with adequate accuracy and coverage for hazard assessment on sediment disasters.
N/A	Building survey	Public Works	Survey building structure and fragility to develop a fragility curve for earthquake hazard and risk assessment.

・ Priority Action Items for Enhanced Hazard Assessment

No.	Action Items	Responsible Agencies	Summary
23	Technical and Scientific Capacity	NDRMO, FMS, MRD	Strengthen technical and scientific capacity to utilize and consolidate existing knowledge and to develop and apply methodologies and models to assess disaster risks, vulnerabilities and exposures to all hazards in Fiji
85	Multi-Hazard Risk Mapping	NDRMO	Assess and map multi-hazard risks.

・ Priority Action Items for Risk Assessment

No.	Action Items	Responsible Agencies	Summary
27	Institutional Reporting Arrangement	NDRMO	Establish an institutional reporting arrangement on national and local disaster risks and emergency responses.
85	Multi-Hazard Risk Mapping	NDRMO	Assess and map multi-hazard risks.

・ Priority Action Items for Each Stage of Planning

No.	Action Items	Responsible Agencies	Summary
N/A	Consideration of disaster level/return period	NDRMO	Consider a targeted level of disaster (disaster scale, return period, and planning scale) from scientific, political, and economic perspectives at each data collection stage, hazard/risk analysis, and planning. Promote NDRMO's leadership in ensuring that these necessary discussions take place.

3. Roadmap for the Implementation of LDPs

3.1 Roadmap for the Implementation of LDPs

27. The Roadmap for the Implementation of LDPs is shown in Table 4. It includes results of Priority Area DRR Plans for Nadi and Ba, Rakiraki and Greater Suva Area as of 2025.

3.2 Structure of the Roadmap for the Implementation of LDPs

28. The activity list presented in the Divisional DRR Plan, and the Priority Area DRR Plans formulated by MRMDDM consists of Division, location (area), target disaster, activity summary, implementing agency, and target year. In the Roadmap, milestones up to the target year, related projects, and relevant plans are additionally presented through coordination between NDRMO, MRMDDM, implementing agencies, and relevant agencies. It clarifies the pathway for implementing these activities. The Roadmap will be updated as needed, based on coordination with relevant agencies and the progress of project implementation.

29. The Roadmap will be utilized as follows:

30. **Monitoring and Evaluation:** The Roadmap monitors the implementation of Priority Area DRR Plans and evaluates progress. This process is closely related to the 122 action items of the NDRRP and ensures that each activity is progressing according to the plan. Furthermore, based on formulation and implementation progress of Priority Area DRR Plans, the plans are revised or improved as necessary to achieve more effective disaster risk reduction.

31. **Enhancing Coordination Among Government Agencies:** The Roadmap promotes coordination and information sharing among government agencies, centered around the NDRMO, to enhance cooperation, ensuring that disaster risk reduction efforts are carried out consistently.

32. **Promotion and Follow-up of Implementation:** The Roadmap provides specific guidelines to promote the implementation of the Division DRR Plan and Priority Area DRR Plan. It adjusts the plans based on progress and follows up to ensure their implementation.

Table 4 Roadmap for the Implementation of LDPs

(UPDATED AS OF DECEMBER 2025)

Overall No.	Original No.	Division	Place	Hazard*	Activity	Implementing Agency**	Target Year	Related Policies
1	1-1	Western	Nadi	Coastal	Ensure access along Queens Road (2 locations)	Fiji Roads Authority (FRA)	2035	#54, #55
2	1-2	Western	Nadi	Coastal	Ensure access to Denarau	FRA	2035	#54, #55
3	1-3	Western	Nadi	Coastal	Construction of bypass road to Denarau	FRA, Private	2030	#54, #55
4	2	Western	Nadi	Coastal	Community flood control (2 locations)	Rural	2030	#54, #55
5	3	Western	Nadi	Coastal	BCP for resort hotels (8 locations)	Hotel / Tourism / Industry	2025	#19, #20
6	4	Western	Nadi	Coastal	School inundation prevention measures (2)	Education	2030	#54, #55, #59
7	5	Western	Nadi	Coastal	Flood control for health facilities (2 locations)	Health	2030	#54, #55, #60, #71
8	6	Western	Nadi	Coastal	Land use regulations	iTaukei / Land / Nadi Town	2030	#12, #17
9	1	Western	Ba	Flood	Ensure access along Kings Road (2 locations)	FRA	2035	#54, #55
10	2	Western	Ba	Flood	Community flood control (3 locations)	Rural	2030	#54, #55
11	3	Western	Ba	Flood	School inundation prevention measures (3)	Education	2030	#54, #55, #59
12	4	Western	Ba	Flood	EC inundation prevention measures (2)	NDRMO EPC	2030	#54, #55, #60, #71
13	5	Western	Ba	Flood	Lowland inundation prevention measures (market, bus terminal, etc.)	Ba Town	2035	#54, #55
14	6	Western	Ba	Flood	Inundation prevention measures for residential and commercial areas	Waterways	2030	#55
15	7	Western	Ba	Flood	Land use regulations	Ba Town	2030	#12, #17
16	8	Western	Ba	Flood	Integrated flood risk countermeasures for Ba River	Waterways	2035	#54
17	1	Western	Rakiraki	Flood	Raising/Relocation of Schools (Rakiraki Muslim Primary School)	Department of Climate Change, (Education)	2035	#54, #55, #59

18	2	Western	Rakiraki	Flood	Raising/Relocation of Public Facilities (FSC Quarter, FSC Ground, Town Office)	Department of Climate Change, (Rakiraki Town)	2030	#54, #55
19	3	Western	Rakiraki	Flood	Flood mitigation measures in Rakiraki Town Market and Bus Station	Rakiraki Town	2035	#54, #55
20	4	Western	Rakiraki	Flood, Tsunami	Road heighing of major roads (Kings Road, XXXXX Valley Road, Waimari Roads	FRA	2030	#28, #54, #55, #69
21	5	Western	Rakiraki	Flood, Tsunami	Enhancement of Bridge Resilience (Crossing in Kings Road, Crossing near the market)	FRA	2030	#28, #54, #55, #69
22	6	Western	Rakiraki	Flood	Flood Control Measures for Penang River	Waterways	2027	#54, #55
23	7	Western	Rakiraki	Flood	Flood Control Measures for Nakauvadra Creek	Waterways	2035	#54, #55
24	8	Western	Rakiraki	Flood	Regulation of Urbanization in Flood Plain Areas (Identification of Hazard Risk Zone)	Rakiraki Town	2030	#12, #17
25	9	Western	Rakiraki	Sediment Disaster	Raising Awareness in the Steep Slope Areas	NDRMO, MRD	2030	#5, #33, #69, #90, #110
26	10	Western	Rakiraki	Cyclone	Establishment of Evacuation Center	NDRMO	2030	#62, #64
27	11	Western	Rakiraki	Cyclone	Evacuation Plan Formulation and Training	NDRMO	2030	#62, #64
28	12	Western	Rakiraki	Flood, Tsunami	Tsunami and Flood Response Training	NDRMO, MRD	2030	#69, #90
29	1	Central	Entire	All	Update of the Strategic Plan 2020-2024 for the Waterways	Waterways	2027	#7, #54, #55
30	1	Central	Entire	All	Update the priority list for river management in the Divisional level	Waterways	2027	#7, #54
31	05-01	Central	Lami	Flood	Dredging in Lami River	Waterways	2035	#54
32	05-02	Central	Lami	Flood	Riverbank Protection in Lami River	Waterways	2035	#54
33	06-01	Central	Samabula	Flood	Dredging in Samabula River	Waterways	2035	#54
34	06-02	Central	Wailoku	Flood	Dredging in Wailoku River	Waterways	2035	#54
35	06-03	Central	Wailea	Flood	Dredging and Riverbank Protection in the Downstream of Wailea area	Waterways	2035	#54

36	06-04	Central	Wailekutu	Flood	Dredging In Wailekutu Creek	Waterways	2035	#54, #55
37	8	Central	Entire	All	Development of Policy for Urban Drainage Network Improvement	Waterways, Drainage Board	2027	#55
38	10-01	Central	Suva	Flood	Drainage Improvement in CBD Area	Suva City, Waterways	2030	#55
39	10-02	Central	Suva	Flood	Drainage Improvement in Low Elevation Area	Suva City, Waterways	2030	#55
40	10-03	Central	Wailea	Flood	Drainage and Sewerage Improvement in Wailea Area	Suva City, Waterways	2030	#55
41	10-04	Central	Suva	Flood	Drainage in New Development Area	Suva City, Waterways	2030	#55
42	11-01	Central	Nasinu Town	Flood	Drainage Improvement in the Streets and in some residential areas	Ministry of Local Government (MoLG)	2030	#55
43	11-02	Central	Kalabu Tax Free Zone	Flood	Improvement of appropriate drainage function in new development area and proper connection to drainage channels	MoLG	2030	#55
44	12-01	Central	Lami	Flood	Drainage Improvement in Lami Central Business District (CBD)	MoLG	2027	#55
45	12-02	Central	Lami	Flood	Drainage Improvement in Wailada Industrial Area	MoLG	2030	#55
46	13-01	Central	Nausori	Flood	Improvement of appropriate drainage function in Nakasi new development area and proper connection to drainage channels	MoLG and Land developer	2030	#55
47	13-02	Central	Nausori	Flood	Regulation to install run-off control measures in new development areas	Department of Town and Country Planning (DCTP)	2030	#55
48	13-03	Central	Nausori	Flood	Drainage Improvement in Waidamdam	Ministry of Housing	2035	#55
49	13-04	Central	Nausori	Flood	Improvement of drainage Channel in the area	Waterways	2035	#55
50	14-01	Central	Maravu	Flood	Consideration of Relocation of Informal Settlements in Maravu Area	NDRMO, Department of Climate Change	2035	#41, #54, #55, #105
51	15-01	Central	Nasinu	Flood	Drainage Improvement near Laqere Bridge and Kings Road Crossing	Waterways, FRA	2030	#55
52	15-02	Central	Nasinu	Flood	Drainage Improvement in Kings Road near Rishikul Primary School	Waterways, FRA	2030	#55
53	16-01	Central	Suva	Sediment	Steep Slope Hazard Prevention Measures (Slope	Suva City, MRD, DTCP,	2035	#5, #6, #23, #33,

				Disaster	Stabilization, Relocation, Evacuation and Raising Awareness) in Suva city	NDRMO		#57, #110
54	16-02	Central	Suva	Sediment Disaster	Review of Steep Slope Hazard Prevention Measures (Slope Stabilization, Relocation, Evacuation and Raising Awareness) in Suva city	Suva City, MRD, DTCP, NDRMO	2035	#5, #6, #23, #33, #57, #110
55	16-03	Central	Nasinu	Sediment Disaster	Review of Steep Slope Hazard Prevention Measures (Slope Stabilization, Relocation, Evacuation and Raising Awareness) in Nasinu town	Nasinu Town, MRD, DTCP, NDRMO	2035	#5, #6, #23, #33, #57, #110
56	16-04	Central	Lami	Sediment Disaster	Steep Slope Hazard Prevention Measures (Slope Stabilization, Relocation, Evacuation and Raising Awareness) in Lami town	Lami Town, MRD, DTCP, NDRMO	2035	#5, #6, #23, #33, #57, #110
57	16-05	Central	Nausori	Sediment Disaster	Review of Steep Slope Hazard Prevention Measures (Slope Stabilization, Relocation, Evacuation and Raising Awareness) in Nausori town	Nausori Town, MRD, DTCP, NDRMO	2035	#5, #6, #23, #33, #57, #110
58	17-01	Central	Along the Kings Road	Sediment Disaster	Steep Slope Measures in Kings Roads	MRD, FRA	2030	#57
59	17-02	Central	Along the Queens Road	Sediment Disaster	Steep Slope Measures in Queens Roads	MRD, FRA	2030	#57
60	17-03	Central	Along the Princess Road	Sediment Disaster	Steep Slope Measures in Princess Roads	MRD, FRA	2030	#57
61	19-01	Central	Suva	Coastal	Promotion of Measures Conducted in Jittu Settlement	Ministry of Housing, Public Rental Board, Suva City	2030	#56, #77
62	22-01	Central	Suva	Coastal	Construction of Seawalls in Suva City in the Section South of the Grand Pacific Hotel	Suva City, XXXXXXX	2035	#56, #77
63	22-02	Central	Suva	Coastal	Construction of Seawalls in the East Coastline Development in Suva City	Suva City, XXXXXXX	2035	#56, #77
64	22-03	Central	Lami Bay	Coastal	Construction of Seawalls in the Lami Bay Coastal Areas	Lami Town, XXXXXXX	2035	#56, #77
65	22-04	Central	Nasinu	Coastal	Construction of Seawalls in the East Coastline of Nasinu Town	Nasinu Town, XXXXXXX	2035	#56, #77

66	23-01	Central	Lami Bay	Coastal	Rehabilitation of Seawall in the Lami Bay Coastal Areas	Lami Town, XXXXXXX	2035	#56, #77
67	26-01	Central	To be identified	All	Consideration of Disaster Risk Reduction Measures in New Development Area (Land Heightening, Change of Location etc.	NDRMO, MRD, DTCP	2035	#12, #17
68	30-01	Central	Suva	Cyclone (Heavy Rain / Strong Wind)	Identification and Establishment of New Evacuation Center in Suva City	Suva City, NDRMO	2030	#62, #64
69	30-02	Central	Nasinu	Cyclone (Heavy Rain / Strong Wind)	Identification and Establishment of New Evacuation Center in Nasinu Town	Nasinu Town, NDRMO	2030	#62, #64
70	30-03	Central	Nausori	Cyclone (Heavy Rain / Strong Wind)	Identification and Establishment of New Evacuation Center in Nausori Town	Nausori Town, NDRMO	2030	#62, #64
71	30-04	Central	Lami	Cyclone (Heavy Rain / Strong Wind)	Identification and Establishment of New Evacuation Center in Lami Town	Lami Town, NDRMO	2030	#62, #64
72	31-01	Central	Suva to Nausori	All	Review and upgrade on the Resilience of Kings Road between Suva and Nausori	FRA, Waterways	2030	#54, #55
73	31-02	Central	Suva to Nausori	All	Review and upgrade on the Resilience of Princess Road from Suva to Nausori	FRA, MRD, Waterways	2030	#54, #55
74	31-03	Central	To be identified	All	Consideration of Development of Proposed Regional Road	FRA, MRD, Waterways	2035	#54, #55
75	31-04	Central	Nasinu	All	Consideration of possible new road network of the East Coastline of Nasinu Town	FRA	2035	#54, #55
76	32-01	Central	Lami	All	Upgrade of the Vulnerable Bridges in Lami Town	FRA	2035	#54, #55
77	35-01	Central	To be identified	All	Enhance Resilience or relocation of the Health Facility	Health	2035	#60

78	36-01	Central	To be identified	Flood	Enhance Resilience or relocation of Education Facility Vulnerable to Flood	Education	2035	#54, #55, #59
79	36-02	Central	To be identified	Sediment Disaster	Enhance Resilience or relocation of Education Facility Vulnerable to Steep Slope Failure	Education	2035	#54, #55, #59
80	38-01	Central	Suva	Coastal	Kings Wharf Rehabilitation Project	FPCL	2035	#14, #77
81	38-02	Central	Suva	Coastal	Conducting DRR measures identified in the Hazard Analysis of Suva Port and Update of the Suva Port BCP	FPCL	2035	#14, #77
82	39-01	Central	To be identified	Flood	Enhance Resilience or relocation of Critical Public Facility Vulnerable to Flood	NDRMO	2035	#54, #110
83	39-02	Central	To be identified	Sediment Disaster	Enhance Resilience or relocation of Critical Public Facility Vulnerable to Steep Slope Failure	NDRMO	2035	#54, #110
84	40-01	Central	Suva	All	Update of the Existing BCP Plan	FPCL	2035	#14, #20, #77

Roadmap for NDRRP Implementation

National Disaster Risk Management Office

Republic of Fiji

Developed in December 2024

Endorsed by the Disaster Risk Reduction Committee in March 2025

Updated in December 2025

Disaster Risk Reduction Annual Report for Fiji 2022-2023

National Disaster Risk Management Office

Republic of Fiji

March 2025

Message

It is a great honor for me to share with you this 1st issue of the Disaster Risk Reduction Annual Report for Fiji. This publication covers the policy, strategies, plans, disaster reports, statistical data on damage and loss, and a range of information on Disaster Risk Reduction (DRR) programmes and projects in Fiji. It compiles lessons from disaster experiences to inform and strengthen our DRR policies and programs.

As one of the action items in the National Disaster Risk Reduction Policy 2018-2030 (NDRRP), the Fiji National Disaster Risk Management Office (NDRMO) took an active role in gathering DRR data and information from all relevant government agencies and partners to produce this publication. I am grateful to our experts, who in cooperation with external advisers, provided all available disaster data and considered the DRR challenges we face to make this document useful to policymakers, practitioners, experts, and the general public.

Recognizing the depth and quality of data and information in this document, the Fiji National Disaster Risk Management Council (NDRMC) will endorse the publication of this DRR Annual Report. I hope that all stakeholders can benefit from this document, particularly in designing and improving their respective programs and projects in Fiji. Since this publication is useful to promote resilience in Fiji, the NDRMO will produce this annually to serve as reference and archive document on DRR of Fiji for all stakeholders.

Mr. Napolioni Boseiwaqa
Acting Director
Fiji National Disaster Risk Management Office
March 2025

Introduction

1. The Fiji Government has prepared its first Disaster Risk Reduction Annual Report by using Japan's Disaster Management White Paper as an example.

2. Japan's Disaster Management White Paper is an obligation that is mandated by the Japan Cabinet Office and is intended to report to the Japanese Diet an overview of the legislative, financial, and other measures taken by the government (as a whole) concerning disaster management.

3. Historically, Japan has been struck by numerous disasters, including earthquakes, tsunamis, volcanic eruptions, typhoons, and floods. In 1923, the Great Kanto Earthquake struck the capital, resulting in over 100,000 deaths and causing economic damage equivalent to about 40% of Japan's GDP at the time.

4. In 1959, during Japan's period of rapid economic growth following the end of the World War II and the subsequent reconstruction from devastation, Typhoon Ise-wan (Typhoon Vera in 1959) struck the Tokai region. This typhoon caused over 5,000 deaths and missing persons and inflicted economic damage exceeding 4% of Japan's GDP. At that time, Japan's annual real economic growth was about 10%, so the economic damage exceeding 4% of GDP was extremely significant.

5. At that time, there was already criticism that disaster management measures were mainly reactive. Additionally, there were institutional criticisms that disaster-related laws were not unified, disaster measures by various government agencies were fragmented, and responsibilities among them were unclear. These criticisms exploded following the typhoon damage in 1959 and became the driving force behind the enactment of the Basic Act on Disaster Control Measures.

6. The main features of the Act, enacted under such circumstances, include:

    1) Clarification of responsibilities related to disaster management measures.
    2) Establishment of comprehensive disaster management administration.
    3) Development of systematic disaster management administration.

7. The Act mandates each Japanese government agency to clearly assume responsibility and promote comprehensive disaster management administration in a planned manner as a government.

8. Under the Basic Act on Disaster Control Measures, the Japanese government is legallyobliged to report annually to the Diet an overview of legislative, financial, and other measures related to disaster management. This is intended to allow the Diet to oversee administrative efforts in disaster management and to widely disseminate this information to the public, thereby raising public awareness. Additionally, special committees on disaster management measures are established in both the House of Representatives and the House of Councilors to investigate significant disaster-related issues and establish countermeasures.

9. In Japan, where the executive branch has relatively high independence, the framework in which the Diet monitors through annual reports in the White Paper to ensure that disaster management measures are not only promoted individually by each administrative agency but also comprehensively and systematically by the entire government is considered groundbreaking. Additionally, for the executive branch, continuously accumulating records and information on government-wide disaster management measures provides a valuable archive of information on past disaster responses, which can otherwise be prone to dissipation.

1. Fiji's Disaster Risk Reduction Annual Report

10. Japan's Disaster Management White Paper is a tool of the Diet in monitoring administrative efforts in disaster management, and it is mandated by law for the administration to report to the Diet. In contrast, Fiji's DRR Annual Report does not have such a legal and institutional backing.

11. Fiji's DRR Annual Report is specified as one of the 122 Action Items in the National Disaster Risk Reduction Policy 2018-2030 (NDRRP), with the National Disaster Management Office (NDMO), renamed to National Disaster Risk Management Office (NDRMO) in October 2024) being the responsible agency for its creation as stated in the Action Item No. 104. Fiji's DRR Annual Report is drafted by NDRMO as the secretariat, reported to the National Disaster Risk Management Council (NDRMC), and then published on the NDRMO's official website.

12. In the Annual Report, the NDRMO compiles and reports on records of past cyclones that caused significant damage, recent disaster records, and disaster management efforts by the government agencies of Fiji, the status of M&E surveys to promote NDRRP by NDRMO, and activity reports of NDRMO. In doing so, the Annual Report includes disaster management efforts by various government agencies and not just those by NDRMO.

13. To continue understanding the disaster management efforts of the entire government in future Annual Reports, it will be necessary to obtain information on these efforts from the activity reports and budget documents of the respective agencies.

2. Comparison of Disaster Management Budgets

14. In the following section, the challenges of disaster management budgeting for government agencies is outlined.

15. Disaster management projects may be described as projects solely for disaster management purpose, but there are also projects whose primary purpose is not disaster management yet contribute to it within the project. Taking school construction as an example, while the primary purpose is to construct educational facilities, if these facilities are designed to function as community shelters, they contribute to disaster management. In other words, even agencies, whose primary responsibilities are not disaster management, can implement or should handle budgets in a way that allows them to demonstrate that they are implementing disaster management-related projects. It is important to cultivate an awareness that disaster management is not solely the responsibility of organizations like NDRMO or MRMDDM, but rather a cross-sectoral administrative challenge that can be implemented across a wide range of government agencies.

16. Table 1 outlines discuss Fiji's disaster management budget in comparison with Japan and the Philippines as an attempt to examine and analyse our investment in disaster management.

Table i Disaster Management Budget in Fiji, Japan and the Philippines in 2021

Country/ Region	Area [km2]	Population [ppl]	GDP [USD] _a	Budget [USD] _b	Disaster Management Budget [USD]_c	b/a, c/b
Fiji	18,270	925,000	4.6 billion	1.8 billion	0.0015 billion	39.3%, 0.1%
Japan	378,000	125,682,000	5,378 billion	648.3 billion	26.8 billion	19.2%, 4.1%
Philippines	300,000	113,880,000	403 billion	129.4 billion	1.9 billion	32.1%, 1.5%

1. Population of Fiji (2021): Source: World Bank data.
2. GDP of Fiji (2021): Source: IMF data.
3. Budget of Fiji: Source: Revised Budget Estimate 2021-2022.
   Fiji's disaster management budget is taken from the MINISTRY OF RURAL AND MARITIME DEVELOPMENT AND DISASTER MANAGEMENT Programme 4 - Disaster Management and includes aid-in-kind.
4. Conversion Rate from Fijian Dollar to US Dollar: Rate used: 1 FJD = 0.48483 USD (as of January 1, 2021).
5. Population of Japan (2021): Source: World Bank data.
6. GDP of Japan (2021): Source: IMF data.
7. Budget of Japan: Source: General Account Budget Summary for Fiscal Year 2021 by the Ministry of Finance.
8. Conversion Rate from Japanese Yen to US Dollar: Rate used: 1 JPY = 0.00969 USD (as of January 1, 2021).
9. Japan's Disaster Management Budget: Source: White Paper on Disaster Management 2023.
10. Population of the Philippines (2021): Source: World Bank data.

11. GDP of the Philippines (2021): Source: IMF data.
12. Philippines' Disaster Prevention Budget (2021): Source: NDRRMF Budget.
13. Conversion Rate from Philippine Peso to US Dollar: Rate used: 1 PHP = 0.0208 USD (as of January 1, 2021).

17. Population, land area, GDP, etc., are cited from common sources for Fiji, Japan, and the Philippines. However, it's important to note that budgets are defined differently by each country, requiring caution in making simple comparisons. For example, the budget for the Philippines refers to the Budget of the National Disaster Risk Reduction and Management Fund , while Japan's budget is based on the Disaster Management White Paper, encompassing a broader range of disaster management expenditures. In contrast, Fiji's budget pertains to the figures that have been obtained from the Ministry of Rural and Maritime Development and Disaster Management (MRMDDM) Revised Budget Estimate for 2021-2022.

18. The ratio of general account budgets to GDP ranges from 19% to 39% across the three (3) countries, but considering that Japan's 19% does not include Special Accounts, there are no significant differences observed among the three countries. Each country's budget as a proportion of its economic size does not show significant disparities.

19. However, when examining the proportion of disaster management-related budgets to general account budgets, Japan and the Philippines show disparities of more than ten (10) times compared to Fiji's ratio, which is particularly noticeable. Despite there not being significant differences in the proportion of government budgets to economic size, the fact that there is more than a tenfold difference in the proportion of disaster management-related budgets to government budgets suggests that Fiji's efforts in disaster management may be insufficient.

20. It should be noted that Fiji's disaster management-related budget comprises the budget amount of Programme 4 of MRMDDM, excluding disaster management-related budgets from other government agencies. However, on the other hand, Fiji's disaster management-related budget includes approximately half of the total amount as aid-in-kind. This refers to funds from overseas donors considered as part of the disaster management-related budget. Excluding this, and considering only the Fiji government's own budget, the figures would be even smaller.

(1) Japan's Disaster Management Budget

21. In Japan's Disaster Management White Paper, the disaster management budgets of various agencies are aggregated and published annually. These disaster management budgets include not only budget items classified under expense categories such as erosion and flood control measures or disaster recovery in the official budget document but also any budget items that each government agency deems to contribute to disaster management. These are compiled by the Cabinet Office and further categorized into scientific research, disaster prevention, land conservation, disaster recovery, etc., and then published in the White Paper.

22. The important aspect here is that by treating disaster management efforts as projects that can be widely implemented by government agencies, the Disaster Management White Paper encourages government agencies to have their disaster management budgets prominently featured in the White Paper reported to the Diet and made public. This creates an incentive for agencies to secure a larger share of disaster management budgets. Especially in the event of a major disaster, various government agencies actively compete to secure disaster management budgets and strive to formulate and implement disaster management plans and projects. Additionally, for the Cabinet Office, which coordinates disaster management policies, this approach allows for the broad and continuous tracking of disaster management budgets and projects by government agencies, even without special requests like interim reports for SFDRR.

23. The following table is an excerpt from the 2023 edition of the Disaster Management White Paper by the Cabinet Office of Japan. The table data collects disaster management budgets not only from government agencies primarily responsible for disaster management, such as the Cabinet Office and the Ministry of Land, Infrastructure, Transport, and Tourism, but also from a wide range of other government agencies, including the Ministry of Education, Culture, Sports, Science and Technology; the Ministry of Agriculture, Forestry and Fisheries; and the Ministry of Economy, Trade and Industry. These budgets are categorized by purpose into Science and Technology Research, Disaster Management, Land Conservation, Disaster Reconstruction, and others.

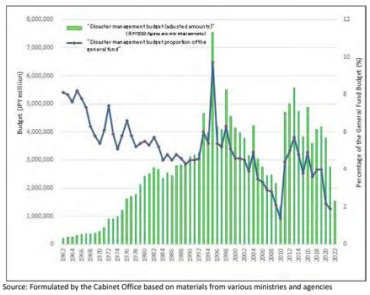
24. Additionally, the following graph shows the changes over the years in both the annual disaster management budget and the proportion of this budget relative to the general account budget. The major trend indicates that while the proportion of the disaster management budget to the general account budget has decreased, the total amount of the disaster management budget has significantly increased around the years of major disasters occurred, such as the 1995 Great Hanshin-Awaji Earthquake and the 2011 Great East Japan Earthquake and Tsunami.

Table ii Disaster Risk Management Budgets by Year

Fiscal Year	Science and Technology Research		Disaster Prevention		Land Conservation		Disaster Reconstruction		Total
	(JPY million)	Share (%)	(JPY million)	Share (%)	(JPY million)	Share (%)	(JPY million)	Share (%)	(JPY million)
1962	751	0.4	8,864	4.3	97,929	47.1	100,642	48.3	208,006
1963	1,021	0.4	8,906	3.7	116,131	47.7	117,473	48.2	243,522
1964	1,776	0.7	13,724	5.4	122,409	48.3	115,393	45.6	253,302
1965	1,605	0.5	17,143	5.6	147,858	48.3	139,424	45.6	306,030
1966	1,773	0.5	20,436	5.9	170,650	49.0	155,715	44.7	348,574
1967	2,115	0.6	23,152	6.1	197,833	52.3	154,855	41.0	377,955
1968	2,730	0.7	25,514	6.8	207,600	55.4	138,815	37.1	374,659
1969	2,747	0.7	30,177	7.5	236,209	59.0	131,270	32.8	400,403
1970	2,756	0.6	36,027	8.2	269,159	60.9	133,998	30.3	441,940
1971	3,078	0.5	50,464	8.6	352,686	60.3	178,209	30.5	584,437
1972	3,700	0.4	93,425	10.3	488,818	54.1	316,895	35.1	902,838
1973	6,287	0.7	111,321	12.4	493,580	54.9	287,082	32.0	898,270
1974	14,569	1.5	118,596	12.1	505,208	51.5	342,556	34.9	980,929
1975	17,795	1.5	159,595	13.3	615,457	51.3	405,771	33.9	1,198,618
1976	21,143	1.3	186,297	11.5	711,159	43.9	700,688	43.3	1,619,287
1977	22,836	1.4	234,409	13.9	904,302	53.6	525,886	31.2	1,687,433
1978	29,642	1.7	307,170	17.3	1,093,847	61.6	345,603	19.5	1,776,262
1979	35,145	1.6	435,963	20.4	1,229,401	57.6	432,759	20.3	2,133,268
1980	29,929	1.2	456,575	18.9	1,229,615	50.8	705,168	29.1	2,421,287
1981	29,621	1.2	474,926	18.9	1,240,788	49.5	761,950	30.4	2,507,285
1982	28,945	1.1	469,443	17.2	1,261,326	46.3	963,984	35.4	2,723,698
1983	29,825	1.1	489,918	18.4	1,268,712	47.6	875,851	32.9	2,664,306
1984	28,215	1.2	485,219	20.7	1,350,592	57.7	475,878	20.3	2,339,904
1985	27,680	1.1	512,837	20.2	1,355,917	53.5	640,225	25.2	2,536,659
1986	28,646	1.2	482,889	19.7	1,354,397	55.3	581,462	23.8	2,447,394
1987	38,296	1.4	612,505	21.9	1,603,599	57.2	548,337	19.6	2,802,737
1988	31,051	1.1	587,073	20.8	1,550,132	54.9	657,681	23.3	2,825,937
1989	34,542	1.2	588,354	20.7	1,638,104	57.5	587,819	20.6	2,848,819
1990	35,382	1.1	625,239	20.0	1,669,336	53.4	796,231	25.5	3,126,188
1991	35,791	1.1	628,596	19.8	1,729,332	54.3	788,603	24.8	3,182,322
1992	36,302	1.1	745,405	22.8	2,017,898	61.6	475,411	14.5	3,275,015
1993	43,152	0.9	866,170	18.6	2,462,800	52.9	1,280,569	27.5	4,652,691
1994	40,460	1.0	747,223	18.9	1,945,295	49.1	1,230,072	31.0	3,963,050
1995	105,845	1.4	1,208,134	16.0	2,529,386	33.5	3,696,010	49.0	7,539,375
1996	52,385	1.2	1,029,658	24.5	2,156,714	51.3	968,182	23.0	4,206,938
1997	49,128	1.2	1,147,102	28.2	2,014,695	49.4	864,370	21.2	4,075,295
1998	62,435	1.1	1,228,539	22.3	2,905,921	52.8	1,310,515	23.8	5,507,411
1999	78,134	1.7	1,142,199	25.0	2,400,534	52.6	941,886	20.6	4,562,752
2000	73,502	1.8	1,011,535	24.4	2,376,083	57.3	689,225	16.6	4,150,346
2001	49,310	1.2	1,060,445	26.7	2,238,816	56.4	618,427	15.6	3,966,998
2002	48,164	1.3	1,202,984	31.9	1,981,686	52.5	543,949	14.4	3,776,783
2003	35,133	1.1	814,101	25.7	1,625,670	51.4	689,255	21.8	3,164,159
2004	30,478	0.7	815,059	19.3	1,753,418	41.5	1,622,112	38.4	4,221,067
2005	11,097	0.4	866,290	28.6	1,426,745	47.0	728,606	24.0	3,032,738
2006	11,627	0.4	689,505	25.1	1,439,129	52.3	610,302	22.2	2,750,563
2007	9,687	0.4	706,853	29.0	1,332,222	54.6	391,637	16.0	2,440,399
2008	8,921	0.4	819,359	33.2	1,275,135	51.7	363,471	14.7	2,466,886
2009	8,761	0.4	498,397	23.0	1,383,254	63.7	279,789	12.9	2,170,201
2010	7,695	0.6	224,841	16.9	813,359	61.1	285,038	21.4	1,330,933
2011	28,072	0.6	383,384	8.2	743,936	15.9	3,534,830	75.4	4,684,652
2012	53,496	1.1	1,010,535	20.1	951,561	19.0	2,854,537	56.9	4,656,656
2013	15,339	0.3	786,046	14.1	879,932	15.8	3,881,875	69.6	5,578,036
2014	16,688	0.4	777,210	16.3	841,367	17.8	3,102,691	65.6	4,594,789
2015	14,961	0.4	701,843	18.4	155,239	4.1	2,951,923	77.2	3,838,268
2016	14,023	0.3	696,399	14.3	318,320	6.5	3,855,516	78.9	4,884,258
2017	10,123	0.3	790,361	22.1	267,629	7.5	2,515,384	70.2	3,583,497
2018	22,781	0.6	737,429	18.1	482,711	11.8	2,834,284	69.5	4,077,205
2019	14,390	0.3	814,471	19.5	512,324	12.3	2,835,790	67.9	4,180,246
2020	15,726	0.4	1,037,401	27.2	437,134	11.5	2,320,286	60.9	3,810,547
2021	26,756	0.5	1,108,485	33.3	404,554	7.5	1,226,931	58.2	2,766,726
2022	14,806	0.5	1,122,603	37.2	693,159	23.0	1,186,362	39.3	3,016,930
2023	7,432	0.5	643,841	40.0	110,084	6.8	846,522	52.6	1,607,879

Notes:
1. These are adjusted budget (national expenditures) amounts. However, the FY2023 figures are preliminary figures reflecting the initial budget.
2. The reduced amount allocated to science and technology research in FY2007 is largely due to the structural conversion of national lab and research institutions into independent administrative agencies (the budgets of independent administrative agencies are not included in this table).
3. The amount allocated to disaster prevention in FY2009 is reduced because a portion of the revenue sources set aside for road construction were converted to general fund sources making it impossible to allocate certain portions to the disaster management budget.
4. The reduced amount allocated to disaster prevention and land conservation in FY2010 is due to the fact that, following the creation of the General Grant for Social Capital Development, some disaster prevention policies and many subsidy programs in land conservation were established using those grants.

Source: Formulated by the Cabinet Office based on materials from various ministries and agencies



Source: Formulated by the Cabinet Office based on materials from various ministries and agencies

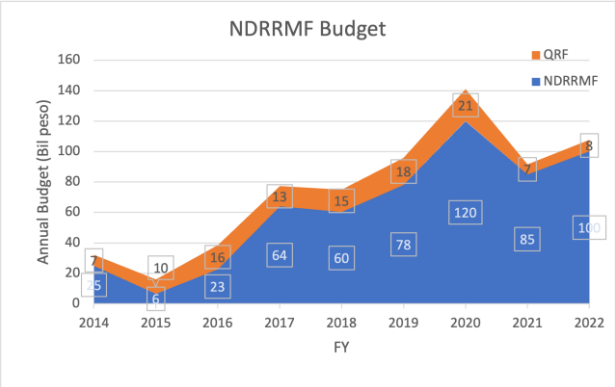
Source: Disaster Management White Paper of Japan, 2023

25. For reference, we attempt a comparison with Kochi Prefecture, a local government in Japan. As of 2021, Kochi Prefecture has an area of 7,105 square kilometers, a population of 684,049, and a Gross Prefectural Product of US$ 23 billion. In comparison, Fiji has an area of 18,270 square kilometers, a population of 925,000, and a GDP of US$ 4.6 billion.

26. According to the budget briefing materials of Kochi Prefecture for the fiscal year 2024, one of the four key policy goals includes "Building a Disaster-Resilient Prefecture." While it is not possible to determine the total amount allocated for disaster management measures in Kochi Prefecture, the budget for measures to prepare for the Nankai Trough Earthquake, considered the largest disaster risk for the prefecture, alone accounts for 5.2% of Kochi Prefecture's 2024 budget. This is a stark contrast to Fiji's disaster prevention budget, which stands at 0.1% of its total budget.

(2) The Philippines' Disaster Management Budget

27. The Philippines' National Disaster Risk Reduction and Management Fund (NDRRMF) is a budget measure mandated by the Disaster Risk Reduction and Management Act (RA10121) enacted in 2010. The NDRRMF is divided into two main components: the National Disaster Risk Reduction and Management Fund (NDRRMF) for national agencies, and the Local Disaster Risk Reduction and Management Fund (LDRRMF) for Local Government Units (LGUs). On average, the NDRRMF accounts for approximately 1-2% of the national budget.



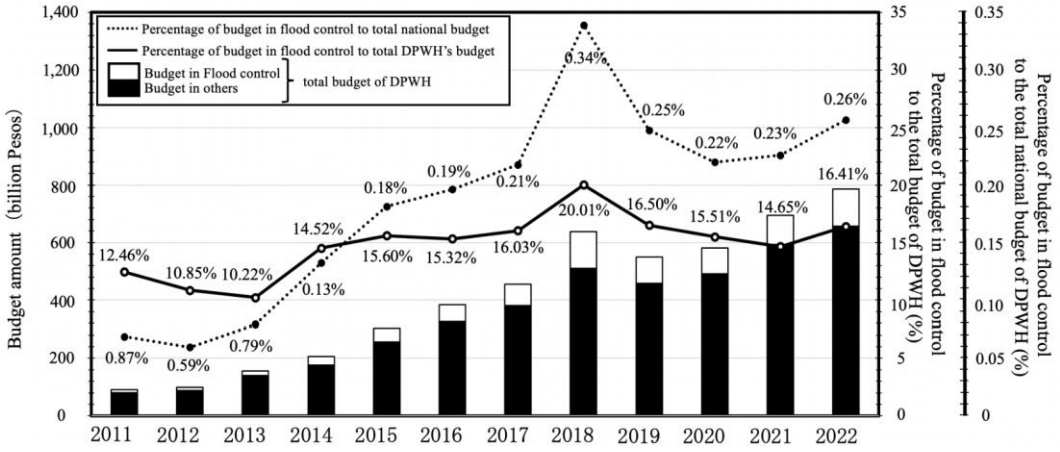
Source: 2011 Annual Financial Report for the National Government Volume-I-A, Government of the Philippines

Figure i NDRRMF Budget in the Philippines FY2014-FY2022

28. Local governments in the Philippines are mandated to allocate 5% of their annual budget to the LDRRMF for disaster management projects. If the amount listed in the Annual Investment Plan (AIP) within the disaster management plan is approved by the Department of Budget and Management (DBM), it can be utilized from the local government budget as the LDRRMF. Additionally, both National Government Agencies (NGAs) and Local Government Units (LGUs) are required to reserve 30% of their respective NDRRMF or LDRRMF as Quick Response Funds for recovery and reconstruction in the event of unexpected disasters.

29. The LDRRMF is governed by the Local Disaster Risk Reduction and Management Plan (LDRRMP), which specifies its use. It is expected to be used systematically over a three-year plan for infrastructure investment and disaster recovery.

30. In this way, the Philippines has an institutional framework to ensure disaster management projects and budgets, striving for a systematic enhancement of disaster risk reduction capabilities.



Source: "Study on Sufficient Condition for Value Creation on ODA Program Management in the Context of Disaster Risk Reduction that is uncertain and complex", Taichi MINAMITANI, Fumihiko OKIURA, JICA Report, 2022 Autumn 121

Figure ii Budget Trend for Flood Control Measure by DPWH (2011-2022)

31. In addition, the Philippines has a budget for flood control measures by the Department of Public Works and Highways (DPWH), which accounted for 0.23% of the national budget as of 2021. This can also be considered a disaster management budget which is not included in the NDRRMF budget.

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Acronyms and Abbreviations

ACRONYM	ABBREVIATION
ADB	Asian Development Bank
ADRC	Asia Disaster Reduction Center
AHP	Australian Humanitarian Partnership
BOM	Australian Bureau of Meteorology
Cat	Category
CBDRM	Community Based Disaster Risk Management
CDRI	Coalition for Disaster Resilient Infrastructure
COP	Conference of the Parties
COVID-19	Coronavirus disease 2019
CRVAF	Comprehensive Risk Vulnerability Assessment Framework
CPP	Country Preparedness Package
CSO	Civil Society Organization
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
DWS	Department of Water and Sanitation
EC	Evacuation Center
EFL	Energy Fiji Limited
EMTAG	Fiji Emergency Management Training Advisory Group
EOC	Emergency Operation Center
FCOSS	Fiji Council of Social Services
FMS	Fiji Meteorological Services
FRA	Fiji Roads Authority
FRCS	Fiji Red Cross Society
FPCL	Fiji Ports Corporation Limited
FPF	Fiji Police Force
FJD	Fijian Dollar
FSP	Family Safety Plan
FY	Fiscal Year
GIZ	Germany Agency for International Cooperation and Development
GP	Global Platform for Disaster Risk Reduction
HFR	High Frequency Radio
HLM	High Level Meeting
IFIS	Infrastructure Resilient in Island States
IWRMP	Integrated Water Resources Management Program
JCC	Joint Coodination Committee
JICA	Japan International Cooperation Agency
M4C	Market for Change
MRMDDM	Ministry of Rural and Maritime Development and Disaster Management
MHMS	Ministry of Health and Medical Services
MRD	Mineral Resources Department
MTR-SF	Mid-term Review for the Sendai Framework for Disaster Risk Reduction
NBC	National Building Code
NDAW	National Disaster Awareness Week
NDMA	National Disaster Management Act
NDMC	National Disaster Management Council
NDMO	National Disaster Management Office
NDRMO	National Disaster Risk Management Office (former NDMO)
NDRRP	National Disaster Risk Reduction Policy
NEMA	New Zealand Emergency Management Agency
NEOC	National Emergency Operations Center
NFA	National Fire Authority
NFI	Non-Food Item
NGO	Non-Government Organization
NZ	New Zealand
NZDF	New Zealand Defence Forces

ACRONYM	ABBREVIATION
REDD-Plus	Reducing Emissions from Deforestation and Forest Degradation
RFMF	Republic of Fiji Military Forces
SAO	Senior Administrative Officer
SAMOA Pathway	SIDS Accelerated Modalities of Action Pathway
SFDRR	Sendai Framework for Disaster Risk Reduction
SIDS	Small Island Developing State
SOP	Standard Operating Procedure
SPC	Pacific Community
TC	Tropical Cyclone
TWG	Technical Working Group
UN	United Nations
UNDP	United Nations Development Programme
USD	United States Dollar
WAF	Water Authority of Fiji
WASH	Water, Sanitation and Hygine
WEOC	Working in an Emergency Operation Center
WFP	World Food Program
WRD	Women's Disaster Resilience Program

Terminology

32. **Capacity:** The combination of all the strengths, attributes and resources available within an organisation, community or society to manage and reduce disaster risks and strengthen resilience.

33. **Climate Change:** A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and in addition to natural climate variability observed over comparable time periods.

34. **Disaster:** A serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and coping capacity, leading to one or more of the followings: human, mental, economic and environmental losses and impacts.

35. **Disaster Mitigation:** The lessening or limitation of the adverse impacts of hazards and related disasters. Mitigation measures encompass engineering techniques and hazard-resistant construction as well as improved environmental policies and public awareness.

36. **Disaster Preparedness:** The knowledge and capacities developed by governments, professional response and recovery organizations, communities, and individuals to effectively anticipate, respond to, and recover from, the Impacts of likely, imminent or current hazard events or conditions.

37. Preparedness action is carried out within the context of disaster risk reduction and management and aims to build the capacities needed to efficiently manage all types of emergencies and achieve orderly transitions from response to sustained recovery. Preparedness is based on a sound analysis of disaster risk and good linkages with early warning systems, and includes such activities as contingency planning, stockpiling of equipment and supplies, the development of arrangements for coordination, evacuation and public information, and associated training and field exercises. These must be supported by formal institutional, legal and budgetary capacities.

38. **Disaster Prevention:** The outright avoidance of adverse impacts of hazards and related disasters. It expresses the concept and intention to completely avoid potential adverse impacts through action taken in advance such as construction of dams or embankments that eliminate flood risks, land-use regulations that do not permit any settlement in high-risk zones, and seismic engineering designs that ensure the survival and function of a critical building in any likely earthquake.

39. **Disaster Response:** Provides for key actions that give importance to activities during the actual disaster response operations such as needs assessment, search and rescue, relief operations, and early recovery activities. The activities identified below will be done either before the actual response operations or during the disaster event. For those activities that need to be completed prior to actual response operations, they will be linked to activities earlier identified in the preparedness aspect.

40. **Disaster Risk:** The potential loss of life, injury, destroyed or damaged assets which could occur to a system, society or community in a specific period of time, determined probabilistically as a function of hazard, exposure, vulnerability and capacity.

41. **Disaster Risk Assessment:** A qualitative or quantitative approach to determine the nature and extent of disaster risk by analysing potential hazards and evaluating existing conditions of exposure and vulnerability that together could harm people, property, services, livelihoods and the environment on which they depend.

42. **Exposure:** The situation of people, infrastructure, housing, production capacity and other tangible human assets located in hazard-prone areas.

43. **Hazard:** A process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation.

44. **Structural and Non-Structural Measures:** Structural measures are any physical construction to reduce or avoid possible impacts of hazards, or the application of engineering techniques or technology to achieve hazard resistance and resilience in structures or systems. Non-structural measures are measures not involving physical construction which use knowledge, practice or agreement to reduce disaster risks and impacts, in particular through policies and laws, public awareness raising, training and education.

45. **Vulnerability:** The conditions determined by physical, social, economic and environmental factors or processes, which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards.

1. Overview on Disasters in Fiji [1]

1.1 Overview

46. Fiji has an inherently high potential of exposure to a considerable array of disasters. The probability of catastrophic damage and loss of lives from hazards such as cyclone and tropical storm, storm surge, flooding and landslide, earthquake and tsunami, is assessed as very high.

47. Fiji is extremely vulnerable to natural and human-induced/technological hazards. Overall, the associated risk appears to be increasing due to population pressures, poorly regulated land resources, and climate change.

48. Human-induced/technological hazards increase the impacts of cyclonic and tropical storm events and geological (including seismic) activities. The impacts result from poorly planned and developed urban and peri-urban areas, vulnerable tourist facilities and infrastructure, unstable economic development processes and activities, and inadequately resourced disaster response mechanisms.

49. Lack of preparation against natural and human-induced/technological hazards increases the underlying risks. While core hazards and risks have been identified and priority issues are known, they are not integrated into national and sector plans and policies.

50. The ability to manage population growth in certain areas, land use, maintenance of infrastructure and protection of environment are severely undermined by institutional constraints, including professional and technical capacities of government agencies.

[1] NDRRP Country Assessment for Fiji (P12, Section 29)

1.2 Past Major Tropical Cyclones

51. Fiji is repeatedly impacted by cyclones. Below is an overview of the tropical cyclones (TCs) that had particularly large impacts.

Table 1 Past Major Tropical Cyclone and the Effect

Year	Event Name	Category	Areas Affected	Deaths	Missing	Damage Costs	Population Affected	What was mostly affected
2010	TC Tomas	Cat 4	Northern & Eastern Division	2	0	34.8m (US$)	39,101	Agriculture
2012	TC Evan	Cat 2	Northern Vanua Levu & Western Viti Levu	0	0	64.3m (US$)	70,000	Tourism
2016	TC Winston	Cat 5	Nation Wide	44	1	2.98b (USD)	540,414	Housing
2018	TC Gita	Cat 4	Southern Lau	0	0	1.27m (FJ$)	1,608	Housing
2019	TC Sarai	Cat 3	Parts of Central, Eastern, Northern & Western Division	2	0	10.35m (FJ$)	77, 756	Agriculture
2019	TC Tino	Cat 1	Northern & Eastern Division	0	2	3.23m (FJ$)	TBC	Infrastructure
2020	TC Harold	Cat 4	Eastern, Central & Western Division	1	0	100.9m (FJ$)	182,000	Agriculture
2021	TC Yasa	Cat 5	Nation Wide	4	1	381.72m (FJ$)	139,259	Agriculture
2021	TC Ana	Cat 2	Central, Northern & Western Divisions	3	2	201.44m (FJ$)	18,147	Infrastructure

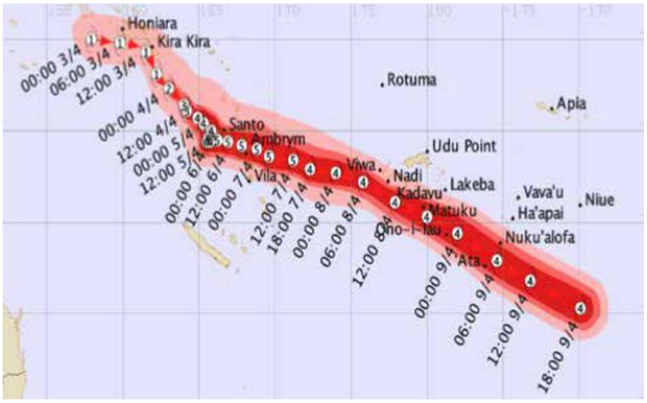
Source: NDRMO, Tropical Cyclone Reports

1) Cyclone Harold (March 2020)

a) Outline of TC Harold

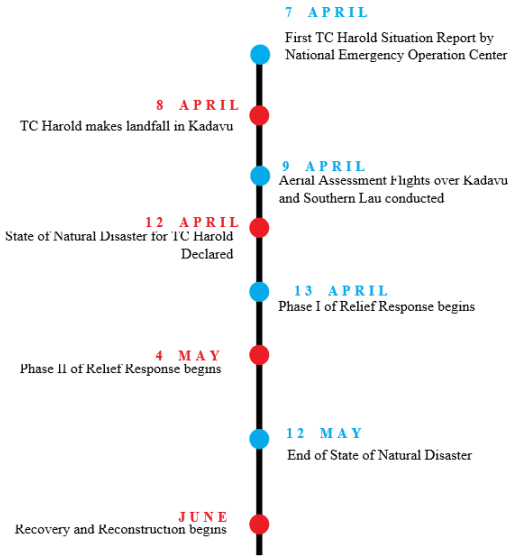
52. TC Harold was the eighth cyclone to occur in the Southwest Pacific during the 2019-2020 season, and the third cyclone to affect the Fiji Group. TC Harold attained a maximum intensity of Category 5, but it downgraded to a Category 4 system when it reached Fiji. On 1 April, the Australian Bureau of Meteorology (BOM) reported that Tropical Low 12U had developed along a trough of low pressure to the east of Papua New Guinea. After increasing in intensity, the BOM upgraded the storm to a Category 1 tropical cyclone and named it Harold just before it passed about 135 km to the southeast of Honiara in the Solomon Islands.

53. The system began to intensify by 3 April, reaching Category 4 status by 4 April. Later that day, the Fiji Meteorological Services (FMS) predicted it to further strengthen to Category 5 status. On 5 April, it increased into a Category 5 severe tropical cyclone. It made landfall on Espiritu Santo, Vanuatu on 6 April and maintained this status for only six (6) hours before being downgraded to Category 4.



