# PCRAFI

PACIFIC CATASTROPHE RISK ASSESSMENT & FINANCING INITIATIVE

# Annex 03:

## Event Briefing
## Earthquake and Tsunami in Solomon Islands

FEBRUARY 26, 2013  //  COUNTRIES AFFECTED: SOLOMON ISLANDS
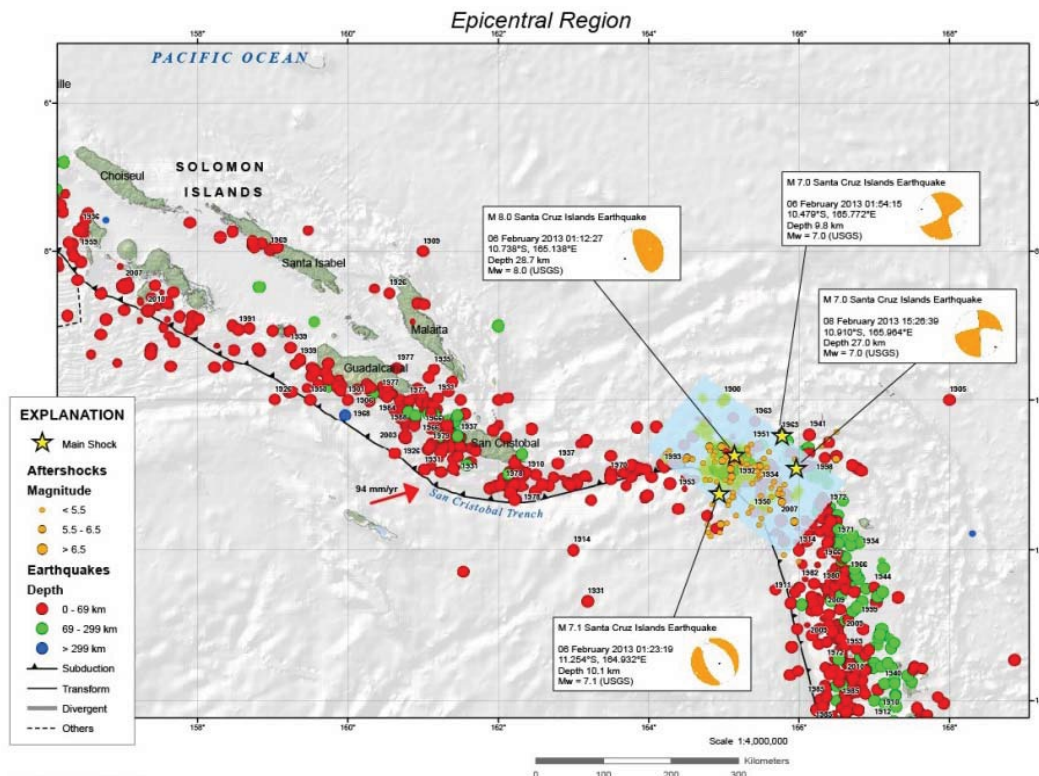
## Event Description

On 6 February 2013, at 12:12 local time (01:12 UTC) a 29 km deep M8.0 earthquake struck the Santa Cruz Island Group of the Solomon Islands, about 75 kilometers west of the town of Lata on Nendö Island, over 500 kilometers east-southeast of the Solomon Island capital of Honiara (see Figure 1). The earthquake occurred as a result of shallow thrust faulting around the plate boundary interface between the Australia and Pacific plates. In the region of this earthquake, the Australia plate converges with and subducts beneath the Pacific plate, moving towards the east-northeast at a rate of approximately 94 mm/yr. Over the month leading up to the February 6th earthquake, there have been dozens of earthquakes in the epicentral region – over 40 M4.5 or larger in the preceding seven days alone, seven of which were larger than M6. Several strong aftershocks were reported, including three with magnitudes of M7.0 or greater. (USGS, 2013)

Following the M8.0 earthquake, the Pacific Tsunami Warning Center (PTWC) issued a tsunami warning for the Solomon Islands, Papua New Guinea, Vanuatu, Fiji, and several other islands in the region; the agency also issued a tsunami watch for Tonga, Samoa, Marshall Islands, Australia, New Zealand, and other locations (PTWC, 2013). The earthquake produced a tsunami measuring about one meter in the Lata wharf in the Solomon Islands. Smaller tsunamis of 8 cm and 33 cm were reported in Honiara (the capital of Solomon Islands) and Vanuatu, respectively (NOAA, 2013). Further assessments indicated that the tsunami wave was closer to 3.5 meters high in some areas of Nendö Island (OCHA, 2013).

**Figure 1–** Map of the M8.0 event, foreshocks, aftershocks, and historical seismicity near the epicentral region (Source: USGS)

# Post Event Loss Calculation Results

Under the Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI), a post event loss calculation (PELC) protocol has been developed, which determines modeled mean loss estimates for impacted countries based on catastrophe risk models (earthquake, tsunami, and tropical cyclone) developed by AIR Worldwide Corporation for 15 Pacific Island Countries (PICs[1]). These modeled mean loss estimates are used for the Pacific Catastrophe Risk Insurance Pilot Program for five pilot countries (Samoa, Tonga, Marshall Islands, Vanuatu, and Solomon Islands). This program aims to increase the financial resilience of PICs against natural disasters. The modeled loss calculation is being conducted by AIR Worldwide Corporation.

Under this protocol, for an individual event, country-wide modeled ground-up mean losses (defined as the estimated cost to repair or replace damaged assets, including residential, commercial, industrial, and public buildings, cash crops, and major infrastructure) caused by earthquake ground shake and tsunami wave are calculated. In addition, estimates of emergency losses that national governments may sustain as a result of providing necessary relief and undertaking recovery efforts are calculated as a fraction of the ground-up losses. Earthquake parameters are obtained from the United States Geological Survey (USGS).

Based on a strict application of the PELC protocol, the modeled mean ground-up and emergency losses for the Solomon Islands are listed in Table 1.

It is emphasized that these estimated mean losses are only one view of the potential loss estimates; the estimated mean losses are for a single representation of the earthquake based on the USGS parameters and resulting calculated parameters as required by the PELC protocol. These losses represent averages which have uncertainty associated with them. The uncertainty (or range) around the mean loss value can be significant due to multiple sources of uncertainty, including but not limited to observation uncertainty (in hypocenter location and reported magnitude), uncertainty of the mean damage functions used to derive the modeled mean loss value, and the uncertainty in the hazard relationships used within the framework of the model. Additionally, it should be noted that the reported modeled mean loss values may differ from reported estimates. This is due to many factors including inconsistent definitions and methodologies used to derive the losses, exclusion of some sector losses from reported estimates, and limited completeness of the damage assessments conducted. Thus, any comparison between modeled mean loss estimates and reported estimates should be done with caution and with a full understanding of the limitations on the loss estimates.

**Table 1–** Modeled Mean Losses for the Solomon Islands from the Post Event Loss Calculation (PELC)[2]

| Peril Type | Modeled Ground-up Losses (USD million) | Modeled Emergency Losses (USD million) |
|---|---|---|
| Ground Shaking | 1.1 | 0.2 |