Source: FMS

Fig. 1 Track map for TC Harold



Source: NDRMO

Fig. 2 TC Harold Timeline with respect to preparedness and Response

Fig. 3 Storm Surges Captured in Nadi during TC Harold

Fig. 4 Bhawani Dayal Arya College Sustained Extensive Damage from Tornado

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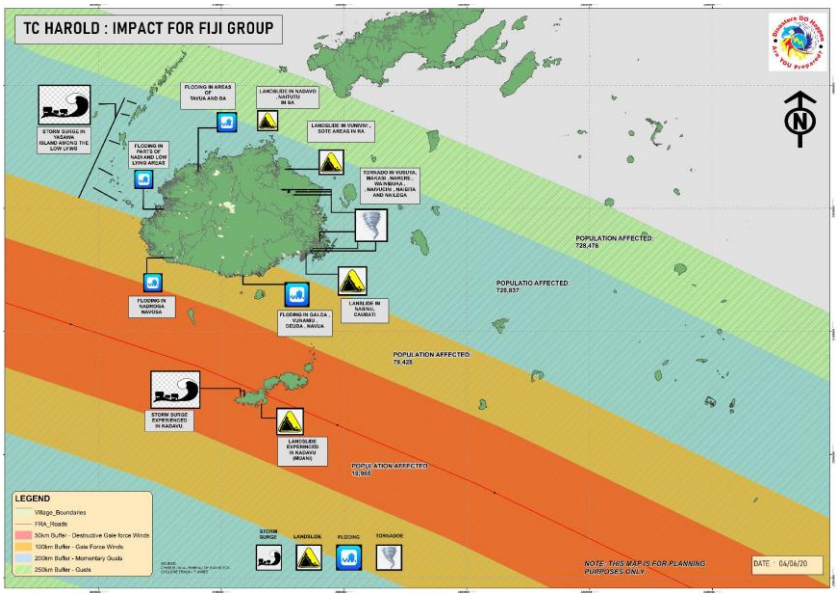


Source: NDRMO

Fig. 7 TC Harold Impacts Map in Fiji with Respect to Its Associated Secondary Hazards

b) Response

54. In anticipation of the impact of TC Harold, the Government initiated emergency preparedness and early warning mechanisms, including the activation of national and divisional Emergency Operations Centers (EOCs). Situation Reports generated by the National Emergency Operation Center (NEOC) were distributed via email to the Honourable Prime Minister, members of the National Disaster Management Council (NDMC), and relevant agencies. The Situation Reports detailed the coordination effort, and any developments and actions taken in response to the impacts of TC Harold. First Responders comprising of the Fiji Police Force (FPF), the Republic of Fiji Military Forces (RFMF), the National Fire Authority (NFA) and the Fiji Red Cross Society (FRCS), together with critical service agencies including the Ministry of Health and Medical Services (MHMS), Fiji Roads Authority (FRA), Water Authority of Fiji (WAF) and Energy Fiji Limited (EFL) coordinated with the NEOC to deliver life-saving activities within the first hours and days of TC Harold impacting the Fiji Group.

55. In the first hours after the cyclone, WAF and EFL workers immediately attended to minor damage. Based on previous experience, the focus was on being prepared to swing into action immediately after the cyclonic event, ensuring that water supply and energy infrastructure continue to function. Following the cyclone, and as soon as access became possible, WAF and EFL teams were on the ground in the affected areas. Response teams made damage assessments and provided 'quick fixes' as interim measures before the rehabilitation effort began for affected areas. Damage reports were being shared with Divisional and National EOCs. Critical information was also conveyed at high-level briefings on a daily or twice daily meetings.

56. Within 24 hours of TC Harold's impact, the Government was able to mobilise an aerial situation overview with the assistance of the Australian and New Zealand Governments. The information gathered from the aerial situation overview was analysed by the Emergency Committee that convened on 9 April. The Committee recommended for the worst affected areas to be declared as a 'State of Natural Disaster'. The emergency relief response by the Government for TC Harold was implemented in two primary phases. This was led by the Government through the National Disaster Risk Management Office (NDRMO) at the national level and the Divisional Commissioners at sub-national level.

57. **Phase 1 Response.** Phase I of the TC Harold response was deployed within five (5) days of TC Harold's passing. The response included the delivery of immediate relief supplies such as food, water, and non-food items (NFIs). A total of 691 tons of food rations were deployed on six (6) vessels to Kadavu, Vatulele, Yanuca, Beqa, Yasawa, Malolo and the Southern Lau Group. Families sheltering in the evacuation centers (ECs) were also included in the food ration distribution carried out across the four divisions. Restoration of critical infrastructure such as communications, water and power supply was also initiated immediately.

58. **Phase 2 Response.** Phase II of response involved distribution of food rations, water and NFIs which were delivered to affected communities commencing on 4 May. This included 158 tonnes of food rations, which were deployed simultaneously on board eight (8) Government vessels to Kadavu, Vatulele and the Southern Lau Group. These two (2) phases of relief deployment were carried out within six (6) weeks of TC Harold's passing, highlighting the Government's commitment to respond in a timely and effective manner to those in need. The Government also deployed a desalination plant to provide safe drinking water in adequate quantities to affected communities.

59. **Activation of Evacuation Centers.** ECs were activated to accommodate families needing shelter before and after TC Harold. Information on opened ECs was disseminated to the public, and advisories were issued early to accommodate the needs and to provide sufficient time for persons living with disabilities to settle into the ECs. The scale of displacement, including the number of ECs, the number of evacuees, as well as humanitarian needs in the Eastern Division was not available in the early days of response as communication with Kadavu and the Lau Group was lost. Digicel and Vodafone re-established coverage on parts of Kadavu on 9 and 10 April and this provided a clearer overview of the scale of displacement. The number of shelters and evacuees increased during and after TC Harold's passing; over 6,100 people sought refuge at 204 ECs. Apart from those living in ECs many families remained in host family situations. Figure 11 shows details on the number of evacuees and ECs activated in the 4 divisions.

c) Impacts by sectors

60. **Agriculture.** The agriculture sector was significantly affected with the Ministry of Agriculture estimating damages of up to 80% to crops while livestock farmers, particularly dairy farmers in the Central Division, were also affected. A total of 51,164 farmers were directly affected by TC Harold, out of which 57% were recorded in the Western Division followed by Central Division at 19%, Eastern Division at 15% and Northern Division at 9%.

61. **Infrastructure.** Roads, jetties and utility (water, electricity, telecommunications) infrastructure also sustained major damage that contributed to difficulties in response and relief operations in the immediate aftermath of TC Harold. The WAF also sustained damages to both water and wastewater schemes in the Western and Eastern Divisions. Approximately 30% damage was recorded by service providers in the telecommunications sector. Communications with Kadavu and the Lau Group in the immediate aftermath of the cyclone were lost.

62. **Housing.** The housing sector also incurred major losses. Approximately 1,000 houses were completely destroyed, and more than 2,000 homes sustained partial damages across the four divisions. Rehabilitation of the housing sector is a key priority for Government.

Table 2 TC Harold Detailed Damage Assessments per Sector

(FJ$)

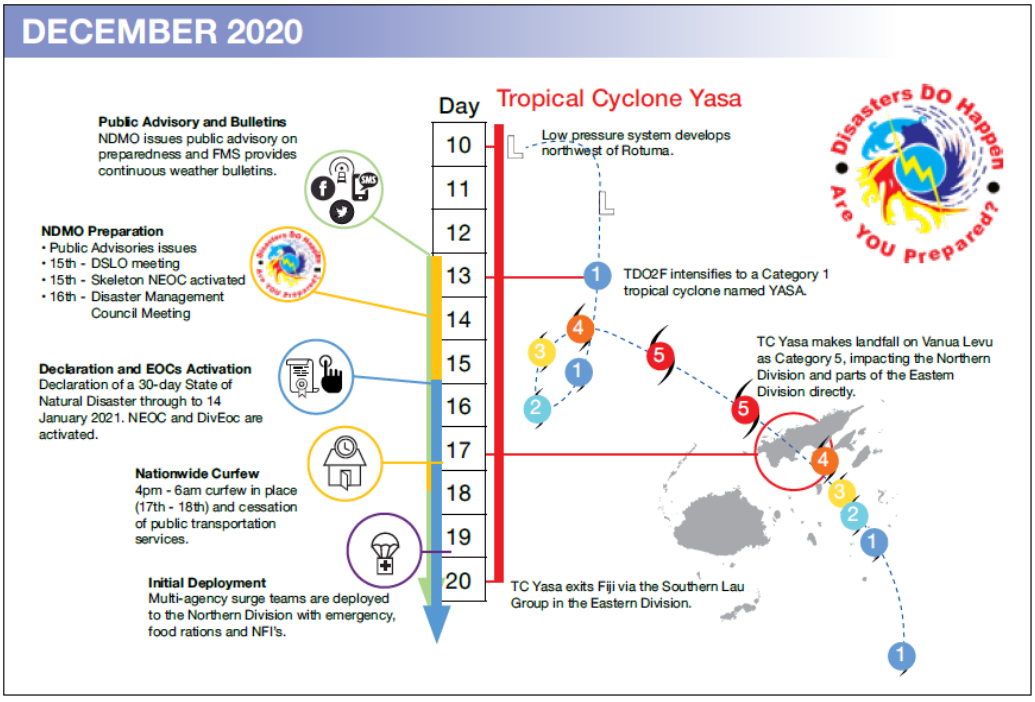
Divisions	Sector						Total
	Housing	Agriculture	Infrastructure	Education	Fisheries & Forestry	Social Infrastructure	
Eastern	17,591,650	11,621,314	8,729,309	9,735,414	7,784,464	1,264,105	56,726,253
Western	5,791,000	3,960,000	915,148	10,004,430	133,420	1,380,000	22,183,998
Central	974,000	5,279,709	1,086,949	4,220,480	107,400	10,000	11,678,538
Northern	66,500	6,918,325	7,100	3,218,956	130,000	-	10,340,882
Total	24,423,150	27,779,348	10,738,503	27,179,282	8,155,284	2,654,105	100,929,673

Source: NDRMO

2) *Cyclone Yasa (December 2020)*

a) Outline of TC Yasa

63. TC Yasa, a massive Category 5 cyclone that ravaged Vanua Levu and islands in the Eastern Division on 17 – 18 December 2020, is considered to be one of Fiji's worst cyclones in recent history.



Source: NDRMO

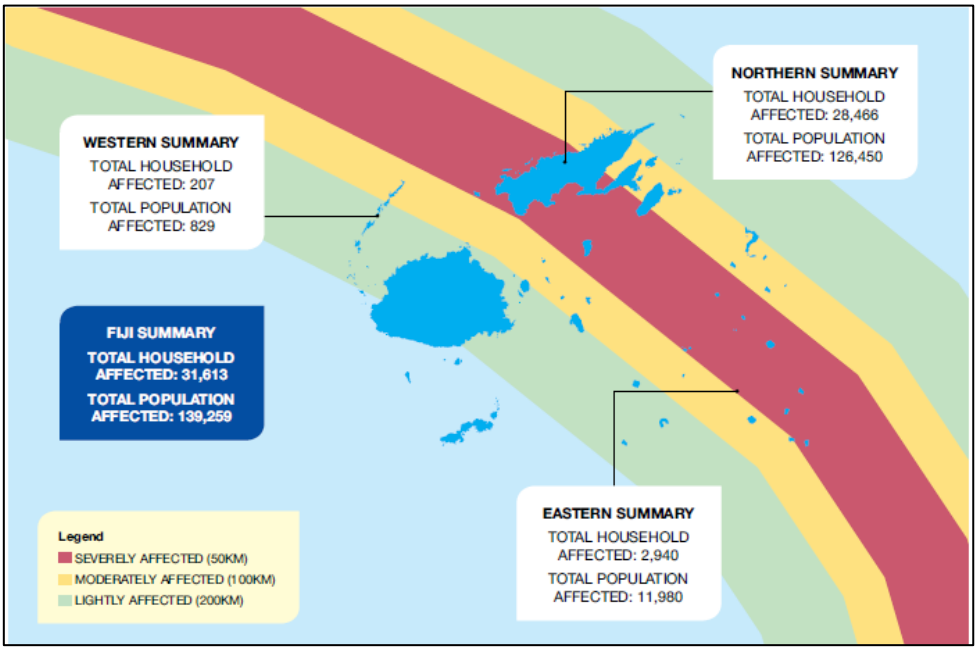
Fig. 8 TC Yasa Sequence of Events and Cyclone Track Map

b) Response

64. The emergency response by the Government and its partners was well-coordinated and managed. Prior to the cyclone impact EOCs were activated at national and sub-national levels. During the response the NEOC released 136 Situational Reports. A 30-day State of Natural Disaster was declared on 17 December 2020. Early warning advisories issued by NDRMO were broadcast throughout the country. As a result, many residents took shelter in ECs. Generally, the public were well informed and able to make adequate preparations.

c) Impact

65. The cyclone was responsible for four fatalities and left widespread destruction in its path. Dwellings and their contents were damaged or destroyed and critical infrastructure was severely affected. The livelihoods of many of those affected were significantly compromised, and economic activity disrupted. The cyclone brought down power and communications systems linking the islands. The impacts of TC Yasa were further compounded by the damage experienced from the floods and slow-moving TC Ana in January 2021.



Source: NDRMO

Fig. 9 TC Yasa Impact Map

Table 3 TC Yasa Victims

(people)

Division	Deaths	Missing
Central	-	-
Eastern	-	-
Northern	2	1
Western	2	-
Total	4	1

Table 4 Summary of TC Yasa Detailed Damage Assessment per Sector by Division

(M FJ$)

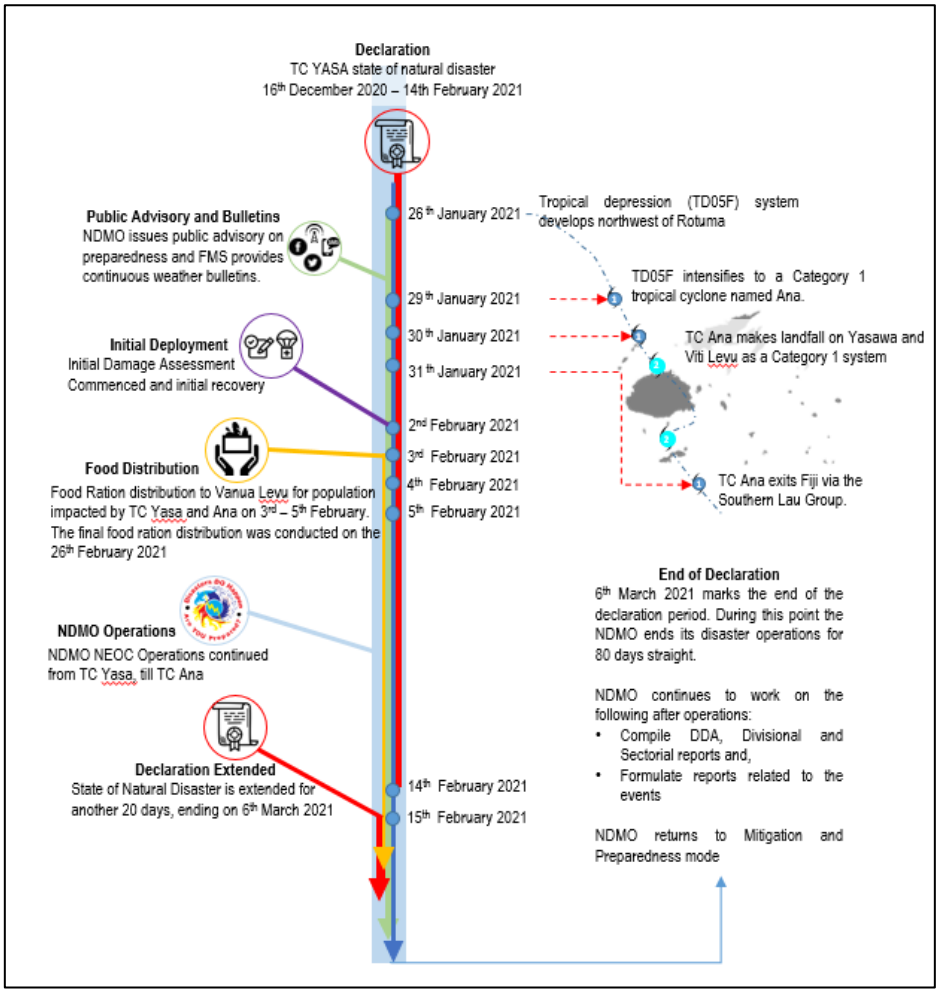
Division	Sector					Total
	Housing	Agriculture	Infrastructure	Education	Health	
Eastern	8.81	8.00	3.81	0.22	-	20.60
Western	0.42	1.50	35.43	0.18	-	37.53
Central	-	-	3.85	-	-	3.85
Northern	109.47	138.00	64.73	5.27	2.03	319.50
Total	118.70	147.50	107.82	5.67	2.03	381.72

Source: NDRMO

3) Cyclone Ana (January 2021)

a) Outline of TC Ana

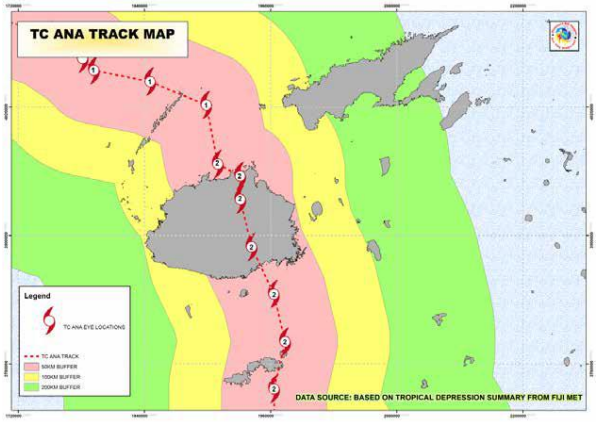
66. TC Ana was a Category 2 cyclone that affected Fiji only 6 weeks after Category 5 TC Yasa devastated the Fiji group. TC Ana further compounded the impacts of TC Yasa and brought about widespread suffering and hardships. TC Ana made landfall over the Province of Ra at 0600 hours on 31 January 2021 before it exited Suva at 1600 hours on the same day.



Source: NDRMO

Fig. 10 TC Ana Sequence of Events and Cyclone Track Map.

b) Response



Source: NDRMO

Fig. 11 TC Ana Sequence of Events and Cyclone Track Map.

67. A State of Natural Disaster was not made for TC Ana, since the country was still under the disaster declaration for TC Yasa, which was scheduled to end on 14 February 2021. Instead, the government extended the Disaster Declaration for TC Yasa for another 20 days from 15 February to 6 March 2021; this was to accommodate the responses for both TC Ana and TC Yasa. The NDRMO issued warning messages through media outlets and its social media platforms, advising Fijians of TC Ana's pending arrival and how best to prepare. As a result, many Fijians took the necessary precautions and prepared themselves accordingly.

c) Impact

68. TC Ana claimed the lives of three (3) Fijians and left two (2) missing at sea, destroyed livelihoods, damaged (or destroyed) infrastructure and also damaged or destroyed houses. The cost of damages to critical infrastructure was significant and will take a considerable amount of time and investment to recover. The emergency response was coordinated by the NDRMO and the Divisional Commissioners with assistance from the civil service, the security forces, civil society organizations and development partners. To ensure efficiency, the assistance provided for TC Ana was consolidated with the TC Yasa assistance.

Table 5 The Break-down of Housing Damage Costs by Division by TC Ana

Division	Partially Damaged	Destroyed	Partially Damaged Replacement Cost	Destroyed Replacement Cost	Total Replacement Cost
	(House)	(House)	(FJ$)	(FJ$)	(FJ$)
Central	344	26	3,440,000	629,000	4,064,000
Eastern	13	1	130,000	24,000	154,000
Northern	597	45	5,970,000	1,080,000	7,050,000
Western	293	15	2,930,000	360,000	3,290,000
Total	1,247	87	12,470,000	2,088,000	14,558,000

Source: Ministry of Housing and Community Development

Table 6 Cost of Damages Sustained by the Agriculture Sector by Divisions by TC Ana

Division	Infrastructure	Crop	Livestock	Total	Percentage Distribution
	(FJ$)	(FJ$)	(FJ$)	(FJ$)	(%)
Central	87,560	2,189,387	345,864	2,622,811	16.2
Eastern	17,345	67,869	4,990	90,204	0.6
Northern	732,658	2,569,555	5,248,719	8,550,932	52.7
Western	256,523	3,105,349	1,604,345	4,966,217	30.6
Total	1,094,086	7,932,160	7,203,918	16,230,164	100.00

Source: Ministry of Agriculture

Table 7 Damage to Road Infrastructure Caused by TC Ana

(FJ$)

Division	Immediate Response	Emergency Restoration On-going	Replacement	Total
Central	181,828	27,116,806	3,000,000	30,298,634
Western	755,642	26,904,251	2,200,000	29,859,893
Northern	1,041,836	70,559,592	4,000,000	75,601,428
Eastern	-	28,822,247	-	28,822,247
Total	1,979,306	153,402,896	9,200,000	164,582,202

Source: FRA

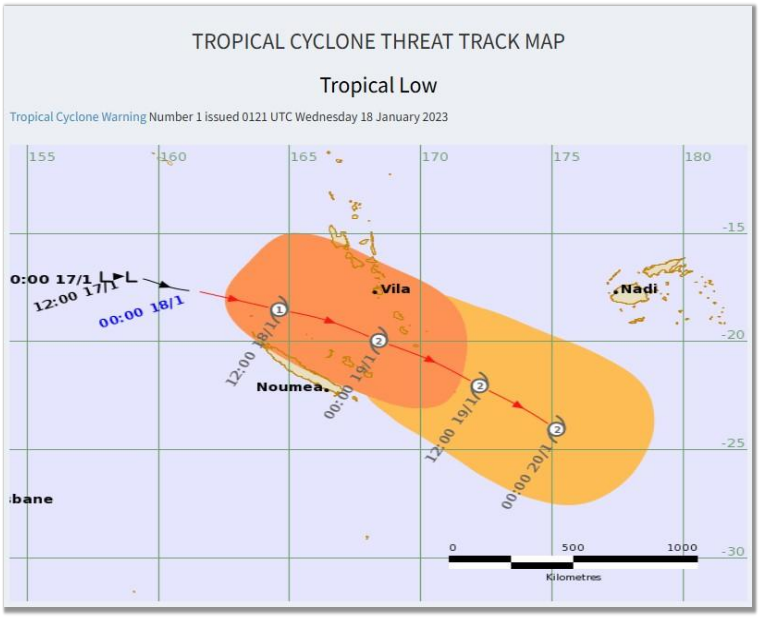
2. State of Disasters

2.1 Disasters in FY22-23

69. The following two (2) events of heavy rains are the main natural disasters that occurred this fiscal year 2022-2023.

1) Heavy Rain and TD05F

70. Tropical depression TD05F had intensified into a Category 1 tropical cyclone named Irene on 18 January 2023 while located to the west of Vanuatu. TC Irene had upgraded into a Category 2 system while being located to the south of Port Villa, Vanuatu. Warning messages on winds, heavy rain, and coastal inundation were issued but there were no substantial damages due to TC Irene.



Situation assessment in Rewa recorded Lami Catholic Church was flooded due to poor drainage. (Central Division)

Fig. 12 Situation Report of Heavy Rain and TD05F

2) Heavy Rain and Flash Flooding

71. An active trough of low pressure with associated clouds and rain affected the Northern and Eastern parts of Fiji on 3 February 2023. Heavy rain and flash flood warning messages were issued to the public. The Northern Division was affected and had three (3) ECs activated that accommodated fourteen (14) households; with a total of eighty-one (18) people. Minor flooding of roads and crossings were reported and was quickly rectified by FRA. Overall, there were no significant damages recorded.

Fig. 13 Situation Report of Heavy Rain on 3 February 2023

2.2 Response for Disasters in FY22-23

72. The Northern Divisional EOC deployed FRA to the affected areas to clear affected roads and crossings. Relief items were distributed to the activated ECs by the Team FRCS and affected households. Items included dignity kits and hygiene kits. By 4 February 2023, all ECs were cleared and closed with schools disinfected by the District EOC team members in collaboration with MHMS.

3. Outline of DRR Related Activities of the Government of Fiji

3.1 Economic Sector

1) Partnership Framework derived from the propose Policy-based Loans, Republic of Fiji: Sustainable and Resilient Recovery Program

73. The Financial Management (Amendment) Act of 2021 and the new Climate Change Act of 2021 will both be taken into account as the government updates financial management and procurement laws with the goals including implementing project appraisal frameworks that take climate and disaster risk into account for budgeting and planning, and creating regulations for the full operationalization of the Climate Change Act in 2021.

74. The Government intends to continue rolling out the market-based climate risk parametric micro-insurance product, and create a social registry supported by a digital management information system to better target social assistance programmes.

2) Building Safety and Resilience in the Pacific

75. Effective preparedness, response and recovery, strengthened institutional arrangements for Disaster Risk Management (DRM) and Climate Change Adaptation and improved knowledge, information, public awareness, and training and education by development partners including Building Safety and Resilience in the Pacific (BSRP) with 19.36 million euro.

3) Risk-informed investment and business models

76. To lessen the chance of disasters and their effects on economic activity, risk-informed investment and business models have been put into effect in Fiji through the creation of standards for development and investment based on disaster risk, which led to the formulation of the Public-Private Partnership (PPP) Policy of 2019.

77. The Fiji Business Disaster Resilience Council (FBDRC) helps private sector become more resilient to disasters by offering advice and support through the provision of Business Continuity Plan (BCP). It has also been instrumental in implementing mitigation strategies by providing sponsorship during the National Disaster Awareness campaign.

4) Parametric Micro-Insurance

78. In August 2021, Fiji launched a market-based parametric micro-insurance program for climate risk. The Parliament passed legislation to exempt parametric insurance products from value-added tax in order to make them more accessible for low-income and vulnerable groups. On 1 August 2021, the Value—Added Tax Act 2021 was passed to that effect.

5) Risk-informing development projects

79. The Ministry of Rural and Maritime Development and Disaster Management (MRMDDM) and United Nations Development Programme (UNDP) have co-financed eighty-nine (89) risk informed community development projects, to a total value of FJ$3.4 million. Around 14,200 people in rural communities are estimated to have benefitted.

6) The REDD-Plus (Reducing Emissions from Deforestation and Forest Degradation) Policy

80. The REDD-Plus Policy of Fiji aims to lessen emissions from deforestation and forest degradation and also illustrate how investments in disaster risk mitigation measures will rise in Fiji from 2016 to 2023.

7) Community Development Initiatives

81. NDRMO conducts Community Based Disaster Risk Management (CBDRM) training at the community level in partnership with Non-Government Organizations (NGOs) including Partners in Community Development in Fiji (PCDF), Adventist Development Relief Agency (ADRA), and Live and Lean Fiji. Based on the lessons learnt from TC Winston, the development of a standard CBDRM manual has been developed through Australian Humanitarian Partnership (AHP) Disaster Ready Phase 1 programme.

8) Climate Vulnerability Assessment (CVA)

82. In order to assess and measure the impacts of climate change and DRR in a more suitable manner, the Government of Fiji has adopted the Climate Vulnerability Assessment.

9) Rural Water Sanitation Policy

83. In June 2021, the Cabinet approved a new Rural Water and Sanitation Policy, which is being implemented by WAF through the Government-subsidized Rural Water Supply programme and NGOs. It ensures the sustainable development of water resources and sewerage systems to benefit rural communities.

3.2 Administration Sector

1) Development of National Level Policies

84. Fiji has been a strong advocate in strengthening governance arrangements since the adoption of the Sendai Framework for Disaster Risk Reduction (SFDRR). At the World Humanitarian Summit in Istanbul May 2016, Fiji announced its Post-TC Winston Disaster Response Agenda to transform adversity into disaster and climate resilience through the National Humanitarian Policy. This Policy was endorsed by Cabinet in 2017.

85. In addition, the National Disaster Risk Reduction Policy (NDRRP) was formulated thereafter and endorsed by cabinet in 2019.

2) Legislative review and establishment of localized coordination systems

86. The Government is working towards creating an enabling environment and promote an all of society approach. To accomplish this, the following initiatives have taken place;

- Fiji's disaster legislation reinforces the establishment of NDMC which comprises of all key Government agencies, the Fiji Council for Social Services (FCOSS) and FRCS. This membership allows the Disaster Controller and Coordinator to collate and triangulate information from all sectors and make informed decisions.
- Furthermore, the Fiji Cluster system was established at the national level to coordinate and collaborate with all key humanitarian actors involved in DRR. The National Cluster System was instituted following TC Evans in 2012 and was put to test for the first-time during TC Winston in 2016. The Fiji Cluster system is currently led by appropriate Permanent Secretaries of line Government Ministries and co-led by the United Nations (UN) and local NGOs.

- The Government has ventured into creating online data collection platforms to capture real time data more efficiently. Also included is the collation of 'Who's doing, What and Where" - commonly known as '3Ws update' from clusters that helps map out areas assisted and identify gaps where the Government and partners can strategically direct assistance. FCOSS is also undertaking a lot of work complimenting Government's coordination efforts.

- Fiji is currently in the process of reviewing its disaster legislation. One of the main purposes of the review of the Natural Disaster Management Act 1998 is to develop a way forward to overcome the overlapping roles in administrative boundaries and to create a stronger sense of shared responsibility for DRR and DRM in Fiji. It also aims to promote disaster risk governance and incorporate emerging issues.

- The Rights of Persons with Disabilities Act 2018; The Act has mainstreamed DRR into its Implementation Plan and the NDRRP acknowledges the need to engage people with disabilities in all facets of DRR since they are particularly vulnerable to the effects of catastrophes. The Policy places a strong emphasis on the need to support an inclusive and accessible DRR strategy that considers the requirements of individuals with disabilities.

3) The Fijian Presidency of the Twenty-Third Conference of the Parties (COP23)

87. In 2017, Fiji's Prime Minister was the COP23 President. Fiji became the first Small Island State to take on the presidency of the Conference of Parties of United Nations Conventions on Climate Change. The main agenda issues of the COP23 were endorsed that is, to advance the implementation guidelines of the Paris Agreement and prepare for more ambitious action through the Talanoa Dialogue of 2018.

4) *Governments Commitment to climate action*

88. The Government is committed to climate action to ensure Fijians are protected from the impacts of climate change. The Government has allocated financing towards building community resilience against climate change.

3.3 Infrastructure Sector

1) Road Infrastructure

89. The increased frequency and intensity of extreme weather events coupled with the projected impacts of climate change have resulted in the paradigm shift in FRA's planning, design, and funding of capital projects. This paradigm shift has been implemented by FRA to account for projected increases in sea-level rise and extreme weather events. In addition, FRA has incorporated disaster management and mitigation measures into planning.

90. The Australian Infrastructure Financing Facility for the Pacific (AIFFP) support provided to the Fiji Government in 2022 with FJ$ 117 million in financing to support the restoration and upgrade of key roads and bridges in Fiji. Under the financing package, the Government will ensure that upgraded assets will have climate resilience, a design life of 100-years, and the ability to withstand a one in 100-year rainfall event.

2) Build-back-better approaches

91. Fiji continues to invest in scientific research and human capital to foster resilience and adaptation. In the aftermath of the TC Winston in 2016, a Category 5 cyclone, Fiji adopted the 'build back better' principle and built more than 350 schools and thirty (30) public buildings. A total of sixty-three (63) schools, and seventy-seven (77) buildings were in the path of TC Yasa in 2020, also a Category 5 cyclone, and withstood destructive winds when the cyclone passed through the Fiji Group.

92. Habitat Fiji's Build Back Safer programme that was introduced to reduce disaster risk and improve resilience won a certificate of merit with a grant of US$15,000 at the 2017 UN Sasakawa Award for DRR.

3) Relocation Projects

a) *Overall of Relocation Projects*

93. The Government has deemed more than 800 communities across the country to be "at risk" from the impact of disasters and climate change.

94. In 2014, the Government relocated the community of Vunidogoloa in Vanua Levu, Fiji's second largest island. The community was moved to higher ground because seawalls were no longer able to prevent flooding and coastal erosion.

95. Landslide disasters due to tropical cyclones have struck Tukuraki Village in Viti Levu's highlands many times. To tackle the difficulty, the Tukuraki Village Relocation Project was developed, and in 2017, eleven (11) houses were built in a new and safer site with the EC designed to withstand up to a Category 5 cyclone.

96. In the following years, Narikoso Village was also relocated through the support of the Germany Agency for International Cooperation and Development (GIZ). Based on the lessons learnt from relocation initiatives, Fiji launched its National Relocation Standard Operation Procedure (SOP) on 18 April 2023.

b) *Narikoso Planned Relocation Project*

97. The Narikoso Planned Relocation Project relocated 7 houses in Narikoso village, Ono, Kadavu. The Project was co-funded by the Government, the European Union (EU) and GIZ under the Adapting to Climate Change and Sustainable Energy (ACSE) Program. The Project was implemented by NDRMO.

98. In addition to the relocation, the project also aimed to improve the livelihood opportunities of the Narikoso community. The total financial investment for the Narikoso Planned relocation was FJ$1.218 million. The Narikoso Planned Relocation Project was commissioned on 20 November 2020.

Source: NDRMO

Fig. 14 Photos of the completed Narikoso houses before commissioning.

4) *<u>Telecommunication</u>*

99. In Fiji, over 95% of the population have access to mobile service, yet only a third of the country's land area is covered, depriving many rural and remote areas of acceptable communication options. The Government has initiated a programme named "Connect the Unconnected" to give previously unconnected people in rural areas access to the internet.

100. This programme has made it easier for students in schools on outer islands to stay current on local, regional, and global news. It is vital to ensure that consumers have access to digital banking services.

5) Rural Housing Programme

101. The overall aim of the Rural Housing Programme, administrated by MRMDDM, is to eliminate homelessness in rural Fiji through the provision of affordable, durable and cyclone-resistant structures. In an on-going commitment to alleviate poverty while increasing standards of living in rural communities, the Government has been supporting this project through the allocation of funds for rural housing assistance.

6) Revision of Fiji's National Building Code

102. Fiji's Building Code is 40 years old since its initial development, and since 2022 through the support of the Asian Development Bank (ADB), this legislation is under review. With the housing sector recording significant damages in the aftermath of disasters, incorporating DRR measures into building codes will ensure sturdier building foundations, more damage-resistant building materials, better structural design to withstand strong winds or earthquakes, and making sure that structures have adequate drainage and flood protection.

103. In 2019, the Ministry of Industry, Trade, and Tourism (MITT) with technical and financial support from the World Bank and its consultants - Alexander & Lloyd Group, revised some phases of construction, from site selection to roof sheeting, and highlighted the importance of routine maintenance.

104. The National Building Code (NBC) governs the majority of construction in Fiji, but houses in iTaukei lands are exempt from this rule and are instead governed by local government systems connected to the iTaukei Affairs Board. The Guidelines for Improving Building Safety and Resilience of New Single Storey Houses and Schools in Rural Areas of Fiji Report offers recommendations for enhancing housing quality and implementing excellent construction techniques, particularly in rural areas threatened by natural disaster.

7) Improvement of the Water Services in Fiji

105. The renovation and repair of the Nausori Water Treatment Plant following TC Winston in 2016 is an illustration of DRR in the infrastructure sector of Fiji. Over half of Fiji's population live in the greater Suva area, which depends on the Nausori Water Treatment Plant for drinking water.

106. The Fiji Government initiated a project to rebuild and modernize the plant with the help of ADB, with a focus on enhancing resilience to disasters in the future. A new water intake structure, a new raw water pump station, new treatment machinery, and pipelines were all built as part of the project, which was finished in 2020. The renovated plant has improved the water delivery system's resistance to upcoming calamities, allowing it to tolerate greater flood levels and continue to provide water during protracted power outages. The project also included measures to increase stakeholders' capacity to manage catastrophe risk in the water sector and to promote the sustainability of the renovated facility. This includes teaching the WAF about asset management, catastrophe risk reduction, and emergency preparedness. An illustration of how DRR can be included into infrastructure projects to increase resilience to future disasters is the repair and upgrade of the Nausori Water Treatment Plant.

8) Fiji International Ports of Entry

107. There are seven (7) ports of entry on Fiji that are administered by the Fiji Ports Corporation Limited (FPCL). The FPCL launched the Green Port Master Plan, Timeline and Port Sustainability Guidelines. The Plan provides a high level road map to becoming 'The Green Port' of the South Pacific (FPCL, 2019). The initiatives under the Plan of FPCL includes improving waste management for both liquid and solid waste, the use of improved energy efficiency via the installation of LED lights and improved air conditioning system. In addition, FPCL and NDRMO conducted a table top tsunami evacuation exercise in 2019 to improve tsunami awareness and preparedness (FPCL, 2019).

3.4 Social Sector

1) All of society engagement and partnership

108. Fiji's NDRRP provides a framework that guides all sectors to mainstream DRR activities.

109. A whole-of-society community-inclusive approach is considered the most suitable for developing and prioritizing DRR policies and strategies. This approach allows affected communities to have a sense of ownership over their development priorities and fosters confidence while building strong partnerships. It also provides an opportunity for communities to gain a better understanding of disaster risks, enabling them to make informed decisions regarding DRR. In Fiji, the membership of the FCOSS in the Disaster Management Council, as mandated by the Natural Disaster Management Act (NDMA) 1998, ensures that the whole-of-society inclusive approach is implemented through the coordination of civil society organizations (CSOs). This ensures that the perspectives and contributions of CSOs are integrated into the decision-making processes related to DRR.

110. The involvement of local communities is essential in preparing for and responding to disasters. In Fiji, communities take the lead in providing immediate assistance and support to those affected by disasters. Within hours of a disaster, relatives, neighbours, and CSOs step in to conduct search and rescue operations and provide basic necessities to the injured and families who have lost their homes. Given this crucial role, it is important for communities to actively participate in planning, decision-making, and the development of strategies related to DRR and environmental/disaster risk governance. Their input is vital in formulating effective strategies that can reduce loss of life, protect livelihoods, and minimize damage to infrastructure.

2) Market for Change (M4C)[2]

111. The UN Women and UNDP are collaborating on the Markets for Change (M4C) Programme in Fiji, Vanuatu, and the Solomon Islands. This six-year project aims to transform markets in both rural and urban areas into inclusive spaces that promote gender equality and empower women. In Fiji, the project focuses on thirteen (13) markets, including Sigatoka, Nadi, Namaka, Lautoka, Ba, Tavua, Rakiraki, Nausori, Suva, Levuka, and Vunisea in Kadavu, Labasa, and Savusavu. These markets play a crucial role in the social and economic advancement of women as many vendors are women. The M4C initiative aligns with the broader goal of Pacific Women's Economic Empowerment by creating safe, productive, and sustainable employment opportunities for women, with a specific focus on female market vendors.

[2] https://www.undp.org/pacific/projects/markets-change

3) Innovation technologies to manage disasters in Fiji

a) *Find your Evacuation Center*

112. In 2020, NDRMO of Fiji introduced the "Find your Evacuation Center" messaging platform. This platform serves as a valuable resource for all Fijians. It enables users to locate their nearest EC and offers guidance on safety measures to be taken during a disaster. The platform aims to enhance preparedness and ensure the well-being of individuals in times of emergencies.

b) *Family Safety Plan (FSP) Mobile Applications*

113. The FSP Mobile App is a project led by Save the Children (Fiji) in collaboration with NDRMO, Ministry of Education, and local communities.

114. The project aims to promote risk reduction and resilience at the household level. FSP, designed to be child-friendly, educates and informs families about assessing and reducing risks, provides guidance for responding to hazards, and encourages active participation of children in family safety and resilience. Data collected from the app is used to inform decision-making on risk reduction and resilience.

c) *Flood Forecasting and Warning System*

115. NDRMO is collaborating with the Korea National Disaster Management Institute to develop and execute a flood forecasting and warning system. The project involves the installation of the Flood Forecasting Alert System (FFAS) and the Automatic Rainfall Warning System (ARWS), along with the operation of a training and education program. The initial implementation of this project is focused on the province of Ba, which is the largest province in Fiji. The project aims to expand its coverage to other regions of Fiji in the future. The primary objective of the system is to enhance flood forecasting and provide timely warnings to mitigate the impacts of floods in vulnerable areas.

d) *Invitation to join the Asia Disaster Reduction Center (ADRC)*

116. Fiji has the opportunity to become a member of ADRC. This membership would offer several benefits, such as participation in research programs, sharing information on disasters and DRR, accessing the Sentinel Asia Emergency Observation Request (EOR), and learning from other member countries with similar exposure to disasters.

Joining ADRC would provide Fiji with valuable resources, training, and knowledge-sharing opportunities for the NDRMO staff. Since adopting SFDRR, Fiji has made significant progress in the social sector of DRR, including strengthening community engagement, integrating DRR into development policies, promoting innovation and technology, and fostering partnerships and collaboration. These efforts have contributed to enhancing resilience and minimizing the impact of disasters on communities and economies.

4) Inclusive DRR

117. Fiji recognizes that DRR requires a multi-hazard approach and inclusive risk-informed decision-making based on the exchange of disaggregated data, including information on sex, age, and disability. The country is actively working to ensure that decision-makers have access to easily accessible, up-to-date, science-based data, complemented by traditional knowledge, particularly in crisis situations.

118. Fiji has taken steps to strengthen data collection and analysis for a more targeted and efficient response. During the response to TC Yasa and Ana, the country trailed a development of multisectoral assessment forms on an online platform that included disaggregated data. This marked Fiji's first online-based rapid data collection for a large-scale event. Since then, NDRMO has been working to enhance digital data assessment systems and the processing of complex data sets to better serve communities and ensure inclusivity for all.

5) Traditional Knowledge

119. Traditional bure, a type of traditional housing, is still prevalent in some villages and settlements across Fiji. These structures have demonstrated their resilience in withstanding strong cyclones. Navala Village in the Ba Province serves as a notable example, where many buildings are traditional bure. In cyclone-prone areas, traditional houses have shown to be well-adapted to withstand cyclone hazards effectively. Furthermore, traditional housing in the Pacific exhibits resilience against earthquakes due to their ductility, allowing them to bend and sway without collapsing. It is crucial to preserve and maintain traditional coping mechanisms such as traditional bure as a valuable means of mitigating the impact of disasters.

4. NDRRP Monitoring & Evaluation

120. The National Disaster Risk Reduction Policy 2017-2030 (NDRRP) is the Government’s guideline for the integration of disaster risk reduction into development planning systems and processes.

121. NDRRP was launched in 2019 by the Prime Minister of Fiji and NDRMO has been responsible for creating awareness and fostering ownership among Government agencies for the implementation of the NDRRP action items.

122. NDRRP is Fiji's contextualization of SFDRR and identifies key disaster risk reduction priorities for the country in light of its status of one of the world's most at risk countries to the impacts of climate change and inherent vulnerabilities such as being a Small Island Developing State (SIDS), having a narrow economic base, distance from major markets and trading partners and a population that is mostly concentrated along coastlines.

123. NDRRP has a total of 122 action items which are to be implemented in three phases, namely Phase 1 from 2018-2022, Phase 2 from 2023-2023 and Phase 3 from 2027-2030. These action items have been assigned to Government agencies for implementation according to their respective mandates and areas of expertise. NDRMO has formulated a Monitoring and Evaluation (M&E) Guideline (Guideline) aimed at tracking the progress of implementation of the NDRRP action items over the duration of the Policy. The draft Guideline has been discussed with Government agencies over the course of three (3) workshops in which outcomes, indicators and activities to be used in tracking the implementation of NDRRP action items were finalized.

124. Government agencies have shown a preference for a quantitative M&E system over a more qualitative assessment of progress and thus the draft M&E Guideline assigns percentages to activities that contribute to each output (See Table 8). In this way, progress of implementation is easily quantified, and trend analysis may be calculated over the duration of NDRRP. It also allows for the identification of action items that may be lagging in implementation and for corrective actions to be undertaken.

Table 8 Example of NDRRP Monitoring and Evaluation Guideline

#	**Action Item**				
2	<u>DRR Monitoring Committee and DRR Monitoring Unit</u> Establish a new DRR Monitoring Committee under the National Disaster Management Council and a new DRR Monitoring Unit in the NDRMO to follow-up, periodically assess and report the progress on the action items of the NDRRP				
	Questions for Verification of Indicators	**Contributory Activities**	**How to Answer**	**Weighing Criteria**	**Percentage Progress**
1	New DRR Monitoring Committee Established.	1. Consultations with line agencies 2. Draft Concept Note, TOR etc. for new DRR Committee 3. Cabinet Endorsement 4. Inclusion into NDMA	Rate (xx %)		
2	GEDSI assessment training is carried out	1. Consultations 2. Training and Logistics	Rate (xx %)		

	Questions for Verification of Indicators	Contributory Activities	How to Answer	Weighing Criteria	Percentage Progress
		Plan 3. Training Conducted			
3	New DRR Monitoring Unit in the NDRMO Established	1. Consultations with line agencies 2. Draft Concept Note, TOR etc. for new DRR Monitoring Unit 3. Draft Cabinet Paper for new Unit 4. Cabinet Endorsement	Rate (xx %)		
	Please attach the relevant documents		Free text		
	(Total)			100	

Source: NDRMO

125. The M&E system assigns weights to each contributory activity in order to determine the relative importance of each activity towards the respective action item. These weights have been determined and agreed upon by Government agencies.

126. Upon the finalization of the M&E system, NDRMO will then host it on the NDRMO's website for Government agencies to update the progress of their respective action items online. NDRMO will also draw up a SOP that will clearly articulate to Government agencies the methodology of how they are to update their progress of implementation online.

127. The formulation of the NDRRP M&E Guideline has coincided with NDRMO's shift in its interaction modality with Government agencies. Over the course of discussions with Government representatives, they have expressed their desire to have more regular meetings to discuss potential synergies and collaboration in the implementation of the NDRRP action items. As a result, NDRMO has clustered Government agencies into four (4) Technical Working Groups (TWGs) based on thematic groups namely, Administrative, Economic, Infrastructure and Social. These TWGs have been instrumental in providing their sector specific lenses into the Guideline and will continue to be critical to the overall coordination of the NDRRP's implementation.

128. The formulation of the NDRRP M&E Guideline is timely as NDRMO will be conducting the Mid Term Review of the NDRRP in 2024. Updates from Government agencies have been instrumental and feeds into the Government's periodic updates on the implementation of SFDRR targets and outputs. The NDRRP M&E will therefore be key in providing statistical evidence of Fiji's progress towards the implementation of SFDRR and also provide a baseline for Fiji's successor disaster risk reduction framework post 2030.

5. Outline of activities of NDRMO in FY22-23

129. The Fiji NDRMO was actively engaged in a wide range of disaster risk reduction and disaster management activities during the Financial Year (FY) 2022-2023. Outline below is a summary of the key activities and achievements mentioned:

5.1 Policy Making

130. Efforts were made to build and strengthen networks and reporting mechanisms for stakeholder engagement during all phases of emergency operations.

1) National Disaster Management Council

131. NDMC meeting held on 28 October 2022 addressed critical aspects of disaster preparedness and response in Fiji. Several key initiatives were discussed and endorsed to enhance the country's resilience and capacity to manage disasters effectively.

132. Firstly, the Flood Taskforce was established with clear objectives to strengthen community awareness, address drainage issues, and ensure road safety measures to mitigate flood-related hazards. The planned nationwide cleanup campaigns and collaborative efforts with various stakeholders demonstrated a proactive approach to address flood risks.

133. Secondly, the formation of the Fiji Emergency Management Training Advisory Group (EMTAG) signifies a commitment to fostering lifelong learning and professional development in disaster management. EMTAG's role in providing strategic advice and coordinating learning initiatives among member organizations is crucial for building a skilled and knowledgeable workforce.

134. Thirdly, the Country Preparedness Package (CPP) represents a significant collaboration between the government and international actors to strengthen disaster preparedness and response mechanisms. By aligning international support with national priorities and systems, the CPP ensures a coordinated and needs-based approach to humanitarian assistance.

135. Lastly, the National Operational Readiness Check (ORC) conducted annually before the cyclone season plays a pivotal role in assessing and updating operational readiness levels. This initiative facilitates efficient coordination and deployment of resources, enhancing the effectiveness of disaster response efforts.

136. Furthermore, committee meetings focusing on preparedness, emergency response, and mitigation measures underscore the comprehensive approach adopted by Fiji to address potential tropical disturbances and cyclones in the FY 2022-2023. These committees include;

i. Preparedness Committee

ii. Emergency Committee

iii. Mitigation & Prevention Committee

137. These initiatives reflect Fiji's proactive stance in disaster management, emphasizing collaboration, capacity building, and strategic planning to safeguard lives, infrastructure, and livelihoods from natural hazards and emergencies.

2) Review of the Natural Disaster Management Act

138. The review and the update of the Natural Disaster Management Act continued in 2020 despite the limitations posed by the COVID-19 pandemic. The most significant update to the current legislation will be the change to the title of the Act to “National Disaster Risk Management Act”. This will ensure that the updated legislation encompasses natural and human induced disasters and to ensure alignment to the 1995 National Disaster Management Plan.

139. A workshop was conducted at the Naviti Resort to discuss the proposed revisions of the 1998 Natural Disaster Management Act. The workshop was held from 14-18 September 2020.

140. The workshop participants were from NDRMO, the Solicitor General’s Office, International Federation of the Red Cross and Red Crescent Societies (IFRCS) and the Pacific Community (SPC).

141. NDRMO is working to complete the Act review and submit to Cabinet before the end of the FY 2022-2023.

5.2 Disaster Response

1) Emergency Water Supply

142. They forecasted and facilitated the supply of emergency water to affected communities during disasters.

5.3 Disaster Preparedness

1) Suva Tsunami Siren Testing

143. NDRMO in partnership with the Mineral Resources Department (MRD) under the Ministry of Lands and Mineral Resources conducts testing of the thirteen (13) Tsunami Sirens along Suva Peninsula. These tests are scheduled for the fifth day of every month unless rescheduled by senior management.

2) Installation of High Frequency Radios

a) Background

144. In 2017, NDRMO with the technical assistance of the World Food Program (WFP) conducted a communication assessment in the Northern Division to assess the status of their communication equipment and identify problem areas that needed to be rectified in in order to sustain continuous telecommunications during and after a disaster. The telecommunication assessment team visited the nine (9) EOCs in the Northern Division and found that they needed to be upgraded due to the unavailability of spare parts and deterioration of the telecommunication infrastructure.

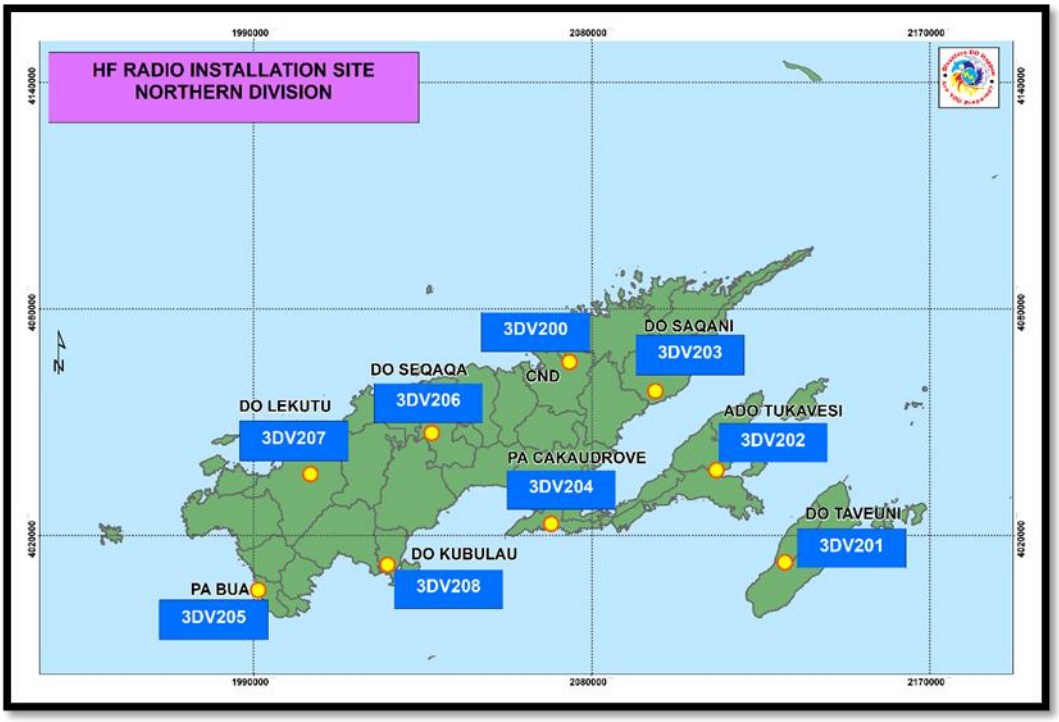
145. Based on the assessment findings, it was recommended that an upgrade of the Commissioner Northern Division telecommunication system was required to have a continuous, reliable emergency High Frequency (HF) communication platform and interoperability with existing systems with first responders like FPF, RFMF and NFA. The upgraded platform must be capable of providing email, fax data and internet through the current High Frequency Radio (HFR) system free of charge during any contingency. The system should also be easily dismantled for safe keeping before disaster strikes and quick set up straight after the disaster, doing away with the old permanent structure set up.

146. The HFR system will ensure that all Fijians will receive quick information, understand the threat of a cyclone and other risks as well as receiving ample warning to get prepared before any natural disaster. Furthermore, the HFR system will be under the duty and care of NDRMO and will be solely used to provide dissemination of early warning message to the divisional, district offices and to communities.

b) Implementation and Funding

147. The project was funded through the Government of Japan's Grass Roots Grant Program in enhancing NDRMO's communication capabilities through the Project for the Upgrading of High Frequency Communications to NDRMO. In addition, Live and Learn Fiji donated nine (9) desktop computers towards the Project.

148. RFMF also provided additional manpower to assist in the installation of the HF Radios. Professional Electronic PTE Ltd was awarded the contract to install the nine (9) HF Radio upon satisfactory completion of Government procurement regulations. Despite the COVID-19 restrictions the team completed the installation work by mid-October, 2021. The total funding for the project provided by the Government of Japan is FJ$ 179,000.00.



Source: NDRMO

Fig. 15 Map of Northern Division Emergency Operations Center Locations with Station Call Sign

3) <u>National Disaster Awareness Week</u>

a) Background

149. National Disaster Awareness Week (NDAW) is an annual event mandated under NDMA 1998. NDAW is aligned to the International Day for Disaster Risk Reduction, which is held annually on 13 October. This event aims to enhance the level of disaster preparedness of communities and assist in the reduction of damages and losses that may occur if a disaster strikes. It also assists in preparing communities for the beginning of the Cyclone Season in November.

b) United Nations International Day For Disaster Risk Reduction National Disaster Awareness Week 2022

150. The commemoration of the United Nations International Day for Disaster Risk Reduction (UNIDRR) and the launch of the National Disaster Awareness Campaign coincided on Thursday 13 October. The 2022 edition continues under the "Sendai Seven" campaign, which centers on the seven (7) targets of SFDRR. In 2022 the theme focused on Target G: “Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to the people by 2030.”

151. The objectives of the National Disaster Awareness Week (NDAW) are:

i. To strengthen community awareness and preparedness towards disasters;

ii. Provide an advocacy platform to highlight best practices and examples of international cooperation which have a positive impact on the lives of people who live in disaster-prone parts of the world i.e. reducing the numbers of people affected by man-made and natural hazards;

iii. To empower children in disaster risk management & risk reduction; and

iv. To enhance working relationships between key stakeholders.

152. The 2022 NDAW was conducted at the Laqere Market Car park space, in Nasinu on 3 November, 2022 with the theme “early warning early action for all”. The Honourable Inia Seruiratu, Minister responsible for Disaster Management launched the NDAW event. A grant of $65,000 was given by New Zealand MFAT for the 2022/2023 NDAW Week; In addition, balance from NDAW 2021/2022 totalling to $27,877.39 complemented this funding for this event. A total of $60,905.05 expenditure was incurred for this activity.

4) <u>NDRMO Key Documents</u>

153. In FY 2021-2022, NDRMO was able to develop and launch NEOC SOPs and the EC Management SOPs. NDRMO was also able to develop and launch the NDRMO Logistics Manual.

154. In FY 2022-2023, NDRMO reviewed disaster legislation and initiated the formulation of guidelines related to tsunami evacuation, EC retrofitting, country preparedness, disaster volunteerism, and updated the NEOC SOP.

5) Disaster Risk Information

155. NDRMO has strengthened it's disaster risk information system, including the development and launch of the NDRMO website and the establishment of the Disaster Risk Information System.

5.4 Training Activities

156. NDRMO undertakes two major training activities which are; CBDRM training and Working in an Emergency Operation Center (WEOC).

157. For FY 2022-2023, NDRMO was allocated $10,000 for its Training Budget and as at the end of 31st July 2023 utilized $9,963.86. Expenditure incurred was on the preparation for the National Emergency Response Training and Training Allowances and logistics for officers that attended overseas training. These were trainings that are cost shared with the Ministry.

1) Community Based Disaster Risk Management Training

158. Efforts were made to improve public knowledge, attitudes, and practices related to disaster response and risk reduction. This included national and community awareness campaigns and CBDRM training.

159. CBDRM Committees: The NDRMO established CBDRM committees to enhance community engagement and preparedness.

2) Working in an Emergency Operation Center

160. The WEOC training facilitated by NDRMO teaches civil servants and first responders the proper procedures and processes while working in an EOC during a disaster operation. A total of three (3) WEOC trainings were conducted across the four (4) divisions and funded by Live and Learn during this reporting period.

5.5 Global Partnerships

1) Government of Fiji Support To New Zealand For Tropical Cyclone Gabrielle

161. Severe Tropical Cyclone Gabrielle (TC Gabrielle) was an extremely intense TC which hit the North Island of New Zealand (NZ) as well as parts of Vanuatu and Australia.

162.

163. It was the costliest TC on record in the Southern Hemisphere, with damages estimated to be at least NZ$13 billion (US$ 8.12 billion), and it additionally was the most intense Cyclone to hit New Zealand since Cyclone Giselle in 1968, surpassing Cyclone Bola in 1988.

164. NDRMO was in communication with the New Zealand Emergency Management Agency (NEMA), who stated their need for surge support assistance in the form of emergency management specialists to supplement their efforts in coordinating the response to TC Gabrielle.

165. RFMF also liaised with the New Zealand Defence Forces (NZDF) in the deployment of RFMF personnel to assist in the response and early recovery efforts for TC Gabrielle.

166. The Government of Fiji formally offered its support to the NZ Government on 19 February 2023 which was duly accepted by the NZ Government. In that regard, the Government of Fiji sent a humanitarian assistance team to New Zealand to assist in the response and recovery effort. The Government of Fiji humanitarian assistance team included the following;

(i) **NDRMO (5 pax) -** The NDRMO team consisted of emergency management specialists who provided surge support to NEMA in the NZ National Emergency Operations Centre. The NDRMO team was led by the Director NDRMO and members of the Emergency Planning and Coordination (EPC) team in NDRMO;

(ii) **RFMF (25 pax) –** The RFMF team comprised of an infantry and engineering platoon and was led by a Navy Lieutenant Commander and assisted by a RFMF Captain. The RFMF team liaised closely with the NZDF in the deployment of the RFMF contingent to affected areas to assist in response and recovery operations; and

(iii) **NFA (3 pax) -** NFA also sent three (3) personnel who were specialists in search and rescue operations to assist in the response effort.

167. Fiji's proactive response and deployment of specialised teams to support New Zealand in the aftermath of TC Gabrielle demonstrate the region's collective resolve to address complex challenges posed by extreme weather events. This collaborative response reflects the strength of regional partnerships and coordinated action by Fiji to support New Zealand.

2) Government of Fiji Support To Vanuatu For Tropical Cyclone Judy and Kevin

168. In response to the devastating TC Judy and Kevin that made landfall in Vanuatu in March 2023, the Government of Fiji deployed a fifty-five (55) member Rapid Response Team to assist the Government and people of Vanuatu recover from the impacts of the two Cyclones.

169. The Fiji Rapid Response Team comprised of officials from NDRMO, Fiji Emergency Medical Assistance Team and RFMF. The Rapid Response Team was led by the Commissioner Eastern Division, Mr. Vitale Varo and made key interventions in the areas of Water, Sanitation and Hygiene (WASH), food security, health and the restoration of critical infrastructure for the people of Vanuatu.

170. The Rapid Response Team was deployed for a total of twenty-eight (28) days from 11 March 2023 to 12 April 2023 and worked with the Government of Vanuatu to identify, prioritize and implement activities that would assist in the quick recovery of the people of Vanuatu from the impacts of the two Cyclones. The RFMF component of the team was asked by the Government of Vanuatu to remain for a further fourteen (14) days to complete their work and eventually returned to Fiji on.

171. In summary, the deployment to Vanuatu was a success with key partnerships and relationships built and maintained in regards to regional deployments for disaster responses. The Rapid Response team assisted the Vanuatu National Disaster Management Office in the overall coordination and delivery of the response to TC Judy and Kevin and was instrumental in supporting the Vanuatu Ministry of Health deliver quality medical services to the affected population. The team also played a key role in the resumption of school and the delivery of public services as they repaired three schools that had classrooms damaged by cyclonic winds and assisted in the repair and clean-up of public and health facilities.

172. The Rapid Response Team broke new ground by going down to communities to engage in targeted interventions involving the delivery of food rations, conducting of quick fixes, debris clearance and free medical checks for community members. A total of three (3) communities were assisted in this manner.

173. Key achievements for Fiji Rapid Response Team to Vanuatu were as below;

- 4 WASH facilities installed in communities
- 5 major public buildings repaired
- 3 community quick fixes completed
- 1,000 food ration buckets and 1,200 cartons of water distributed to communities

- 2000 plus patients reviewed and screened by Fiji Emergency Medical Assistance Team
- 3 community interventions completed

3) *Mid Term Review of Sendai Framework for Disaster Risk Reduction at the United Nations in New York*

a) *Outline*

174. The High-Level Meeting (HLM) of the General Assembly on the Midterm Review of the Sendai Framework for Disaster Risk Reduction (MTR-SF) was convened in-person by the President of the seventy-seventh session of the United Nations General Assembly in New York on 17-19 May 2023.

175. Globally the midterm review of SFDRR was expected to inform policy adjustments, implementation modalities and recovery from the COVID-19 pandemic and generate critical analysis and formulate recommendations for prioritised, accelerated and integrated for action in the period 2023 to 2030 and beyond. It also generated learning and recommendations that are grounded in country-level experience.

176. Specifically for the Pacific, MTR-SF informed:

> *A "Pacific Resilience Outlook" – identifying on a regional scale what has worked, what has stalled, and what has failed in terms of achieving global and regional target; Impact stories charting successes and failures of Sendai Framework implementation, particularly at the local level; Implementation of relevant regional and national polices; and recommendations and the provision of a roadmap for achieving key Sendai Targets, identifying barriers and suggesting enabling activities*

177. The HLM featured a plenary segment specifically designed for high-level representatives who were also present for the adoption of the political declaration. The political declaration and outcomes of the HLM generated policy guidance to support the integration of risk reduction in the global agreements/processes under review in 2023 and 2024, including the 2030 Agenda, the Paris Agreement, the International Water Decade, the New Urban Agenda, the successor programmes of action to the SIDS Accelerated Modalities of Action Pathway (SAMOA Pathway) and the Vienna Programme of Action for the Landlocked Developing Countries (LLDCs), the post-2020 biological diversity framework, and potentially work towards building sustainable food systems, and just and equitable energy transitions.

b) Fiji's Participation

178. The Fijian Delegation was led by the Minister for Rural and Maritime Development and Disaster Risk Management, Hon. Sakiasi Ditoka along with the following senior officials;

i. Acting Permanent Secretary for Rural and Maritime Development and Disaster Risk Management, Mr. Mitieli Cama;
ii. Director National Disaster Risk Management Office (NDRMO), Ms. Vasiti Soko;
iii. Director Women, Ms. Selai Korovusere;
iv. Commissioner Western Division, Mr. Apolosi Lewaqai;
v. Manager Risk Management and Research NDRMO, Mr. Naipolioni Boseiwaqa;
vi. Senior Aid & Humanitarian Coordination Officer NDRMO, Ms. Prishika Nadan; and
vii. Senior Communications Officer NDRMO, Ms. Aqela Susu.

179. The Fiji delegation participated in the following sessions;

i. Panel at the Side event on Next generation disaster risk analytics: Strengthening the DRR Data Ecosystem to meet tomorrow's global challenges
ii. Moderator at the Side Event on Accelerating Action for Gender Responsive Disaster Risk Reduction
iii. Speaker at the Side Event on DRR and SIDS successor framework SAMOA and Sendai: Twin pillars for a Resilient, Gender- Responsive and Productive Future in all Small Island Developing States
iv. Panellist at the Side Events on Roles states for promoting investments in DRR towards resilient and sustainable futures
v. Plenary session on Charting liveable pathways for humans and nature whereby Head of Fiji Delegation delivered National Statement and Regional statement as the current Chair of the Pacific Islands Forum Leaders;
vi. Leaders roundtable meeting

180. Apart from the above sessions, a total of nine (9) bilateral meetings were held with the following countries/organisations;

i. Maldives Minister for Defence and National Disaster Management, Her Excellency Mariya Ahmed Didi
ii.

iii. United Nations Office for Coordination of Humanitarian Affairs (UNOCHA) Director Operations and Advocacy Division, Ms. Eden Worsonu

iv. United Nations Office for Disaster Risk Reduction (UNDRR) Special Representative of the Secretary General (SRSG), H.E. Mami Mizutori

v. Japan Parliamentary Vice-Minister for Disaster Management, H.E. Mr. Hideyuki Nakano

vi. Norway Minister for Justice and Public Security, Ms. Emilie Enger Mehl

vii. German Head of Delegation, Parliamentary State Secretary of the Ministry of the Interior and for Community, H.E. Mr. Johann Saathoff, SPD

viii. Indonesia Head of delegation, Deputy Minister for System and Strategy, H.E. Mr. Raditya Jati,

ix. Australia's Humanitarian Coordinator, Humanitarian Division of the Australian Department of Foreign Affairs and Trade (DFAT), Ms. Beth Delany

x. Administrator of the United Nations Development Programme, Mr. Achim Steiner

c) Fiji's Progress

181. Fiji is a party to the SFDRR and has formulated its own NDRRP, which is an adaptation of SFDRR and outlines strategies and activities to be carried out by Government and stakeholders in the integration of disaster risk reduction into development systems and processes. NDRRP has 122 action items that have delegated to Government agencies to implement according to their respective mandates and areas of expertise.

182. The Government of Fiji through NDRMO had conducted several workshops with Government stakeholders in raising awareness and providing guidance on the implementation of NDRRP. The work of mainstreaming DRR is well underway and the NDRMO has formulated a monitoring and evaluation guideline that is to track the implementation of the NDRRP action items.

183. NDRMO had conducted stock take workshops on the progress of DRR in Fiji with Government agencies and CSOs in partnership with FCOSS in the lead up to MTR-SF. This was then used to collate their progress towards SFDRR targets and complete Fiji's report for MTR-SF. This report was be tabled to cabinet and was approval prior to the meeting in New York.

184. Fiji's SFDRR Mid-Term report was shared with partners during the meeting in New York and was referenced in Fiji's country statements and bilateral meetings.

d) Way Forward for Fiji

185. The NDRMO will continue to create more awareness amongst all stakeholders on the NDRRP and its linkage to SFDRR targets and priorities. Through the establishment of the M&E framework for NDRRP, NDRMO envisages to present a clear quantitative picture of where Fiji stands in its achievements against the Sendai Framework targets. This will have to be an on-going initiative backed up with efficient resources to support data collection and updating of the M& E framework.

4) *Global Platform for Disaster Risk Reduction*

a) Outline

186. The Fiji Government sent a delegation to attend the Global Platform for Disaster Risk Reduction (GP 2022) which was held at the Bali Nusa Dua Convention Center (BNDCC) and at the Bali International Convention Centre (BICC) in Bali, Indonesia between 23- 28 May 2022.

187. The overall theme of the GP 2022 was; From Risk to Resilience: Towards Sustainable Development for All in a COVID-19 Transformed World. This focused on how the COVID-19 pandemic had challenged the traditional understanding of risk and disaster risk governance. It also explored how the global crisis could be turned into an opportunity for the necessary radical transformation needed to achieve the goal and targets of SFDRR, as well as of the 2030 Agenda.

b) Recommendations for Fiji

i. To have a pre-event meeting specifically for SIDS before the upcoming Asian Ministerial Conference for Disaster Risk Reduction. This to be implemented in conjunction with Pacific Islands Forum Secretariat (PIFS) & The Pacific Community (SPC).

ii. Systematic collection of disaster risk data and risk assessment by all key stakeholders working in the disaster space. Such risk data to be hosted by the Meteorological Service/National Disaster Management Organization.

iii. Create and integrated and comprehensive framework which clarifies the roles, responsibilities and relationships with all players in the disaster space.

iv. Strengthen all the components of Fiji's Multi-Hazard Early Warning System and address existing gaps too.

v.

vi. All technical agencies (FMS, MRD, Health, etc.) to implement Common Alert Protocol (CAP) to allow all warning messages for all types of hazard to be consistently disseminated simultaneously over many warning systems to many warning applications.

5.6 Disaster Risk Management Initiatives

1) Mainstreaming of Disaster Risk Reduction

188. The Project for Mainstreaming Disaster Risk Reduction is funded by Japan International Cooperation Agency (JICA). The project commenced in December 2020 and is scheduled to close in the second quarter of 2025. The total budget for the project is FJD $6.4 million. The project purpose and outcomes are provided below;

Overall Goal: DRR Activities in the NDRRP roadmap are implemented under the coordination of NDRMO.

Purpose: Capacity of NDRMO is strengthened to implement and promote DRR activities in line with the international, regional and national policies.

Output 1: Hazard / Risk Assessment (Working Group 1)

Output 2: Local DRR Plan (Working Group 2)

Output 3: DRR Projects Promotion (Working Group 3)

189. Under the three (3) Working Groups (WG) outputs are led by NDRMO personnel and supported by technical expertise provided by contracted experts. The project implementation involves NDRMO organising consultation(s) with government agencies and statutory bodies.

190. The second Joint Coordination Committee (JCC) meeting was held in June 2023, the meeting was attended by Government stakeholders. The JCC meeting allowed NDRMO to update stakeholders on the status of project implementation.

2) Women's Resilience to Disasters Program

191. The Women's Resilience to Disasters (WRD) Program is administered by the UN Women and implemented by Ministry of Women and NDRMO.

192. The WRD Programme is fully funded by the Government of Australia. The total budget for the programme is AU$13.5 million. The project duration is from June 2021 to June 2005 and; the outcomes of the programme are;

Outcome 1: Prevention, preparedness, and recovery policy frameworks, systems, processes, and tools are gender-responsive and implemented as a result of local women's and girls' advocacy.

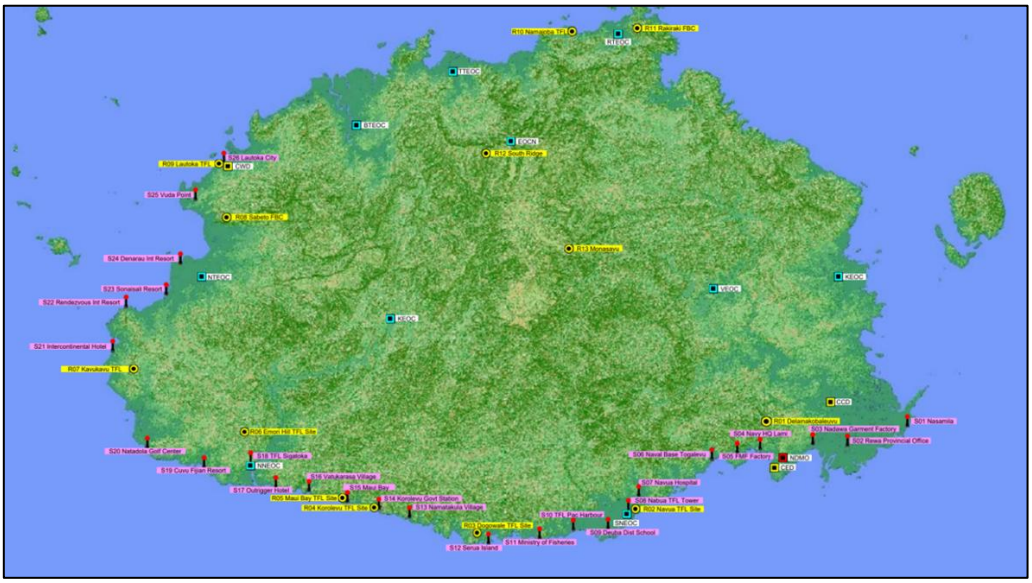
Outcome 2: Women and girls have voice and agency to withstand multiple hazards, recover from disasters, and increase their resilience to future crises.

193. The WRD Program will be implemented in Fiji, Kiribati, Vanuatu and Solomon Islands. Programme implementation will be driven at country level and supported by regional and global components. A consultant will be hired under the program to assist NDRMO with strengthening gender and disability components of NDRMO Policies and SOPs.

3) <u>Digital Radio System and Siren Project</u>

194. NDRMO through the partnership with the Government of Japan and the Japan International Cooperation System (JICS) is currently implementing the Digital Radio System and Siren Project. This Project will see the extension of the current tsunami siren network where an additional thirty-three (33) tsunami sirens will be installed between Nasamila Primary School Compound, Nasilai/Kiuva, Tailevu to a yet to be determined site in Rakiraki town.

195. The Project will also see the installation VHF Radio set within selected EOCs in the Central and Western Divisions. The total budget for this initiative is approximately FJ$13.9 million. NDRMO has already scoped the potential siren and EOC sites.



Source: NDRMO

Fig. 16 Map of the Proposed Tsunami Extension Sites

4) Planned Relocation Standard Operating Procedures

196. NDRMO is part of the Fiji Taskforce on Relocation and Displacement, as a member of this taskforce NDRMO is significantly involved in the development of the Planned Relocation SOP. This SOP operationalizes the 2018 Planned Relocation Guidelines and provides guidance to Government when relocating communities affected by the impacts of climate change and disasters.

197. The Climate Change and International Cooperation Division (CCICD) with assistance from GIZ led the consultation process for the development of the SOPs. The SOPs has a Comprehensive Risk Vulnerability Assessment Framework (CRVAF) which is a tool to assess the viability of communities who have requested to be relocated.

198. In addition to the CRVAF, the SOP has a Monitoring, Evaluation, Reporting, Assessment and Learning (MERAL) framework which is currently under development. The SOP has been launched by the Government of Fiji on 18 April, 2023.

5) Coalition for Disaster Resilient Infrastructure

199. NDRMO and the Coalition for Disaster Resilient Infrastructure (CDRI) are in continued discussions on potential areas of collaboration. In addition, NDRMO and CDRI collaborated in the formation of Infrastructure Resilient in Island States (IRIS). This was highlighted during COP 27 held in Sharm El-Sheikh, Egypt where NDRMO prepared the speaking notes for the Fiji delegations' presentation for the IRIS Session: Accelerating Resilient Infrastructure in SIDS- IRIS Call for Proposals.

6) Integrated Water Resources Management Program

200. The development of the Integrated Water Resources Management Program (IWRMP) is led by the Department of Water and Sanitation (DWS) under the Ministry of Public Works, Transport and Meteorological Services and Transport. NDRMO is responsible for the Flood Component of IWRMP, NDRMO has attended and contributed to consultations organized by DWS. NDRMO will work with the National Flood Taskforce to further develop this initiative.

7) Humanitarian Day Statement

201. They formulated a statement for World Humanitarian Day, highlighting the importance of humanitarian efforts.

202. Overall, the NDRMO in Fiji undertook a comprehensive set of activities to enhance disaster preparedness, response, and risk reduction in collaboration with various stakeholders during the specified financial year. These efforts aimed to make Fiji more resilient to disasters and better equipped to protect its communities during emergencies.

END

National Annual Report on Disaster Risk Reduction 2023-2024

National Disaster Risk Management Office

Republic of Fiji

November 2025

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Message

Given Fiji's high vulnerability to disasters and the impacts of climate change, international cooperation in disaster management is of utmost importance. In particular, under the "Sendai Framework for Disaster Risk Reduction 2015–2030," Fiji is actively promoting Disaster Risk Reduction (DRR) efforts and formulating policies and strategies aimed at reducing losses caused by disasters. We also believe that by becoming a disaster-resilient nation itself, Fiji can play a leading role in enhancing disaster risk reduction capabilities across the Pacific Island countries.

The "Sendai Framework 2015–2030", which was adopted by the United Nation (UN) member states at the Third UN World Conference on Disaster Risk Reduction held in Sendai, Japan, on March 18, 2015, underscores the importance of local disaster management plans, advocating for an international framework to mitigate disaster risk and enhance the resilience of communities. The key significance of local initiatives within the Framework can be summarized as follows:

1. **Importance of Local Leadership and Planning**

The Sendai Framework highlights the vital role of local governments and community leadership in disaster risk management. Through local disaster management plans, risks specific to each region are identified, enabling the development of tailored actions that are essential to reducing disaster risks and protecting lives and property.

2. **Risk Assessment Aligned with Local Needs**

To understand unique regional disaster risks—such as earthquakes, floods, and landslides—detailed risk assessments at the local level are necessary. The Sendai Framework underscores that local disaster management plans, based on such assessments, play a critical role in safeguarding the lives and assets of residents.

3. **Community Participation and Strengthening**

Community involvement is indispensable for local disaster management. The Sendai Framework emphasizes that community understanding and participation in planning boost preparedness and resilience. Involvement fosters awareness and cooperation, which aids actual disaster response.

4. **Integration of Sustainable Development and Disaster Risk**

The Sendai Framework states that local disaster management plans should closely relate to sustainable development. Integrating disaster risk reduction efforts into development plans and policies at the local level is essential to achieve both regional development and safety.

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5. Promotion of Education and Awareness

The Sendai Framework views local disaster management plans as a means to disseminate knowledge and raise awareness across communities about disaster risks, with particular emphasis on education and training. Through disaster education, knowledge transfer to the next generation is also promoted.

In this way, the Sendai Framework positions local disaster management plans as crucial to enhancing community resilience and ensuring the effective implementation of practical disaster risk reduction efforts.

Currently, NDRMO is working on developing **Local Disaster Risk Reduction Plans (LDPs)**. These plans consist of Division DRR Plans for each of the four Divisions, and Priority Area DRR Plans, which take into account factors such as population density and economic activity within each Division. The Division DRR Plans set out the basic policies for each Division and conduct preliminary risk assessments. Meanwhile, in the Priority Area DRR Plans, more detailed risk assessments are conducted, and necessary activities are clarified. Details of NDRMO's current work on Division DRR Plans and Priority Area DRR Plans are discussed in this document.

In October 2024, with support from Japan International Cooperation Agency (JICA), I participated in an Invitation Program in Japan alongside H.E. Mr. Ditoka, the Minister for Disaster Management, Permanent Secretary, Commissioner Central Division, and Commissioner Western Division. This Program included a lecture at the Shizuoka Prefectural Earthquake Disaster Prevention Center, where we learned about the prefecture's Earthquake and Tsunami Action Program. Although this Action Program is not part of the regional disaster management plans stipulated in Japan's Basic Act on Disaster Management, it is an exemplary disaster management plan at local level. There are many points within this plan that Fiji can reference in developing, implementing, evaluating, publishing, and revising our Local DRR Plans. This is also explained in the main text.

This National Annual Report on Disaster Risk Reduction, following on from last year, has been prepared as an official government record of disaster management efforts within Fiji and to document the initiatives of the Fiji government agencies, including those of NDRMO, in the field of disaster risk reduction. It is published with the approval of the National Disaster Management Council/DRR Committee. I would like to express my sincere gratitude to the many related organizations that provided information and data for this Report.

Mr. Napolioni Boseiwaqa
Director
Fiji National Disaster Risk Management Office
November 2025

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TOPICS - Local Disaster Risk Reduction Plans

1. Development of Local DRR Plans in Fiji

In Fiji, the formulation of Local Disaster Risk Reduction Plans (LDPs) is currently underway under the leadership of the National Disaster Risk Management Office (NDRMO). These plans are being developed for each of the four divisions in the country, with the Ministry of Rural and Maritime Development and Disaster Management (MRMDDM) serving as the lead agency.

The LDP consists of two main components: the Division DRR Plan and the Priority Area DRR Plan. The Division DRR Plan outlines the preliminary risk assessments and fundamental policies for strengthening disaster resilience in each Division. On the other hand, the Priority Area DRR Plan identifies specific priority areas—such as Ba and Nadi in the Western Division—based on an evaluation of hazard, population concentration and economic activity within each Division. For these areas, more detailed risk assessments are conducted and concrete response measures are formulated as action items.

The Government of Fiji officially launched the National Development Plan (NDP) 2025–2029 and Vision 2050 in September 2024. These are medium- to long-term strategic documents aimed at building a sustainable and inclusive future for Fiji. The formulation of LDPs for the four Divisions is also stipulated as a key initiative under the NDP.

This is the first-ever effort to develop DRR plans at the sub-national level in Fiji, and its success will require active engagement and support from various government agencies and Town Councils across the country.

2. Outlook on Local DRR Planning Utilization of Japan's Support and Expertise

The formulation of LDPs by the NDRMO is being carried out with support from a technical cooperation project by Japan International Cooperation Agency (JICA). This process draws on Japan's experience in disaster planning, including the structure and methodologies for plan formulation as well as the systems for evaluation and revision of such plans.

In October 2024, a delegation from the Government of Fiji—including Minister H.E. Mr. Ditoka, the Permanent Secretary, Commissioner Central, Commissioner Western, and the Acting Director of NDRMO—visited Japan under a JICA invitation program. One of the key objectives of this visit was to learn from Japan's practices in local-level disaster risk reduction planning, and as part of the program, they visited Shizuoka Prefecture, one of Japan's local governments. In Shizuoka, the delegation observed concrete initiatives under the Earthquake and Tsunami Action Program, which aims to prepare for a potential mega-earthquake along the Nankai Trough.

This National Annual Report on Disaster Risk Reduction 2023–2024 introduces an overview of disaster risk reduction (DRR) planning in Japan, including local-level DRR plans that serve as a

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reference for the LDPs currently being developed by NDRMO.

It also highlights advanced initiatives under the Earthquake and Tsunami Action Program in Shizuoka Prefecture, a local government in Japan. Through these examples, the report aims to contribute to enhancing the effectiveness of DRR planning in Fiji.

3. Local Disaster Management Plans in Japan

Under Japan's Disaster Countermeasures Basic Act, local governments are required to formulate Local Disaster Management Plans. These plans are developed at both the prefectural and municipal levels, each serving distinct roles and purposes.

Japan's administrative system is composed of three tiers: the national government, prefectural governments, and municipal governments (cities, towns, and villages). At the prefectural level, disaster management plans are designed to address large-scale disasters that may affect multiple municipalities. These plans often include measures for coordinating responses across municipal boundaries and with neighbouring prefectures.

In contrast, municipal-level plans, formulated by basic local governments, focus on more community-specific actions such as the operation of evacuation shelters, dissemination of information to residents, and organization of relief efforts. These plans also address local hazards such as floods, landslides, and tsunamis. Municipal plans typically incorporate:

- Disaster education and evacuation drills
- Development and maintenance of evacuation shelters and routes
- Support measures for vulnerable populations such as the elderly and persons with disabilities

In addition to these statutory plans, District Disaster Management Plans are developed voluntarily by community-based organizations such as neighbourhood associations. These plans provide concrete action guidelines to ensure that residents can respond quickly and effectively when disasters occur. Examples of such community-led initiatives include:

- Establishing evacuation support networks for elderly individuals
- Organizing community kitchens and relief supply distribution systems
- Creating systems for checking the safety of neighbours

Furthermore, public-private partnerships are essential for practically advancing disaster preparedness. Japan promotes collaboration among the national and local governments, private companies, and local residents to enhance disaster resilience. In times of disaster, the Self-Defense Forces, police, fire departments, and volunteers work together in an integrated manner to

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protect the lives and safety of citizens.

4. Shizuoka Prefecture's Earthquake and Tsunami Action Program

This section introduces the disaster management plan of Shizuoka Prefecture, one of Japan's local governments, with a specific focus on earthquakes and tsunamis. It is important to note that while Fiji's LDP, currently under development, is being formulated by a national-level agency—the Ministry of Rural and Maritime Development and Disaster Management (MRMDDM)—and is a plan of the national government, the disaster management plan of Shizuoka Prefecture is not a national plan of the Government of Japan, but rather a local plan developed independently by a prefectural government. Moreover, it is a hazard-specific plan that focuses particularly on earthquake and tsunami preparedness. It should be noted that the Regional Disaster Management Plan is a statutory plan developed in accordance with the Disaster Countermeasures Basic Act of Japan.

While the Earthquake and Tsunami Action Program of Shizuoka Prefecture is not a disaster management plan mandated by the Act, it is an independently developed initiative formulated at the discretion of the prefectural government. Whereas the Regional Disaster Management Plan of Shizuoka Prefecture, based on the Disaster Countermeasures Basic Act, provides the overall disaster management framework, the Earthquake and Tsunami Action Program sets out specific measures focusing on earthquake and tsunami hazards, in alignment with that overarching framework. Shizuoka Prefecture's Earthquake and Tsunami Action Program is a comprehensive plan that outlines concrete and feasible measures aimed at protecting the lives of residents from the threat of a major Nankai Trough earthquake and resulting tsunamis.

The program emphasizes the importance of risk assessment based on scientific data and focuses on strengthening evacuation systems and disaster prevention infrastructure to minimize damage caused by earthquakes and tsunamis. In the risk assessment conducted under the Earthquake and Tsunami Action Program, damage scenarios are developed using tsunami simulations and seismic source models to predict ground motion, tsunami arrival times, and inundation areas. The resulting data is used to create hazard maps, which are then incorporated into public awareness efforts as well as Shizuoka Prefecture's Regional Disaster Management Plan. For example, in coastal areas at zero-meter elevation where tsunami arrival is anticipated, evacuation measures are being enhanced through the construction of evacuation towers and the development of evacuation routes to ensure residents can escape quickly and safely. Furthermore, efforts are being made to raise public awareness through disaster education and outreach activities. Regular disaster drills are conducted in schools and communities, and support systems for people requiring assistance during emergencies—including the elderly and persons with disabilities—are being strengthened. In addition, real-time monitoring systems for earthquakes and tsunamis, as well as disaster prevention apps, are being utilized to ensure the timely dissemination of information and enhance the safety of residents. The Prefecture is also making significant efforts to strengthen the seismic resilience of its infrastructure, promoting seismic retrofitting of public facilities, roads, bridges, and water

supply systems. In addition, the prefecture collaborates with community-based disaster prevention organizations to support resident-led disaster risk reduction activities, thereby enhancing the overall disaster preparedness of the region. These initiatives are based on public–private partnerships and aim to improve the effectiveness of disaster response. To this end, regular reviews of disaster management plans and simulation-based training exercises are conducted.

Shizuoka Prefecture's Earthquake and Tsunami Action Program is implemented through the following steps:

- Plan Formulation: The plan is developed based on scientific assessments of earthquake risks and incorporates input from relevant agencies and local residents.
- Progress Monitoring: The implementation status of measures is regularly monitored and evaluated.
- Public Disclosure: Progress is made available to the public through reports, official websites, and briefing sessions.
- Revision: The plan is periodically updated to reflect the latest scientific knowledge and feedback from residents.

The Prefecture’s initiatives are recognized as a practical approach tailored to regional-specific risks, while aligning with the overall framework of Japan’s national disaster risk reduction plans. Through such multifaceted measures, the prefecture aims to build a disaster-resilient society.

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1. Disasters in Fiji in 2023-2024

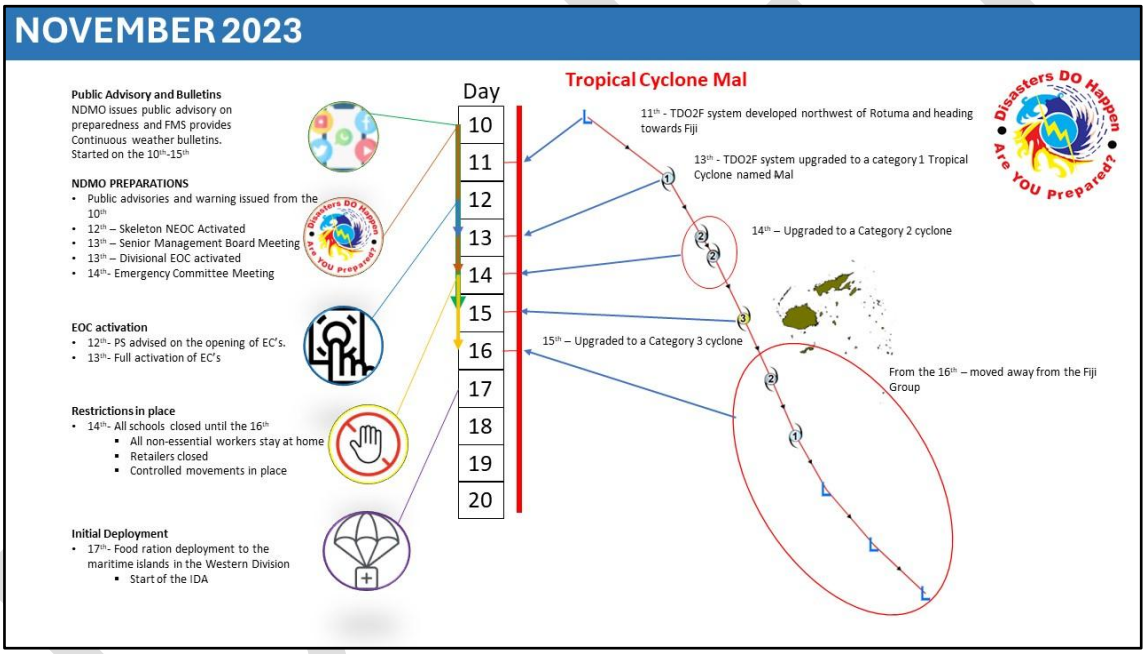
1.1 Initial Damage Assessment Report for Tropical Cyclone Mal

Period: 17–23 November 2023

Affected Areas: Western (Ba, Nadroga/Navosa), Eastern (Kadavu, Lomaiviti), Central (Namosi)

1) *Background and Purpose*

In mid-November 2023, Tropical Cyclone Mal passed through the Fiji Islands, maintaining Category 3 status for up to nine hours. Although it did not make landfall, moderate damages were recorded in Yasawa, Mamanuca, southwestern Viti Levu, and Kadavu. The cyclone caused road and bridge inundation due to flooding and coastal flooding due to high waves (6–8m at sea, 2–4m along the coast).



Source: NDRMO

Fig. 1 TC Mal timeline of Events

2) *Assessment Methodology and Coverage*

Based on the National Disaster Management Plan, initial assessments began within 48 hours of impact. From 17 November, assessments covered 64 communities (13 villages + 51 settlements) and 16 households across Central, Eastern, and Western Divisions. Out of the 16 households assessed, 9 experienced partial damage while 7 had no damage. Crop losses were valued at approximately FJD 3.7 million.

3) *Key Findings*

- The Western Division (Ba and Nadroga/Navosa) was the most affected.

- Limited severe housing damage, but significant agricultural losses.
- No critical damage to lifelines such as power, water, and roads.
- Food aid distribution completed; priority now shifts to tarps, hygiene items, and shelter kits.

Table 1 Breakdown of the scope of the IDA survey for TC Mal

DIVISION/ PROVINCE	COMMUNITIES & HOUSEHOLDS ASSESSED		
	SETTLEMENTS	VILLAGE	TOTAL
IDA Community	**13**	**51**	**64**
Eastern Division	11	25	36
Kadavu	11	25	36
Western Division	2	26	28
Ba	2	21	23
Nadroga/Navosa		5	5
IDA Household	**6**	**10**	**16**
Central Division	4	1	5
Namosi	4	1	5
Eastern Division		7	7
Lomaiviti		7	7
Western Division	2	2	4
Ba	2	2	4

Source: NDRMO

4) *Sectoral Damage Assessment*

a) *Agriculture*

Agriculture suffered the most damage, with 35% (132 areas) affected. Key affected crops included cassava, banana, breadfruit, eggplant, and okra. Approximately 1,850–2,000 households required immediate food assistance. Yaqona (kava) crop losses were valued at FJD 2.2 million, representing a primary income source for many households.

Recommendations include food packs with rice, flour, and Vitamin A supplements, and short-term recovery support such as vegetable seeds, kumala and bele cuttings, and day-old chicks.

b) *Roads*

54 roads were affected, but no major structural damage was reported. FRA responded in Ovalau (Wainalako, Rukuruku, Arovudi).

c) *Water*

Water Authority of Fiji reported no systemic damage, but some blockages from debris were cleared.

d) Energy

Power disruptions were mainly due to fallen trees and debris. Outages were reported in Nadi, Lautoka, and Rakiraki. Recovery included 95 power lines in Rakiraki and Tavua, and 662 locations in Nadi–Sigatoka–Central areas.

5) Community Conditions

- 92% of communities had access to safe water; only Yalobi (Ba) lacked access.
- 66% of communities suffered crop damage (notably in Kadavu and Nadroga).
- 84% had communication access (Vodafone, Digicel, TFL); 16% had none.
- 98% of residents remained in good health; 25 suspected flu cases in Najia (Ba).

Table 2 Community Assessed Access to Safe Water

DIVISION/PROVINCE	COMMUNITIES ASSESSED		
	NO	YES	TOTAL
IDA Community	5	59	64
Eastern Division	4	32	36
Kadavu	4	32	36
Western Division	1	27	28
Ba	1	22	23
Nadroga/Navosa		5	5
Grand Total	*5*	*59*	*64*

Table 3 Community Assessed Access to Food Supply

DIVISION/PROVINCE	COMMUNITIES ASSESSED		
	DAMAGED	NOT DAMAGED	TOTAL
IDA Community	42	22	64
Eastern Division	19	17	36
Kadavu	19	17	36
Western Division	23	5	28
Ba	19	4	23
Nadroga/Navosa	4	1	5
Grand Total	*42*	*22*	*64*

Table 4 Community Assessed Access to Safe Water

COMMUNICATION	COMMUNITIES ASSESSED		
	EASTERN DIVISION	WESTERN DIVISION	TOTAL
IDA Community	36	28	64
CAN_COMMUNICATE	27	27	54
Mobile	19	22	41
Mobile,Telephone	8	5	13
CANNOT_COMMUNICATE	9	1	10
Mobile	1		1
No Network	8	1	9
Grand Total	*36*	*28*	*64*

Table 5 Health Assessed in the Communities

DIVISION/PROVINCE	COMMUNITIES ASSESSED		
	HEALTHY	SICK_PEOPLE	TOTAL
IDA Community	**63**	**1**	**64**
Eastern Division	36		36
Kadavu	36		36
Western Division	27	1	28
Ba	22	1	23
Nadroga/Navosa	5		5
Grand Total	***63***	***1***	***64***

6) *Recommendations*

- Focus on non-food relief items: tarpaulins, hygiene supplies, and shelter kits.
- Continue nutritional food pack distributions.
- Support replanting and provide agricultural inputs for affected farmers.

1.2 Initial Damage Assessment Report for Heavy Rainfall in March

Period: 16-29 March 2024

Affected Areas: Western (Ba, Ra, Nadrofa/Navosa), Central (Rewa, Naitasiri)

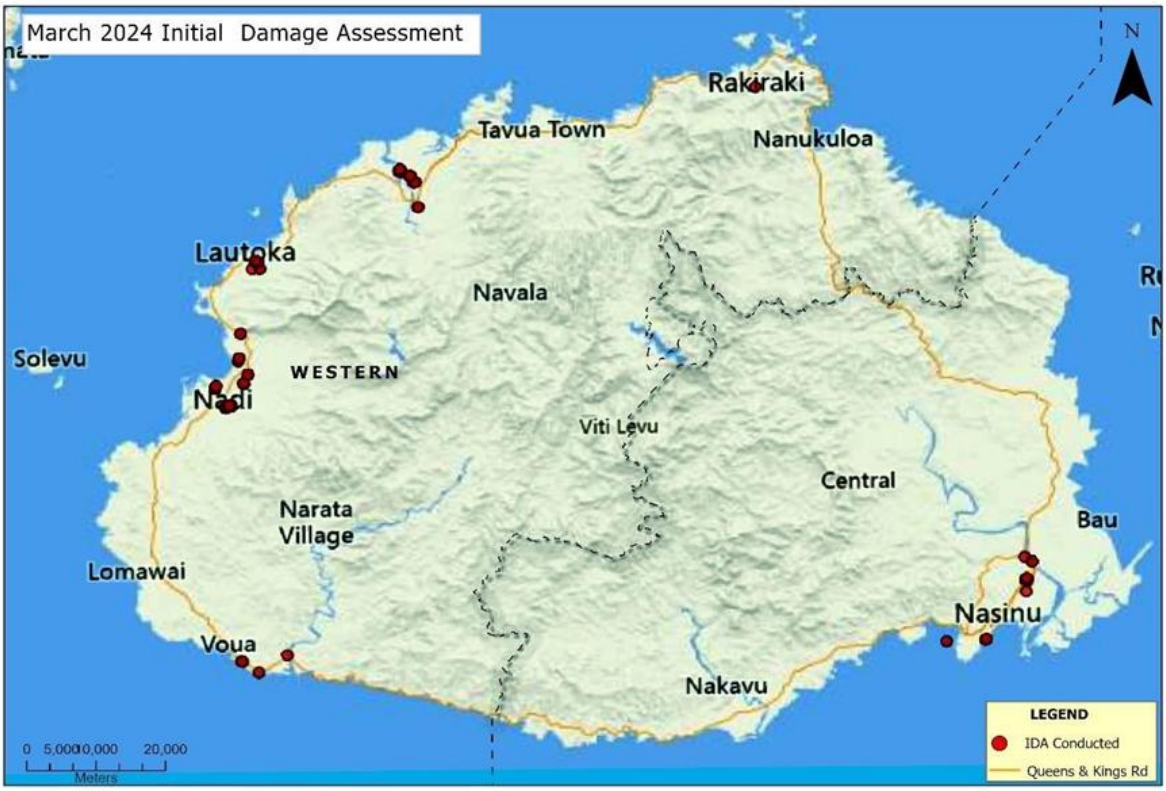


Fig. 2 Map of Initial Damage Assessment conducted in the Central & Western Division

1) Background and Purpose

Between 16 and 29 March 2024, sustained heavy rainfall associated with a trough of low pressure impacted Fiji, triggering severe flooding and landslides across central and western regions. The resulting damage affected road and bridge infrastructure, housing, utilities, and agricultural lands, prompting the National Disaster Risk Management Office (NDRMO) to initiate a coordinated Initial Damage Assessment (IDA).

2) Assessment of Methodology and Coverage

NDRMO-led Divisional IDA teams conducted ground surveys starting 25 March 2024 across 41 communities, assessing 439 households. The survey employed revised IDA forms and digital reporting tools to ensure real-time data collection. Assessments spanned 5 provinces: Rewa and Naitasiri (Central Division); Ba, Nadroga/Navosa, and Ra (Western Division).

3) Key Findings

A total of 439 households were assessed. Ba Province reported the highest concentration (348 households).

12 homes were severely damaged, 1 completely destroyed, and 177 sustained minor damage.

Key infrastructure (roads, bridges, power) sustained minor damage; however, agriculture and water services were significantly impacted.

Table 6 Total Household Assessed

LOCATION	HOUSEHOLD ASSESSED	TOTAL HOUSEHOLD	ASSESSMENT %
Central	**35**	**57169**	**0.06%**
Naitasiri	22	35554	0.06%
Rewa	13	21615	0.06%
Western	**404**	**67408**	**0.60%**
Ba	348	49537	0.70%
Nadroga_Navosa	55	11788	0.47%
Ra	1	6083	0.02%
Grand Total	439	124577	0.35%

4) Sectoral Damage Assessment

a) Agriculture

Estimated total loss: FJD 197,889.85 across 1,442 farmers and 58.63 ha.

Key crop losses include dalo (taro), cassava, kumala (sweet potato), and assorted vegetables.

Recommendations: de-silting, seed and cutting distribution, stakeholder coordination.

Table 7 Agricultural Damage Assessment (Central Division)

Province	Farmers Affected	Area (ha)	Damage Value (FJD)
Naitasiri	85	21	50,775.72
Rewa	1,165	13.755	105,018.00
Serua/Namosi	157	16.67	35,115.58
Tailevu	35	7.2	6,980.54
Total	**1,442**	**58.625**	**197,889.84**

b) Infrastructure Sector

Roads, Irish crossings, and bridges affected, especially in Vanua Levu east and Suva–Nausori corridor.

Suva-Lami experienced water cuts due to pipe burst in Savura pipeline.

Minor power disruptions in Rakiraki, Tavua, Lautoka–Nadi, and parts of Central Division.

c) Educational Sector (Supplemental IDA notes)

8 schools temporarily closed, 3 with structural damage.

Learning materials lost in floodwaters.

Some schools used as evacuation centers.

d) Health and Water, Sanitation and Hygiene (WASH)

9% of households lacked access to safe water (notably in Ba and Nadroga/Navosa).

5% lacked access to safe toilets, mainly in Nadi District.

Health facility access limited in Tavua; 2% households reported injuries.

Table 8 Household Access to Basic Services

Indicator	% Households	Notes
Safe Drinking Water	91%	Rainwater, piped supply common
Functional Toilets	95%	Pit latrines in rural households
Access to Lighting	93%	Power cuts in 7%
Access to Health Facilities	82%	Tavua most underserved

5) Community Conditions

N/A

6) Recommendations

- Distribute food rations and NFIs (tarpaulins, hygiene kits) to unassisted households.
- Collaborate with Ministry of Agriculture for recovery supplies.

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- Initiate early repair of damaged infrastructure.
- Strengthen water safety and sanitation in flood-prone areas.
- Expand digital IDA tools and data training for NDRMO.

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2. DRR Activities of the Government of Fiji - Formulation of Local DRR Plans

This activity is being carried out with the support of JICA, with the objective of promoting the formulation of Local Disaster Risk Reduction Plans (Local DRR Plan) in Fiji and enhancing their feasibility for implementation.

The Local DRR Plans are formulated by the NDRMO under the MRMDDM, based on scientific hazard risk assessments. These plans are composed of two components: the Division DRR Plan and the Priority Area Plan.

The Division DRR Plan is developed for each of the four Divisions in Fiji and outlines the fundamental strategies and policies related to disaster risk reduction. It also includes preliminary risk assessments for each division.

The Priority Area Plan is a plan formulated for regions within each Division that are identified—based on scientific risk and hazard assessments—as having particularly high vulnerability, and where population and economic resources are concentrated. The plan specifies particular activities for each type of disaster.

From 2023 to 2024, efforts have been primarily focused on formulating the Division DRR Plan for the Western Division, and on developing the Priority Area Plans for targeted locations such as Nadi Town and Ba Town.

The following is a summary of the main activities and challenges undertaken between April 2023 and June 2024.

2.1 Formulation of the Local DRR Plan and Challenges in the Western Division

Since April 2023, discussions on the formulation of the Local DRR Plan for the Western Division have been underway. Initially, a review of the existing development plans was conducted to ensure that the DRR Plan would be more effective and evidence based. In Fiji, development plans often take the form of extensive project lists, or "wish lists," which tend to exceed available ministerial budgets and human resources. As a result, the feasibility of these plans has been a persistent challenge.

The Western Division's development plan proposed 377 projects over a five-year period starting in 2023, with an estimated total cost of FJD 90.81 million (approximately FJD 18 million per year on average).

In light of this situation, consultations were held with the Western Division Planning Office and the National Disaster Risk Management Office (NDRMO) to clarify the criteria for project selection and to establish objective indicators for setting priorities. A direction was agreed upon to develop and propose selection criteria for priority projects, based on disaster event history, hazard analyses, and risk assessment results.

Furthermore, in Fiji, government agencies responsible for infrastructure development in urban and

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rural areas differ. Complicating matters further, rural communities are often scattered within designated urban areas, making coordination more complex. These circumstances sometimes hinder the planning and development of disaster-related facilities and land-use plans.

To address these issues, efforts have been made to foster a shared understanding through coordination with stakeholders at both the national and divisional levels, including relevant agencies and Town Councils.

2.2 Formulation of Local DRR Plans in Nadi Town and Ba Town

Since May 2023, efforts have been focused on Nadi Town and Ba Town as part of the process of formulating the DRR Plan for the Western Division practically. Particular attention was given to areas vulnerable to flooding, storm surges, and tsunamis, where analyses of potential inundation zones and the organization of disaster risk data were conducted.

However, a key challenge emerged: the lack of sufficient baseline data in Fiji and the limited availability of past disaster event reports have made it difficult to gain a detailed understanding of disaster risks. In response, a policy was adopted to strengthen collaboration with NDRMO, relevant agencies in the Western Division, and each Town Council to collect additional information and improve data availability.

In October 2023, additional information was collected to finalize the Western Division Local DRR Plan. At the same time, efforts were made to ensure consistency with the Divisional Development Plan, while incorporating feedback from both the Fijian and Japanese sides.

As part of the formulation of the Local DRR Plan for the Nadi Town area, consultations were held with the Lautoka Town Council and the Nadi Town Council. These discussions helped to clarify the respective roles of central ministries, local governments, and the private sector, and led to a reassessment of the implementation approach and schedule for the plan.

In November 2023, meetings concerning the Local DRR plans for the Western Division, Nadi Town, and Ba Town were initially scheduled. However, due to the impact of a cyclone, the meetings had to be postponed. Nevertheless, information was collected through email and online communications with relevant agencies, and a decision was made to conduct remote consultations on the revised documents in December.

2.3 Disaster Risk Reduction Infrastructure Measures in Priority Areas

Since December 2023, concrete disaster risk reduction (DRR) infrastructure measures have been examined for the Priority Areas within the Western Division. Particular emphasis has been placed on the following interventions:

- **Ba**: Flood mitigation measures such as diversion channels, retention basins, river channel improvements, and road elevation.
- **Nadi**: Road elevation to prevent inundation of key roads due to storm surges and tsunamis.

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- **Rakiraki**: On-site assessments conducted to consider the area as a new target for the Priority Area Plan.

In Ba, flood risks caused by overflow from the Ba River and its tributaries have been identified, and it has been recognized that comprehensive upstream and midstream measures are necessary. In Nadi, there are concerns about inundation of the access road to Denarau, a major resort area, prompting consideration of road elevation and the development of alternative routes. However, site inspections also indicated that the likelihood of severe damage may be relatively low.

In February 2024, based on disaster risk analysis and site assessment results, further examination of infrastructure measures in the Priority Areas was conducted. However, planned consultations with local stakeholders had to be postponed due to torrential rainfall that reached disaster-alert levels.

In May 2024, detailed on-site inspections were carried out for the Priority Area Plans in Ba and Nadi. In Ba, the need for flood mitigation in areas where urban development is expanding was once again emphasized. In Nadi, addressing flooding along Queens Road was deemed essential, and it was concluded that drainage capacity improvements for the roadway are also required.

2.4 Future Direction and Initiation of Planning in the Central Division

In June 2024, further progress was made toward finalizing the Division DRR Plan for the Western Division and examining the Priority Area Plan. At the same time, preparations began for initiating the formulation of a disaster risk reduction (DRR) plan for the Central Division.

Moving forward, the goal is to leverage the experiences gained in the Western Division to effectively develop DRR plans in the Central Division as well.

2.5 Conclusion

The formulation of Local DRR Plans has been progressing, primarily in the Western Division. However, numerous challenges have been identified in enhancing their effectiveness. In particular, the lack of clear criteria for project selection and the insufficiency of baseline data have posed significant obstacles to the planning process.

Nevertheless, through continuous consultations with relevant agencies, progress has been made in clarifying priorities and examining concrete DRR measures. As a result, a foundation is gradually being established for the implementation of future plans.

Moving forward, while finalizing the DRR plan for the Western Division, efforts will begin on plan formulation in the Central Division, with the overarching goal of strengthening disaster resilience across the entire country of Fiji.

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3. DRR Activity Monitoring

3.1 NDRRP Monitoring and Evaluation Guideline Development

National Disaster Risk Reduction Policy (NDRRP) - Monitoring and Evaluation Guideline in June 2023, with support from a technical advisor from the Government of Japan, the NDRMO developed the Monitoring and Evaluation (M&E) Guideline for the NDRRP, which outlines 122 Action Items. A consultation session was subsequently held with Disaster Service Liaison Officers (DSLOs) from various government ministries, during which they were organized into four sectoral Technical Working Groups (TWGs)—Administration, Economic, Infrastructure, and Social—to implement the Action Items relevant to their sectors. In April 2024, a validation workshop was conducted, during which DSLOs reviewed and validated the proposed contributory activities and the associated weighting criteria. NDRMO continues the implementation of the NDRRP with other government agencies and statutory bodies ensuring DRR are mainstreamed into their programs and policies.

3.2 Roadmap for NDRRP Implementation

1) Purpose and Structure of the Roadmap

The Roadmap for NDRRP Implementation, is under development under the leadership of the NDRMO and the MRMDDM. It aims to serve a strategic guide to implement the NDRRP adopted in 2018. It aims to support local-level DRR planning through Local Disaster Risk Reduction Plans (LDPs), ensuring alignment with national goals.

As of the end of the 2023-2024 fiscal year, the Roadmap has been drafted with the following purposes and structure. NDRMO aims for the Roadmap to function government-wide by putting it on the agenda at the first National Disaster Risk Management Council (NDRMC) meeting of the 2024-2025 fiscal year.

The main purposes of the Roadmap are as follows:

1. **Promote Disaster Risk Reduction Activities:** The Roadmap promotes DRR by guiding the formulation and implementation of LDPs, contributing to the NDRRP, with the NDRMO leading M&E.
2. **Raise Awareness:** It raises awareness among government agencies about the NDRRP's importance and enhances their understanding of DRR to improve the effectiveness of efforts.
3. **Support LDP Formulation and Implementation:** It supports the creation and execution of LDPs in each division, providing timelines and monitoring the progress of risk reduction activities.
4. **Organize and Promote Action Items:** It selects, organizes, and prioritizes action items from the NDRRP that are closely related to the activities outlined in the LDPs.
5. **Clarify Additional Action Items:** It identifies and clarifies necessary action items for LDP implementation that are not explicitly included in the NDRRP.

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The Roadmap is divided into two main parts:

- Promotion of LDP formulation
- Implementation of LDPs

LDPs comprise two levels of planning:

- Division DRR Plans (Western, Central, Northern, Eastern)
- Priority Area DRR Plans targeting high-risk zones within each division (e.g., Nadi, Ba, Rakiraki in the Western Division)

2) Roadmap for Promoting the Formulation of LDPs

The first section of the Roadmap, titled "Roadmap for Promoting the Formulation of LDPs," details which of the 122 action items in the NDRRP are likely to be accelerated by the formulation of LDPs. Furthermore, the Roadmap identified and clearly defined activities that are critical for advancing LDP formulation, even though they were not included as NDRRP action items, to facilitate their implementation. Following this, the Roadmap presents a schedule for LDP formulation. The timeline will then be used to monitor and manage both the LDP formulation process and the corresponding implementation of the relevant NDRRP action items.

Note that the formulation of LDPs is included as one of the strategies in the National Development Policy 2025–2029, which is scheduled to be finalized and announced in 2024. This policy requires that the formulation of LDPs be completed across all 4 divisions by 2029.

3) Roadmap for the Implementation of LDPs

The second half of the Roadmap, titled "Roadmap for the Implementation of LDPs," presents the actual roadmap for executing the formulated LDPs.

The LDPs, which include both Division DRR Plans and Priority Area DRR Plans, list activities prioritized for implementation in their respective regions. This section of the Roadmap establishes target timelines for these activities, clearly identifies the implementing agencies, and is structured to allow for cross-sectoral annual monitoring of implementation status. Furthermore, each activity is linked to its corresponding NDRRP Action Item to demonstrate its contribution to the acceleration and M&E of the NDRRP.

This Roadmap will be updated as the number of LDP formulation areas increases. The status of its implementation will be monitored annually, and the results will be reported in the National Annual Report on Disaster Risk Reduction.

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4. NDRMO Activity Report, 2023 – 2024 Financial Year

4.1 Review of the Natural Disaster Management Act

NDRM Bill was approved by Cabinet on 27th February 2024 and tabled in Parliament in April.

4.2 Response to Tropical Cyclones and Natural Disasters

1) TC Mal

Tropical Cyclone Mal (TC Mal) was the first cyclone in the 2023- 2024 season to directly affect Fiji group. TC Mal began as a tropical depression (TD02F) that developed near Solomon Islands and transformed into a Category 1 cyclone on the 12th of November around 0600 UTC. It was upgraded to a TC category 2 on 13 November while located over open waters, about 650 kilometres northwest of Rotuma. At 1200 UTC on November 14, TC Mal had escalated to a severe category 3 tropical cyclone. It initiated a south-south-eastward trajectory at an approximate speed of 30 km/h, heading towards a somewhat favourable environment located around 180 kilometres west of Nadi in the Fiji group. Six hours into this path, Severe TC Mal reached its maximum intensity at a position about 170 kilometres west of Kadavu or 140 kilometres southwest of Nadi. It exhibited estimated sustained wind speeds of up to 130 km/h, accompanied by momentary gusts reaching 185 km/h. (Ref. *1.1 Initial Damage Assessment Report for Tropical Cyclone Mal*)

2) Response

The National Emergency Operation Centre (NEOC) was activated on the 12th of November to start monitoring the TD02F system that had developed northwest of Rotuma and heading towards Fiji. Government initiated its first response on the 15th of November with the food ration basket to the evacuation centres and/ or affected population. The New Zealand government offered assistance with the HMNZS MANAWANUI (NZ boat in Fiji) used for food ration distribution and also to take Government officials to conduct IDA in areas including Vatulele, Mamanucas and Yasawa. Initial Damage Assessment (IDA) had begun with the Central Division (areas in Namosi and Naitasiri), Eastern Division (Kadavu and Lomaiviti) and Western Division (maritime islands covered by officers in the HMNZS MANAWANUI and mainland including Ba and Nadroga Province). Given that TC Mal had very minimal impact in the Northern Division, there was no IDA conducted however food rations and Non-food items (NFIs) were taken to Nabavatu for the Northern Division. These people were accommodated at the Maramarua Primary school.

4.3 Disaster Preparedness

1) National Disaster Management Council

The National Disaster Management Council meeting was convened on 5th September 2023.

2) Preparedness Committee

The preparedness Committee convened on 11 October 2024 in preparation for the National

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Disaster Awareness Week (NDAW).

4.4 Suva Tsunami Siren Testing

NDRMO in partnership with the Mineral Resources Department (MRD) under the Ministry of Lands and Mineral Resources conduct testing of the 13 Tsunami Sirens along Suva Peninsula. These tests are scheduled for the fifth day of every month unless directed otherwise by senior management.

4.5 Fiji's Membership of the Asian Disaster Reduction Center

The Government of Fiji formally submitted an application to join the Asian Disaster Reduction Center (ADRC) as part of its ongoing efforts to strengthen regional cooperation, knowledge sharing, and capacity building in disaster risk reduction and management.

We are pleased to report that Fiji's application for membership was approved on 1 October 2023. As a result, Fiji has officially become the 32nd member country of the ADRC for an initial term of five years.

Membership in the ADRC presents significant opportunities for Fiji, including access to technical expertise, regional training programs, research collaboration, and platforms to share best practices and experiences in disaster risk reduction. It will also enhance Fiji's ability to contribute to and benefit from collective efforts in building resilience against natural hazards across the Asia-Pacific region.

Through this membership, Fiji reaffirms its commitment to regional partnerships and its proactive approach to advancing disaster risk reduction initiatives aligned with international frameworks such as the Sendai Framework for Disaster Risk Reduction and the Paris Agreement on Climate Change.

The NDRMO will serve as the focal agency coordinating Fiji's engagement with ADRC and ensuring that the benefits of this partnership are integrated into national disaster risk reduction strategies and practices.

4.6 Fiji Country Report for Mid–Term Review of Sendai Framework for Disaster Risk Reduction

The Fiji Country Report for the Mid-Term Review of the Sendai Framework for Disaster Risk Reduction (SFDRR) was formally completed and presented as part of Fiji's commitment to global disaster risk reduction efforts. The report was officially handed over by the MRMDDM to the Special Representative of the United Nations Secretary-General for Disaster Risk Reduction during the Sendai Framework High-Level Meeting held in New York on 19 May 2023. The Fiji Country Report outlines the nation's progress in achieving the priorities and targets of the Sendai Framework, highlighting key achievements, ongoing challenges, and recommendations for future action. It reflects Fiji's comprehensive efforts in mainstreaming disaster risk reduction across national policies, improving early warning systems, strengthening community resilience, and fostering

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partnerships at all levels.

4.7 Grant Funding Arrangement between New Zealand's Ministry of Foreign Affairs and Trade and Fiji's Ministry of Rural and Maritime Development and Disaster Management

The funding arrangement is for a two-year term and will conclude in November 2025. It supports a suite of targeted interventions aimed at enhancing the NDRMO's capacity to raise disaster awareness and strengthen national response mechanisms.

For the fiscal year 2023–2024, the department was allocated a budget of $3,230,000. However, only 7% of the total funds have been utilized to date. Activities undertaken under this arrangement include the procurement of an ArcGIS license, installation of Emergency Operations Centre (EOC) equipment for both the Commissioner Central Division EOC and the Provincial Administrator Ba EOC, the first Peer-to-Peer learning exchange between Fiji NDMO and New Zealand's National Emergency Management Agency (NEMA), and Drone Pilot Training.

Other planned activities are currently in progress and are expected to be fully implemented in the new financial year. One key reason for the delay in project implementation is the evolving scope of work for the Commissioner Northern Division (CND) Warehouse, which has extended the project timeline. Nonetheless, the department remains committed to completing this work before the end of the funding period.

4.8 Building Safety and Resilience in the Pacific Phase II Project

The Memorandum of Understanding (MoU) was signed between the NDRMO and the Pacific Community (SPC), facilitating the rollout of the BSRP Phase II Project. The National Steering Committee was also established to oversee the implementation of the project. The project is valued at $290,000.

4.9 Pilot Project for Anticipatory Action for Tropical Cyclones

The implementation of the Pilot Project for Anticipatory Action for Tropical Cyclones in Fiji was successfully carried out under the funding support of the Central Emergency Response Fund (CERF). The project aims to proactively reduce the impacts of tropical cyclones by initiating timely interventions based on pre-identified risk indicators.

As part of this initiative, the Anticipatory Action Framework was operationalized and activated when pre-agreed triggers and thresholds were met, allowing for early action ahead of disaster impact. A formal agreement was signed between the Ministry of Finance, Strategic Planning, National Development and Statistics, the Ministry of Women, Children and Social Protection, and the United Nations World Food Programme (WFP) to facilitate the delivery of anticipatory cash transfers to vulnerable households expected to be affected by tropical cyclones.

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4.10 Nabavatu Village Relocation Project

The Government has approved the relocation of Nabavatu Village to the proposed site at Nadoiviri, with preparatory works—particularly earthmoving—already underway. A Divisional Taskforce, led by the Commissioner Northern Division, has been established to oversee the implementation of the project.

To support the relocation, the Department of Climate Change has been approved to finance the additional FJD $5.33 million required, using the Climate Relocation of Communities Trust Fund or through bilateral budget support. In the event these funds are not available, the Ministry of Finance, Strategic Planning, National Development and Statistics will step in to cover the costs.

Additionally, the Government has agreed that a Planned Relocation and Displacement Policy be developed by the Department of Climate Change to guide and support future climate-induced relocation efforts.

4.11 National Disaster Awareness Week - Fighting Inequality for a Resilient Future

1) *Background*

The NDRMO is mandated by the Natural Disaster management Act (1998) to conduct the National Disaster Awareness Week (NDAW) annually. This is aligned to the International Day for Disaster Risk Reduction, annually held on October 13th to promote a global culture of DRR. This event aims to enhance the level of disaster preparedness amongst stakeholders and communities and anticipate a reduction of damages and losses that may occur if a disaster strikes.

2) *Objective*

The objective of the NDAW 2023 was to enhance public awareness on the progress Fiji is making in preventing and reducing disaster risks and associated losses, while also strengthening national preparedness for earthquake and tsunami threats. The event aimed to test the implementation of the Tsunami Response Plan, ensure interoperability between agencies' Standard Operating Procedures (SOPs), and familiarize all involved agencies with their respective roles and responsibilities. Additionally, NDAW 2023 sought to boost the readiness of the National Emergency Response Team (NERT) at both national and sub-national levels and provide key recommendations for updating the National Tsunami Response Plan.

3) *Activities*

NDAW was conducted from 12th-18th October 2024 and consisted of the following activities:

i. National Simulation Exercise (SIMEX), and
ii. Disaster Risk Reduction Exhibition

4.12 National Disaster Risk Reduction Policy - Monitoring and Evaluation Guideline

In June 2023, the NDRMO developed the Monitoring and Evaluation (M&E) Guideline for the

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National Disaster Risk Reduction Policy (NDRRP), which outlines 122 Action Items. (Ref. *3.1 NDRRP Monitoring and Evaluation Guideline Development*)

4.13 Disaster Risk Management Initiatives

The NDRMO also works closely with development partners to improve Fiji's resilience to disasters. This is illustrated by the current projects that NDRMO is implementing with other government agencies and development partners. This section will discuss the ongoing initiatives that NDRMO is currently involved.

1) Mainstreaming of Disaster Risk Reduction

The Project for Mainstreaming Disaster Risk Reduction in Fiji funded by JICA commenced in December 2020 and is scheduled to close in November this year 2025. The project purpose and outcomes are provided below;

Overall Goal: DRR Activities in the NDRRP roadmap are implemented under the coordination of NDRMO.

Purpose: Capacity of NDRRMO is strengthened to implement and promote DRR activities in line with the international, regional and national policies.

Output 1: Hazard / Risk Assessment (Working Group 1)

Hazard/Risk Assessment aims to enhance Fiji's capacity for scientific hazard assessment focusing on flooding, sediment disasters (debris flow and steep slope collapse), coastal hazards (storm surge and tsunami), and earthquakes in collaboration with technical agencies such as NDRMO GIS Unit, FMS and MRD. The team concluded preliminary hazard assessment in Western Division and enhanced hazard assessment in Nadi and Ba. Technical transfer from the consultant team to the technical agencies included usage of simulation models and multi- hazard risk mapping. Also, the importance of historical flood data, observation and archives of meteorological/hydrological data, and integrating hazard assessments, building structure survey was emphasized. Furthermore, on-site verification surveys were recommended for improved risk assessment accuracy.

Output 2: Local DRR Plan (Working Group 2)

Based on the hazard risk assessment and consultation in Western Division including divisional officers of each ministry, Local DRR Plans (LDPs), including Divisional DRR Plan for Western and Priority Area DRR Plan in Nadi for Coastal Hazard and in Ba for Flood, were developed. These plans will be submitted and discussed to the DRR Committee under the National Disaster Management Council.

Output 3: DRR Projects Promotion (Working Group 3)

To promote development and implementation of the LDPs, Roadmap was formulated. It shows timelines and linkage between activities in the LDPs and the action items in the NDRRP. In addition, the National Annual Report on Disaster Risk Reduction was formulated as the first integrated report

showing summary of disaster affected to the country and DRR related projects and activities conducted by the Government of Fiji.

4.14 Community Based Disaster Risk Management Policy

The Community-Based Disaster Risk Management (CBDRM) Policy was developed in April 2024 as part of efforts to enhance Fiji's legal and institutional framework for disaster resilience. The development of the national CBDRM Policy aims to reinforce a bottom-up, evidence-based approach to disaster risk reduction, grounded in community participation. This initiative seeks to mitigate the long-term impacts of climate change and build community resilience through strengthened regulatory frameworks. Key strategies include promoting ecosystem-based solutions, improving community early warning systems, integrating adaptive development approaches, and increasing community preparedness. Four divisional workshops were scheduled between April and October 2024 to support the policy's rollout. The first two workshops were successfully conducted for the Central Division (25–26 April 2024) and Northern Division (29–30 May 2024). Participants include representatives from the planning team, Provincial Administrators (PA), District Officers (DOs), Assistant District Officers (ADOs), Roko Tuis, Mata ni Tikina, Turaga ni Koro, and District Advisory Council (DAC) representatives.

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4.15 Financial Performance

DEPARTMENT OF NATIONAL DISASTER RISK MANAGEMENT OFFICE
APPROPRIATION STATEMENT
FOR THE YEAR ENDED 31 JULY 2024

Budget Revised

SEG	Particulars	Estimates	Changes	Estimates	Actual	Balance	Percentage
	Operating Expenditure	**($)**	**($)**	**($)**	**($)**	**($)**	**(%)**
1	Established Staff	645,155	-55,749	589,406	581,483	7,993	98%
2	Unestablished Staff	72,401	+45,751	118,152	118,151	1	100%
3	Travel and Communication	46,000	-3,000	51,000	45,559	5,441	89%
4	Maintenance & Operations	296,000	-39,000	257,000	221,483	35,517	86%
5	Purchase of Goods and Services	55,000	+34,000	89,000	78,496	10,504	100%
6	Operating Grants and Transfers	0.00	0.00	0.00	0.00	0.00	0%
7	Special Expenditures	3,270,000	0.00	3,270,000	263,668	3,006,332	8%
	Total Operating Expenditure	**4,384,556**	**-6,399**	**4,374.558**	**1,308,840**	**3,065,787**	**98%**
	Capital Expenditure						
8	Construction	200,000	0.00	200,000	99,469	100,531	49%
9	Capital Purchases	0.00	0.00	0.00	0.00	0.00	0%
10	Capital Grants & Transfers	1,000,000	0	1,000,000	1,000,000	1,000,000	100%
Total Capital Expenditure		**1,200,000**	**0.00**	**1,200,000**	**1,099,469**	**1,100,531**	**100%**
13	Values Added Tax	95,500	0.00	95,500	39,930	55,570	42%
Total Expenditure		**5,680,056**	**0.00**	**5,670,058**	**2,448,239**	**55,570**	**42%**

Source: FMIS Compost report

Notes

In the 2023–2024 financial year, the department's annual budget increased significantly to $5.6 million, marking a substantial rise from the previous year's allocation of $1.4 million. This increase was primarily driven by the $3.4 million in funding provided by the Ministry of Foreign Affairs and Trade (MFAT) to the Fiji Government. The MFAT funding aims to strengthen disaster preparedness, response capacity, and climate resilience across Fiji.

The funding supports a suite of targeted interventions designed to enhance the National Disaster Management Office's (NDMO) ability to manage disaster awareness and improve national response mechanisms. Despite the increased budget, the department utilized only 43% of the total allocated funds over the course of the year. The underutilization of funds from the $3.4 million (MFAT) fund is attributed to several factors, including:

- Delays in program implementation and procurement processes

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- Project timelines extending beyond the financial year

The lower utilization rate highlights the need for improved planning and execution mechanisms; the department in the new financial year is focused on improving implementation capacity and enhancing inter-agency coordination to ensure optimal use of resources in line with strategic goals.

END.

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Guidelines for Preparing National Annual Report on Disaster Risk Reduction

National Disaster Risk Management Office

Republic of Fiji

October 2025

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Acronyms and Abbreviations

ACRONYM	ABBREVIATION
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
FY	Fiscal Year
MRMDDM	Ministry of Rural and Maritime Development and Disaster Management
NDRMA	National Disaster Risk Management Act
NDRMC	National Disaster Risk Management Council
NDRMO	National Disaster Risk Management Office (former NDMO)
NDRRP	National Disaster Risk Reduction Policy

1. Introduction

1.1 Purpose of the Guidelines

The issuance of the Disaster Risk Reduction Annual Report for Fiji was approved during the Disaster Risk Reduction (DRR) Committee held under the framework of the National Disaster Risk Management Council (NDRMC) on March 6, 2025.

At this meeting, the DRR Committee approved the DRR Annual Report for Fiji 2022–2023—the first-ever cross-sectoral report on Fiji's DRR activities. The committee also approved its public release and confirmed that the report will be issued annually going forward. It was also confirmed that the report, under the initiative of the National Disaster Risk Management Office (NDRMO), will detail the DRR activities of all Fiji government agencies.

Effective with the 2023–2024 fiscal year (FY) edition, this document will be renamed to the National Annual Report on Disaster Risk Reduction (the Report), and its continuous publication will be maintained under this new title.

The Guidelines aim to ensure the continuous annual publication of the Report, starting from 2024. They do this by explaining the Report's purpose and providing specific guidance on the items that must be included in each edition.

1.2 Terminology

EPC Unit: Emergency, Coordination & Planning Unit, NDRMO.

GIS Unit: A team within the EPC Unit primarily focused on tasks utilizing GIS applications.

Local Disaster Risk Reduction Plan (LDP): A Local DRR Plan is a comprehensive, area-specific strategy designed to reduce the impact of disasters at the local level formulated by NDRMO with collaboration with related implementing agencies, technical agencies and local town/city councils. It includes two specific types of plans: Divisional DRR Plan and Priority Area DRR Plan.

Ministry for Rural and Maritime Development and Disaster Management (MRMDDM): The ministry is the ultimate authority responsible for disaster risk management. The NDRMO is a department within this ministry.

National Annual Report on Disaster Risk Reduction (the Report): The content of this report is explained in these guidelines.

National Disaster Risk Management Act 2024 (NDRMA, the Act): This is the foundational law for disaster management in Fiji, as amended in 2024.

National Disaster Risk Management Council (NDRMC, the Council): It is convened under

the provisions of the NDRMA and holds overall responsibility for disaster risk management. Chaired by the Minister for Disaster Management, it is scheduled to meet at least twice a year. The Council has a Disaster Risk Reduction (DRR) Committee and an Emergency Committee directly under it, and these committees function under the Council's guidance and control.

National Disaster Risk Management Office (NDRMO): Functions as the National Coordinator for disaster management, implementing and promoting DRR policies at the ground level under the direction of the Director of NDRMO. It also coordinates disaster response, training, and international assistance, and provides advice to the Council.

National Disaster Risk Reduction Policy 2018-2030 (NDRRP): The NDRRP was established and endorsed by the Government of Fiji as the fundamental national policy for disaster risk reduction.

Its policy goal is to strengthen disaster risk governance and promote disaster risk reduction measures as a means of alleviating poverty, contributing to the country's overall efforts towards sustainable and resilient development. The NDRRP analyses the characteristics of climate and disasters in Fiji, organizes the international, regional, and domestic frameworks surrounding Fiji's DRR policy, and, based on the status of relevant sectors, presents 122 action items under 8 policy strategies. Each action item is assigned an implementing agency and a target implementation timeline, making the promotion and monitoring of this implementation one of the major missions of the NDRMO.

RMR Unit: Policy, Research & Risk Management Unit, NDRMO.

Roadmap for NDRRP Implementation (the Roadmap): The Roadmap for NDRRP Implementation, was developed under the leadership of the NDRMO and the MRMDDM to serve a strategic guide to implement the NDRRP adopted in 2018. It aims to support local-level DRR planning, ensuring alignment with national goals. The Roadmap is divided into two main parts: Promotion of LDP formulation; and Implementation of LDPs.

1.3 Report Issuer and Stakeholders

The Report is compiled, prepared, reported, and released by the NDRMO. The specific roles and responsibilities within the NDRMO will be explained in a later chapter.

The content of the Report encompasses the DRR activities of the entire Government of Fiji. The NDRMO is responsible for requesting information from Fiji government agencies and synthesizing the collected data. For the purposes of this Report, Fiji government agencies include both ministries and public sector entities.

The Report will be submitted to the NDRMC annually.

2. Preparing the Report

2.1 What is the National Annual Report on Disaster Risk Reduction?

A National Annual Report on Disaster Risk Reduction is the official annual report of Fiji to share the DRR related information and is open to the public.

Functions of the Report are;

- To table disaster reduction on the national agenda;
- To draw public attention to disasters in “peaceful” time;
- To record disaster damages and response of the government; and
- To record risk reduction investment, policies, and initiatives

The Report will be a vital document for raising awareness, both locally and internationally, of the Fiji government's DRR efforts. It will heighten the public’s interest in DRR and actively support the implementation of government projects. Moreover, it functions as a critical record of disaster response and DRR project execution. Documenting how past disasters were handled provides invaluable guidance for the future. Simply put, ensuring the consistent publication of this Report is paramount.

The Report is formulated with the following contents;

1) Message from Director for Disaster Management (DDM)
2) Topics (Commentary and Highlights on the Year's National Annual Report on DRR) [Optional]
3) Summary of natural disasters in Fiji and record of disaster response
4) Outline of DRR related activities of the Government of Fiji
5) NDRRP M&E
6) Outline of activities of NDRMO in the fiscal year

2.2 Reporting and Publishing the Report

The Report shall be compiled and prepared by the NDRMO.

The source documents required for the structure of each chapter are to be prepared by the respective organizations listed in the table below (Table 1). The NDRMO RMR Unit shall be responsible for collecting these materials and compiling them for inclusion in the Report.

The paramount priority during this process is to ensure that the Report is submitted to the

NDRMC and publicly released by the specified deadlines. All contributing organizations are urged to prepare their source documents accurately and in a timely manner. Concurrently, the NDRMO RMR Unit must ensure that excessive time is not spent on the compilation process to meet the established timelines.

The Report shall be compiled by the NDRMO. Following compilation, it will be reported to the NDRMC by DDM by attaching an information paper. The final Report, subsequent to discussions at the NDRMC, will then be published on the NDRMO website.

The National Disaster Risk Management Act (NDRMA) mandates that the NDRMC be held at least twice a year. One of these meetings is consistently scheduled between October and November, prior to the annual cyclone season.

Considering the Fijian fiscal year and the NDRMC meeting schedule, the NDRMO will prepare the Report according to the timeline presented in the table below (Table 2).

Table 1 Contents of National Annual Report on DRR and Base Materials

Item No.	Contents Title	Base Materials	Editor of Base Materials
1	Message from DDM	N/A	DDM
2	Topics [Optional]	N/A	RMR Unit supported by in-house technical advisers in NDRMO
3	Summary of natural disasters in Fiji and record of response	Situation report	EPC Unit and GIS Unit, NDRMO based on rapid assessment report from relevant agencies
4	Outline of DRR related activities of the Government of Fiji	Monitoring results of the NDRRP Roadmap DRR activity summary report for an international conference (if existing)	RMR Unit, NDRMO
5	NDRRP M&E	NDRRP M&E	RMR Unit, NDRMO
6	Outline of activities of NDRMO in the fiscal year	NDRMO Annual Report	RMR Unit, NDRMO

Source: NDRMO

Table 2 Timeline for Publishing National Annual Report on DRR (example in 2025)

Year	FY	Month	Actions for National Annual Report on DRR	Actions for related reports	Responsible authority
2025	FY24-25	After a disaster		Draft disaster situation report	EPC
		June		Prepare monitoring sheets for NDRRP Roadmap	RMR
		July		Conduct monitoring survey for the NDRRP Roadmap	RMR
				Draft NDRMO Annual Report	RMR
				Conduct monitoring survey for the NDRRP 122 action items (**)	BSRP TA's
	FY25-26	August		Finalize the disaster situation reports	EPC
				Finalize the NDRMO Annual Report and submit to HQ	RMR
			Message of DDM		Draft - RMR / Finalization - DDM
			Topics		RMR
			Summary of natural disasters and response in the fiscal year		EPC
			Summarize the NDRMO Annual Report for the National Annual Report on DRR		RMR – Policy
			Formulate the monitoring report for the NDRRP 122 action items		RMR – SAO DRR Central
			Formulate the monitoring report for the NDRRP Roadmap		RMR
		September	Formulate the draft National Annual Report on DRR		RMR
			Prepare information paper to report the National Annual Report on DRR	Prepare information paper to report update of the NDRRP Roadmap and local DRR plans	RMR
		October	Report to the NDRMC		DDM
		November	Reflect feedback from the NDRMC to the draft National Annual Report on DRR		RMR
			Finalize the National Annual Report on DRR		RMR
			Open to the public (Upload to the NDRMO website)		RMR / Media officer in MRMDDM HQ

**Online system development is on going. It will end July 2026.

Source: NDRMO

3. Development of Contents

3.1 Messages

The DDM is requested to prepare a lead message for this fiscal year, summarizing the Government's DRR activities. It would be best to aim for a manuscript length of approximately one A4 page

3.2 Topics [Optional]

This section is optional as it is not an essential reporting function of the Report. It would be beneficial to include a column that contributes to raising public awareness of DRR. A good option is to invite contributions not only from NDRMO staff but also from external organizations or technical DRR advisers.

The 2022–2023 edition included a topic titled "What is the DRR Annual Report? A Comparison between Fiji and Japan," and the 2023–2024 edition featured "What is a Local DRR Plan?"

3.3 Summary of Natural Disasters in Fiji and Record of Response

This section reports the overview of major disasters, the extent of damage, and the response actions taken by government agencies during the target fiscal year. This content is based on the Situation Reports prepared by the NDRMO, which are compiled by collecting data from relevant agencies after each disaster event. The Report should present this information concisely, aiming to keep the description for each disaster within one A4 page. The preparation of this content will be led by the EPC Unit and carried out by the GIS Unit.

3.4 Outline of DRR Related Activities of the Government of Fiji

This content aims to visualize the implementation status of the Government's DRR activities. To achieve this, it presents the monitoring results of the NDRRP Roadmap implementation progress. The methodology for this monitoring will be explained in a subsequent section of this Guideline. The monitoring and the drafting of this content will be performed by the RMR Unit.

3.5 NDRRP M&E

This content also aims to visualize the implementation status of the Government's DRR activities. For this purpose, it presents the monitoring results of the implementation progress

of the 122 action items in the NDRRP. The methodology for this monitoring is detailed in a separate M&E Guideline created by the NDRMO. The monitoring and the drafting of this content will be performed by the RMR Unit.

3.6 Outline of Activities of NDRMO in the Fiscal Year

This section reports on the activities of the NDRMO. The NDRMO Annual Report submitted to the MRMDDM HQ at the end of each fiscal year will be used as the source document. However, when incorporating this information into the National Annual Report on DRR, the RMR Unit will lead a collaborative effort across the entire NDRMO to confirm that no content unsuitable for external public release is included.

4. Monitoring of the NDRRP Roadmap

4.1 What is the NDRRP Roadmap

Roadmap for NDRRP Implementation (NDRRP Roadmap) outlines technical guidelines and commitments to support the implementation of the NDRRP, led by the NDRMO and the MRMDDM. It will be regularly reviewed and updated with progress reports submitted to the NDRMC via the National Annual Report on DRR.

The Roadmap is structured in two parts to achieve its purpose: one for developing the LDPs and the other for their implementation. It clarifies and prioritizes the issues to be considered during the LDPs planning process, the activities to be carried out to reduce disaster risks as outlined in the plans, and the specific action items in the NDRRP that will be achieved by promoting these activities.

4.2 Methodology of Monitoring

a) Required Materials

- Roadmap (timeline) for LDP development
- Activity List
- Contact information for the Commissioner's Office
- Contact information for Ministerial DRR Liaison Officers: (Division-level disaster management liaison contact information is to be obtained through the Commissioner's Office. Central liaison contact information is to be verified within the NDRMO.)

b) Work Procedure

(1) Update of the Roadmap for LDP development

The status of Local DRR Plan formulation will be confirmed internally by the NDRMO and subsequently documented in the Roadmap.

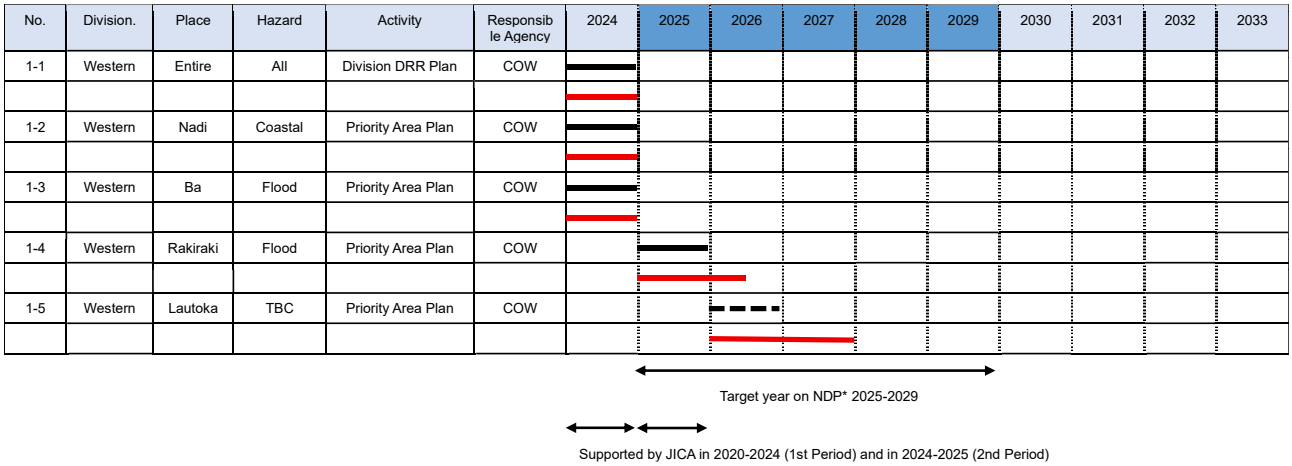


Fig. 1 Example of Development Status of Local DRR Plans

(Black line ▬ : Plan, Red line ▬ : Actuals)

(2) Update of the Activity List (June)

The NDRRP Roadmap Activity List must be prepared with columns for recording **Implementation Status** and **Remarks**.

Implementation Status must be a selection from: (Not Started, In Progress, Completed, No Data).

The Remarks column should be used to record specific details for "In Progress" activities (e.g., "discussion started," "budget allocated," or the implementation location).

The Activity List shall be **reviewed annually** during this monitoring period. If new Local DRR Plans have been formulated, their corresponding activities must be added and the list updated accordingly.

(3) Segmentation of the Activity List (June)

The Activity List must be segmented by **implementing agency** to create separate lists, making them easily distributable for the hearing process.

(4) Email Distribution of Activities (1st–2nd Week of July)

The segmented Activity Lists shall be emailed from the NDRMO to **the division-level disaster**

management liaison officers of each Ministry and request a reply within approximately **2 weeks**.

For activity progress that cannot be confirmed at the district level, the liaison officers should be instructed to consult with the relevant department at their Ministry's Headquarters. The NDRMO shall work with Commissioner Offices closely.

(5) Collection of Responses (3rd Week of July)

If no reply is received after two weeks, the NDRMO shall follow up by conducting telephone or in-person interviews with the division-level liaison officers to obtain activity progress updates.

This follow-up process should be completed within approximately **1 week**.

Any data not collected within this one-week period shall be designated as "**No data** for this fiscal year's progress."

(6) Data Aggregation (August)

The Implementation Status (Not Started, In Progress, Completed, No Data) shall be aggregated for **each Local DRR Plan** (Divisional DRR Plan and Priority Area DRR Plan).

Items whose implementation was advanced and contributed to **the NDRRP 122 action items** shall also be extracted. In this compilation, progress of the development of local DRR plans should be included.

(7) Archiving Responses (August – NDRMO)

While only the aggregated results will be published, the raw response materials contain a better understanding of the progress. The original response materials must be appropriately archived within the NDRMO for convenient future reference. The retention period for these materials shall be **5 years**.

c) Compilation Format

A pie chart illustrating the percentage of implementation status shall be created for each Local DRR Plan (Divisional and Priority Area Plans).

Activities that contributed to the progress of the NDRRP 122 action items shall be listed.

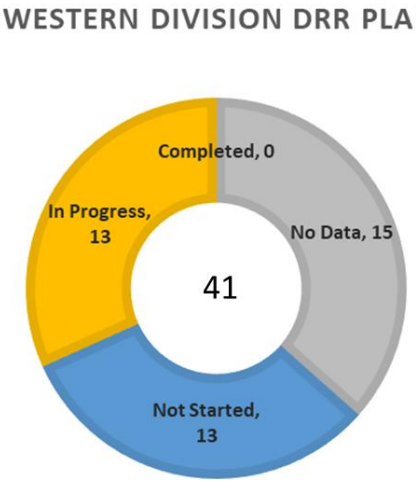


Fig. 2 Example of Implementation Status in a Division DRR Plan

d) Key Considerations

To ensure the National Annual Report on DRR compilation is completed in September, the monitoring process must prioritize **timeliness** and avoid spending excessive time on coordination.

End.

Challenges of Investment in Disaster Risk Reduction

- Accelerating the implementation of Sendai Framework

防災投資の促進 仙台防災枠組の実現に向けて

Japan International Cooperation Agency
Disaster Risk Reduction Group

Efforts for Promotion of Investment in DRR in Fiji

World Bosai Forum 2025 - Sendai

Ms. Melenia Tuinasau
Senior Administration Officer Disaster Risk Reduction
NDRMO, Fiji

1. The disaster in Fiji and overview of the project

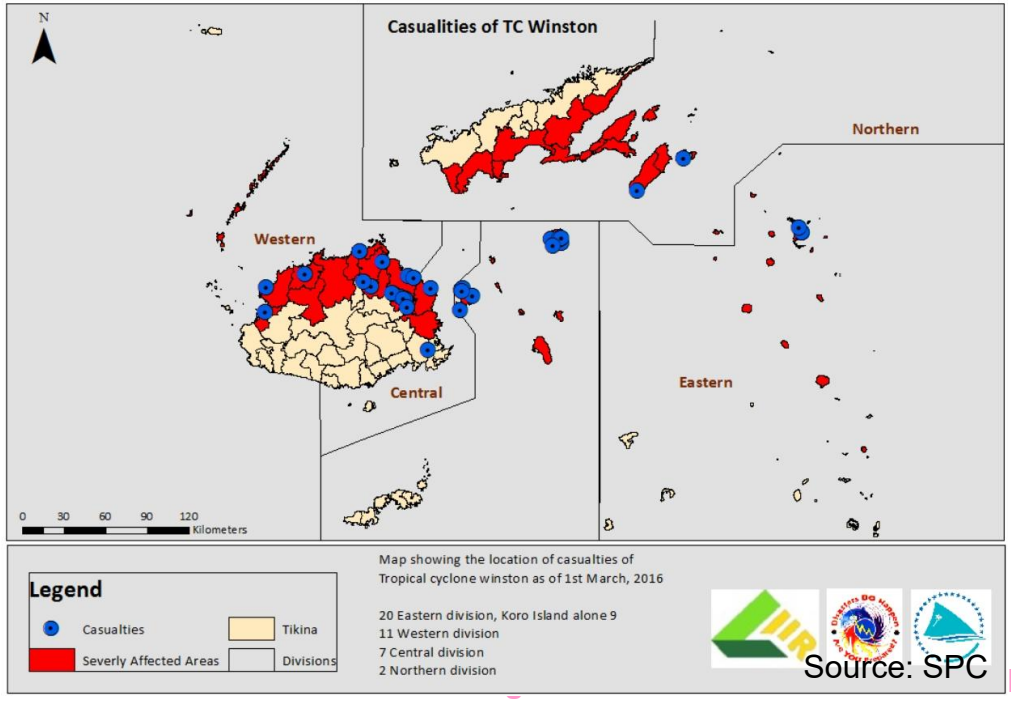
Fiji

- Small Island Developing State in the Pacific
- 4 Divisions, 13 towns and cities
- 0.9 million population (2023)
- Prone to Tropical Cyclones, floods, earthquakes, coastal inundation and landslides
- Affected by sea level rise

Natural Disaster in Fiji

- Tropical Cyclones
  TC Winston (2016), TC Harold (2020),
  TC Yasa and TC Ana (2021)
- Floods
- Landslides
- Storm surge
- Earthquakes / Tsunami

Source: Ba T/C, 30 Dec 2024



Source: SPC

Source: FRA, 26 Dec 2024

The Project for Mainstreaming Disaster Risk Reduction

- Technical cooperation project from 2020 with the partnership between NDRMO and JICA
- **Project Purpose**: Capacity of NDRMO is strengthened to implement and promote DRR activities in line with the international, regional and national policies.
- **Activities**

  WG1: Hazard/Risk Assessment
  WG2: Local DRR Planning
  WG3: DRR Projects Promotion

2. Good practices and activities

Efforts for Hazard/Risk Assessment and DRR Planning

Hazard/Risk Assessment (Division Level)

↓

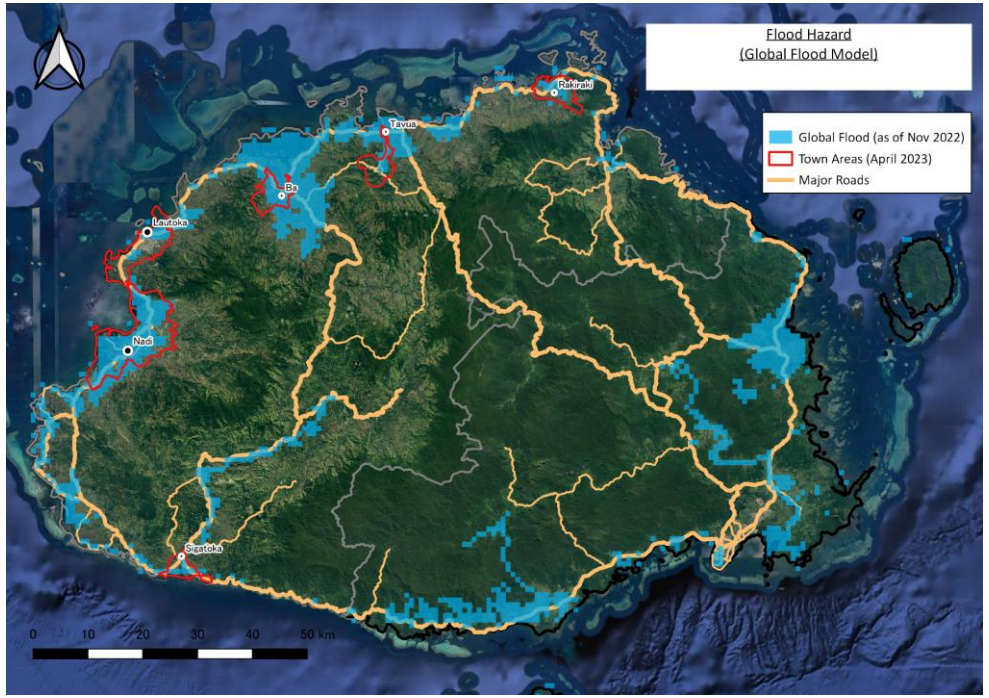
Division Level DRR Plans
- DRR direction / Policy in the division
- Prioritization of areas / disasters

↓

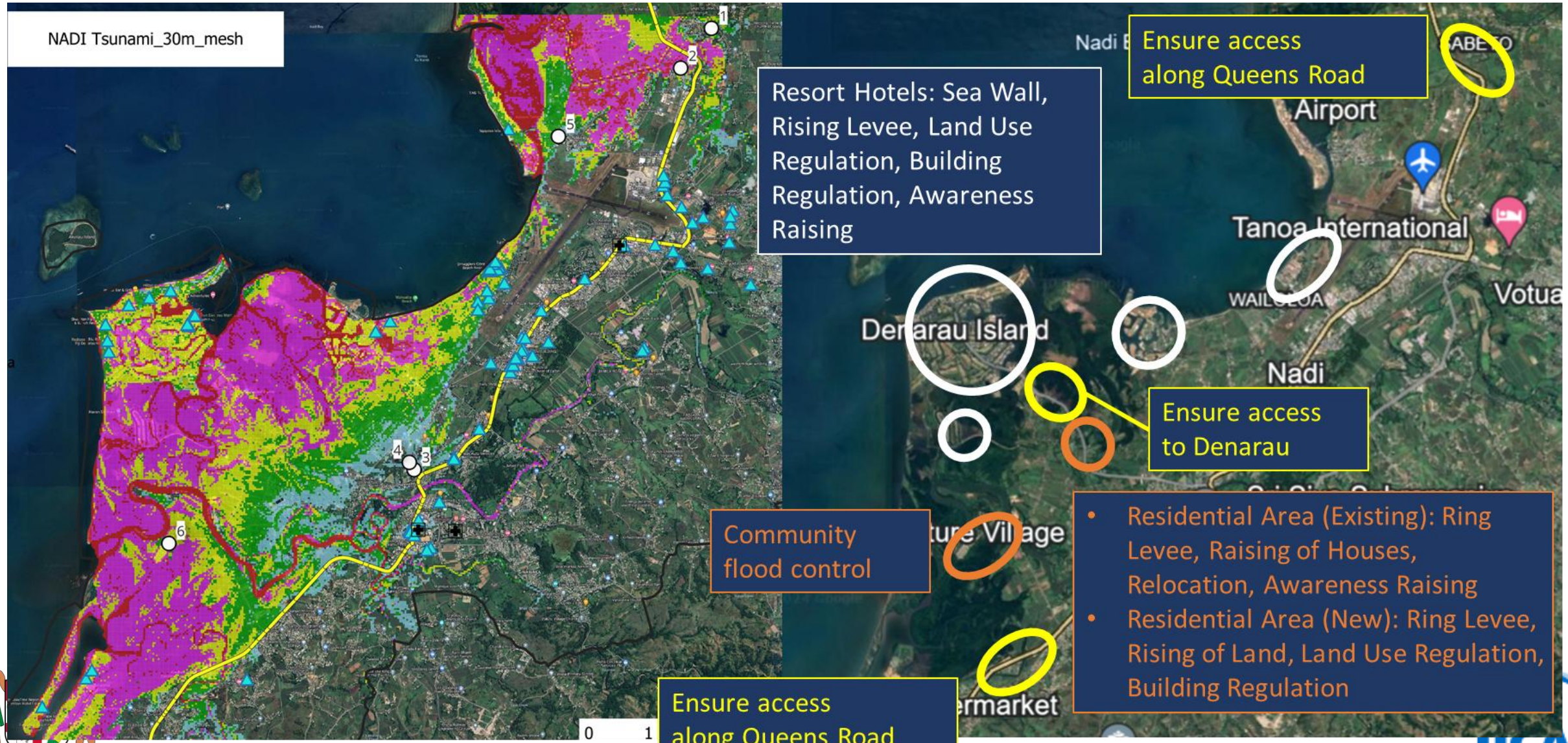
Hazard/Risk Assessment (Priority Area)

↓

Priority Area DRR Plans
- Nadi area for the coastal disasters
- Ba area for the flood disaster
- Rakiraki area



Local DRR Plan in Nadi (for Tsunami)



National Development Plan 2025-2029 & Vision 2025

Disaster Risk Reduction is a national issue now.

Chapter 7

Focus area 6: Developing public Infrastructure, protecting Environment and addressing Climate change

7.6: National Disaster Risk Reduction

Goal: Building resilience through risk informed socioeconomic development	
Policies	**Strategies**
Mainstreaming disaster risk reduction planning and implementation at the local level	• Develop disaster risk reduction plans for the four divisions. • Review and incorporate disaster risk reduction strategies into sectoral plans. • Develop a community-based disaster risk management policy.

Indicators	Baseline	3 Years (2025-2027)	5 Years (2025-2029)
DRR Divisional Plan developed (number)	NA	2	4

NDRRP Roadmap for LDP Development and LDP Implementation

NDRMO has developed a Roadmap for formulating and implementing LDPs

- Strategic approach needed for developing LDPs to achieve NDP
- Important to follow through with the implementation after planning

Key elements of the Roadmap:

- Development and implementation timeline
- Linkage with the 122 action items outlined in the National Disaster Risk Reduction Policy (NDRRP)

National Development Plan

No.	Div.	Place	HZ.	Activity	Responsible	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
						JICA Mainstreaming									
1-1	W	Entire	A	Division DRR Plan	W. Division	▬									
1-2	W	Nadi	C	Priority Area Plan	W. Division	▬									
1-3	W	Ba	F	Priority Area Plan	W. Division	▬									
1-4	W	Rakiraki	F	Priority Area Plan	W. Division		▬								
1-5	W	Lautoka	TBC	Priority Area Plan	W. Division			▪▪▪▪							
1-6	W	Sigatoka	TBC	Priority Area Plan	W. Division				▪▪▪▪						
1-7	W	Tavua	TBC	Priority Area Plan	W. Division					▪▪▪▪					
2-1	C	Entire	A	Division DRR Plan	C. Division		▬								
2-2	C	TBC	TBC	Priority Area Plan	C. Division		▬								
…	C	…	…	Priority Area Plan	C. Division					▪▪▪▪	▪▪▪▪	▪▪▪▪			
3-1	N	Entire	A	Division DRR Plan	N. Division				▬	▬					
…	N	Entire	TBC	Priority Area Plan	N. Division						▪▪▪▪	▪▪▪▪	▪▪▪▪		
4-1	E	Entire	A	Division DRR Plan	E. Division					▬	▬				
…	E	Entire	TBC	Priority Area Plan	E. Division							▪▪▪▪	▪▪▪▪	▪▪▪▪	

A: All, C: Coastal hazards, F: Flood / W: Western, C: Central, N: Northern, E: Eastern

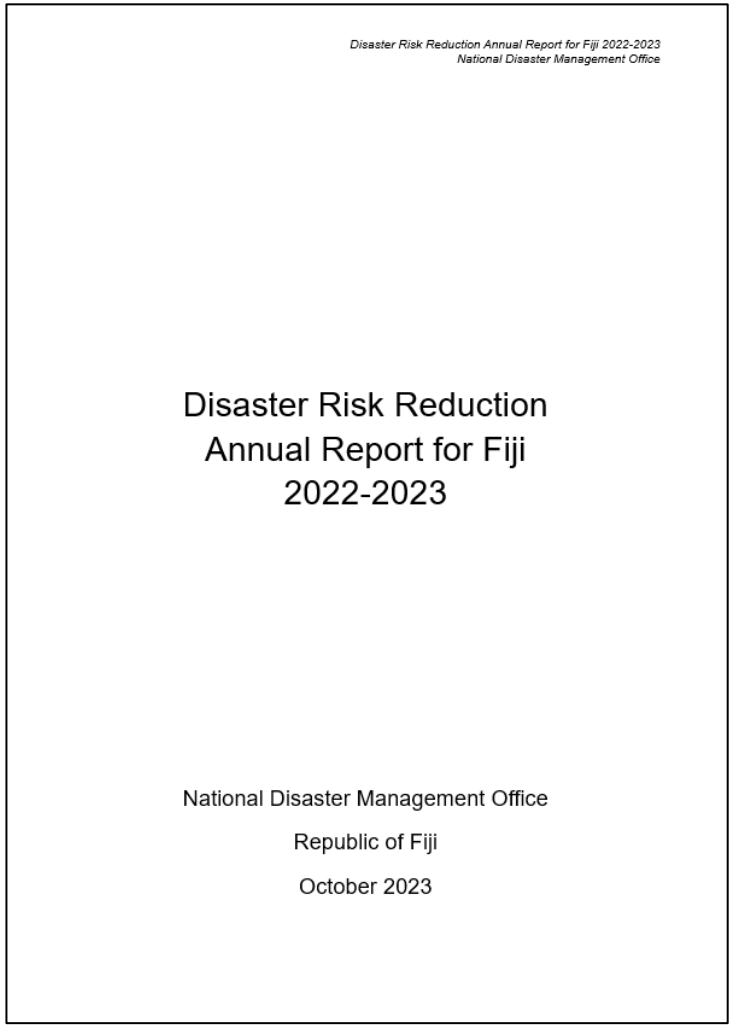
DRR Annual Report for Fiji

Fiji's first “DRR Annual Report” will be issued.

The report will serve as a DRR white paper

- Summarizes disaster overview from previous years
- Records government activities related to disaster risk reduction
- Demonstrates findings to the public and archives the information

Efforts are underway to establish a system for continuous publication.



3. Remaining Challenges

Remaining Challenges

1. Promotion of implementation for the Roadmap
   - Budget allocation
   - Regular monitoring

2. Basic data needs
   - Disaster damage record
   - Meteorological/Hydrological data
   - Topographical data
   - Geological data
   - Building structure data etc.

VINAKA

DISASTER RISK REDUCTION PLAN

FOR THE

CENTRAL DIVISION

DRAFT

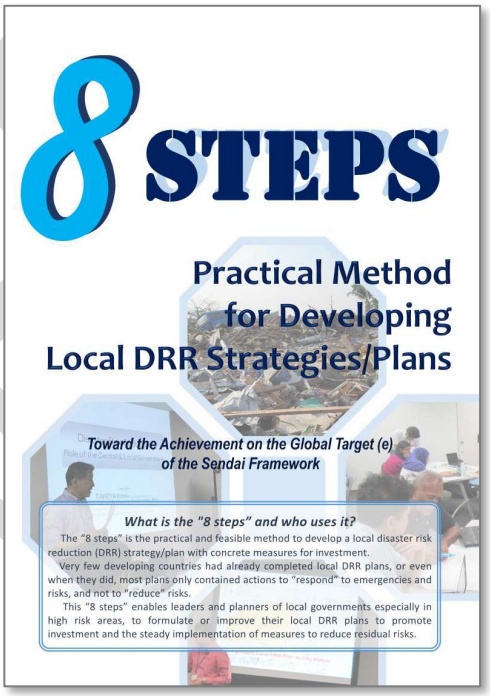
AUGUST 2025

Introduction

How the Disaster Risk Reduction (DRR) Plan was developed

The Disaster Risk Reduction Plan for the Central Division (hereinafter referred to as "DRR Plan") was developed under the Project for Mainstreaming Disaster Risk Reduction supported by the Japan International Cooperation Agency (hereinafter referred to as "JICA").

To develop the DRR Plan, a series of consultation and brainstorming meetings was held with the divisional offices of each line ministry, Town Councils, and other bodies. In addition, desk-review of various documents on the future development perspectives, lessons and challenges faced during past disasters, on-going and planned DRR initiatives and others were conducted.



DRR plan is developed in line with the international and national frameworks in order to prevent the creation of new and reduce existing disaster risks.

The "8 Steps – Practical Method for developing Local DRR Strategies/Plans" was referred to develop the DRR Plan for the Western Division.

Alignment with National and Divisional policies and plans

The DRR Plan was developed in line with the National Disaster Risk Reduction Policy (hereinafter referred to as "NDRRP") and other related development policies in the National and Divisional Level.

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List of Abbreviations

ABBREVIATION	DEFINITION
BoS	Bureau of Statistics
DRR	Disaster Risk Reduction
EFL	Energy Fiji Limited
FPCL	Fiji Ports Corporation Limited
FRA	Fiji Road Authority
JICA	Japan International Cooperation Agency
MHMS	Ministry of Health and Medical Services
MLG	Ministry of Local Government
MLMR	Ministry of Lands and Mineral Resources
MOAW	Ministry of Agriculture and Waterways
MOE	Ministry of Education
MOEnv.	Ministry of Environment
MoH	Ministry of Housing
MPW	Direction for Public Works of the Ministry of Public Works, Transport and Meteorological Services
MRMDDM	Ministry of Rural and Maritime Development and Disaster Management
NDRRP	National Disaster Risk Reduction Policy
NDMO	National Disaster Management Office
NDP	National Development Plan
TC	Tropical Cyclone
WAF	Water Authority of Fiji

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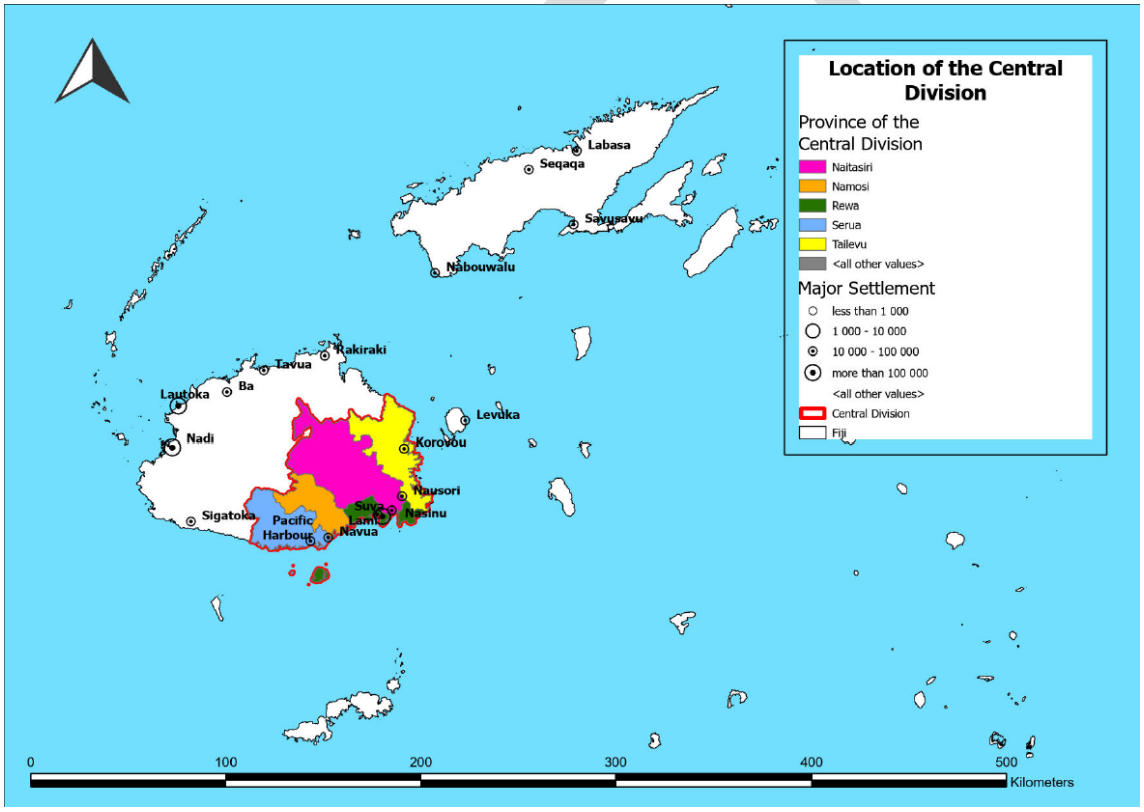
1 Socio-Economic Profile of the Central Division

1.1 Outline of the Division

The Central Division is one of Fiji's four divisions consisting of five provinces, namely Naitasiri, Namosi, Rewa, Serua, and Tailevu in the main island of Viti Levu; and also including the outlying island of Beqa. The capital of the division is Suva, which is also the capital of Fiji.

The Division is composed of five provinces and 19 Tikina. A total of 337 villages and 985 settlements are dispersed within the Division.

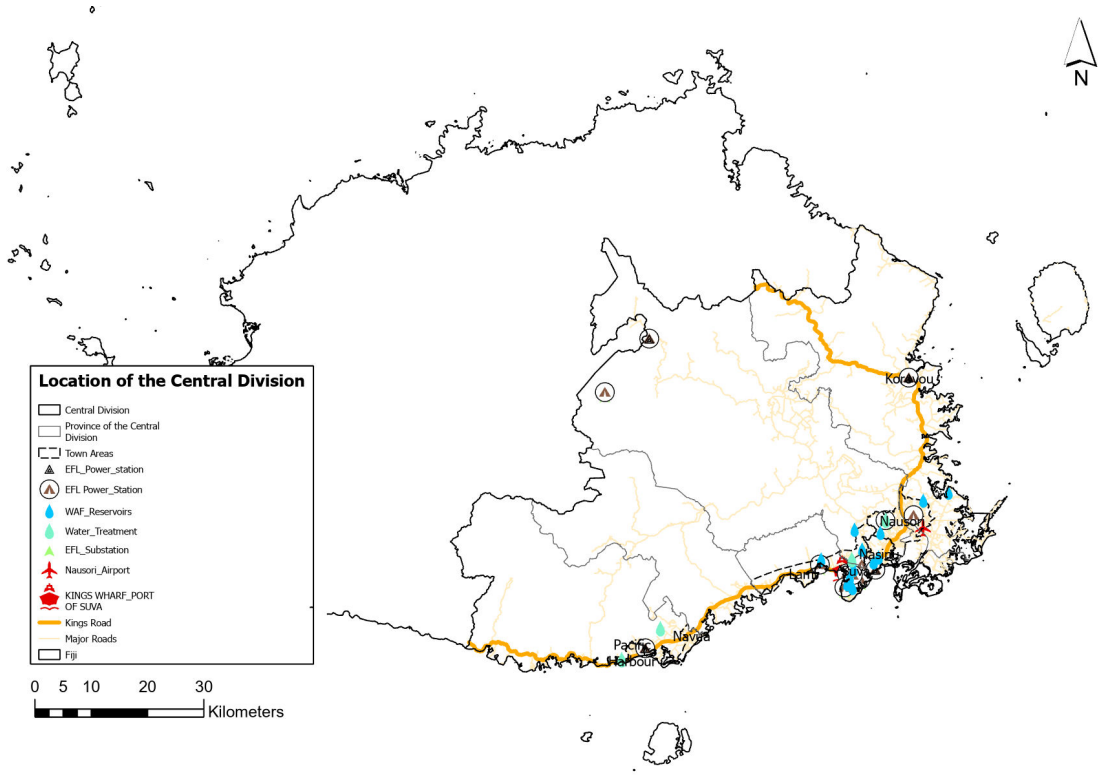
The land area of the Central Division is about 4,293 square kilometers which represents about 40% of Viti Levu or about 23% of the total land area of Fiji.



Source: JICA Project Team

Figure 1. Location of the Central Division

In Central division there is one city which is Suva City and three towns which are Nasinu Town, Nausori Town, Lami Town. Figure 2 shows the town areas including the urban and peri-urban areas, reflecting the enumeration areas of BoS' 2007 and 2017 population census surveys.



Source: JICA Project Team

Figure 2. Location of the seven cities and town areas

1.2 Population

According to the Population Census Survey conducted by the Bureau of Statistics (hereafter referred to as "BoS"), the total population of Fiji was 775,077 in 1996, 837,271 in 2007, and 884,887 in 2017.

The average annual rate of population growth over the decade up to September 2017 was 0.6%. This rate has been decreasing from 2% in 1986, 0.8% in 1996 and 0.6% in 2017, due to lower birth rates and out migration.

The population of the Central Division was 378,284, which represents 42.7% of the Fijian population. The provinces of Rewa and Naitasiri are the two populated provinces in the Central Division. The total population of the two province is 285,845 which represents 32.3% of the Fijian population.

Table 1 shows the changes in land area and population of the Suva city and the three town areas. The total population of the urban population is 268,423 which is 71% of the total population in the Central Division of 378,284. In addition, as Table 2 shows the population is concentrated in the provinces of Naitasiri and Rewa.

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The urban population is increasing in all the areas and especially in Lami town and Nausori town in experienced a significant increase with the growth rate of more than 20% as shown in Table 1. And as shown in Table 2, the urban population has increased by about 8.5% (from 248.486 to 269,505) and the rural population increased by about 15.7% (from 93,900 to 198.643). This represents the demography of this region is not the population movement inside the area from rural to urban area, but the Central division is experiencing population growth from inflow of population from outside the division.

Table 1. Urban Population as of 2007 and 2017

	Urban Population		Percentage Increase (2007-2017)
	2007	**2017**	
Suva	85,691	93,874	109.4%
Lami	20,529	24,637	120.0%
Nasinu	87,446	92,046	105.3%
Nausori	47,604	57,866	121.6%
Total	**241,270**	**268,423**	**111.3%**

Source: Source: Bureau of Statistics, "2007 and 2017 Population Census"

Table 2. Population changes of the 3 Provinces from 2007 to 2017

	Population in 2007				Population in 2017		
	Total	**Urban**	**Rural**		**Total**	**Urban**	**Rural**
Naitasiri	160,760	135,033	25,727	⇨	177,678	148,697	28,981
Namosi	6,898	-	6,898	⇨	7,871	-	7,871
Rewa	100,787	88,763	12,024	⇨	108,016	93,483	14,533
Serua	18,249	6,867	11,382	⇨	20,031	7,005	13,026
Tailevu	55,692	17,823	37,869	⇨	64,552	20,320	44,232
Total	**342,386**	**248,486**	**93,900**	⇨	**378,148**	**269,505**	**108,643**

Source: Source: Bureau of Statistics, "2007 and 2017 Population Census"

To better visualize the population distribution in the Central division, the population distribution with the population density in a 100m grid was visualized in the map based on the 2017 population census.

The population is concentrated in Suva city and the surrounding three towns of Nasinu, Nausori and Lami which is usually considered as the Greater Suva are. The population distribution is not divided among Suva city, Nasinu town and it is totally connected and can be seen as one growth center. In addition, as usually DID (Densely Inhabited Districts" is defined as an area with over 40-50 persons per 100m grid, some DID can be observed in the central area of Nausori town and Lami town.

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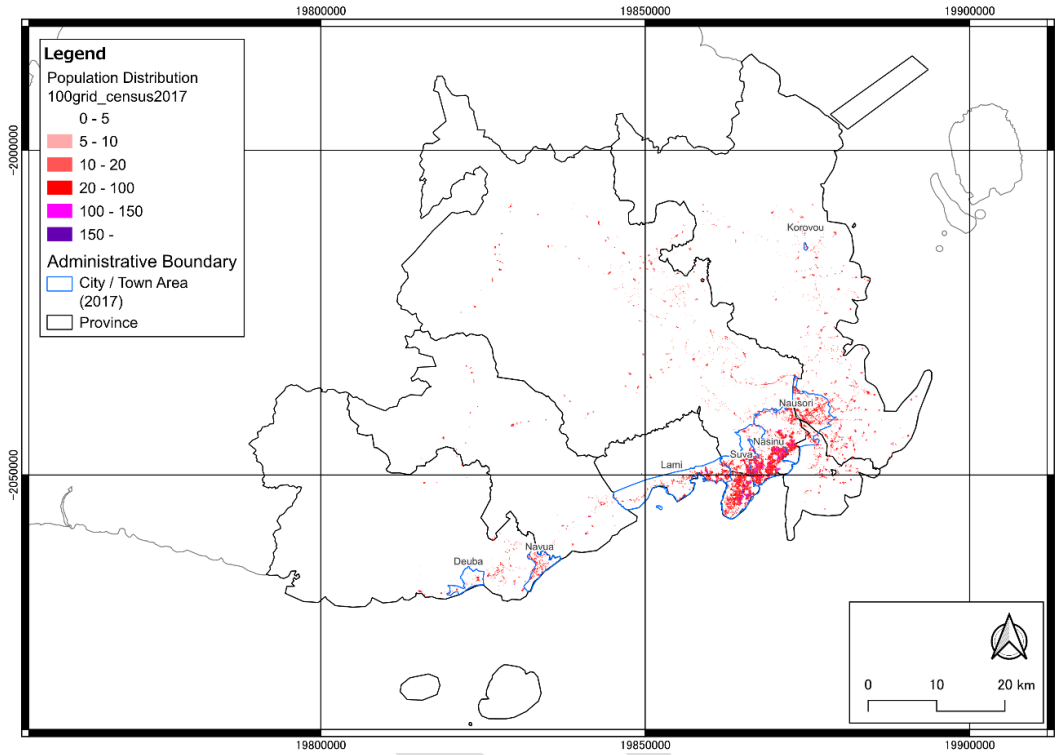
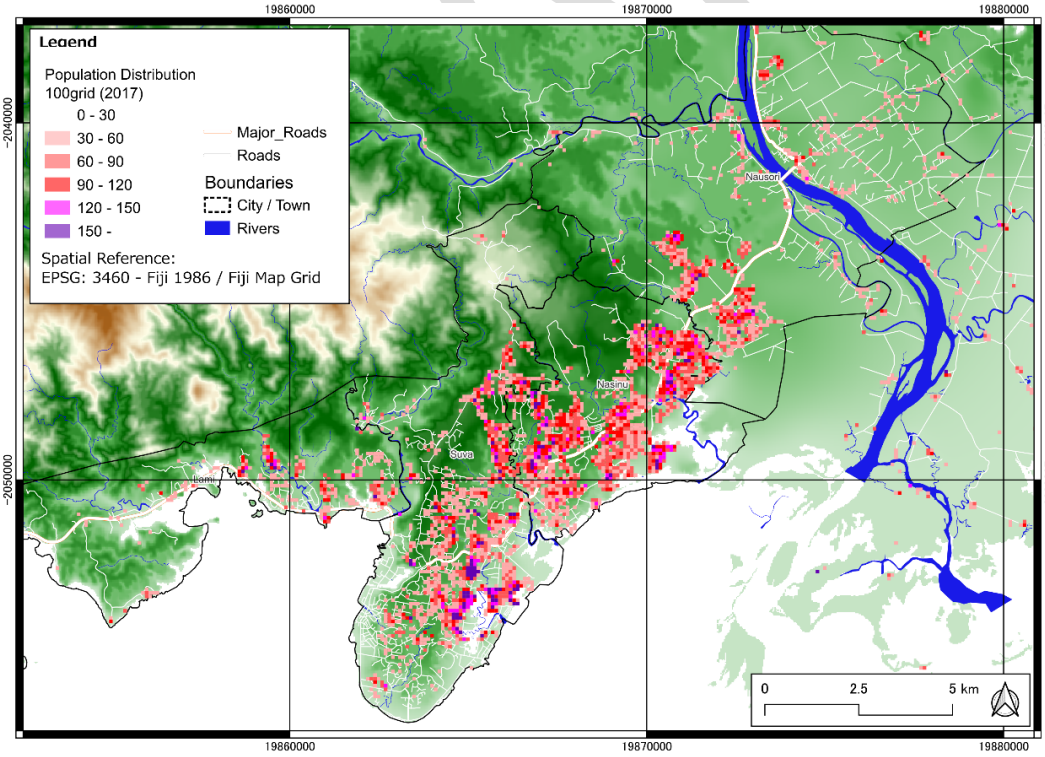


Source: Formulated by JICA Project Team based Bureau of Statistics, "2007 and 2017 Population Census"

Figure 3. Population Distribution in the Central Division

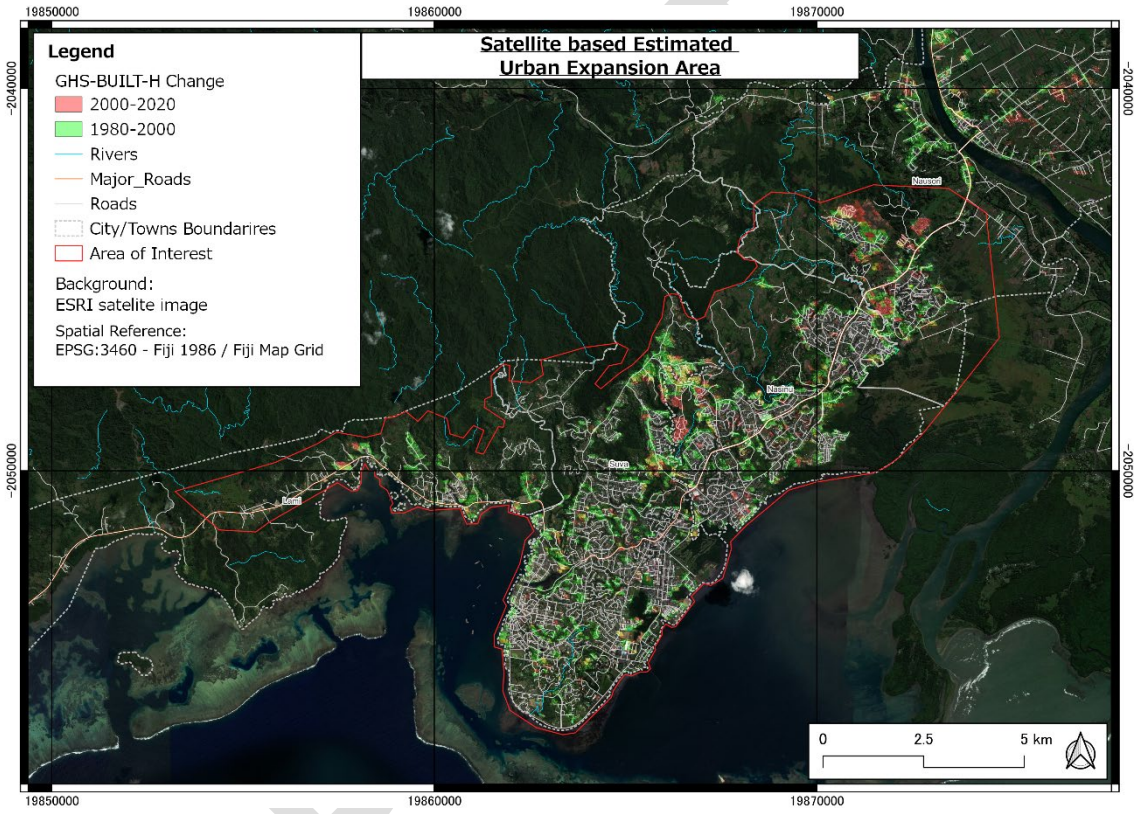


Source: Formulated by JICA Project Team based Bureau of Statistics, "2007 and 2017 Population Census"

Figure 4. Population Distribution in the Greater Suva area

1.3 Urbanization

To recognize the urbanization situation in the population concentrated area. The built-up area after 1980 was identified by utilizing satellite-based information. The green area shows the area possibly developed between 1980 to 2000 and the red area indicates the area possibly developed between 2000 to 2020. It can be observed that urbanization is progressing in the sub-urban areas in the area of Lami, Nasinu and Nausori which is indicating the expansion of greater Suva area, and this corresponds to the high population growth rate in Lami and Nausori. Especially on the hill side of Nausori, major development activity has been implemented.

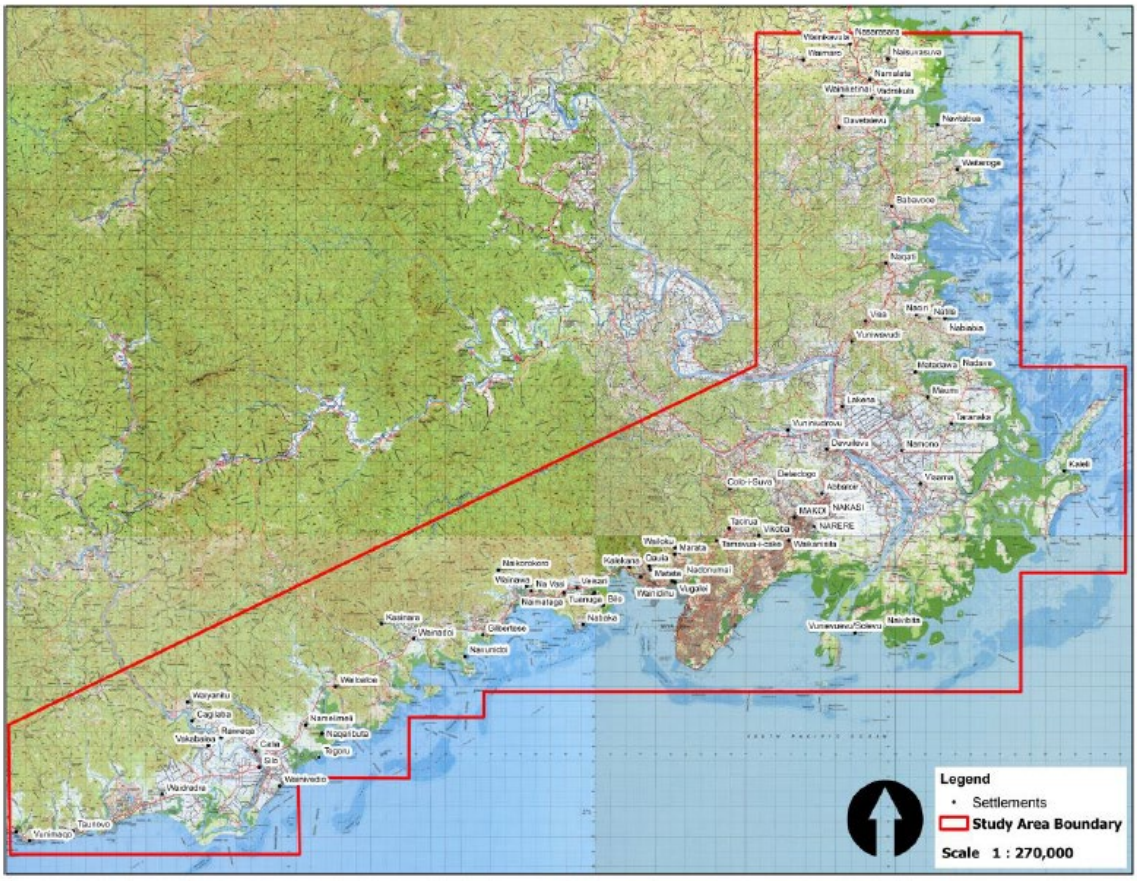


Source: Analyzed by the JICA project team based on Pesaresi M., Politis P. (2023): ***GHS-BUILT-V R2023A - GHS built-up volume grids derived from joint assessment of Sentinel2, Landsat, and global DEM data, multitemporal (1975-2030).*** *European Commission, Joint Research Centre (JRC)*

Figure 5. Estimated Urban Expansion Area in the Greater Suva area

1.4 Informal Settlement

The challenges in the informal settlements are also a major issue in the Central Division. According to the TLTB, Regional Land Release Plan for the Greater Suva area, 15% of the urban population is estimated to live in 200 informal settlement locations in the Greater Suva area. The existence of these informal settlements in high-risk area is specifically an issue from the DRR perspective. Some informal settlements vulnerable to disaster can be identified such as Wailea (vulnerable to flood, coastal disaster), Nanuku (vulnerable to flood, coastal disaster), Jittu (vulnerable to steep slope failure), Qauia (vulnerable to flood).



Source: Regional Land Release Plan for the Greater Suva Area

Figure 6. Estimated Urban Expansion Area in the Greater Suva area

1.5 Basic Infrastructures

The Central Division with Suva city as the capital, is one of the hubs for economic activities in the Country. It envelops the main transportation infrastructures such as road network connecting the divisions, ports, and airports.

1.5.1 Water and Sewerage

The Water Authority of Fiji (hereinafter referred to as "WAF") is the responsible body to manage drinking water and wastewater and relies on individual and collective responsibility with governmental stakeholders in ensuring an integrated planning and implementation of programs.

There are 4 water treatment plants, and 13 reservoirs located in the Central Division. The water supply in the village areas is a challenge to provide secure quality water. In addition, the water consumption in the Suva metropolitan area is vast and securing the water supply is also important. Especially the water supply to the Suva metropolitan area with about 190 million letters per day is supplied from the water intake of 2 locations in the Wainamu river and 1 from the Waidina river. The water intake for the Suva metropolitan area depends on this water intake which makes these facilities a key function for sustainable water supply.

1.5.2 Transportation

- Road Network

The road network is managed and maintained by the Ministry of Public Works, Transport and Meteorological Services (hereinafter the direction for Public Works of the Ministry will be referred to as "MPW") and the Fiji Road Authority (hereinafter referred to as "FRA").

In the central division the focus of the road network can be described in three points. One is the two major inter-division roads of Kings Road and Queens Road. Second, considering the rapid population growth in the Suva metropolitan area, the regional connection road between Suva and Nausori is secured by Kings Road and Princess Road, and improvement of road network is considered. Thirdly, securing connectivity from the hilly terrain villages to the major road is a challenge. Especially one of the missing links with the hilly terrain villages to the major road is between the Vunindama and Korovou through the Wainibuku River.

- Port Development

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The ports of Suva and Lautoka are the two major commercial ports for importation and exportation. Suva Port is the largest of the Country.

The current port was reconstructed in 1963 and has not changed fundamentally from its original 1910 design; the port infrastructure is aging. The port is serviced by three wharves: King's Wharf (containerized cargo, liquid bulk, and cruise ships), Princess Wharf (international fishing vessels) and Walu Bay Wharf (dry bulk). 3 King's Wharf (north and center berths only) was rehabilitated in 2005 and is the only section of the port that is in condition to service container vessels; of the 492 m of King's Wharf, only 293 m is suitable for mobile crane activity.

As the Suva port being the key infrastructure for the economy of Fiji, the maintenance of this function and the enhancement of its resilience is necessary.

1.5.3 Electricity

The Energy Fiji Limited (hereinafter referred to as "EFL") is responsible for electricity supply and supplies the Division through its grid system.

1.5.4 Telecommunication

The development of telecommunication is characterized by the increased use of cellular phone and mobile networks facilitated by private companies, such as Vodafone, Digicel-Fiji, and INKK Mobile.

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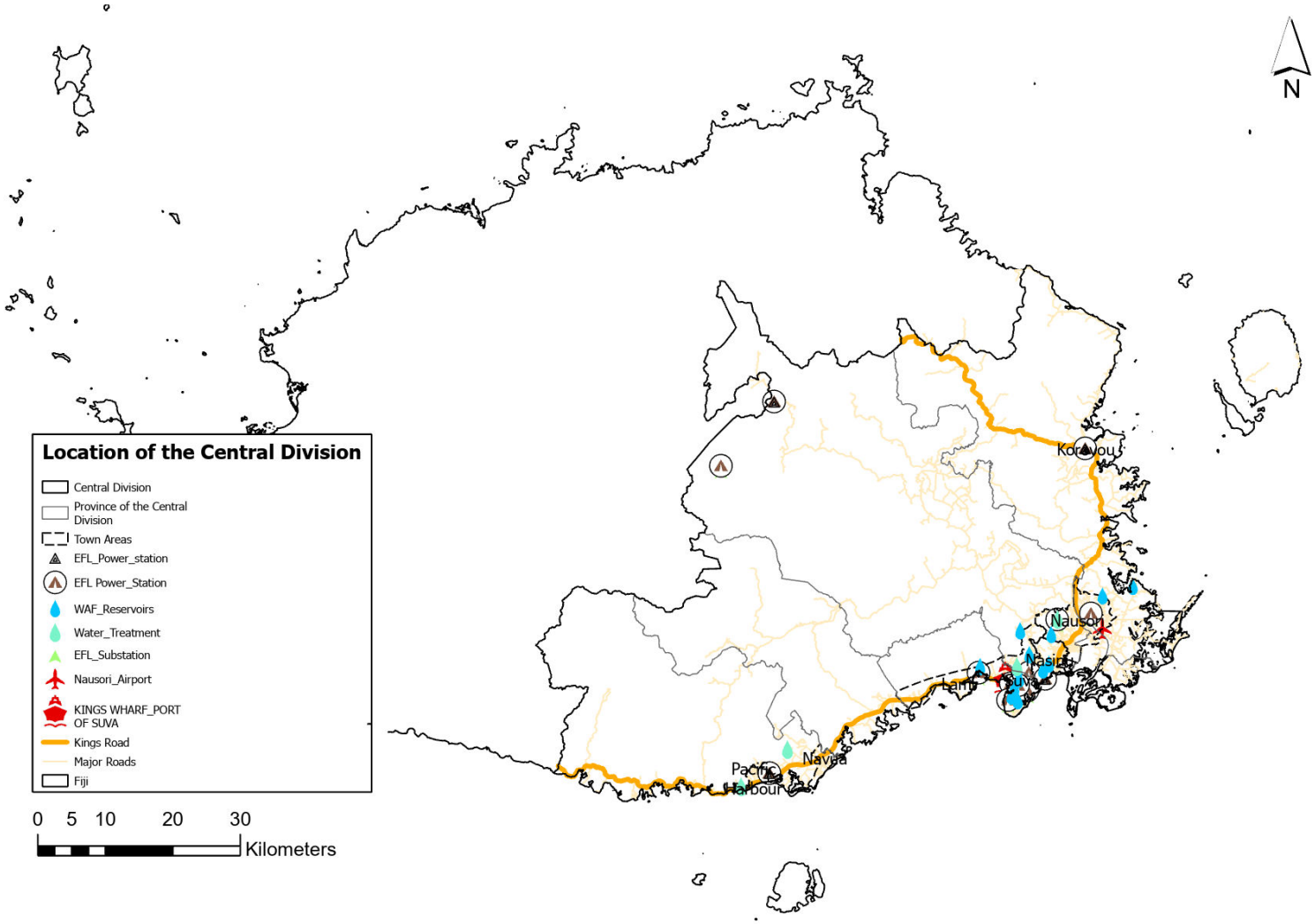


Source: JICA Project Team

Figure 7 Location of the major infrastructures

1.6 Social Services

1.6.1 Health Sector

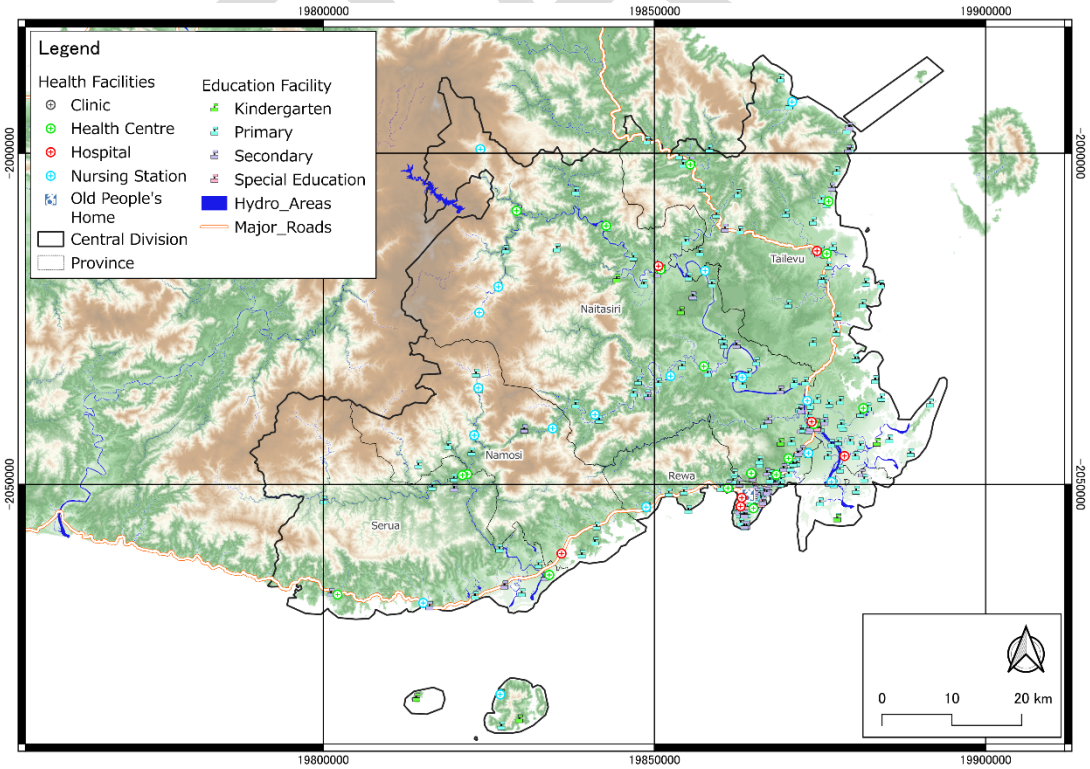
Health continues to be a growing and increasingly complex field of competing priorities from all perspectives from the individuals to governments, businesses, health professionals and the health service system.

According to the database as of 2017 of the Ministry of Health and Medical Services (hereafter referred to as "MHMS"), 47 health facilities, including 20 health centers, 8 hospitals, 17 nursing stations,1 old people's Home and 1 clinic are located in the Central Division. In addition, the Colonial War Memorial (CWM) Hospital is located in the division as one of the central hospitals with importance function as the leading hospital.

1.6.2 Educational Sector

In the Central Division, one of the factors that greatly impacts the access to schools is the geographical distribution of them, especially in the rural areas.

The Central Division currently has 13 kindergarten, 198 primary schools, 67 secondary schools and 5 Special education schools.



Source: JICA Project Team

Figure 8. Location of health facilities and schools

2 Development Perspectives of the Central Division

2.1 National Development Plan (NDP)

The Fiji National Development Plan 2025-2029 and Vision 2050 (hereinafter referred to as "NDP") was published by the Ministry of Finance Strategic Planning, National Development and Statistics in September 2024.

The vision of NDP consists of 3 pillars and 7 focus areas. Among the pillars "Focus Area 3: Sustainably Managing Natural Resources", "Focus Area 5: Uplifting Socioeconomic Wellbeing", "Focus Area 6 Developing Public Infrastructure, Protecting Environment and Addressing Climate Change" are the areas related to DRR.

The NDP mention the importance of Disaster Risk Reduction by setting it as one of the elements for the Focus Area 6 as "7.6 National Disaster Risk Reduction". It emphasizes the importance of building capacity on DRR on the sub-national and local level government, in addition, the capacity of private contractors and operators who participate in flood control and rehabilitation measures are mentioned to be in need on improvement.

In the NDP to provide the direction of investment for development in the division, the goal for DRR is set as to "Building resilience through risk informed socioeconomic development" with 6 Policies and strategies to achieve. In addition, to evaluate the progress of the plan, Key Performance Indicators are listed for the DRR related issues as shown in Table-X.

Table 3. List of Key Performance indicators related to DRR

Indicators	Baseline	3 Years (2025-2027)	5 Years (2025-2029)
Multi Hazard Early Warning System for Fiji (%)	NA	50	100
Joint National Action Plan for Climate Change and Disaster Risk Reduction (%)	NA	50	100
Multipurpose evacuation centers (number)	NA	5	4
DRR Divisional Plan developed (number)	NA	2	4
Disaster Risk Finance Policy (%)	NA	50	100

However, the NDP is a plan to outline the direction of the development and do not identify specific development investment with location. Therefore, to understand the planned investment, the Fiji National Infrastructure Investment Plan 2023-2034 was revised to confirm the investment plan in the development perspective.

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2.2 National Infrastructure Investment Plan (NIIP)

The NDP provides strategy of the development in Fiji in the national level. However, the detailed project to achieve this plan is not mentioned. To understand the projects planned in the national level, the National Infrastructure Investment Plan (hereinafter referred to as “NIIP”) which was prepared under the auspices of Fiji Government was confirmed. NIIP is an initiative to summarize and monitor the major development activities in Fiji. The major development programs planned in the Central Division is listed on Table 4.

Programs related to Disaster Risk Reduction are mentioned in light orange color on Table 4. Major DRR related projects are meteorological observation system, port facility rehabilitation, community road construction, upgrading of informal settlement, flood management, coastal erosion protection, dredging work and maintenance of drainage scheme.

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Table 4. List of Programs located in Central Division in the Fiji National Infrastructure Investment Plan 2023-2024

	Sector	Program Name	Description	Lead Agency
1.	Air	Upgrade of Met Equipment	Upgrade of Nausori Radar	FMS
2.	Air	Installation of AWOS	Installation of Automated Weather Observing System (AWOS) at Nausori Airport	FMS
3.	Air	Weather data stations (blackspots)	Not Mentioned	FMS
4.	Air	Outer Islands Connectivity	Apron expansions and river encroachment in Bureta Airport (Located in Eastern Division but related)	Fiji Airports
5.	Air	Suva Nausori Connectivity	Upgrade in the terminal and related airport facility in Nausori airport	Fiji Airports
6.	Air	Aviation Safety and Security	Equipment for security check and biometric access control	Fiji Airports
7.	Buildings	N/A	Construction of New Maternity Unit Extension (CWM)	AMU
8.	Buildings	N/A	Construction of New Rehabilitation Unit (Tamavua)	AMU
9.	Buildings	N/A	New Medical Waste Incineartor (Naboro Landfill)	AMU
10.	Buildings	N/A	Construction of New National Wellness Center	AMU
11.	Buildings	N/A	Construction of FPBS Warehouse Extension - Suva	AMU
12.	Buildings	Sub-divisional Hospital Refurbishment	Sub-Divisional Hospital of Korovou / Wainibokasi / Vunidawa / Navua, Nausori Health Center and Maternity Hospital, Valelevu Health Center	AMU
13.	Buildings	N/A	Construction of New Hospital or Health Center in Nasinu	AMU
14.	Buildings	LTA (Land Transport Authority) Complex Valelevu	LTA Complex Valelevu	LTA
15.	Buildings	Museum Refurbishment	Museum Refurbishment	AMU
16.	Buildings	Classroom and Ablution Renovations	Renovation and Construction of Ablution Blocks, Classrooms & Staff Quarters	AMU
17.	Buildings	Upgrade of Driveways and Walkways	Upgrade and maintenance of Driveways and Walkways	AMU
18.	Buildings	N/A	New Nasinu Court House	JD
19.	Buildings	Police Station Construction Programme	Nakasi Police Station and Design and Build of Dog Kennel at Navosa Police Barrack	FPF
20.	Buildings	N/A	New Nakasi Market	DLG
21.	Buildings	N/A	Construction of Sub-Urban Shuttle Station- Valelevu	N/A
22.	Buildings	Upkeep of Facilities	Nausori Radar Building upgrade	FMS
23.	Buildings	Public Buildings Refurbishment	N/A	DBGA
24.	Buildings	N/A	Construction of MSAF Head Office	Transport
25.	ICT	Upgrade and Maintenance of ICT in Schools	Upgrade and Maintenance of ICT facilities in schools (Central)	Elearning
26.	Marine	Government Wharf Upgrade (Suva)	Phase 1 Government Wharf Upgrade (Suva Port)	GSS
27.	Marine	Supply of Boat & Engine to Schools	Connectivity and Transportation of Maritime Schools (Central)	AMU
28.	Marine	Vessel Traffic Management System (VTMS)	Vessel Traffic Management System (VTMS) Project (Suva)	AM Unit
29.	Marine	N/A	FSHIL Slipway Rehabilitation Project (Package A)	FSHIL
30.	Marine	N/A	Muaiwalu 2 New Interisland Upgrade (Suva)	AM Unit
31.	Marine	Port Maintenance Dredging	Port Maintenance Dredging (Suva)	Maintenance
32.	Marine	Wharf Rehabilitation Program	Wharf rehabilitation, Suva Port Relocation – Feasibility and Construction, Cruise Terminal Upgrade, and	AM Unit

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	Sector	Program Name	Description	Lead Agency
			Installation of Fenders in Suva Port	
33.	Marine	N/A (Port Related Facility)	Landing Barge Facility at Draunibota Bay, Suva harbour- Lighthouse, Solar PV Powered Lighthouse, Shipbuilding Industry in Fiji, Electric Powered Marine Transport	AM Unit
34.	Road	Government - Community partnership program	Road construction from Nakorovou to Tubarua and Nakida, Nawaisomo to Wairuarua	DBGA
35.	Urban	Formalization of Informal Settlements	Settlement Formalisation in Waidamudamu, Sakoca, Sasawira, Wakanisila, Caubati, Nadonumai, Millenium, River Road, Veivauceva, Nasoqele, Osanabukete and Sakoca 2	No Mention
36.	Water	Water Distribution Programme (Suva- Nausori)	Replacement & Augmentation of Distribution Mains and Trunk Mains, Rewa River Water Supply Servicing Strategy, Increasing Storage Capacity (Flagstaff, Nasinu, Wainibuku & Tacirua), Conditional Assessment of Water Mains (Suva-Nausori), Restoration of Decommissioned Reservoirs & Pump Stations, Refurbishment and Augmentation of Distribution PS	DoWS
37.	Water	Water Distribution Programme (Naboro)	Naboro Reservoir & Mains Upgrade	DoWS
38.	Water	Rural Water Supply Scheme Central Eastern (Upgrade and New)	Installation and upgrade of reservoir, water treatment and water reticulation mains	DoWS
39.	Water	NRW Programme (Suva- Nausori Water Supply Scheme)	Meter, PRV & Air Valve Replacement Programme	DoWS
40.	Water	NRW Programme (Navua - Deuba)	Reticulation leakage repairs, installation of hydrants & isolation valves, continuation of hydrants and isolation valves installation	DoWS
41.	Water	SCADA Automation Programme (Suva-Nausori Water Supply Scheme)	SCADA for Reservoirs, Water Treatment Plant's, Pump Stations & Valve Operations	DoWS
42.	Water	Water Sources & Water Treatment Plant Programme (Suva- Nausori)	Upgrading Waila & Tamavua WTPs, Suva Nausor1 WTP for Greater Suva Area	DoWS
43.	Water	Water Source & Water Treatment Plant Programme (Naboro)	Wainadoi River Intake and WTP, Naboro Weir Upgrade, WTP & PS Upgrade	DoWS
44.	Water	Water Source & Water Treatment Plant Programme (Navua - Deuba)	Raw Water Pipeline (Taunovo Dams to Deuba WTP)	DoWS
45.	Water	Catchment Management Programme (Navua-Deuba)	Water Catchment Protection	DoWS
46.	Water	Waste Water Treatment Plant Upgrade Program	Upgrade of Naboro WWTP, Harbor WWTP, ACS WWTP	DoWS
47.	Water	Upgrade Water Facilities	Upgrade Water Facilities in Schools (Central)	AMU
48.	Waterway	Drainage and Flood Protection	Rewa Riverbank Protection Works at Nakaile Village, Waidamu River Dredging, Qauia Riverbank Protection Works at Matanisivaro Settlement, Sawani Riverbank Protection Works at Sawani Village	MOAW
49.	Waterway	Coastal Erosion Protection Work	Bau island Seawall Rehabilitation Works, Nature Based Seawall (NBS) construction (Ovea Village, Nananu Village, Galoa village, Togoru Village, Veivatuloa Village, Navutu village	MOAW
50.	Waterway	Dredging Works	Qaraniki River and Navua River	MOAW
51.	Waterway	Maintenance of Drainage Scheme	Fabrication of New Flap & Flood Gate Doorson the Existing Tidal Structure	MOAW

Source: JICA Project Team based on Government of Fiji (November 2017), "5, 20 years National Development Plan)

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2.3 Divisional Level Development Plan

The Central Divisional Development Plan is under preparation and there are no comprehensive plans summarizing the strategy and plans do not exist. To identify the projects under consideration in the division, priority projects at the provincial level and existing sector-specific plans in the Central Division were reviewed and confirmed.

2.3.1 Provincial Priority Plans

The total number of the long-listed projects in the provincial level is 531 and the estimated cost to cover all the project is 23,000,000 Fiji Dolars. The project can be categorized to 9 which is Community Access Roads, Footpaths and Footbridges (CARFF), Disaster Risk Reduction (DRR), Evacuation Centers (EC), High Rural Sanitation (HRS), High Rural Water Sanitation (HRWS), Rural Housing Assistance (RHA), Rural Outer Island (ROI), Seafaring Entrepreneurial Assistance (SEA), Self-Help Programme (SHP). Among the long-list plan priorities of the program are made for the top priority and the top three priorities for each activity category are determined. The number of the top three priority project is 110 and the estimated cost to cover the top 3 priority project is about 5,800,000 Fiji Dolars.

Table 5. Long-list Projects in the Provincial Level

Project Category	Province				
	Naitasiri	Rewa	Namosi	Tailevu	Serua
Community Access Roads, Footpaths and Footbridges (CARFF)	13	10	19	20	20
Disaster Risk Reduction (DRR)	0	12	0	0	0
Evacuation Centers (EC)	5	12	9	18	10
High Rural Sanitation (HRS)	0	9	0	0	0
High Rural Water Sanitation (HRWS)	6	0	6	16	16
Rural Housing Assistance (RHA)	0	11	0	0	92
Rural Outer Island (ROI)	4	8	20	17	13
Seafaring Entrepreneurial Assistance (SEA)	7	10	6	12	21
Self-Help Programme (SHP)	5	10	16	17	8
Other	19	0	2	28	4
Total	59	82	78	128	184

Source: Collected from the Province by the Central Divisional Office

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2.3.2 Sector-wise Development Plans

■ River Management

The waterways department at the Ministry of Agriculture and Waterways are responsible for the implementation of the river management project. The latest plans for the department of waterways are the "Strategic Plan 2020-2024" published by the Ministry of Waterways and Environment at that time. Although the programs mentioned at the plan are not fully implemented, the priority considered in the national level can be recognized.

Table 6. Priority Projects Mentioned in the Strategic Plan of the Department of Waterways

Program	Plans and Priorities
Drainage and Flood Protection	• Dredging of river with priority on major rivers including Rewa river • Riverbank protection and Creek de-silting
Coastal Protection	• Coastal and flood protection in Central division of Naloto, Qelekuro, Vatani, Dromuna, Anitioki, Nasilai, Naisausau, Matamaivere, Nawaisomo, and Veivatuloa Village)
Maintenance of Drainage	• Grant for drainage development including the cities in the Central Division • Drainage work in the rural residential areas
Maintenance and Drainage System for Non-Municipal Areas	• Maintenance and refurbishment of drainage structures (flap gates, floodgates, and weirs, etc.)

Source: "Strategic Plan 2020-2024" published by the Ministry of Waterways and Environment

■ Road Development

The Fiji Road Authority (FRA) manages development of road network for the national important roads. The FRA has developed the "Greater Suva Transportation Strategy 2015-2030". To enhance the connectivity between the Suva City and the surrounding Lami Town at the west and Nausori Town at the north. Priority is set and the upgrade of Kings Road is set as a highest priority. The Medium priority includes princess road and other roads to enhance the redundancy of the road network. As a future perspective, the development of Regional Road is planned as a third network to connect Suva City and Naussori Town.

Figure 9 Road Network Development Plans Mentioned in the "Greater Suva Transportation Strategy 2015-2030

■ Port Development

Considering the increase in the capacity of the Suva port. The Government of Fiji have been evaluating port development option by the support of the Asian Development Fund. Currently, options for the relocation of Suva port are considered. Five options have been short listed namely, Rokobili, Draunibota, Navua, Momi bay and Lautoka. According to the interviews to the Fiji Port Authority, the relocation will focus on the Containers and Bulk shipping wharf facilities and Cruising and Fishing wharf facilities to be remain in the current Fiji port area.

Figure 10. Location of the Short Listed Port Location Site in Central Division

Source: Formulated by the JICA consultants team based on the information obtained from the Fiji Ports Authority

■ Informal Settlement Improvement / Housing Development

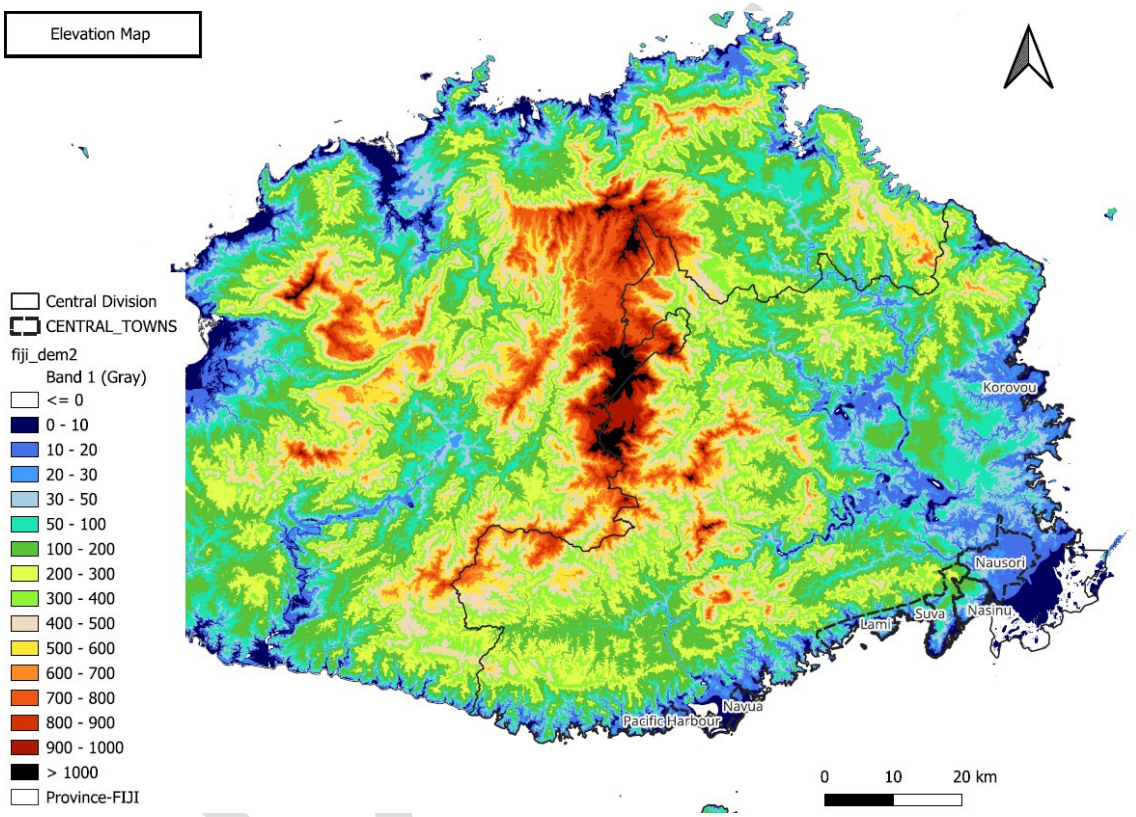
Programs for informal settlement are managed by the Ministry of Housing as an institution responsible for providing appropriate housing and living conditions. Regarding housing development, Housing Authority is responsible for the new housing program and Public Rental Board is responsible for the public housing program. Ministry of Housing is conducting informal settlement upgrade program based on the LOT allocation policy. As a pilot activity, Waidamudamu community is identified in the Central Division and upgrade of roads and drainage network are to be conducted. The LOT allocation policy allows the upgrade of basic infrastructure in the informal settlement and the lot for housing shall be provided to the households based on the criteria based on the income level of the residents. Public housing board has developed public housing to be provided to the informal settlement of Jitsu offering the subside of 45 Fiji Dollars per the total rental fee of 95 Fiji Dollars.

3 Risk Profile of the Central Division

3.1 Environmental Characteristics

3.1.1 Topography

The landscape of the Division ranges from flat to rolling land along the coastal areas to high lands with steep mountains in the inland areas.

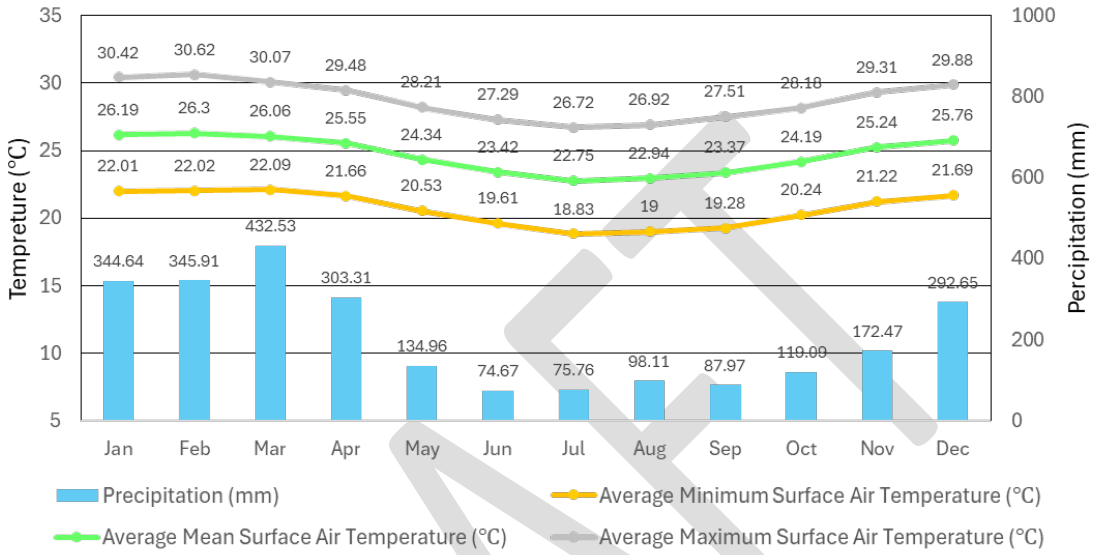


Source: JICA Project Team by using Aster Global Digital Elevation Map Data

Figure 11. Elevation Map

3.1.2 Climate

According to the Climate Change Knowledge Portal, the wettest months is March with an average of 432.53 mm of rainfall for the period from 1991 to 2020 Figure 12shows the monthly average of precipitation and the minimum, mean, and maximum surface air temperature calculated for the period from 1991 to 2020 in the Viti Levu Island.



Source: JICA Project Team by using the Data of the Climate Change Knowledge Portal (https://climateknowledgeportal.worldbank.org/country/fiji/climate-data-historical)

Figure 12. Monthly Average Temperature and Precipitation (1991-2020)

3.1.3 River System

According to the GIS data of the Ministry of Lands and Mineral Resources (hereinafter referred to as "MLMR"), 50 water catchments (sub-catchments) are located within the Division. Two major rivers of Fiji, namely: the Rewa River and Navua River are located in the Division.

The Rewa River is the largest river system in Fiji with its source from the central high lands and flows for 145 kilometers to the Rewa Delta in the east coast. The total water catchment area is 2,887 square kilometers and is composed of 11 sub-catchments.

The Navua River has its source from the east slope of Mountain Gordon down to the south for 65 kilometers to the South Pacific Ocean with its river mouth near Navua town. The total water catchment area is 1,043 square kilometers and is composed of 9 sub-catchments.

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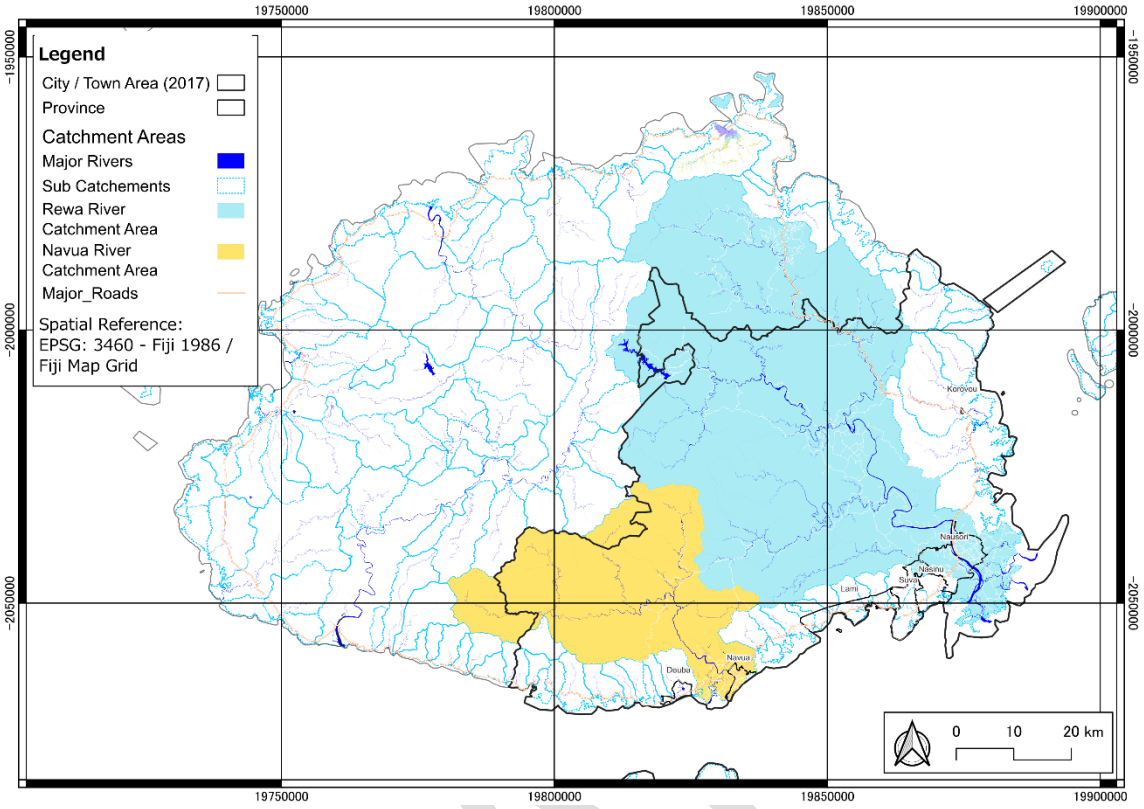

Source: JICA Project Team by using the GIS Data of the Ministry of Land and Mineral Resources

Figure 13. River System

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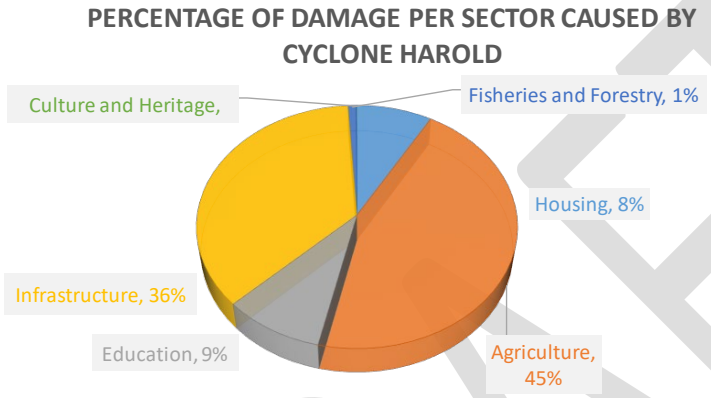
3.2 Past Disasters

The Central Division is exposed to various types of hazards such as tropical cyclones (hereinafter referred to as "TC"), floods, landslides, coastal erosion, storm surge, tsunami, earthquake, and drought. Especially floods and cyclones cause a great amount of damages to buildings, infrastructures, livelihoods, and people.

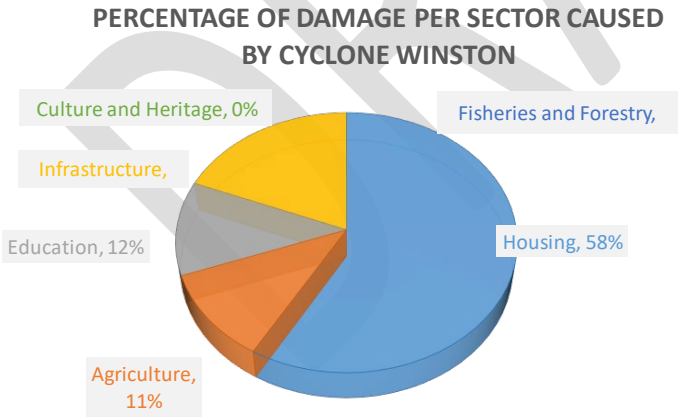
Figure 14 and 16 show the damage per sector caused by each event. Depending on the difference in the impact, Cyclone Winston brought major damage to the housing sector, where the damage was in agriculture in Cyclone Harold.



Sector	Damage (million dollars)
Housing	0.974
Agriculture	5.28
Education	1.087
Infrastructure	4.22
Fisheries and Forestry	0.107
Culture and Heritage	0.01
Total	**11.678**

Source: JICA Project Team

Figure 14. Damage per sector caused by Tropical Cyclone Harold



Sector	Damage (million dollars)
Housing	64.7
Agriculture	12.2
Education	13
Infrastructure	20.9
Fisheries and Forestry	0
Culture and Heritage	0.02
Total	**110.82**

Source: JICA Project Team

Figure 15. Damage per sector caused by Tropical Cyclone Winston

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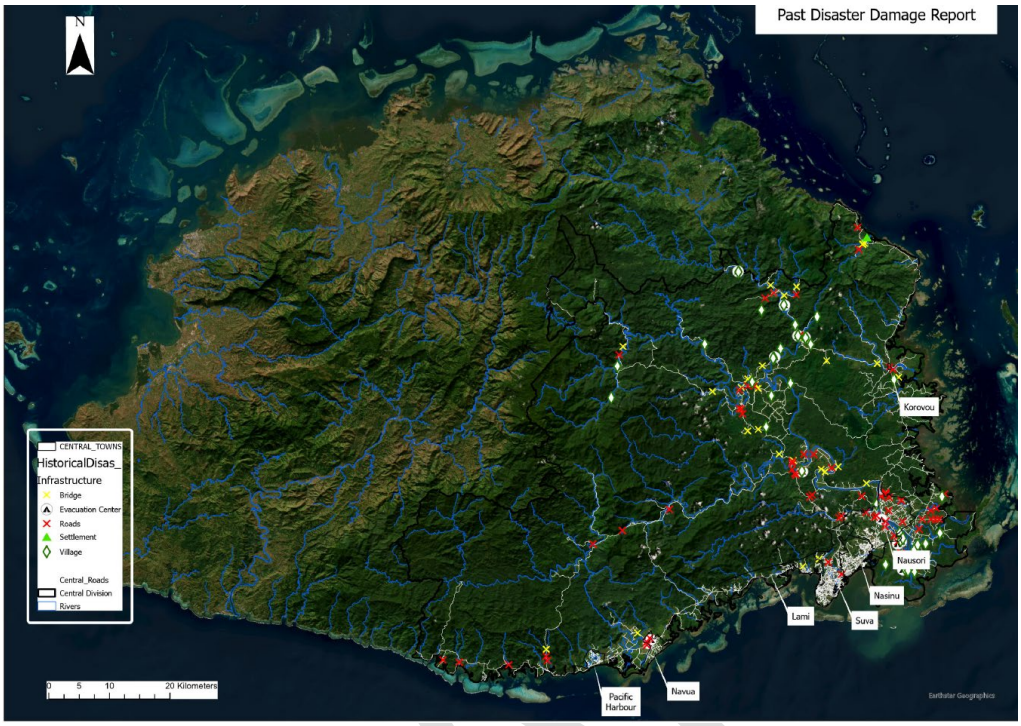
Figure 16 shows the location of the damage reported and registered into NDMO'S GIS database, as of June 2023. Please note that the data for all sectors is not yet available.



Source: JICA Project Team by using NDMO's GIS database on historical disasters (as of November 2024)

Figure 16. Location of the reported damage

Table 7 Number of damage records

Province	Type of Damage					
	Bridge	Roads	EC	Village	Settlement	Total
Serua	4	9	2			**15**
Namosi		3				**3**
Rewa	1	7	4	9		**21**
Naitasiri	33	26	3	11		**73**
Tailevu	25	28	4	19	2	**78**
Total	**63**	**73**	**13**	**39**	**2**	**190**

Source: JICA Project Team by using NDMO's GIS database on historical disasters (as of November 2024)

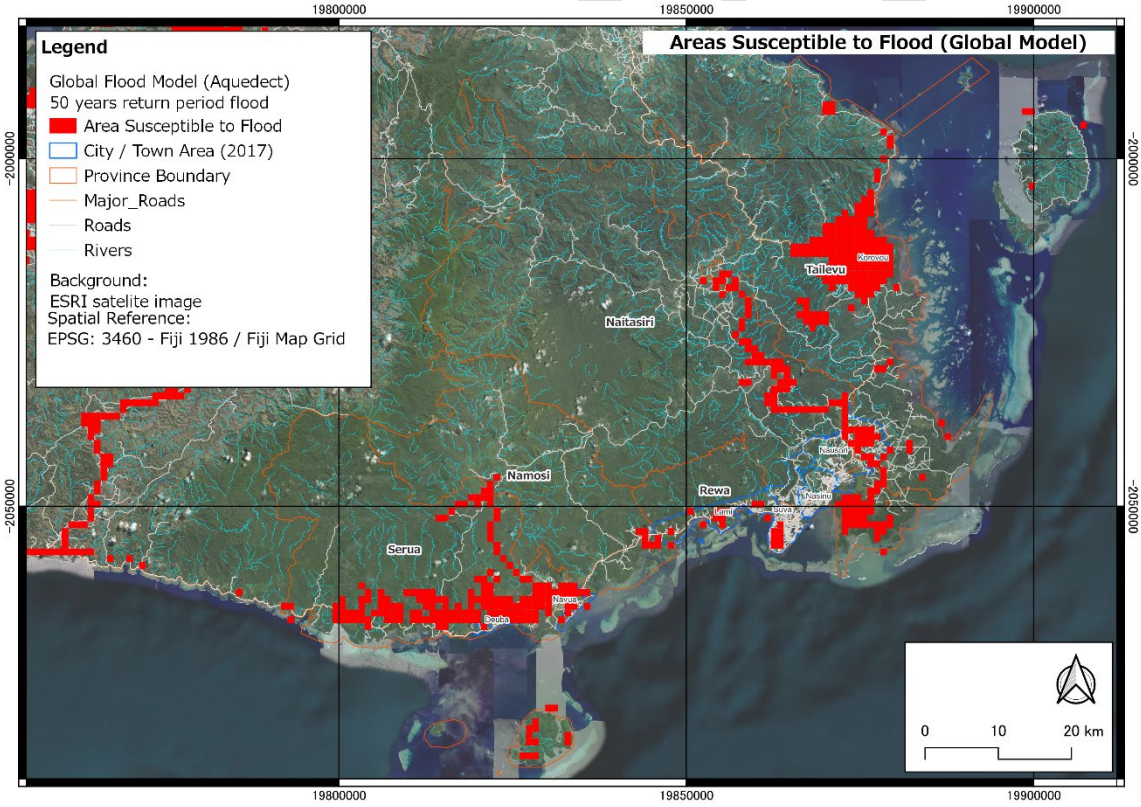
In the reported damage, damage to bridges and roads in the hilly terrain areas and some areas along the major river and major roads of the Queens and Kings road was observed.

3.3 Preliminary hazard analysis

A preliminary hazard analysis covering the entire Division was conducted for floods, landslide, coastal hazards and earthquake hazards.

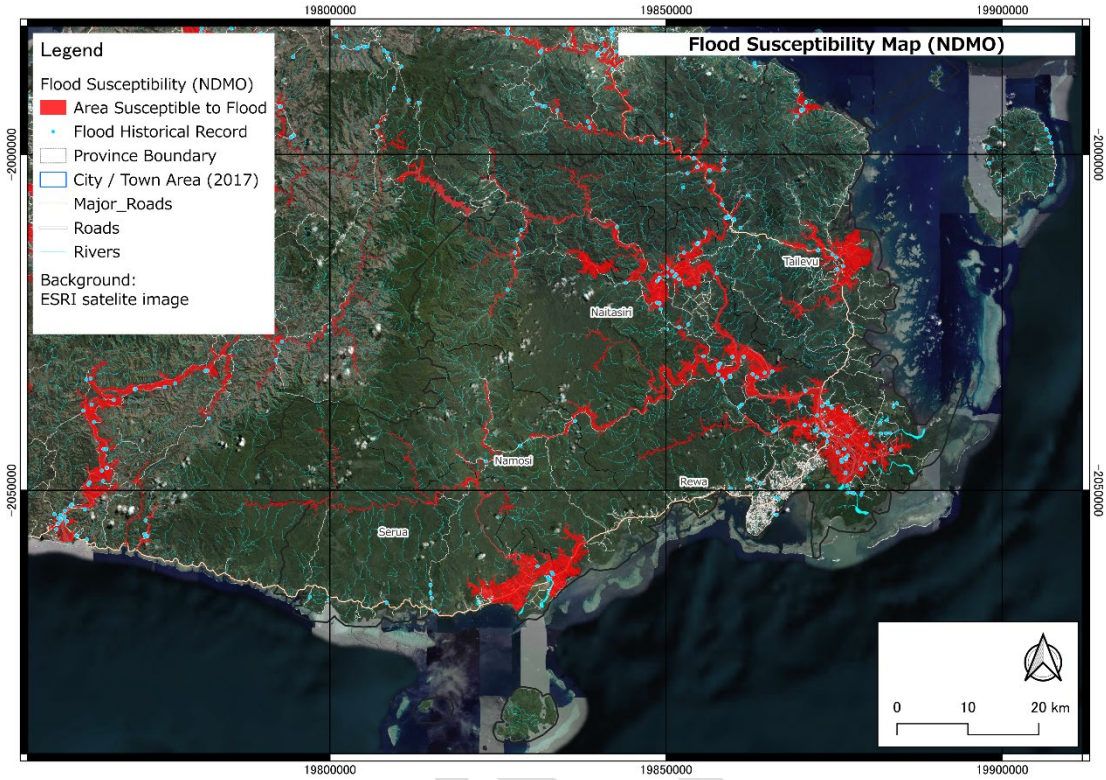
3.3.1 Flood

Figure 17 illustrate in red the locations susceptible to a 50-year intensity flood provided by the World Resources Institute through the Aqueduct Global Flood Analyzer online platform. Aqueduct Floods is an online platform that measures riverine and coastal flood risks under both current base-line conditions and future projections in 2030, 2050, and 2080. In addition, based on the information on the flood susceptibility map, similar situations were observed. However, in the simulation it shall be noted that the rainwater flood caused by the low capacity of the drainage system in urban areas is not reflected in the map.



Source: JICA Project Team by using the Aqueduct Global Flood Risk Maps https://www.wri.org/data/aqueduct-global-flood-risk-maps

Figure 17. Areas susceptible to flood (50-year)



Source: NDMO

Figure 18. Flood Susceptibility Map

According to this map, floods in the major rivers of Rewa river and its tributaries, Navua river and Wainivesi river (flow through Korovou town) and in the Rewa Delta can be observed. In addition, based on the interview to the relevant institution, the Flooding in Rewa Delta is causing impact by flooding but also salination in the Delta area impacting coastal community and agriculture productivity. In Rewa River and its Tributaries, frequent riverbank erosion with flood risk including the tributaries was mentioned. Especially the flood risk in the Waimanu river, which is one of the major tributaries, was mentioned.

Although the inundation issue in the urban areas of cities and towns in the Great Suva area (Suva city, Nasinu town, Lami town, Nausori town) was mentioned the impact of the inundation caused in the urban setting cannot be evaluated by the preliminary level hazard assessment. Therefore, evaluating the impact of flooding in the urban setting requires more detailed hazard analysis.

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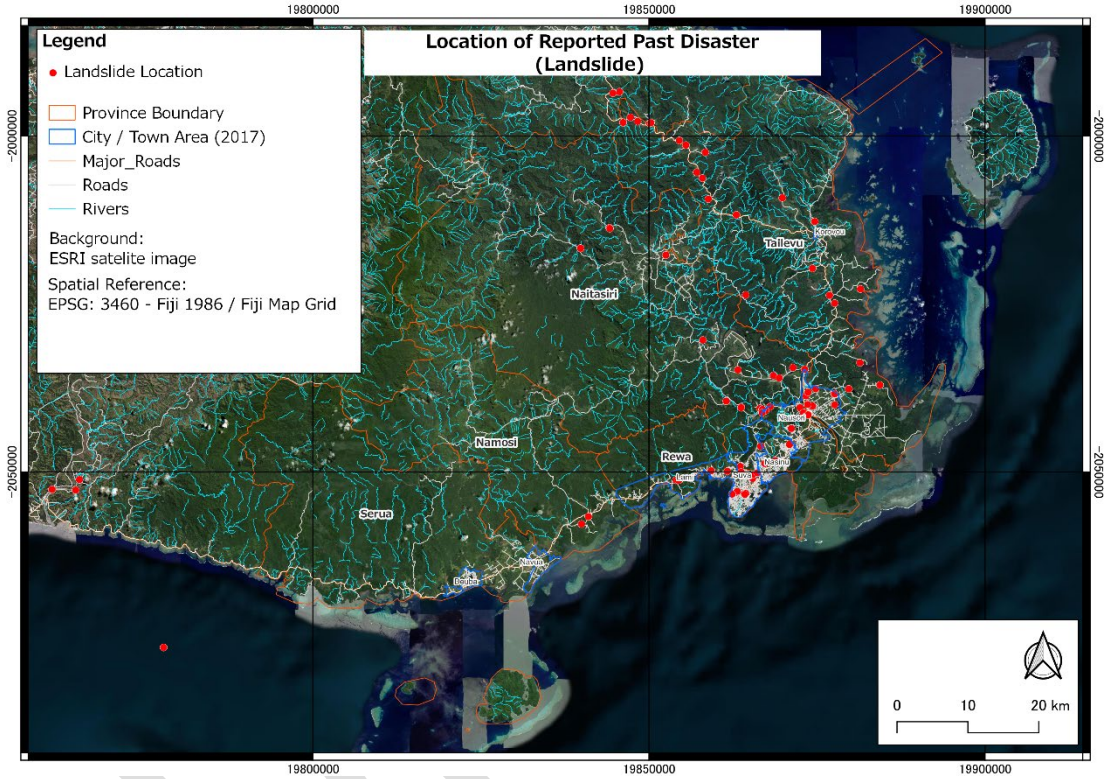
3.3.2 Landslide

Based on the disaster damage database of NDRMO and the report on the hazard assessment report on the landslide disaster in June to July, 2024 jointly conducted MRD the characteristics of the landslide in the central division can be categories to three types which is 1) Riverbank erosion in the river such as Rewa river and other tributaries 2) Collapse in slope and along river causing damage to some houses in hilly terrain villages and risk of isolation in case of major impact, and 3) Slope failure along the major roads such as Kings road and Queens road.

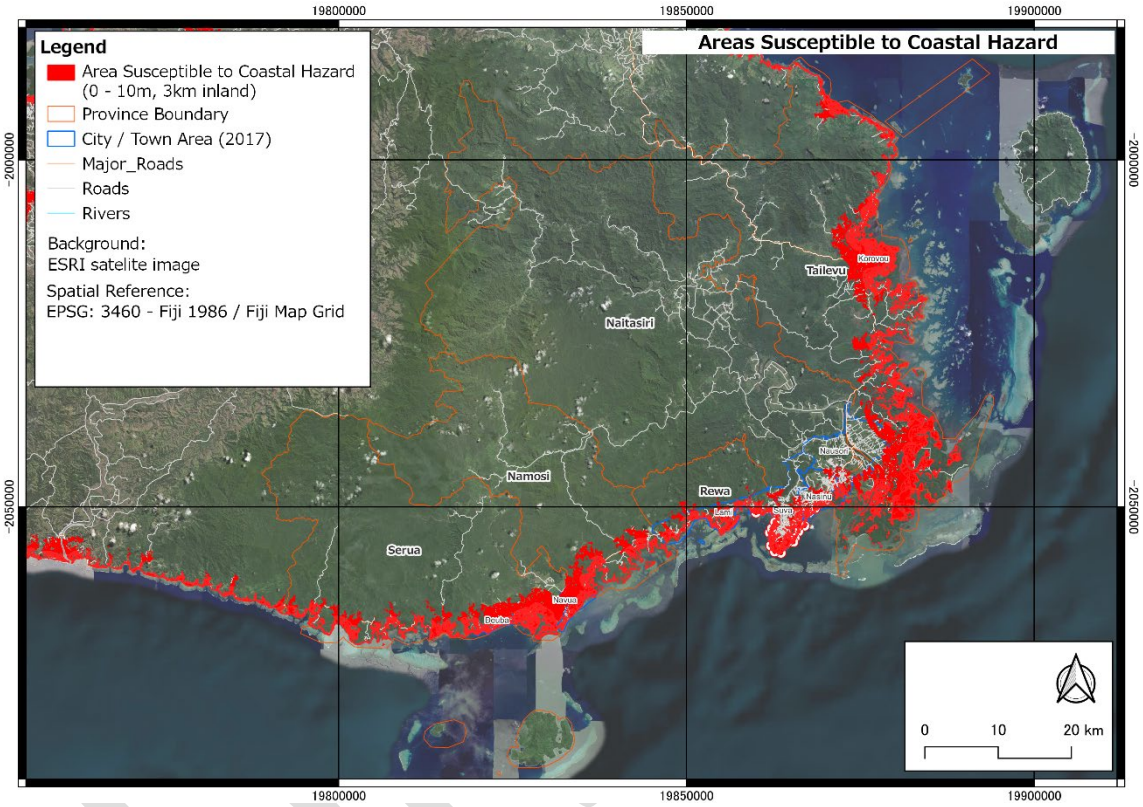


Source: JICA Project Team by using landslide record obtained from NDMO

Figure XX. Location of Landslide for the recent years (2022-2024)

3.3.3 Coastal Hazard

Figure 19 shows the locations susceptible to costal hazard (storm surge and tsunami). As a preliminary analysis, areas located within 3 kilometers from the coastline and below 10 meters were identified. The criteria to conduct this preliminary analysis was set based on the existing Tsunami Hazard Map in Fiji.



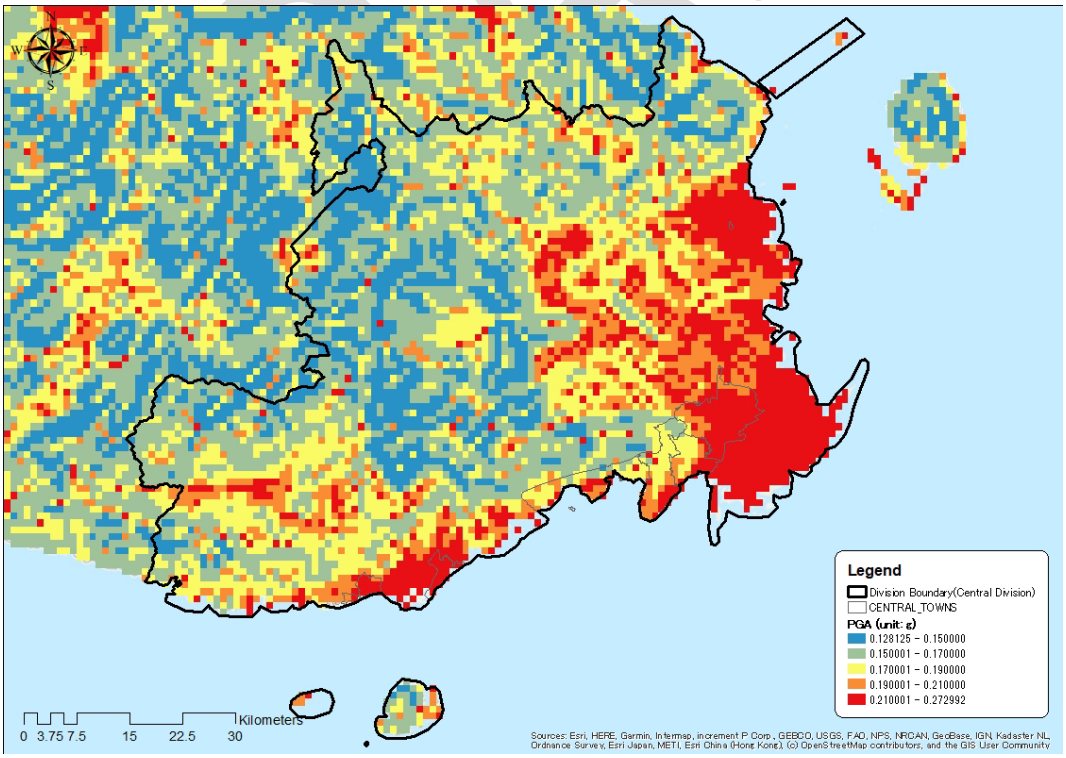
Source: JICA Project Team

Figure 19. Areas susceptible to coastal hazard

3.3.4 Earthquake Hazard

The earthquake hazard assessment is based on the peak ground acceleration (PGA) with a 10% probability of exceedance in 50 years, as provided by the Global Earthquake Model (GEM) Foundation. This PGA is calculated by multiplying the values for engineering bedrock (S-wave velocity, VS30: 760–800 m/s) by ground amplification factors derived from open data published by the United States Geological Survey (USGS). To estimate the population exposed to seismic intensity, mesh grids corresponding to maximum acceleration equivalent to or exceeding Japan's Seismic Intensity Level 5 Upper are shown in red, and the total population within those grids is calculated as the exposed population.

When interpreting these earthquake hazard assessment results, it is important to note that the GEM probabilistic seismic hazard data is periodically updated, and that the USGS ground amplification data includes estimates based on terrain-derived parameters. This assessment result is intended to serve as basic information for a broad understanding, such as the selection of pilot areas. For more detailed evaluations—such as prioritizing seismic retrofitting of individual facilities—it is recommended to conduct a separate, detailed reassessment of local ground conditions.



Source: JICA Project Team

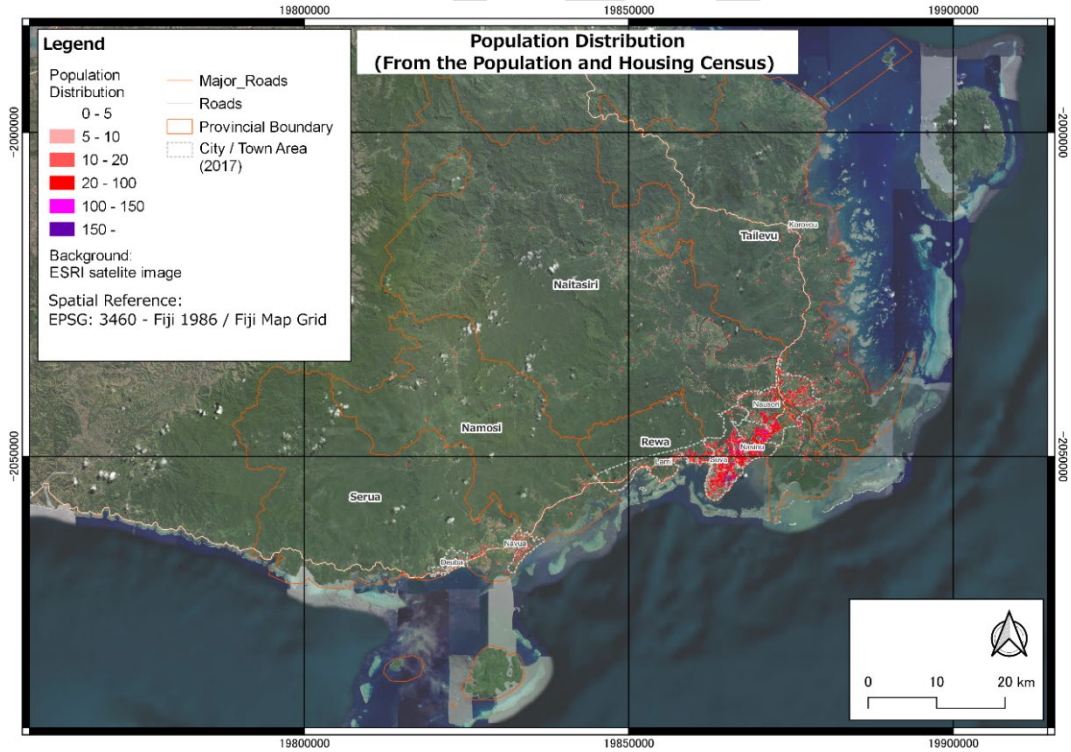
Figure 20. Ground Motion Map

3.4 Elements at risk

Figure 21shows the population distribution based on the location of the households and Figure 22 shows the distribution of business location, the data was collected from the surveyed by BoS during the Population and Housing Census survey of 2017, Figure 23 shows the location of the evacuation centers registered in NDMO's GIS database. The numbers of population and evacuation centers exposed to each hazard summarized in Table 8 were computed by overlaying the information on hazard (Figure 17, Figure 19, and Figure 20Figure 17 to) and elements considered (Figure 21, Figure 22, and Figure 23).

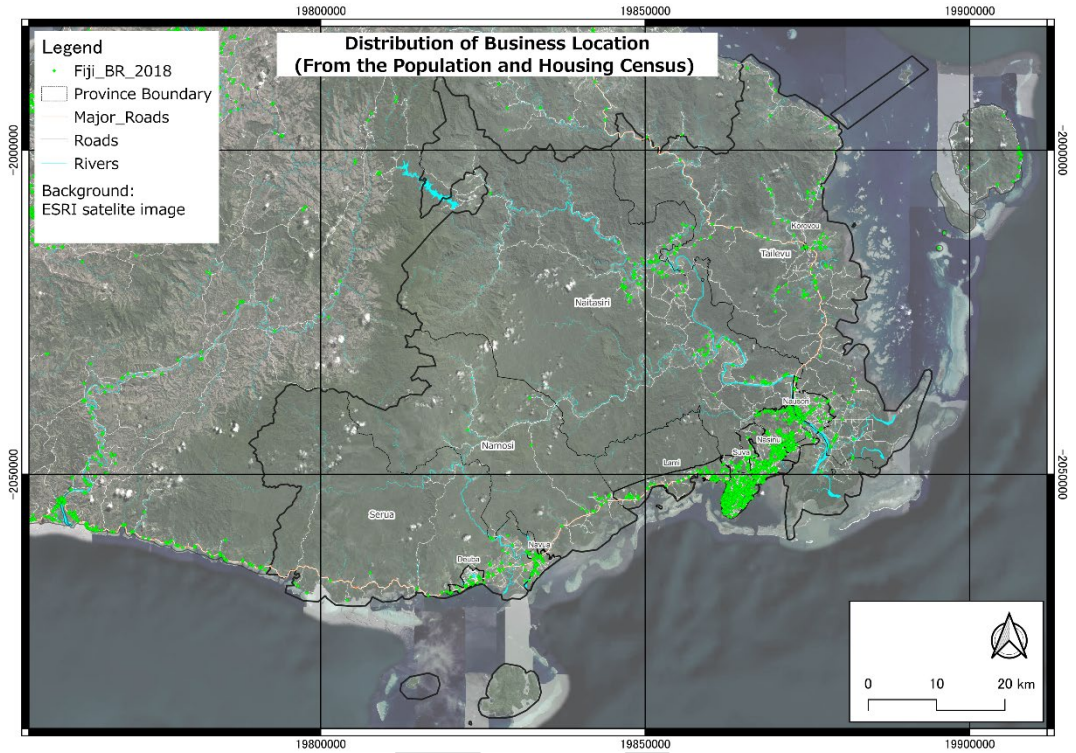
In the Central Division, among the total population of 378,284 in the division, 71% (268,423) of the population is in the Great Suva area including Suva city, Lami town, Nasinu town and Nausori town. Therefore, the element at risk is also accumulated in the Great Suva area.

The number of population exposed to floods is high in Suva which is due to the population concentration in the flat area, Naussori town and Nabua town where major river flows. The number of populations exposed to coastal disaster was high in Suva, Nasinu town with population concentration in the low coastal areas. Regarding Earthquake reflecting the result of the difference in the ground condition, the exposed population was relatively high in Nausori town.



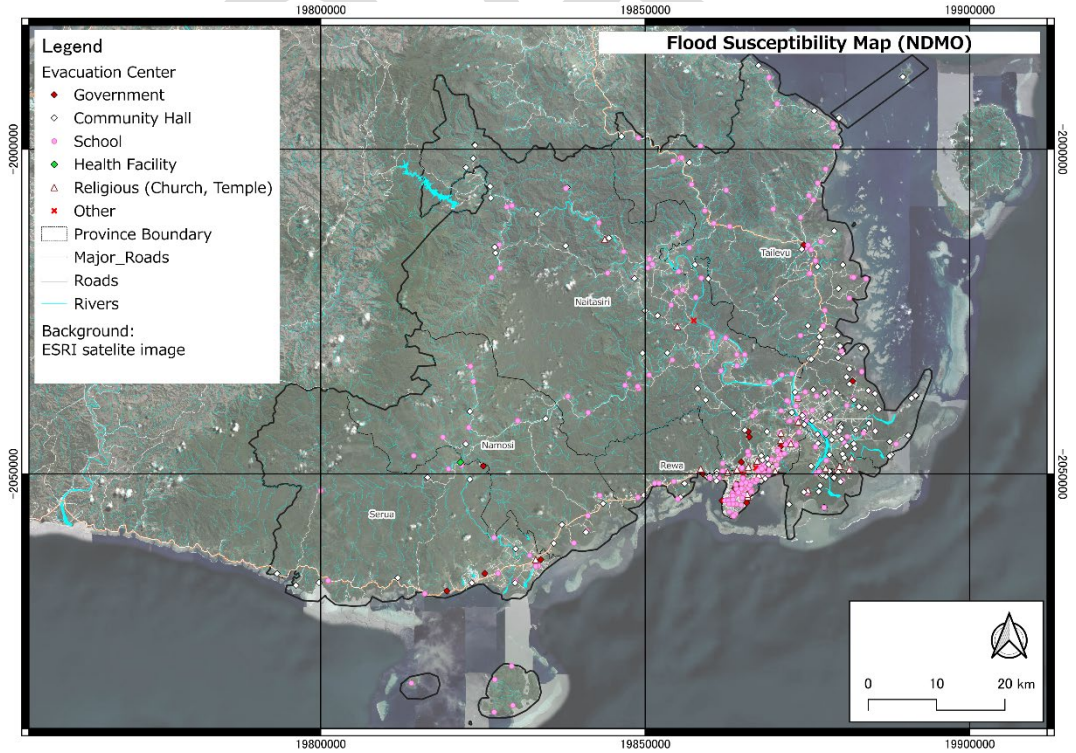
Source: JICA Project Team by using BoS' data

Figure 21. Population Distribution from the Census 2017



Source: JICA Project Team by using BoS' data

Figure 22. Distribution of Business Location from the Census 2017



Source: JICA Project Team by using NDMO's data

Figure 23. Location of the evacuation centers

Table 8 Summary of the elements at risk

Contents	City and Town Areas						
	Suva	**Lami**	**Nasinu**	**Nausori**	**Navua**	**Deuba**	**Korovou**
Actual Situation							
Land Area	66.14 km^2	45.93 km^2	28.66 km^2	66.14 km^2	12.26 km^2	9.69 km^2	0.38 km^2
Population	93,874	24,637	92,046	57,866	5,812	1,963	329
Number of Business	2,860	159	549	790	131	74	36
Number of elements exposed to flood							
Population	12,074	6,151	20	12,069	4,909	1,726	388
Number of Business	1,318	26	0	410	115	38	34
Number of EC	18	4	0	17	8	2	1
Number of elements exposed to coastal hazard							
Population	18,677	3,265	8,251	2,342	3,990	819	331
Number of Business	1,409	117	35	9	38	13	33
Number of EC	70	24	61	10	8	2	1
Number of elements exposed to earthquake *1							
Population	20,395	1,397	19,385	50,137	5,111	1,790	0

*EC: Facilities (Governmental Buildings, Community Hall, Schools, Hospitals, Hotel, Recreation Hall, Shop Compound, Churches, and Temples) registered as evacuation centers in NDMO's database
*1: Regarding earthquake, since the building information (such as building material, number of floors, year of construction) are not complete or available, only the population who may be highly affected in locations where the MMI 8 (more than 150(cm/s2)) was computed.
Source: JICA Project Team

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4 Major Challenges and initiatives related to DRR

4.1 Identification of Priority Areas

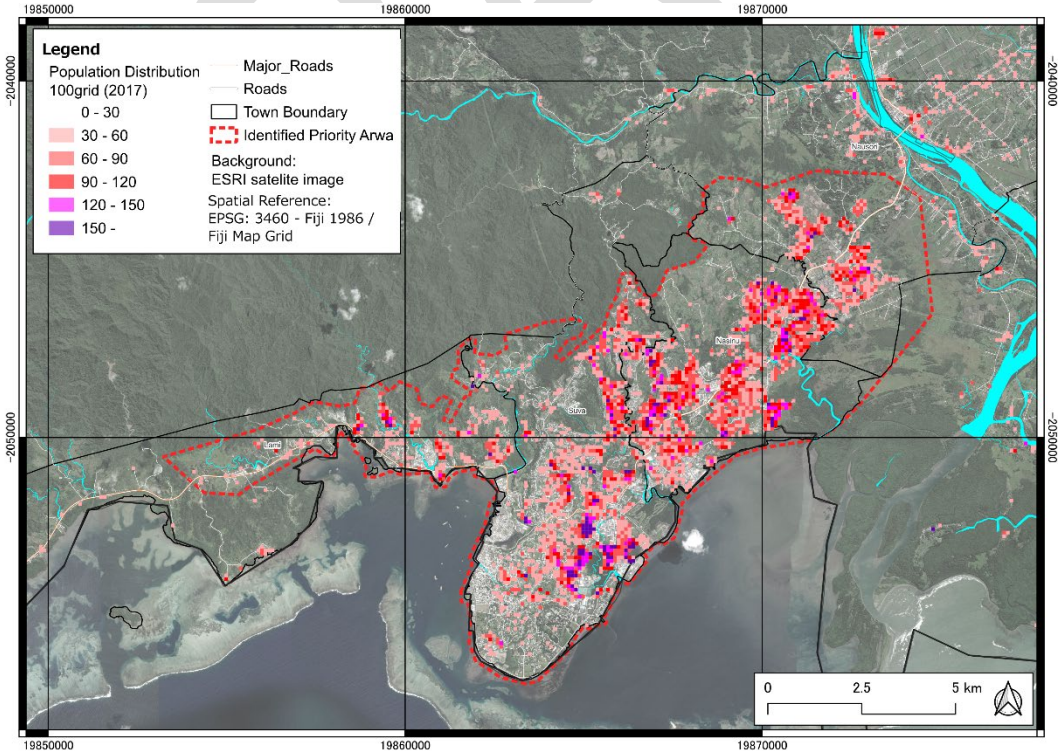
Following the "Guide on the DRR plan formulation in Fiji" formulated under the Project for Mainstreaming Disaster Risk Reduction the priority area to be focused on the initial stage was identified. The definition of this divisional DRR plan and the priority area plan to be developed is as below. As shown below, based on the distribution of population asset accumulation, Greater Suva area was identified as an initial priority area. (*Priority area plan can be applied to other priority areas in the Central division in the future planning efforts)

Divisional DRR Plan

- Aiming to set the fundamental DRR direction at the Division Level
- General Situation Analysis in the Division Level (1. Socio-Economic, 2. Development, 3. Risk Profile)
- Sector and Area-wise Challenges and Issues
- DRR Direction and List of Proposed DRR measures in the Division Level

Priority Area Plan

- Aiming to Provide Detail Consideration of DRR measures in Priority area
- Focus on the Greater Suva Area where the population and economic assets and accumulated
- Considering a comprehensive approach to solve challenges and issues in the expanding urban area



Source: JICA Project Team by using BoS' data

Figure 24 Area Identified as in Initial Priority Area based on Population Distribution

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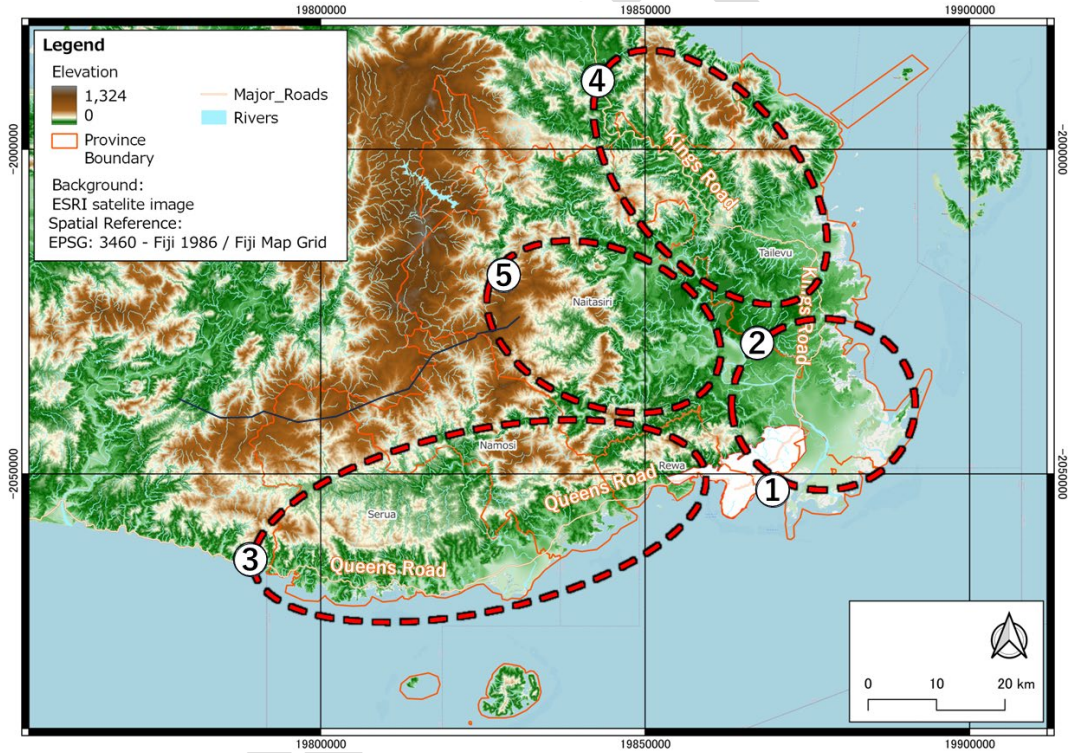
4.2 Spatial Zoning to Break Down the Challenges

To better understand the challenges and issues in Central Division, spatial zoning based on its locational function and geographical condition was considered. Considering the characteristic of the hazard and its impact, the area can be categorized to five areas of 1) Great Suva Metropolitan Area, 2) Lewa River Flood Plain and Delta Area (Nausori, East Coast), 3) Inter-Regional Corridor in the South (Queens Road, Rewa, Nabua and Pacific Harbor), 4) Inter-Regional Corridor in the North (Kings Road, Korovou) and 5) Hilly Terrain (Upstream of Rewa River). Based on the inputs from Provincial administrators and interviews to relevant institutions, the challenges observed in each zoning area are summarized in

Table 9



Source: JICA Project Team

Figure 25. Considered Spatial Zoning to Break Down the Challenges

Table 9. Challenges and Considered Solution in Different Areas

Area	Challenges	Considered Solution
1) Great Suva Metropolitan Area	• Insufficient Drainage to cope with increasing extreme rainfall events and changing land-use • Slope failure in areas with development in steep slopes • New development in higher risk	• Drainage network upgrade and enhancing connectivity • Enhancement of Risk-Informed Development by preparing guiding principles for new development

Area	Challenges	Considered Solution
	area	• Regulate development in high-risk areas • Upgrade informal settlement in high-risk areas
2) Lewa River Flood Plain and Delta Area	• Salinization in Rewa delta area impacting agricultural productivity • Access to villages in Rewa delta in flooding situations and flood gate is not functioning	• Improving access to villages in Rewa delta and in the islands • Improvement of drainage and flood gate in the Rewa delta area (consultation on-going)
3) Inter-Regional Corridor in the South	• Landslide and coastal erosion impacting Queens road and villages • Flooding in major rivers including Navua river • Island and coastal villages in high-risk area	• Improvement of seawalls • Dredging in major rivers (Navua river etc.) • Floodgate to prevent coastal disaster • Relocation of island and coastal villages
4) Inter-Regional Corridor in the North	• Slope failure along Kings road causing minor interruption • Impact of the flooding in Wainivesi river possibly interrupting the Kings Road	• Review of high-risk areas in Kings road to secure connectivity of roads • Evaluation of flood situation in Wainivesi river and secure function of critical facilities
5) Hilly Terrain	• Flooding from Wainimala river • Landslides damaging access roads • Providing relief items to mountain villages	• Relocation of houses damaged by flood • Construction of access roads for evacuation and response, evacuation centers.

4.3 Challenges faced by each sector

A review of the past disaster reports and consultation meetings with the Divisional Offices of concerned ministries were conducted to identify the major challenges faced by each sector.

Table 10. Major Challenges and Considered Solution by each sector

Sector	Major Challenge	Considered Solution
Transportation	• High traffic volume in greater Suva • Insufficient drainage, Forest degradation and upstream development to increase run-off • Riverbank/Coastal erosion causes major impact	• Road network improvement in greater Suva • Resilient design for approach of bridges • Recovery for riverbank/coastal erosion and landslide measures implemented
Housing	• Improvement of Informal Settlement • Relocation of community in high-risk area	• Pilot project for informal settlement improvement and public housing

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Sector	Major Challenge	Considered Solution
Town Planning	• Update of the risk information in case to include hazard perspective to town and urban planning	• Advisory policy may be utilized for risk-informed development • Suva planning scheme under revision
Education	• Understanding of DRR issues at the community level shall be enhanced • Risk Assessment of Schools are not done comprehensively	• Updating Education Emergency Policy • Inclusion of DRR issues in the curriculum in 3-5 schools per division
Health	• Some Health Facility Inundated by Flooding • Issues in accessible to health facilities in case of flooding	• Relocate or upgrade the Health Facility in the Flood risk area • Improving Health Care Facility to increase capacity for adaptation
Ports	• South side of the Kings Warf needs rehabilitation to be used for heavy ships • Business Continuity is an issue in case of major disaster to happen	• BCP plan for the port function is considered but needs update to include relevant institutions • Expansion and Upgrade of Port Facility
Waterways	• The last significant flooding of Rewa river was in 1992 during Cyclone Kina • Dredging for Rewa river stopped after 2014 and only unplanned extraction of sand is conducted • Drainage system in Rewa Delta area needs to be repaired	• Dredging of major rivers including Rewa river to be conducted. • Formulate National Waterway Plan to facilitate implementation of measures • Fundamental observation for flood management planning is facilitated.
Tsunami Preparedness	• Update of the Tsunami risk area (20m → 10m) • Lack in data and information for details Tsunami analysis	• Tsunami Ready activity to be continued • Tsunami Database to be developed including LiDAR observation

Source: JICA Project Team based on the review of past disaster reports and consultation meetings

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5 DRR Measures Planning

5.1 DRR Directions

Considering the expanding urbanization in the greater Suva area, the importance of risk-informed development to avoid future development in high-risk areas was identified as DRR direction.

In addition, with increasing intensity of rainfall and changing land use, flood management also with focus on urban expansion area was also identified as DRR direction. The DRR direction can be understood as a direction of the DRR measures to address the two challenges of "Climate Change / Disaster Risk" and the "Unplanned Development".

Figure 26 DRR Direction based on two challenges in the Central Division

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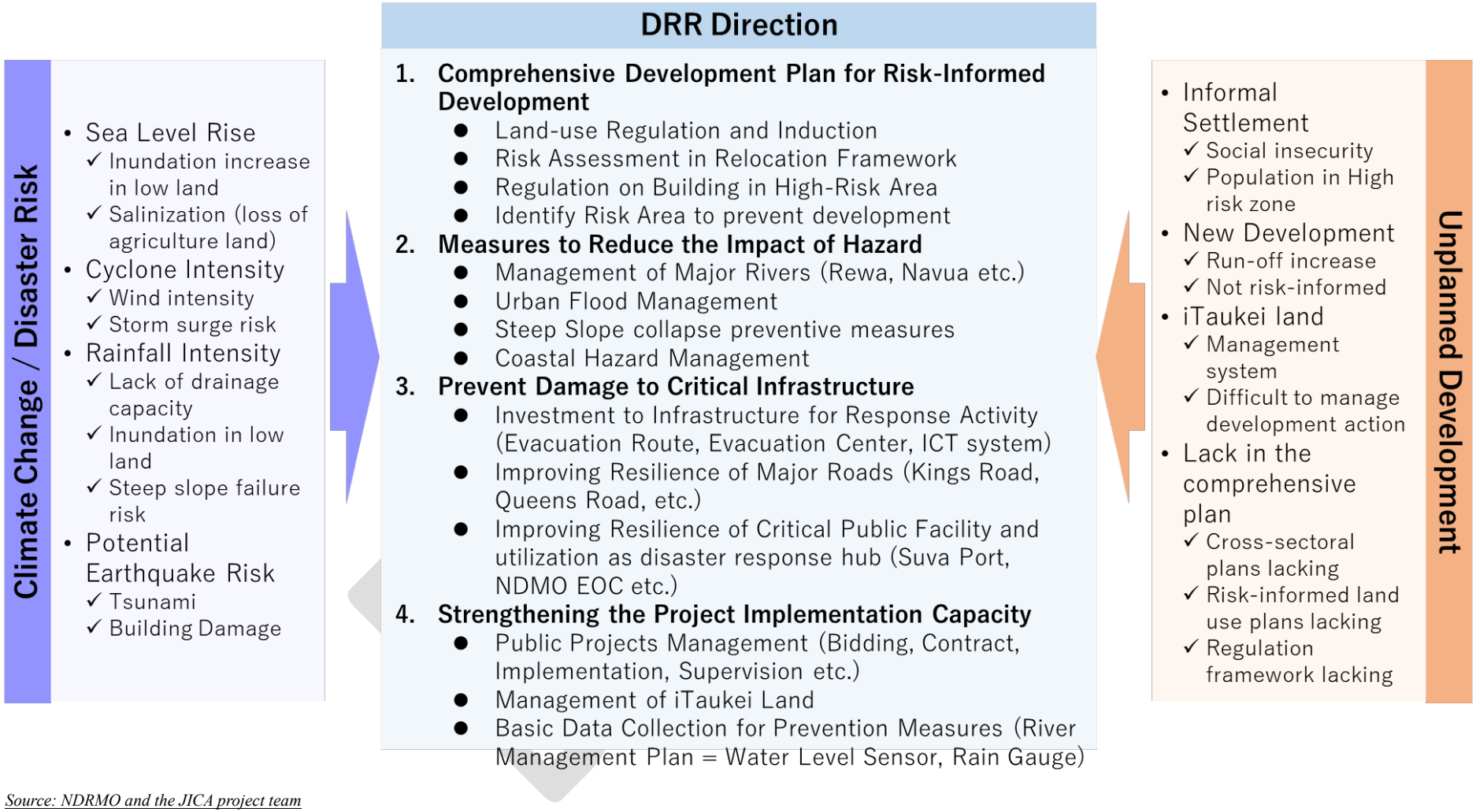

Source: NDRMO and the JICA project team

Figure 27 DRR Direction Identified Through Two Aspects of the Challenges in the Central Division

5.2 Proposed DRR Measures

DRR measures were considered by reflecting the socio-economic profile, development perspectives, disaster risk profile, challenges and initiatives related to DRR.

The Direction 1 "Comprehensive Development Plan for Risk-Informed Development" was set as a first direction considering the rapid urban growth it the Central Division. When considering the development phase of the development can be divided into several categories such as Urban (Central Area, Informal Settlement Area), Sub-urban (Already Developed Area, Future Development Area) and Hilly Terrain (Divisional Connection, Provincial Connection and Village Area).

It is important to consider the different approach for different development Situations which can be summarized as the table below. Based on this table the approach for different measures such as Drainage and Measures in Steep Slopes, Coastal Hazard area, Strong wind and Earthquake can be identified.

Table 11 Matrix of Considerations of Different Approaches in Different Development Situations

	Urban		Sub-urban			Hilly Terrain		
	Central Area	Informal	Already Developed	Inter-City/Towns Connection Road	Future Develop-ment Area	Divisional Connection	Provincial Connection	Village
Drainage								
River Flooding								
Steep Slope Measures								
Coastal Hazard Measures								
Strong Wind Measures								
Earthquake Measures								

Some of the key approaches necessary to be considered in the Suva area are mentioned in following sections of the proposed DRR measures.

1. Comprehensive Development Plan for Risk-Informed Development

- **Prevent Disaster Risk amplified by Development**

  Unplanned development is contributing to increased disaster risks such as obstruction of drainage systems and rapid expansion of residential and commercial areas without corresponding

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infrastructure.

- ⇨ Reducing the drainage issues caused by rapid expansion of road network and missing of the linkage between the road and drainage or natural water body connection (Drainage)
- ⇨ Development in the upstream increasing the run-off amplifying flood risk in the downstream areas (Drainage)

■ **Integration of Disaster Risk into Master Planning**

Begin with the urban development plan of Suva and incorporate disaster risk considerations systematically into broader master planning.

- ⇨ Development of housing, industrial or commercial areas in coastal low-line areas to be avoided (Coastal Hazard Management)
- ⇨ Development of housing, industrial or commercial areas in steep slope areas to be avoided (Steep Slope Management)
- ⇨ Capacity for land use / building regulation and development of implementing system to be enhanced (Urban Planning Capacity)

■ **Measures in Informal Settlement Measures**

Preliminary insights have been gathered from areas such as Wailea and Jittu.

- ⇨ Informal Settlements in low-line areas to be identified and their living conditions to be improved (Drainage)
- ⇨ Development of public housing for relocation of settlers in the informal settlement (Coastal Hazard Management, Steep Slope Management)
- ⇨ Informal Settlement in high-risk areas to be relocated to safer grounds (Coastal Hazard Management, River Management)

■ **Clear Development Direction for the Greater Suva Urban Area**

Outline spatial development strategies for the Greater Suva metropolitan area (Suva, Nasinu, Lami) and its satellite cities (Nausori, Navua) through divisional-level development planning.

- ⇨ Consideration of the regional level road network for redundancy (Resilient Road Network with Redundancy)
- ⇨ Risk evaluation for the Suva port relocation consideration (Prevention and Mitigation of Damage to Critical Facility)

■ **Preparation of Thematic Master Plans (Land use, Land management, Urban Flood)**

Formulate key plans including land use plans, land management strategies, and flood/drainage master plans (particularly focused on urban flooding).

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- ⇨ Formulation of Land-use plans and land management strategies for the Greater Suva area based on the Urban Master Plan under formulation (Urban Planning Capacity)
- ⇨ Master plans for urban drainage for city and town central areas to be developed (Drainage)
- ⇨ Coordination function among the relevant agencies on urban drainage issues to be improved (Urban Drainage Capacity Development)

2. Measures to Reduce the Impact of Hazards

- **Drainage Measures**

  Address overflow risks from drainage channels and small rivers and improve connectivity between road infrastructure and drainage/river networks.

- **Runoff Control Measures**

  Introduce upstream development control strategies to reduce downstream flood impacts.

- **Steep Slope Management**

  Implement regulatory and preventive measures for hillside development, including land use controls and localized interventions within Suva city.

- **Rewa River Countermeasures**

  Implement flood risk management strategies along the Rewa River.

- **Rewa Delta Hydrology and Risk Mitigation**

  Conduct hydrological assessments in the Rewa Delta and implement countermeasures such as sluice gates and dredging.

3. Prevent Damage to Critical Infrastructure

- **Investment in Infrastructure for Response Activity**

  Infrastructure related to response activity is important in reducing the damage to human lives and assets after disaster. Investment in infrastructure such as Evacuation Route, Evacuation Center, and ICT system are important.

- **Resilient Road Network with Redundancy**

  Implement slope stabilization and coastal protection along major roadways (Queens, Kings, Coastal, Princess, and Regional Roads); strengthen critical facilities to ensure redundancy and resilience.

- **Prevention and Mitigation of Damage to Critical Facility**

  Strengthen disaster resilience for schools, hospitals, health centers, logistics hubs, and ports.

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- **Business Continuity Planning (BCP)**

  Develop BCPs for key infrastructure such as Suva Port and other logistics and industrial nodes.

4. Strengthening the Project Implementation Capacity

- **Institutional and Financial Arrangements**

  Establish clear budgeting mechanisms and delineation of responsibilities among national, divisional, and local governments for the implementation of risk-reducing measures.

- **Urban Drainage Capacity Development**

  Address institutional fragmentation in urban drainage management (unclear role-sharing between Waterways agencies and City authorities; potential absence of a national-level coordinating entity).

- **Urban Planning Capacity Enhancement**

  Improve the formulation and operational capacities of urban planning entities, with a specific emphasis on incorporating risk-informed approaches.

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Table 12 List of Projects Proposed in the Central Division

Project No.	DRR Measures	Program	Activity	Responsible Agency	Proposed Implementing Agency	Location	Timeline	Monitoring Year	FINANCIAL STATUS	PHYSICAL STATUS	Remarks
DRR Direction (2): Measures to Reduce the Impact of Hazard											
1	**River Management**	Develop Comprehensive River Management Plan	Update of the Strategic Plan 2020-2024 for the Waterways	Ministry of Waterways and Environment (MOAW)	MOAW	Entire Division	Short (2-3 years)	2025	Not Started	Not Started	
			Update the priority list for river management in the Divisional level	MOAW	MOAW		Short (2-3 years)	2025	Not Started	Not Started	
2	**River Management**	River Management for the Rewa River (including the tributaries such as Waimanu River)	Formulation of river management Master Plan for Rewa River	Central Division, MOAW	MOAW	Rewa River	Short (2-3 years)	2025	Not Started	Not Started	
			Planning for dredging and riverbank protection in the Rewa River	Central Division, MOAW	MOAW		Mid (5 years)	2025	Not Started	Not Started	
			Enhance capacity for managing and regulating commercial dredging	Central Division, MOAW	MOAW		Long (10 years)	2025	Not Started	Not Started	
			Implementation of the measures considered (dredging, riverbank protection)	Central Division, MOAW	MOAW		Long (10 years)	2025	Not Started	Not Started	
3	**River Management**	River Management for the Nabua River	Formulation of river management Master Plan for Nabua River	Central Division, MOAW	MOAW	Nabua River	Mid (5 years)	2025	Not Started	Not Started	*Dredging of the Deuba river is mentioned in the Strategic Plan 2020-2024 for the waterways
			Planning for dredging and riverbank protection in the Rewa River	Central Division, MOAW	MOAW		Long (10 years)	2025	Not Started	Not Started	
			Implementation of the measures considered (dredging, riverbank protection)	Central Division, MOAW	MOAW		Long (10 years)	2025	Not Started	Not Started	
4	**River Management**	River Management in other priority Rivers in Serua Province	Identification of Priorities among the rivers with	PA Serua, Central Division, Ministry of Local Government (MLG)	MOAW	Raiwaqa/ALTA, Waivunu, Wainivilase Settlement, Nakoba, Galoa, Yarawa Flat are areas raised by PA Serua	Short (2-3 years)	2025	Budget Estimated	Target Area/Facility Identified	
			Planning for dredging and riverbank protection in the priority rivers	PA Serua, Central Division, Ministry of Local Government	MOAW		Mid (5 years)	2025	Budget Estimated	Not Started	
			Implementation of the measures considered (dredging, riverbank protection)	PA Serua, Central Division, MLG	MOAW		Long (10 years)	2025	Budget Estimated	Not Started	
5	**River Management**	River Management in Lami River	Formulation of river management Master Plan for Lami River	Lami Town, Central Division, MLG	MOAW	Lami River	Short (2-3 years)	2025	Budget Estimated	Target Area/Facility Identified	***Simple inundation analysis conducted by JICA project team**
			Planning for dredging and riverbank protection of other related measures in Lami River	Lami Town, Central Division, MLG	MOAW		Mid (5 years)	2025	Budget Estimated	Not Started	
5	**River Management**	River Management in Lami River	Implementation of the measures considered (dredging, riverbank protection) in Lami River	Lami Town, Central Division, MLG	MOAW		Long (10 years)	2025	Budget Estimated	Not Started	

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Project No.	DRR Measures	Program	Activity	Responsible Agency	Proposed Implementing Agency	Location	Timeline	Monitoring Year	FINANCIAL STATUS	PHYSICAL STATUS	Remarks
6	**River Management**	River Management in other Smaller Rivers and Creeks (Samabul etc.)	Formulation of river management Master Plan	Suva City, Nasinu Town, MLG	MOAW	Samabul River etc.	Mid (5 years)	2025	Not Started	Not Started	
			Planning for dredging and riverbank protection of other related measures	Suva City, Nasinu Town, MLG	MOAW		Long (10 years)	2025	Not Started	Not Started	
			Implementation of the measures considered (dredging, riverbank protection)	Suva City, Nasinu Town, MLG	MOAW		Long (10 years)	2025	Not Started	Not Started	
7	**River Management**	Informal Settlement in high-risk areas to be relocated to safer grounds	Identification of areas to be relocated	Central Division	-	Entire Division	Short (2-3 years)	2025	Not Started	Not Started	Some location identified in the Waimanu river
			Implementation of relocation program	Central Division	-	Not identified	Long (10 years)	2025	Not Started	Not Started	
8	**Drainage**	Urban Drainage Network Improvement	Development of Policy for Urban Drainage Network Improvement	Central Division, NDRMO	MOAW	Entire Division	Short (2-3 years)	2025	Not Started	Not Started	
9	**Drainage**	Urban Drainage Network Improvement (Nausori)	Development of Urban Drainage Network Improvement Plan	Nausori Town, Central Division	MLG	Nausori Central Area	Short (2-3 years)	2025	Budget Estimated	Target Area/Facility Identified	Plan with budget already submitted
			Urban Drainage Network Improvement in Nausori Town	Nausori Town, Central Division	MLG	Nausori Central Area	Mid (5 years)	2025	Budget Estimated	Target Area/Facility Identified	
10	**Drainage**	Urban Drainage Network Improvement (Suva City)	Development of Urban Drainage Network Improvement Plan	Suva City	Suva City, MOAW	Suva Central Area	Short (2-3 years)	2025	Not Started	Not Started	No detailed plan considered
			Urban Drainage Network Improvement in Suva City	Suva City	MOAW	Suva Central Area	Mid (5 years)	2025	Budget Estimated	Not Started	
			Implementation of the Disaster Waste Management Plan including the contents of waste removal from drainage and rivers before Cyclone events	Suva City	Suva City	Suva Central Area	Mid (5 years)	2025	Budget Estimated	Target Area/Facility Identified	Existing Disaster Waste Management Plan
11	**Drainage**	Urban Drainage Network Improvement (Nassinu Town)	Development of Urban Drainage Network Improvement Plan	Nasinu Town, Central Division	MLG	Nasinu Town (7 wards in Nasinu) *Details to be discussed in the Priority Area Plan	Short (2-3 years)	2025	Budget Estimated	Not Started	Listed as a Capital Project in the "2025 Annual Corporate Plan" but budget not Identified
			Urban Drainage Network Improvement in Nasinu Town	Nasinu Town, Central Division	MLG	Nasinu Town	Mid (5 years)	2025	Budget Estimated	Not Started	

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Project No.	DRR Measures	Program	Activity	Responsible Agency	Proposed Implementing Agency	Location	Timeline	Monitoring Year	FINANCIAL STATUS	PHYSICAL STATUS	Remarks
12	**Drainage**	Urban Drainage Network Improvement (Lami Town)	Development of Urban Drainage Network Improvement Plan	Lami Town, Central Division	MLG	Lami Town	Short (2-3 years)	2025	Budget Estimated	Target Area/Facility Identified	Mentioned in the "A comparative analysis of ecosystem-based adaptation and engineering options for Lami Town, Fiji" supported by UNEP, but no budget allocation
			Urban Drainage Network Improvement in Lami Town	Lami Town, Central Division	MLG	Lami Town	Mid (5 years)	2025	Budget Estimated	Not Started	
13	**Drainage**	Drainage improvement to reduce flooding from creeks and inundation in low-line areas. (Nausori Town, Nakasi - Waidamdam, Waindam River Area)	Comprehensive plan for drainage improvement in the area of Nakasi - Waidamdam - Waidam river	Nausori Town, Central Division, NDRMO	Nausori Town, MOAW, Ministry of Housing (MoH)	Nausori Town, Nakasi - Waidamdam - Daidam River Area	Short (2-3 years)	2025	Not Started	Target Area/Facility Identified	
			Improvement of appropriate drainage function in Nakasi new development area and proper connection to drainage channels	Nausori Town, Central Division, NDRMO	MLG, Land developer	Nausori Town, Nakasi - Waidamdam - Daidam River Area	Mid (5 years)	2025	Not Started	Target Area/Facility Identified	
			Regulation to install run-off control measure in new development areas	Nausori Town, Central Division, NDRMO	Department of Town and Country Planning (DCTP)	Nausori Town, Nakasi - Waidamdam - Daidam River Area	Mid (5 years)	2025	Not Started	Target Area/Facility Identified	
			Drainage Improvement in Waidamdam	Nausori Town, Central Division, NDRMO	MoH	Nausori Town, Nakasi - Waidamdam - Daidam River Area	Long (10 years)	2025	Not Started	Target Area/Facility Identified	
			Improvement of drainage Channel in the area	Nausori Town, Central Division, NDRMO	MOAW	Nausori Town, Nakasi - Waidamdam - Daidam River Area	Long (10 years)	2025	Not Started	Target Area/Facility Identified	
14	**Drainage**	Informal Settlements in low-line areas to be identified and their living conditions to be improved	Identification of areas to be relocated	NDRMO	MoH	Entire Division	Short (2-3 years)	2025	Not Started	Target Area/Facility Identified	
			Implementation of relocation program	NDRMO	MoH	Not identified	Long (10 years)	2025	Not Started	Not Started	
15	**Drainage**	Drainage Along Major Roads to the river or water bodies	Formulation of master plan for drainage network including roads, existing drainage and natural water bodies flow	Central Division, NDRMO	City/Towns, MOAW, FRA	Great Suva	Short (2-3 years)	2025	Not Started	Not Started	
			Identification of responsible institution or agency for the drainage network	Central Division, NDRMO	City/Towns, MOAW, FRA	Great Suva	Mid (5 years)	2025	Not Started	Not Started	
			Implementation of drainage improvement	Central Division, NDRMO	City/Towns, MOAW, FRA	Great Suva	Long (10 years)	2025	Not Started	Not Started	
16	**Steep Slope Management**	Steep Slope Measures in City Area	Identification of high risk area in the population dense area in the greater Suva metropolitan area	Suva City, MRD, NDRMO	Suva City, MRD, NDRMO	Greater Suva metropolitan area	Short (2-3 years)	2025	Not Started	Not Started	
			Identify measures to be implemented in the greater Suva metropolitan area (Structural Measures)	Suva City, MRD, NDRMO	Suva City, MRD	Greater Suva metropolitan area	Short (2-3 years)	2025	Not Started	Not Started	

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Project No.	DRR Measures	Program	Activity	Responsible Agency	Proposed Implementing Agency	Location	Timeline	Monitoring Year	FINANCIAL STATUS	PHYSICAL STATUS	Remarks
16	**Steep Slope Management**	Steep Slope Measures in City Area	Identify measures to be implemented in the greater Suva metropolitan area (Non-Structural Measures)	Suva City, MRD, NDRMO	Suva City Council, Department of Town, and Country Planning (DCTP)	Greater Suva metropolitan area	Short (2-3 years)	2025	Not Started	Not Started	
			DRR plan for steep slope management measures	Suva City, MRD, NDRMO	Suva City Council / MRD / DCTP	Greater Suva metropolitan area	Mid (5 years)	2025	Not Started	Not Started	
			Implementation of Steep Slope Management measures	Suva City, MRD, NDRMO	Suva City Council, MRD, DCTP	Greater Suva metropolitan area	Long (10 years)	2025	Not Started	Not Started	
17	**Steep Slope Management**	Steep Slope Measures along roads (Kings Road, Queens Road)	Identification of high risk areas along the major roads such as Kings road or Queens road	MRD, FRA	MRD, FRA	Kings Road and Queens Road	Short (2-3 years)	2025	Not Started	Not Started	
			Identify measures to be implemented for slope protection along the roads	MRD, FRA	MRD, FRA	Kings Road and Queens Road	Mid (5 years)	2025	Not Started	Not Started	
18	**Steep Slope Management**	Steep Slope Measures in the Hilly terrain area	Identification of high risk areas in the villages or damaged sites	MRD, NDRMO	MRD, NDRMO	Entire Division	Short (2-3 years)	2025	Not Started	Not Started	
			Implementation of steep slope failure prevention measures	MRD, NDRMO	MRD	Not identified	Long (10 years)	2025	Not Started	Not Started	
19	**Steep Slope Management**	Development of public housing for relocation of settlers in the informal settlement	Identification of areas to have intervention	City/Towns	MoH, Public Rental Board, City/Towns	Entire Division	Short (2-3 years)	2025	Budget Allocated	Target Area/Facility Identified	Budget allocated in Jittu Settlement
			Implementation of public housing development	City/Towns	MoH, Public Rental Board, City/Towns	Not identified	Long (10 years)	2025	Not Started	Not Started	
20	**Rewa Delta Hydrology and Risk Mitigation**	Improvement of the Delta Area in the Rewa province	Development of Improvement Plan for the Delta Area	Rewa Province	Rewa Province	Rewa Delta	Short (2-3 years)	2025	Budget Allocated	Target Area/Facility Identified	Situation of Implementation Status to be Confirmed
			Renovation and update of the flap gates	Rewa Province	Rewa Province, MRMDDM	Rewa Delta	Mid (5 years)	2025	Not Started	Not Started	
			Dredging of drainage channel	Rewa Province	Rewa Province, MRMDDM	Rewa Delta	Mid (5 years)	2025	Not Started	Not Started	
21	**Rewa Delta Hydrology and Risk Mitigation**	Improvement of the Delta Area in the Tailevu province	Development of Improvement Plan for the Delta Area	Tailevu Province	Tailevu Province, MRMDDM	Rewa Delta	Short (2-3 years)	2025	Not Started	Not Started	
			Renovation and update of the flap gates	Tailevu Province	Tailevu Province, MRMDDM	Rewa Delta	Long (10 years)	2025	Not Started	Not Started	
			Dredging of drainage channel	Tailevu Province	Tailevu Province, MRMDDM	Rewa Delta	Long (10 years)	2025	Not Started	Not Started	
22	**Coastal Hazard Management**	Construction of Seawalls	Identification of locations for seawall construction and its priorities	City/Towns, Provinces	City/Towns, Provinces, FRA	Entire Division	Short (2-3 years)	2025	Budget Estimated	Target Area/Facility Identified	Some location identified by the provincial level
			Implementation of seawall construction	City/Towns, Provinces	City/Towns, Provinces, FRA	Not identified	Long (10 years)	2025	Not Started	Not Started	

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Project No.	DRR Measures	Program	Activity	Responsible Agency	Proposed Implementing Agency	Location	Timeline	Monitoring Year	FINANCIAL STATUS	PHYSICAL STATUS	Remarks
23	**Coastal Hazard Management**	Rehabilitation of Seawalls	Identification of locations for seawall rehabilitation and its priorities	City/Towns, Provinces	City/Towns, Provinces, FRA	Entire Division	Short (2-3 years)	2025	Budget Estimated	Target Area/Facility Identified	Some location identified by the provincial level
			Implementation of seawall rehabilitation	City/Towns, Provinces	City/Towns, Provinces, FRA	Not identified	Long (10 years)	2025	Not Started	Not Started	
24	**Coastal Hazard Management**	Informal Settlement in high-risk areas to be relocated to safer grounds	Identification of areas to be relocated	NDRMO	MoH	Entire Division	Short (2-3 years)	2025	Not Started	Not Started	
			Implementation of relocation program	NDRMO	MoH	Not identified	Long (10 years)	2025	Not Started	Not Started	
25	**Coastal Hazard Management**	Development of public housing for relocation of settlers in the informal settlement	Identification of areas to have intervention	NDRMO	MoH, Public Rental Board, City/Towns	Entire Division	Short (2-3 years)	2025	Not Started	Not Started	
			Implementation of public housing development	NDRMO	MoH , Public Rental Board, City/Towns	Not identified	Long (10 years)	2025	Not Started	Not Started	
26	**Coastal Hazard Management**	Consideration of Coastal Risk in New Development Area	Hazard Analysis in Possible New Development Areas	NDRMO	NDRMO, MRD	Not identified	Long (10 years)	2025	Not Started	Not Started	
			Consideration of Necessary Measure to Consider Disaster Risk (Elevation of Land, Location Change, etc.)	NDRMO	NDRMO. DCTP	Not identified	Long (10 years)	2025	Not Started	Not Started	
27	**Cyclone (Heavy Rain/Strong Wind) Hazard Management**	Meteorological observation facility enhancement	Enhancement of the Meteorological Observation Function by Installing New Facilities	FMS	FMS	Location identified in the NIIP	Mid (5 years)	2025	Not Started	Target Area/Facility Identified	Some location identified in the NIIP
28	**Cyclone (Heavy Rain/Strong Wind) Hazard Management**	ICT System Improvement for DRR Measures	Identification of the Critical Facility for ICT in Disaster Response and the Implementation of the Identified Measures	NDRMO	NDRMO	Not identified	Mid (5 years)	2025	Not Started	Not Started	
29	**Cyclone (Heavy Rain/Strong Wind) Hazard Management**	Early Warning System for Flooding in Rewa river, its tributaries, and other rivers.	Identification of New Location on Early Warning System and Installment of the System	NDRMO, Central Division	NDRMO	Not identified	Long (10 years)	2025	Not Started	Not Started	Some Activity Conducted by KOICA
30	**Cyclone (Heavy Rain/Strong Wind) Hazard Management**	Evacuation Center Establishment in area with less capacity for evacuation	Implement the Activity to Develop New Evacuation Centers Identified in the Priority Area Plan	Suva City, Nasinu Town, Nausori Town, Lami Town, NDRMO	NDRMO	Identified in the Priority Area Plan	Long (10 years)	2025	Not Started	Not Started	
DRR Direction (3): Prevent Damage to Critical Infrastructure											
31	**Resilient Road Network with Redundancy**	Development of Resilient Road Network between Suva and Nausori	Risk assessment of the road network between Suva and Nausori	Central Division	FRA, MOAW	Kings Road (Section between Suva and Nausori)	Mid (5 years)	2025	Not Started	Target Area/Facility Identified	
			Identification of critical points of the road network	Central Division	FRA, MRD, MOAW	Same as Above	Mid (5 years)	2025	Not Started	Target Area/Facility Identified	
			Implementation of measures to enhance road resilience (road heightening, road drainage, alternative route development etc.)	Central Division	FRA, MRD, MOAW	Same as Above	Long (10 years)	2025	Not Started	Target Area/Facility Identified	

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Project No.	DRR Measures	Program	Activity	Responsible Agency	Proposed Implementing Agency	Location	Timeline	Monitoring Year	FINANCIAL STATUS	PHYSICAL STATUS	Remarks
32	**Resilient Road Network with Redundancy**	Upgrade of the Vulnerable Bridges	Identification of Bridges which Requires Rehabilitation	Central Division	FRA	Some Location Identified in the Priority Plan	Mid (5 years)	2025	Not Started	Not Started	
			Upgrading of the Bridges	Central Division	FRA	Some Location Identified in the Priority Plan	Long (10 years)	2025	Not Started	Not Started	
33		Development of Resilient Road for Regional Connectivity	Risk assessment of the roads with missing linkage for the response activity (Missing linkage between Vunidawa to Korovou through Wianimala River is identified)	Central Division	FRA, MLG	To be Identified besides the Wianimala River Crossing	Mid (5 years)	2025	Not Started	Not Started	
			Identification of critical section for response activity	Central Division	FRA, MLG	Same as Above	Mid (5 years)	2025	Not Started	Not Started	
			Implementation of road enhancement in the village	Central Division	FRA, MLG	Same as Above	Long (10 years)	2025	Not Started	Not Started	
34		Development of Road Network for Response activity and Response	Risk assessment of the roads with missing linkage for the response activity	NDRMO	FRA, MLG	To be Identified	Mid (5 years)	2025	Not Started	Not Started	
			Identification of critical section for response activity	NDRMO	FRA, MLG	Same as Above	Mid (5 years)	2025	Not Started	Not Started	
			Implementation of road enhancement in the village	NDRMO	FRA, MLG	Same as Above	Long (10 years)	2025	Not Started	Not Started	
35	**Prevention and Mitigation of Damage to Critical Facility**	Enhancing Resilience of Health Facility	Identify the Facility in high risk area	NDRMO	MHMS	Identified in the Priority Area Plan	Short (2-3 years)	2025	Not Started	Not Started	
			Priority list for the facility resilience enhancement	NDRMO	MHMS	Identified in the Priority Area Plan	Short (2-3 years)	2025	Not Started	Not Started	
			Implementation of facility relocation or retrofitting	NDRMO	MHMS	Identified in the Priority Area Plan	Long (10 years)	2025	Not Started	Not Started	
36		Enhancing Resilience of Education Facility	Identify the Facility in high risk area	NDRMO	MOE	Identified in the Priority Area Plan	Short (2-3 years)	2025	Not Started	Not Started	

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Project No.	DRR Measures	Program	Activity	Responsible Agency	Proposed Implementing Agency	Location	Timeline	Monitoring Year	FINANCIAL STATUS	PHYSICAL STATUS	Remarks
36	**Prevention and Mitigation of Damage to Critical Facility**	Enhancing Resilience of Education Facility	Priority list for the facility resilience enhancement	NDRMO	MOE	Identified in the Priority Area Plan	Short (2-3 years)	2025	Not Started	Not Started	
			Implementation of facility relocation or retrofitting	NDRMO	MOE	Identified in the Priority Area Plan	Long (10 years)	2025	Not Started	Not Started	
37		Enhancing Resilience of Water Supply Facility	Identify the Facility in high risk area	NDRMO, Central Division	Water Authority of Fiji (WAF)	Some Location in the Waimanu River	Short (2-3 years)	2025	Not Started	Not Started	
			Priority list for the facility resilience enhancement	NDRMO, Central Division	WAF	Some Location in the Waimanu River	Short (2-3 years)	2025	Not Started	Not Started	
			Implementation of facility relocation or retrofitting	NDRMO, Central Division	WAF	Some Location in the Waimanu River	Long (10 years)	2025	Not Started	Not Started	
38		Enhancing Resilience of the Suva Port	Kings Wharf Rehabilitation Project	FPCL (Fiji Port Corporation Limited)	FPCL	Suva Port	Long (10 years)	2025	Not Started	In Progress	
			Hazard and Risk analysis of Suva port facility	FPCL (Fiji Port Corporation Limited)	FPCL	Suva Port	Short (2-3 years)	2025	Not Started	In Progress	
			Priority of program for Suva port resilience enhancement	FPCL (Fiji Port Corporation Limited)	FPCL	Suva Port	Mid (5 years)	2025	Not Started	In Progress	
			Implementation of DRR measures in the Suva Port and related facility	FPCL (Fiji Port Corporation Limited)	FPCL	Suva Port	Long (10 years)	2025	Not Started	In Progress	
39		Enhancing Resilience of Other Critical Facilities	Identify the Facility in high risk area	NDRMO	EFL, WAF	Identified in the Priority Area Plan	Short (2-3 years)	2025	Not Started	Not Started	
			Priority list for the facility resilience enhancement	NDRMO	EFL, WAF	Identified in the Priority Area Plan	Short (2-3 years)	2025	Not Started	Not Started	
			Implementation of facility relocation or retrofitting	NDRMO	EFL, WAF	Identified in the Priority Area Plan	Long (10 years)	2025	Not Started	Not Started	

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Project No.	DRR Measures	Program	Activity	Responsible Agency	Proposed Implementing Agency	Location	Timeline	Monitoring Year	FINANCIAL STATUS	PHYSICAL STATUS	Remarks
40	**Business Continuity Planning (BCP)**	BCP Development for the Suva port	Update and revision of the BCP for Suva port	FPCL	FPCL	Suva Port	Short (2-3 years)	2025	Not Started	Not Started	
			Coordination of BCP plan with relevant institutions	FPCL	FPCL	Suva Port	Mid (5 years)	2025	Not Started	Not Started	
			Implementation of training or DRR measures based on the BCP	FPCL	FPCL	Suva Port	Long (10 years)	2025	Not Started	Not Started	
			Formulate the PDCA cycle for the BCP enhancement	FPCL	FPCL	Suva Port	Long (10 years)	2025	Not Started	Not Started	
41		BCP Development for lifeline facility (electricity, water, sanitation, telecommunication, transportation)	Identify the necessity of development and update of the BCP plan in lifeline facility operation (such as electricity, water, sanitation, telecommunication, transportation)	NDRMO	To be Identified	To be Identified	Long (10 years)	2025	Not Started	Not Started	
			Coordination of BCP plan with relevant institutions	NDRMO	To be Identified	To be Identified	Long (10 years)	2025	Not Started	Not Started	
			Implementation of training or DRR measures based on the BCP	NDRMO	To be Identified	To be Identified	Long (10 years)	2025	Not Started	Not Started	
			Formulate the PDCA cycle for the BCP enhancement	NDRMO	To be Identified	To be Identified	Long (10 years)	2025	Not Started	Not Started	
DRR Direction (4): Strengthening the Project Implementation Capacity											
42	**Institutional and Financial Arrangements**	Coordination among the relevant agencies on urban drainage issues to be improved	Coordination Committee to be Formulated and the Discussion to Define the Role and Responsibility to be Clarified	NDRMO, City/Towns	MOAW, MLG, (FRA)	-	Short (2-3 years)	2025	Not Started	Not Started	
			Development of Official Committee for Coordination on Urban Drainage Issue	NDRMO, City/Towns	MOAW, MLG, (FRA)	-	Mid (5 years)	2025	Not Started	Not Started	
43	**Urban Drainage Capacity Development**	Master plans for urban drainage for city and town central areas to be developed	Master Plan for Urban Drainage to be Developed in the Central Government Level based on the Above Mentioned Activity to Formulate the Official Committee for Coordination on Urban Drainage Issues	NDRMO, City/Towns	MOAW, MLG, (FRA)	-	Mid (5 years)	2025	Not Started	Not Started	

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Project No.	DRR Measures	Program	Activity	Responsible Agency	Proposed Implementing Agency	Location	Timeline	Monitoring Year	FINANCIAL STATUS	PHYSICAL STATUS	Remarks
43	**Urban Drainage Capacity Development**	Master plans for urban drainage for city and town central areas to be developed	The Central Government Master Plan to be Localized in Pilot Cities/Towns to a Local Government Level	NDRMO, City/Towns	MOAW, MLG, (FRA)	-	Long (10 years)	2025	Not Started	Not Started	
44		Enhancement of institutional capacity for urban drainage measures implementation	Identification of Capacity Gaps and Necessary Capacity Building	NDRMO	MOAW, MLG, (FRA)	-	Short (2-3 years)	2025	Not Started	Not Started	
			Implementation of Capacity Building Project on urban drainage measures implementation	NDRMO	MOAW, MLG, (FRA)	-	Long (10 years)	2025	Not Started	Not Started	
45	**Urban Planning Capacity Enhancement:**	Formulation of Land-use plans and land management strategies for the Greater Suva area based on the Urban Master Plan under formulation	Identification of Capacity Gaps and Necessary Capacity Building	NDRMO	NDRMO, Department of Town and Country Planning (DCTP)	-	Short (2-3 years)	2025	Not Started	Not Started	
			Implementation of Capacity Building Project on Land Use Plans and Land Management	NDRMO	NDRMO, DCTP	-	Long (10 years)	2025	Not Started	Not Started	
46		Enhancement of capacity for land use / building regulation and development of implementing system	Identification of Capacity Gaps and Necessary Capacity Building	NDRMO	NDRMO, DCTP, MoH	-	Short (2-3 years)	2025	Not Started	Not Started	
			Implementation of Capacity Building Project on Land Use / Building Regulation	NDRMO	NDRMO, DCTP, MoH		Long (10 years)	2025	Not Started	Not Started	
			Implementation of Actual Project on Land Use / Building Regulation	NDRMO	NDRMO, DCTP, MoH	-	Long (10 years)	2025	Not Started	Not Started	

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PRIORITY AREA
DISASTER RISK REDUCTION PLAN

FOR

THE WESTERN DIVISION
(RAKIRAKI)

DRAFT

AUGUST 2025

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1 Introduction

1.1 Outline

Here, we state the difference between a “Divisional Disaster Risk Reduction (DRR) Plan” and a “Priority Area DRR Plan” as defined in the Local DRR Plan.

■ Divisional DRR plans

Divisional DRR planning is intended to contextualize the National Disaster Risk Reduction Policy (NDRRP) at the local level and set basic disaster management directions and priorities. The size of the region makes a detailed hazard analysis covering the entire district difficult. Therefore, identifying and planning specific disaster reduction measures is difficult, and it is recommended that the results of a "global" hazard analysis be used first to identify priority areas and set basic disaster reduction directions if more accurate data are not available.

■ Priority Area DRR Plan

Once priority areas and locations have been identified at the district level, more accurate data can be used to conduct detailed hazard analysis and simulations. Thus, more specific disaster prevention measures and implementation plans can be considered. This is a “Priority Area DRR Plan”.

Table 1-1 Differences between DRR plans at the Divisional and Priority Area levels

	Divisional DRR Plan	Priority Area DRR Plan
Purpose	To set the fundamental strategies or directions on DRR.	To consider concrete DRR measures to be implemented.
Target Areas	Entire division	Town areas including urban and peri-urban areas.
Involved Agencies	National headquarters and divisional offices of line ministries, and all Town Councils	Target Town Area’s Council, divisional offices of line ministries, private sector.
Secretary	Commissioner	Commissioner
Hazard Analysis	Review of past disasters, and preliminary hazard analysis covering the entire division. ✓ Flood Hazard: Global Flood Map (50-year flood) ✓ Coastal Hazard: Extraction of the areas where the elevation is below 10 meters (Mean Sea Level) and 3 kilometers from the coastline ✓ Earthquake: Global Earthquake Model	Review of past disasters, and enhanced hazard analysis based on more detailed simulation models. ✓ Flood Hazard: Rainfall-Runoff-Inundation Model ✓ Steep Slope: AW3D Elevation Data ✓ Storm surge Hazard: ComMIT Model, ✓ Tsunami: Simulation Model used by FMS

Source: JICA Project Team

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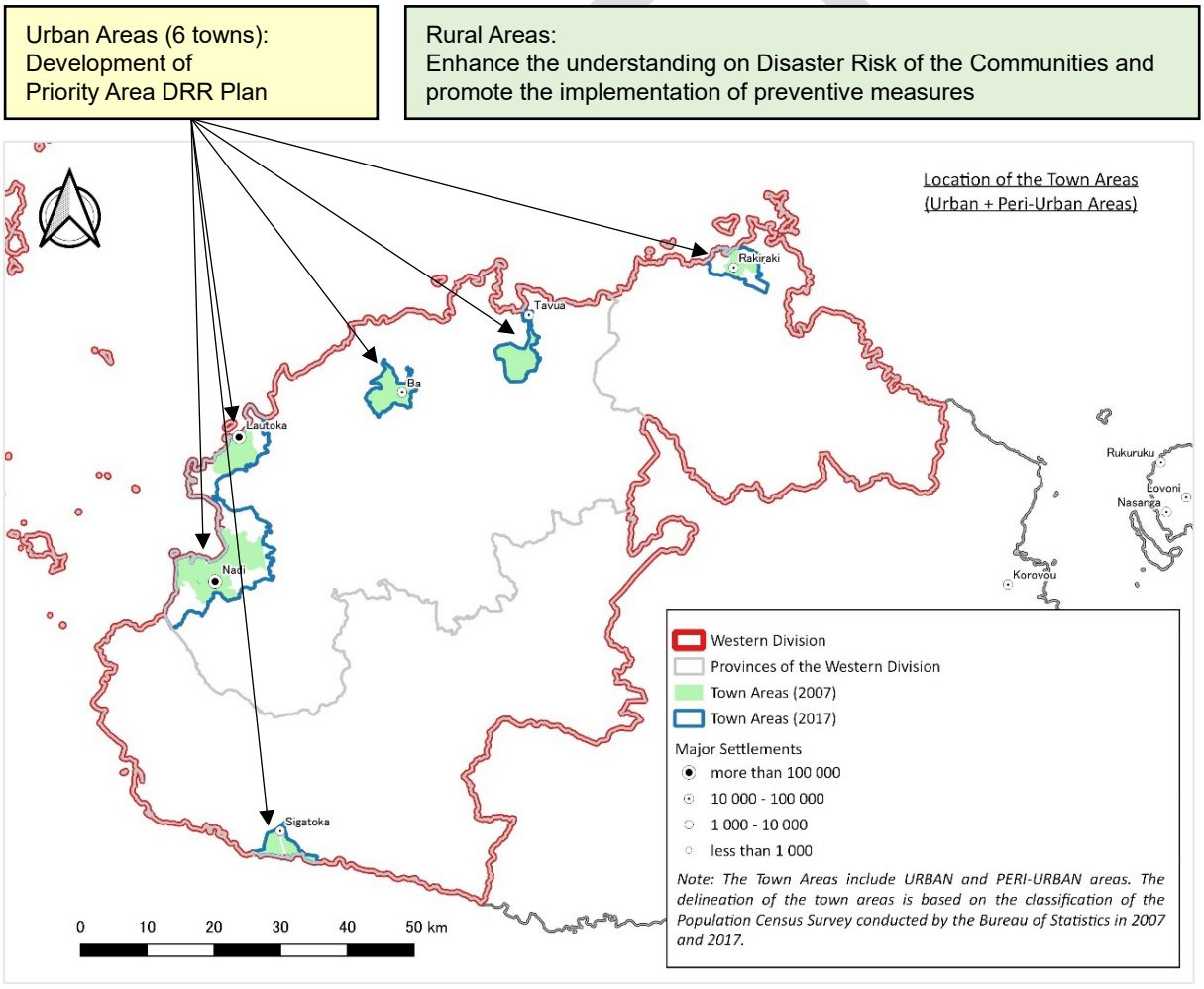
1.2 Selecting Priority Areas

The DRR will be oriented toward the following three (3) points.

- Urban areas need to plan and implement disaster prevention measures.
- In rural areas, there is a need to improve community understanding of disaster risks and promote mainstreaming of DRR and implementation of preventive measures (e.g., review hazard information before installing water tanks, health facilities, schools, etc. in communities).
- Almost all sectors, especially those affected by disasters in the past, are considering ways to promote DRR. More information sharing (e.g., hazard information) and discussions are needed to promote synergies within each sector.

The DRR Plan contributes to the implementation of the Division's Development Plan by setting strategies and priorities.



Source: JICA Project Team

Figure 1-1 Urban (6 Towns) and Rural Areas in the Western Division DRR Plan

One of the objectives of DRR planning is to consider specific and feasible DRR measures that contribute to disaster risk reduction.

Therefore, in order to select priority areas, they will be evaluated according to the following criteria

- Actual socioeconomic profile (population, firms),
- Perspectives from higher-level national and provincial development plans and policies,
- Results of a "preliminary" hazard analysis and risk assessment,
- Past Disaster Records
- Others

The table below evaluates the six (6) urban areas according to the aforementioned evaluation criteria.

Among the six (6) urban areas, the priority area plan was formulated by the support of the JICA project team. As a consequent effort to formulate the priority area DRR plan, Rakiraki was selected as a first area to formulate the priority area plan by the leadership of NDRMO. Rakiraki was selected based on the fact that it has a similar characteristic with Ba town and will be a good example for the expansion of the plans in different towns in the Western Division.

Table 1-2 Evaluation Table for Selecting Priority Areas

	Lautoka Area (63.6 km2)	**Nadi Area (143.1 km2)**	**Ba Area (31.6 km2)**	**Sigatoka Area (20.5 km2)**	**Rakiraki Area (34.8 km2)**	**Tavua Area (29.9 km2)**
Major economic activities	Governmental Center, Sugar Industry, Tourism	Tourism, Sugar Industry, Agriculture	Sugar Industry, Agriculture, Construction	Tourism Agriculture	Sugar Industry, Agriculture, Tourism	Sugar Industry, Agriculture, Mining
Population	69,616	69,834	15,575	10,231	8,901	5,942
Number of Businesses	1,318	1,633	673	278	196	272
Susceptibility to Flood ・ Land Area ・ Population ・ Number of Businesses	 14.3 14,970 100	 103.4 54,154 1,406	 21.0 15,168 672	 7.8 5,077 63	 10.5 2,685 247	 9.7 5,829 189
Susceptibility to Coastal Hazard ・ Land Area ・ Population ・ Number of Businesses	 4.5 3,071 43	 15.2 5,461 76	 0.9 328 4	 4.6 2,748 21	 7.6 1,210 85	 1.0 1,028 26
Susceptibility to Earthquake ・ Population highly affected	5,749	63,617	7,351	3,407	1,428	2,229
Major Challenges to deal with disasters identified during consultation meetings with each Town Council in November 2022	Post-disaster waste management Strict compliance of the Town-Planning Scheme and Building regulations	Post-disaster waste management Tourism protocol	EWS not functioning Post-disaster waste management Lack of funding and resources for recovery	No updated hazard map Basic data difficult to find (challenges on the sharing of data within agencies)	Weather forecast error Workers resides in flood-prone areas Collection of garbage	Prone to drought and flood. Weather forecast error Telecommunication (weak signal)

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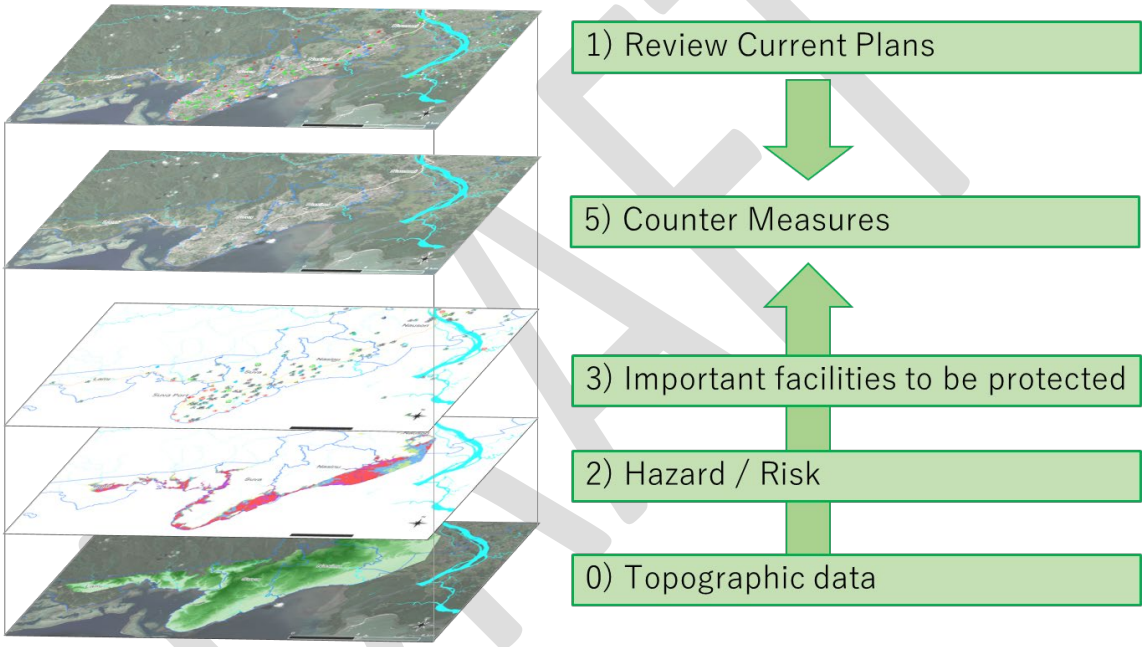
2 Priority Area Plan Study Process

Based on the aforementioned differences between divisional-level and priority area level DRR plans, the following steps should be followed to develop a Priority Area DRR Plan according to the characteristics of the area.

A flow of the Priority Area DRR Plan study is as follows.

1) Review plans and projects related to the Priority Area
2) Identify hazard/risks in the Priority Area
3) Identify important public facilities to be protected in the Priority Area
4) Prepare a Priority Area Plan by reconciling 1), 2), and 3) above
5) Make a list of activities to be implemented to achieve the Priority Area DRR Plan

Detailed process is described in the guideline for development of priority area DRR plan. Here, the Priority Area DRR Plan for Rakiraki is based on the hazard of floods, storm surges and tsunamis.



Source: Prepared in corporation with NDRMO and JICA Project Team

Figure 2-1 A Study Flow of a Priority Area DRR Plan

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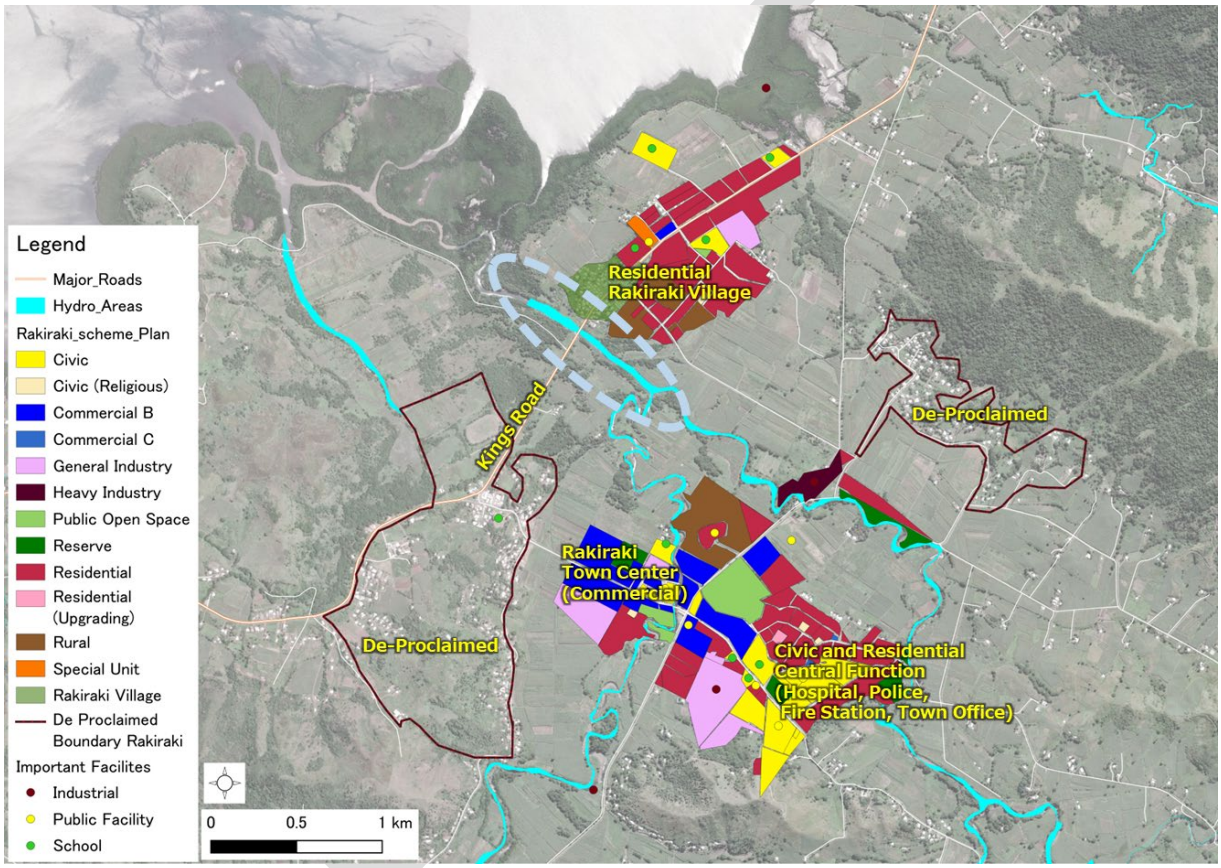
3 Priority Area DRR Plan: Rakiraki 2025-2035

A Priority Area DRR Plan is examined based on the review of current plans (step 1)), the clarified hazard risk (step 2)), and the current status of important public facilities (step 3)).

3.1 Review of current plans

The flow of the planning process mentioned in the previous page following the proceeds in accordance with the guidelines. In reviewing current plans, the Rakiraki Town Planning Scheme, Important Facilities Identified by the Rakiraki town and the intervention considered in the Penang River and Nakauvadra Creek was confirmed.

Based on these conditions, the Priority Area Plan was studied.



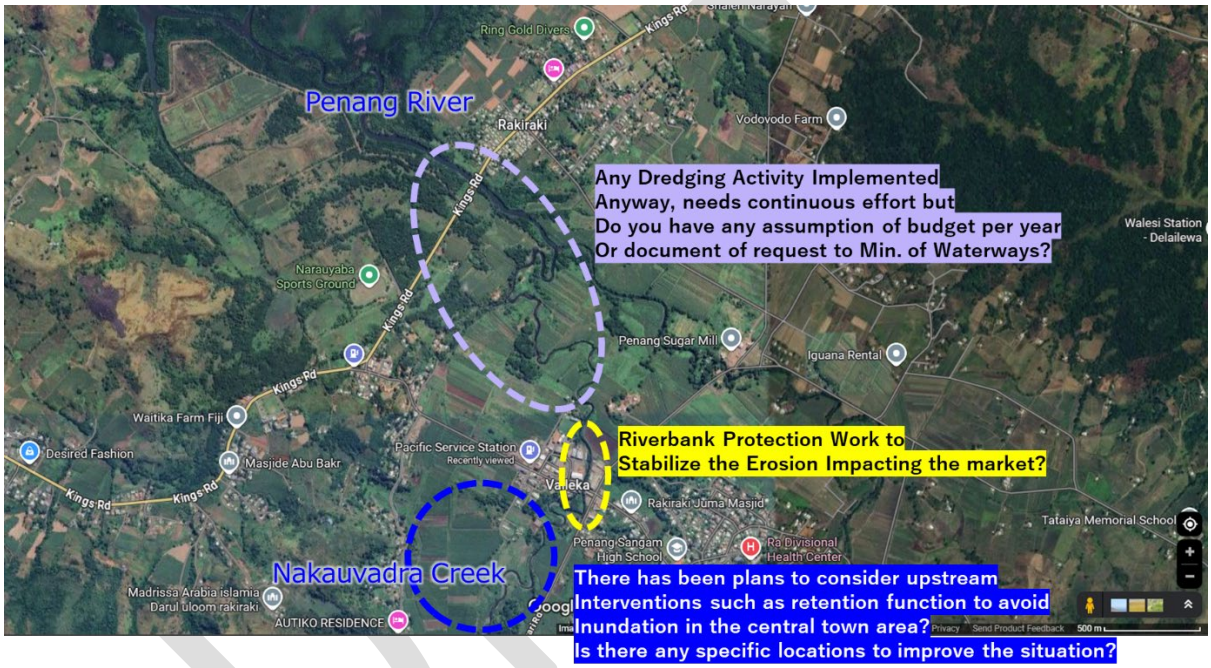
Source: Rakiraki Town Planning Scheme

Figure 3-1 Land use and of Flooding at Major Roads and Intersections

Key concerns and for flood mitigation and waterway management in Rakiraki is focused to the Penang River and Nakauvadra Creek. Overall, the flood mitigation measures which can be considered was sediment control through dredging, stabilization of eroding riverbanks, and upstream interventions to prevent flooding in central urban zones.

In the Penang River area, some dredging was conducted in the past. However, it is essential to establish a sustainable dredging program supported by a dedicated annual budget. Additionally, riverbank erosion protection measures are conducted near the local market but it is expected to be expanded to the surrounding sections.

For Nakauvadra Creek, the central town area is at risk of flooding due to upstream runoff. To address this, the development of retention functions such as reservoirs or divergence channel to divert the water flow at the upstream to avoid the flowing near the town center area. Although several consideration for flood management was considered, it has never been implemented.



Source: Formulated based on the interviews to the Rakiraki town office

Figure 3-2 Location of Flood Management Measures Considered in Rakiraki town

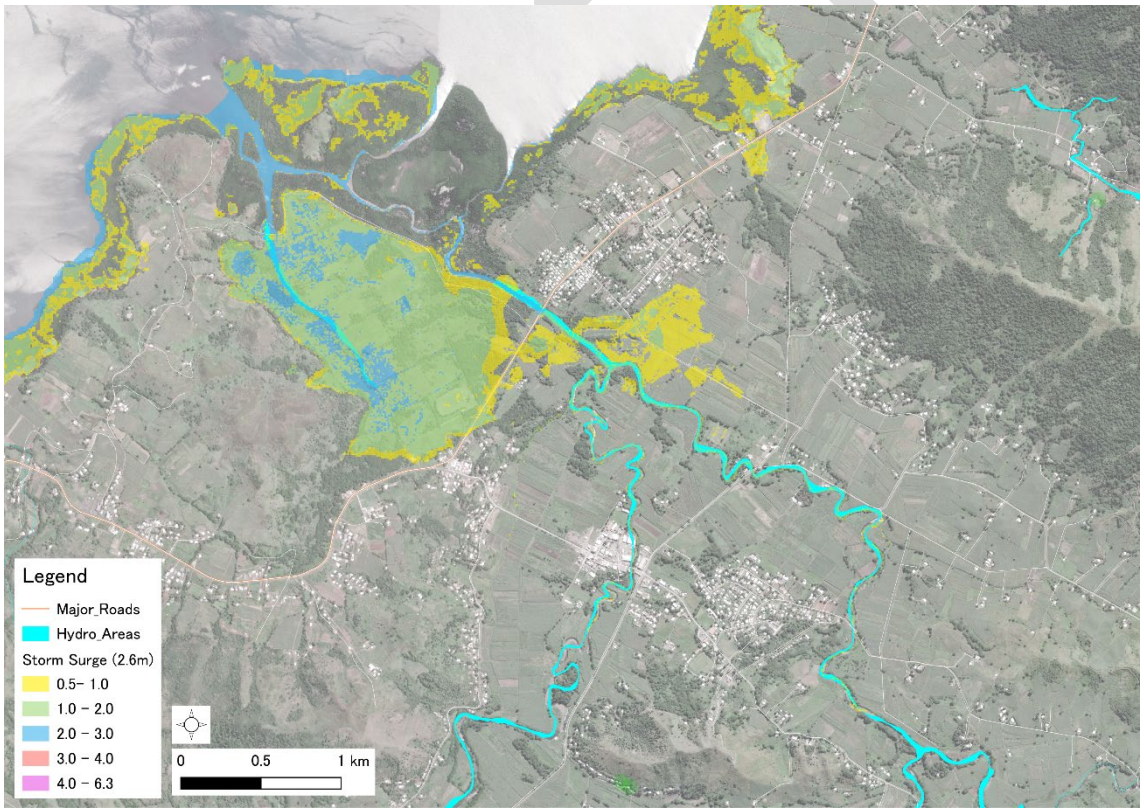
3.2 Hazard/Risks

Hazard/Risks in the Priority Areas was identified for a storm surge and a Tsunami based on the enhanced assessment conducted by the Fiji Meteorological and Hydrological Services (FMS) and Mineral Resources Department (MRD) and for flooding the analysis was conducted in coordination with FMS, NDRMO and Ministry of Waterways and Environment (MoWE) using the RRI (Rainfall-Runoff-Inundation) model.

3.2.1 Storm Surge

Regarding storm surges, past cyclones are analyzed to identify the maximum storm surge deviation in coastal areas. Furthermore, assuming the storm surge deviation occurs at high tide, the maximum storm surge tide level is set by adding the Highest Astronomical Tide (HAT), and the extent and depth of inundation over land are calculated using the fill level method.

The most significant storm surge deviation in Rakiraki was 1.74 meters. By adding the HAT (Mean Sea Level (MSL) +1.142 meters, Lautoka Port) to this storm surge deviation, the extent and depth of inundation over land were calculated using the fill level method to be approximately MSL+2.9 meters.



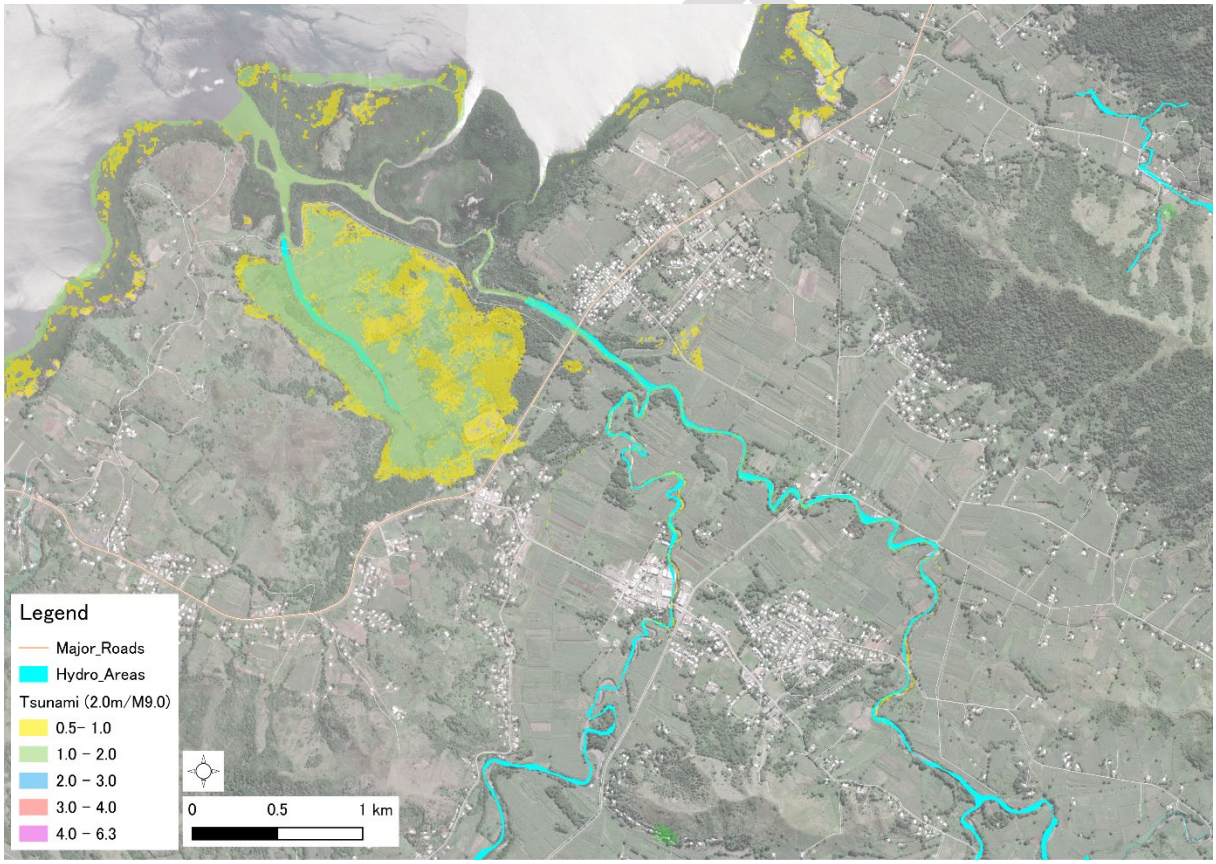
Source: Formulated in cooperation with FMS, NDRMO, MoWE and JICA project team

Figure 3-3 Coastal Disaster in Rakiraki（Storm Surge）

3.2.2 Tsunami

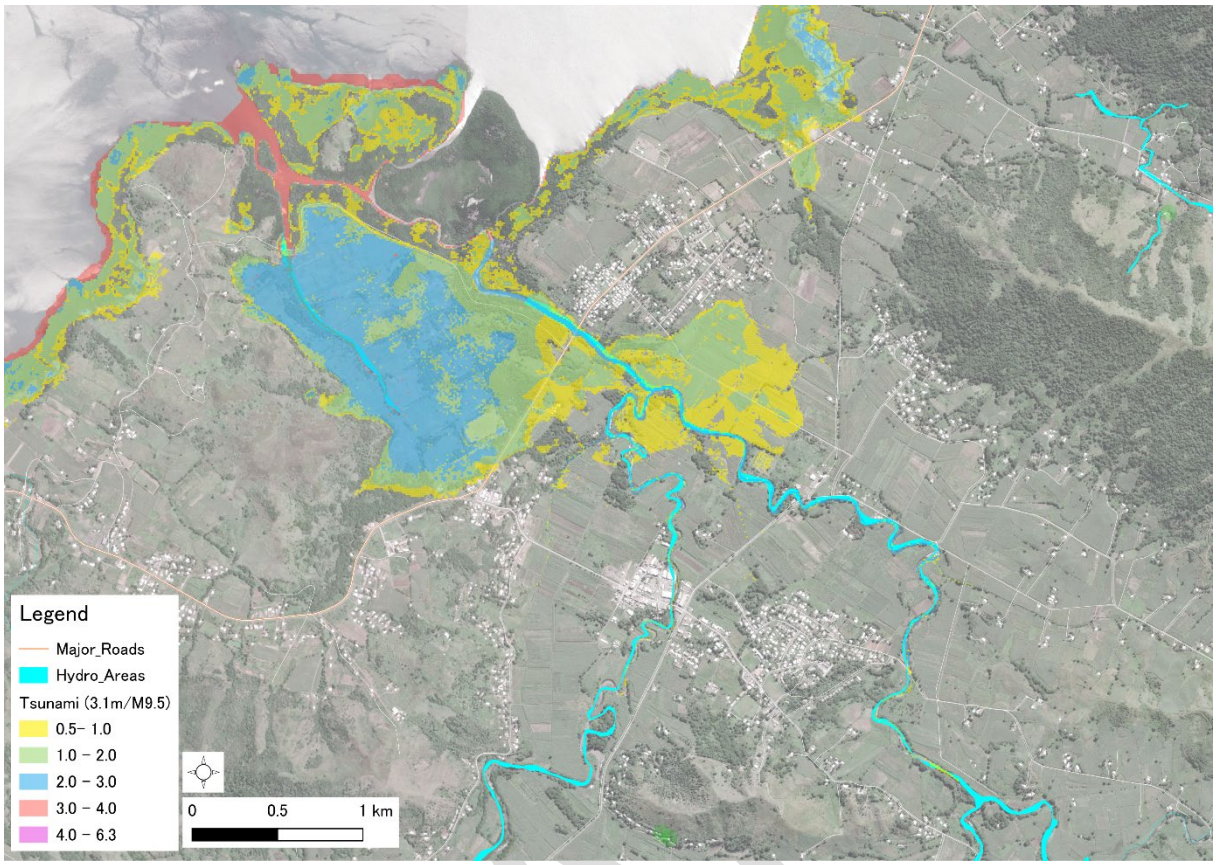
Regarding the examination of tsunamis, past earthquakes and tsunamis are organized, and the largest tsunami height is calculated using a numerical simulation model (ComMIT) to identify the maximum tsunami height in coastal areas. Furthermore, assuming that the tsunami strikes at high tide, the maximum tsunami water level is set by adding the Highest Astronomical Tide (HAT), and the extent and depth of inundation over land are calculated using the fill level method.

The maximum tsunami height for Rakiraki was 2.03 m for a M9.5 earthquake and tsunami in the Tonga Trench and 0.87 for a M9.0 earthquake and tsunami in the Tonga Trench. Adding HAT (MSL+1.142 m, Lautoka Port) to this tsunami height, the inundation area and depth of the land area were calculated by the fill level method as approximately MSL+3.1m for the M9.5 earthquake scenario and MSL +2.0m for the M9.0 earthquake scenario.



Source: Formulated in cooperation with MRD, NDRMO and JICA project team

Figure 3-4 Coastal Disaster in Rakiraki（Tsunami, M9.0 Scenario）



Source: Formulated in cooperation with MRD, NDRMO and JICA project team

Figure 3-5 Coastal Disaster in Rakiraki（Tsunami, M9.5 Scenario）

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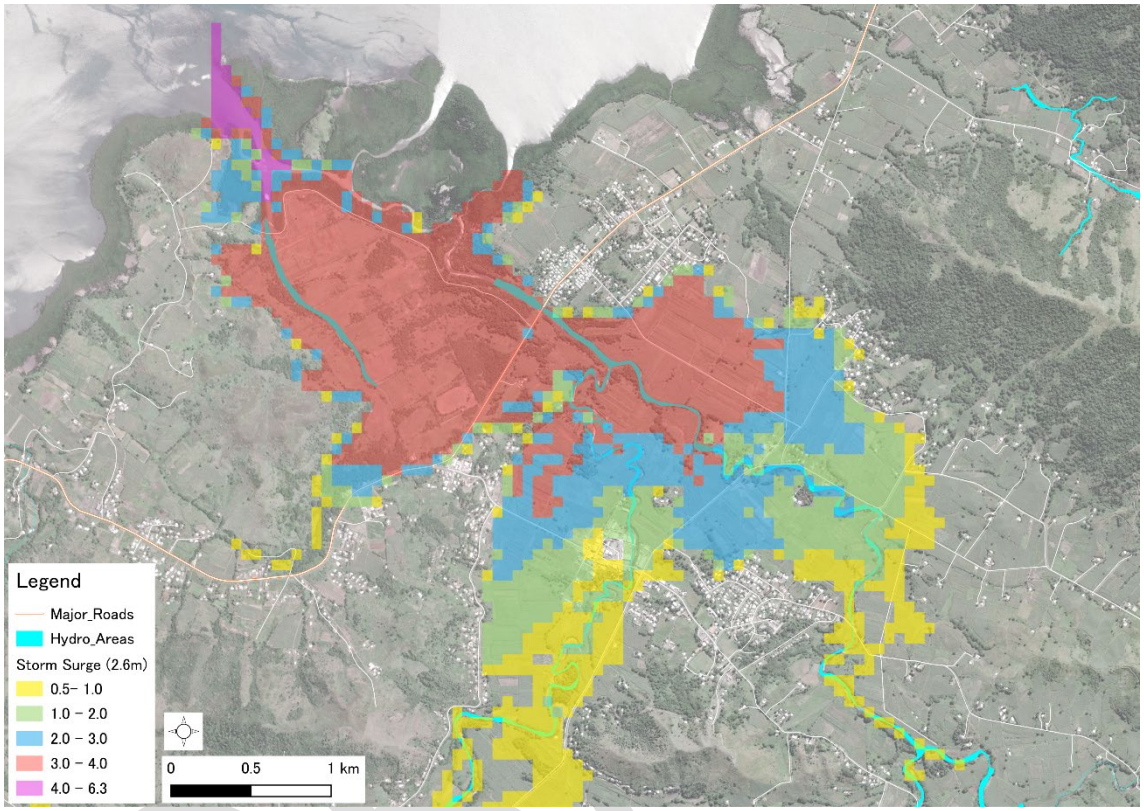
3.2.3 Flood

The calculation of hazard risk is described below.

- Result from WG1 based on 30m mesh size.
- Maximum Inundation area during the flood in January, 2018. (approximately 1 in 3 years return period)



Source: Formulated in cooperation with FMS, NDRMO, MoWE and JICA project team

Figure 3-6 Flood Hazard on Rakiraki

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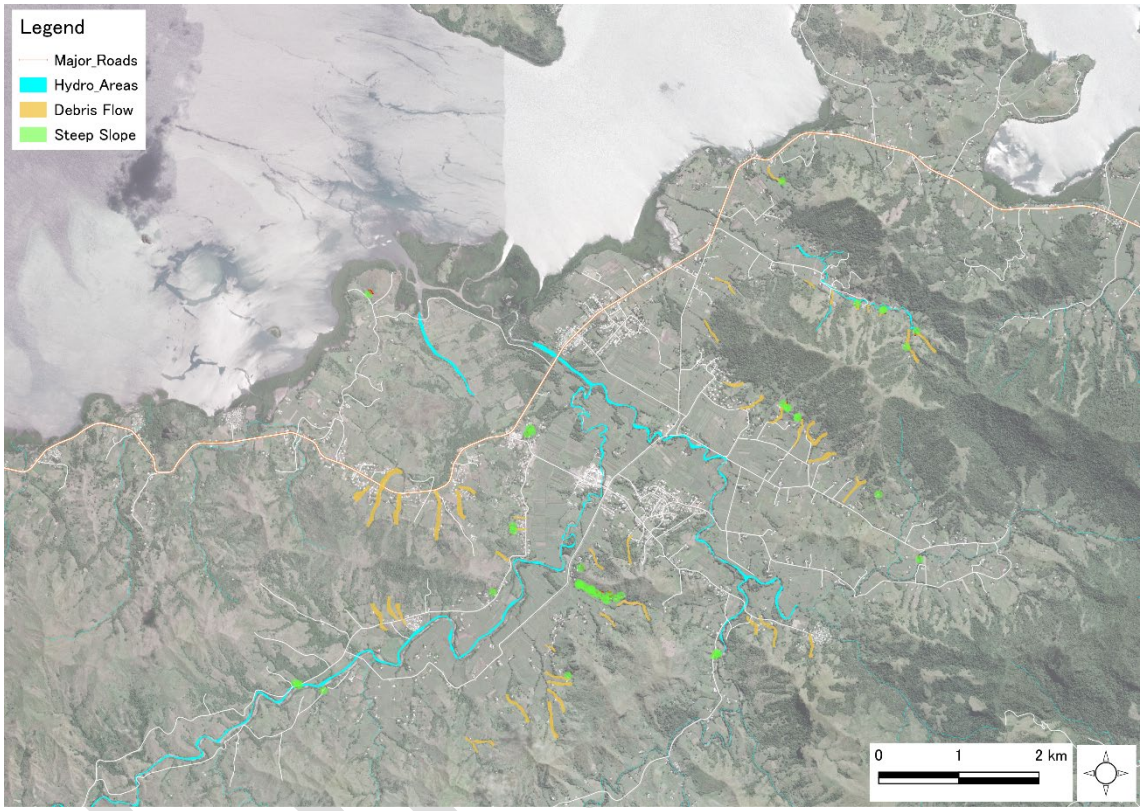
3.2.4 Steep slope and Debris Flow

The hazard analysis for identifying the location of steep slope and debris flow which may cause a disaster event was calculated following the criteria bellow.

- Debris flow: Identification of the possible areas prone to hazard by considering the stream gradient (generated at 10 degrees or more) using DEM,
- Steep slope collapse: Identification of the possible areas prone to hazard by considering the slope angle (30 degrees or more) and slope height (5m or more) using DEM

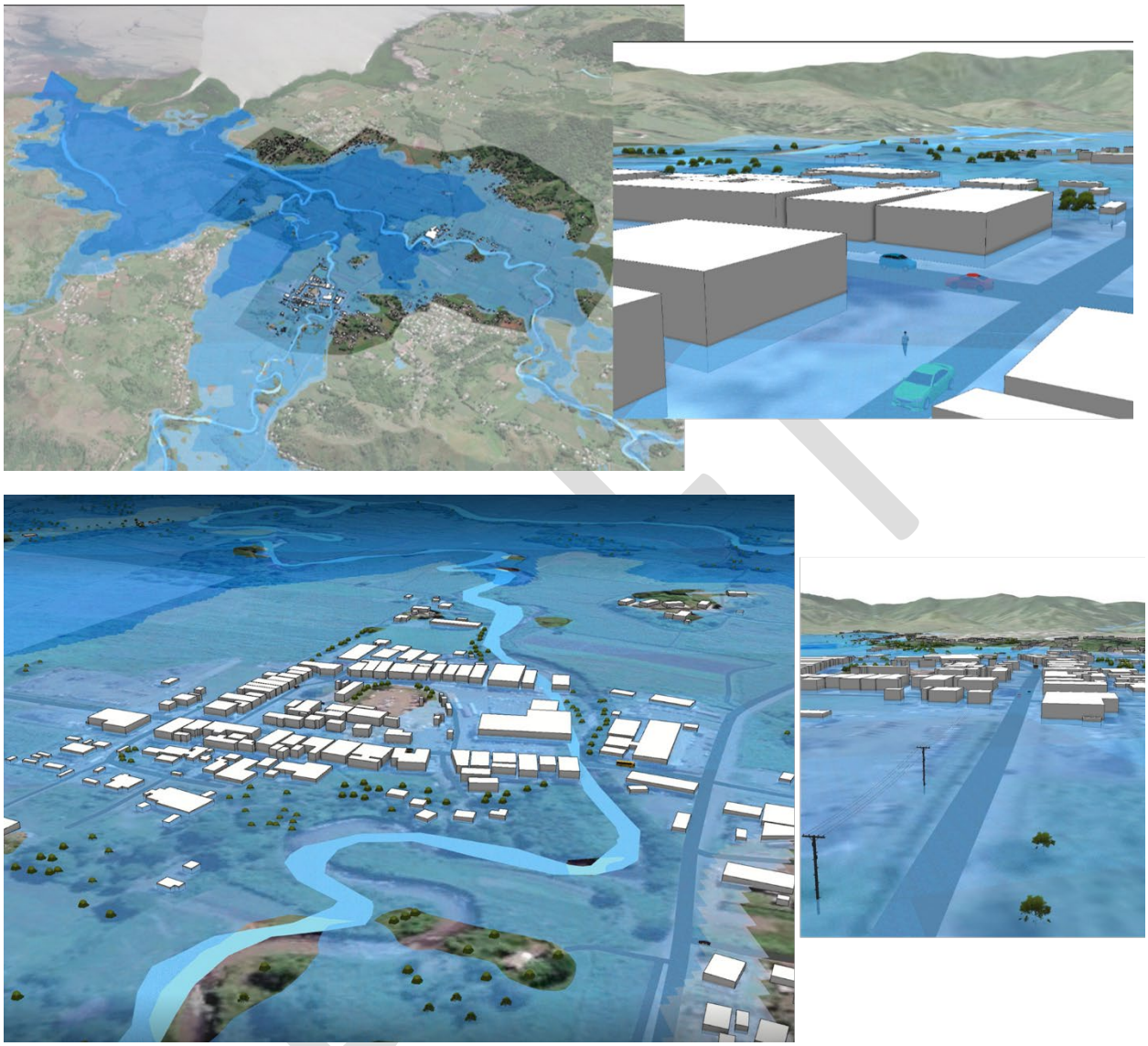


Source: Formulated in cooperation with MRD, NDRMO and the JICA project team

Figure 3-7 Steep slope and Debris Flow on Rakiraki

3.2.5 Visualization of the flood impact to the Rakiraki Cental Areas

The following figure is an overlay of the flood hazard map with a simple 3D model on a 3D topographic map. By the 3D model input, the flood risk can be visualized to enhance the understanding of risk and to promote funding for the counter measures for flood management.



Source: Formulated by the JICA project team for reference

Figure 3-8 3D Model to Enhance the Understanding of Flood Risk in Rakiraki Town

3.3 Important Public Facilities, etc. to be Protected

The location of important public facilities in the priority area was overlaid on the following pages to examine measures to deal with the hazard risk.

The important public facilities are categorized as follows:

Point facilities:

Schools and other educational facilities, hospitals and other welfare facilities, evacuation centers, hotels and other lodging facilities

Liner facilities:

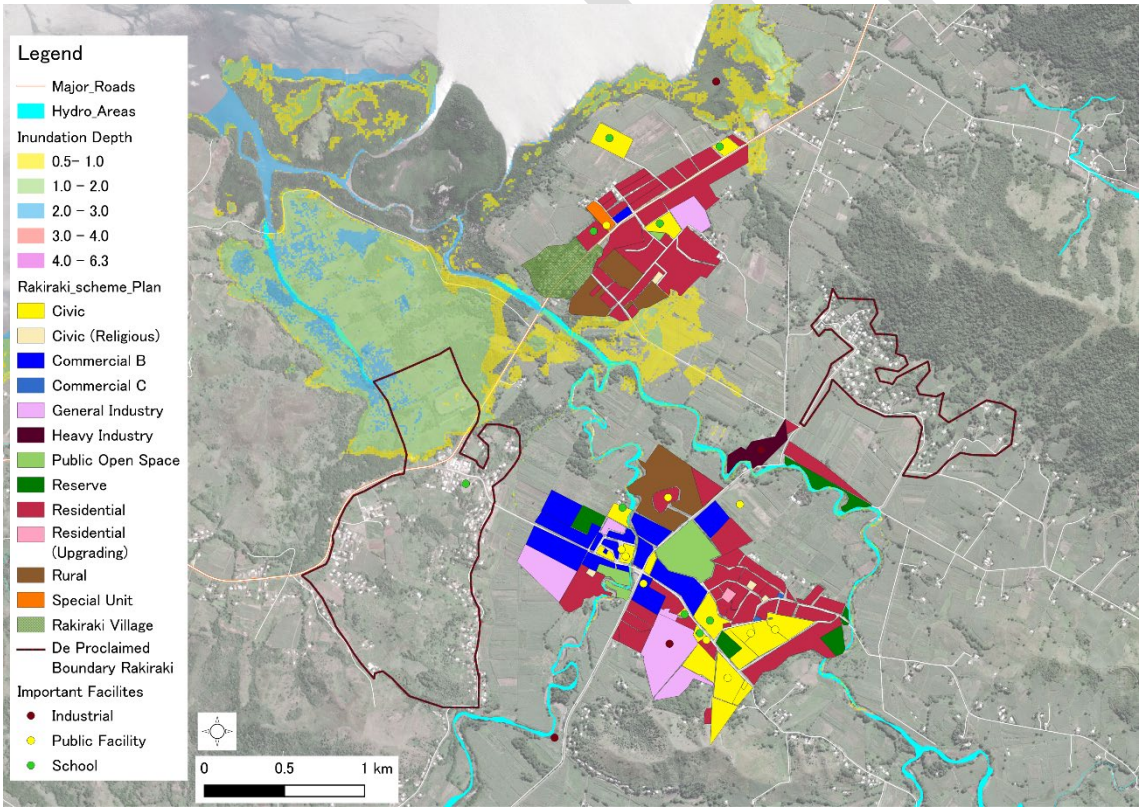
Important arterial roads, etc.

Areal Facilities:

Settlements, urban areas, etc.

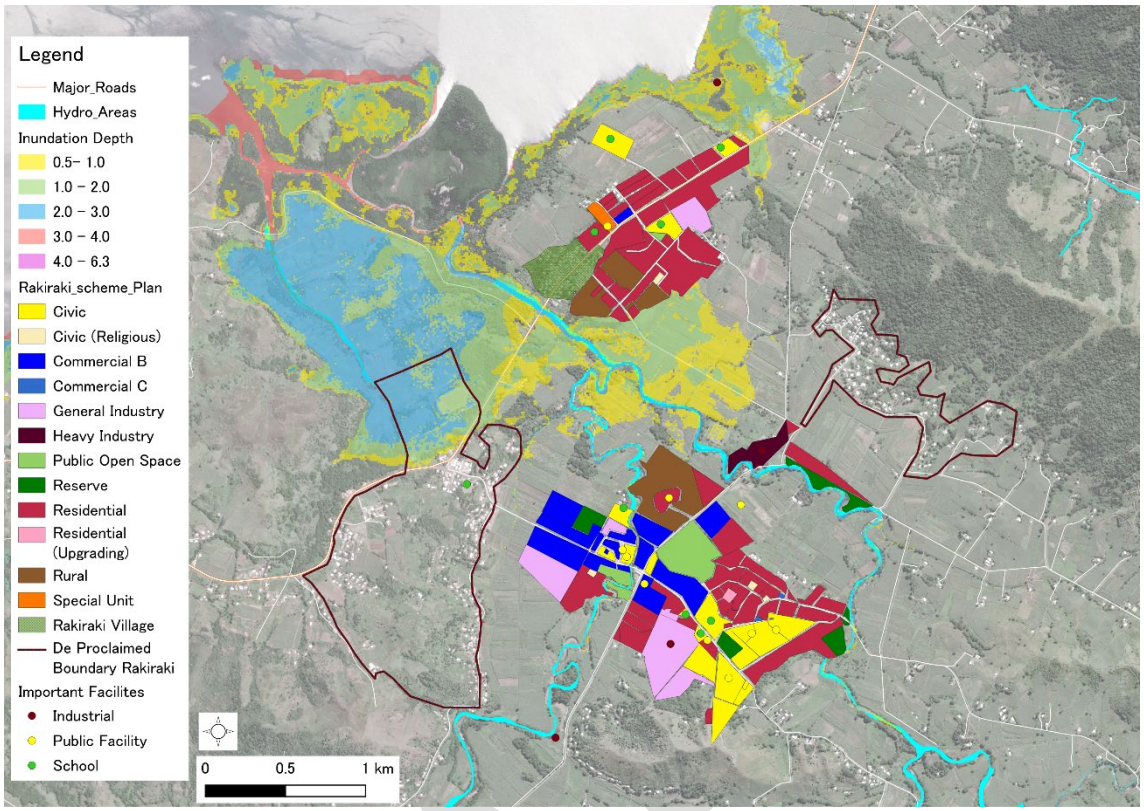
The following pages show 2) Hazard risk and 3) Important public facilities, etc.

■ **Storm Surge and Tsunami**



Source: Formulated in Cooperation with NDRMO and JICA project team

Figure 3-9 Overlay of 2) Hazard Risk and 3) Important Public Facilities (Storm Surge in Rakiraki)



Source: Formulated in Cooperation with NDRMO and JICA project team

Figure 3-10Overlay of 2) Hazard Risk and 3) Important Public Facilities (Tsunami in Rakiraki)

By overlaying 2) storm surge and Tsunami hazard risk and 3) Important public facilities, etc., the following situation can be confirmed.

- **Major Roads** which is the King's Road can be interrupted by a big scale Tsunami
- **Bridge** located in the crossing with the King's Road and the Penang river is at risk of interruption of possible damage by Tsunami and Storm surge.
- Other major important public facility and urbanized area is out of the inundation area caused by Tsunami and Storm Surge.

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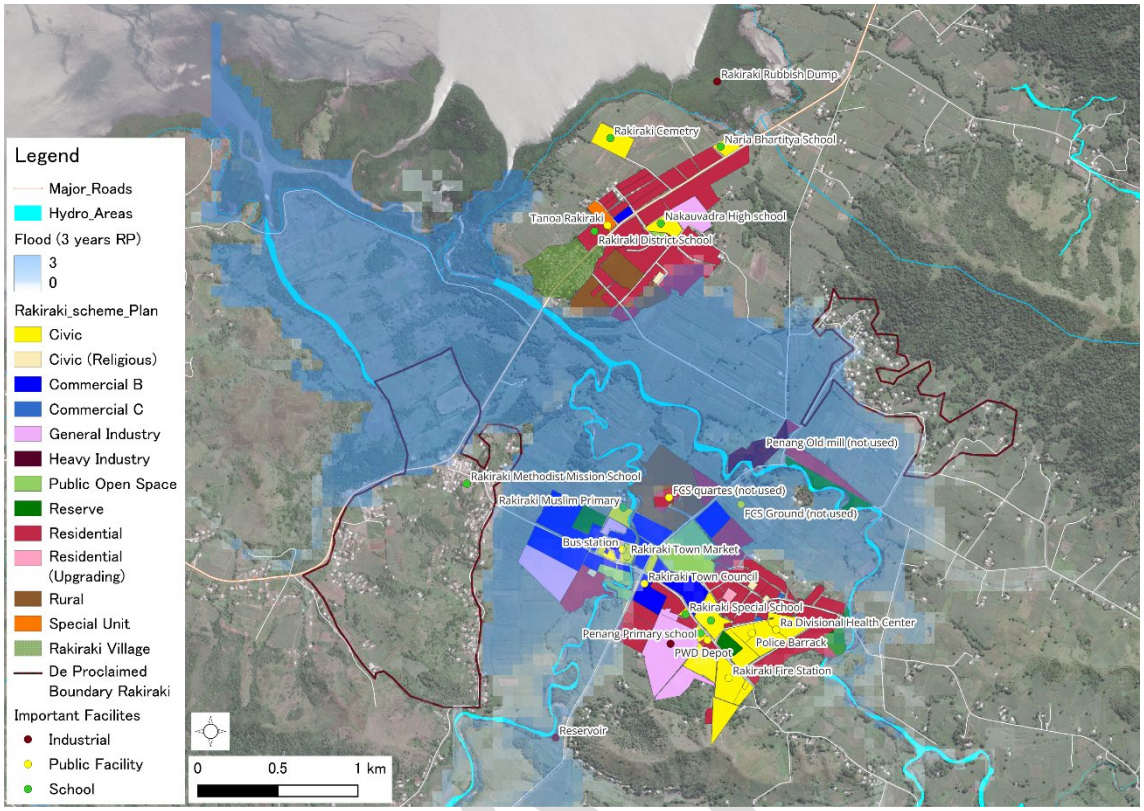
■ **Flood**



Source: Formulated in Cooperation with NDRMO and JICA project team

Figure 3-11 Overlay of 2) Hazard Risk and 3) Important Public Facilities (Flood in Rakiraki)

By overlaying 2) flood hazard risk and 3) important public facilities, etc., the following situation can be confirmed.

- **Major Roads** which is the King's Road and Waimari Road, is interrupted by Flood
- **Bridge** located at the crossing with the King's Road and the Penang river and the Bridge crossing the Nakauvadra Creek near the town central areas is at risk of interruption of possible damage by Flood.
- **School** located near the town center which is the Rakiraki Muslim Primary School is located inside the inundation area.
- **Important Public Facility Bus Station, Public Markets** is located inside the inundation area.
- Residential or Urbanized area in the South of the Town Central area, old town area in the coastal side and some resident in the hill side is out of the inundation area caused by flood, and it is expected to avoid any more development to happen in the inundation area.

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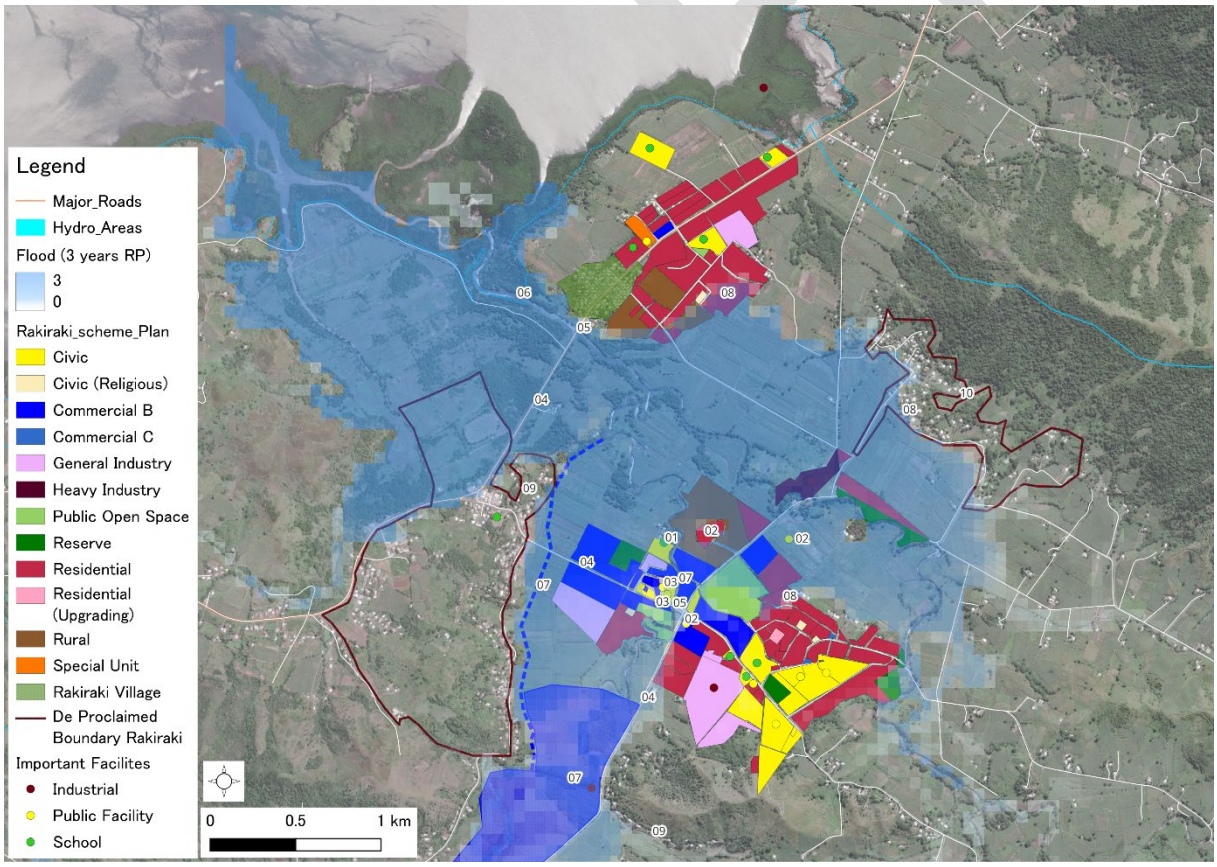
3.4 Priority Area DRR Plan: Nadi for Coastal Disaster

Based on the materials 1), 2) and 3), the Priority Area DRR Plan was developed. The activities as mentioned bellow was identified as a DRR measures to be implemented.

The number of the list is coincidental with the numbers mentioned on the map in Figure 3-11.

1. Raising or relocating of Schools.
2. Raising or relocating public facilities
3. Implementing flood mitigation measures at central Rakiraki town
4. Heightening major roads
5. Enhancing the resilience of bridges (Kings Road and near the market)
6. Flood control (Penang River)
7. Flood control (Nakauvadra Creek)
8. Regulating urbanization in flood areas.
9. Raising awareness (steep slope failure)
10. Establishing evacuation centers.
11. Evacuation Training
12. Tsunami and flood response training.



Source: Formulated in Cooperation with NDRMO and JICA project team

Figure 3-12Location of DRR Measures Identified in Rakiraki (Overlay with the Flood Hazard

3.5 List of activities

The activities listed below will be implemented to achieve the Priority Area DRR Plan.

They indicate **responsible organization** (who), **target year** (when) and **activities** (what).

Table 3-1 List of DRR Activities Identified in Rakiraki Town

No.	Hazard Type	Activity	Responsible Organization	Target Year
1	F	Raising/Relocation of Schools (Rakiraki Muslim Primary School)	Department of Climate Change (Ministry of Education)	2035
2	F	Raising/Relocation of Public Facilities (FSC Quarter, FSC Ground, Town Office)	Department of Climate Change (Rakiraki-Town)	2030
3	F	Flood mitigation measures in Rakiraki Town Market and Bus Station	Rakiraki-Town	2035
4	F, T	Road heighing of major roads (Kings Road, XXXXX Valley Road, Waimari Roads	Fiji Road Authority	2030
5	F, T	Enhancement of Bridge Resilience (Crossing in Kings Road, Crossing near the market)	Fiji Road Authority	2030
6	F	Flood Control Measures for Penang River	Mininsry of Waterways and Environment	2027
7	F	Flood Control Measures for Nakauvadra Creek	Min. of Waterways and Environment	2035
8	F	Regulation of Urbanization in Flood Plain Areas (Identification of Hazard Risk Zone)	Rakiraki-Town	2030
9	L	Raising Awareness in the Steep Slope Areas	NDRMO, MRD	2030
10	C	Establishment of Evacuation Center	NDRMO	2030
11	C	Evacuation Plan Formulation and Training	NDRMO	2030
12	T, F	Tsunami and Flood Response Training	NDRMO, MRD	2030

*Hazard Type: Flood(F), Cyclone(C), Storm Surge(S), Tsunami(T), Steep Slope(L)

Source: Formulated in Cooperation with NDRMO and JICA project team based on the interviews with the Rakiraki Town Office

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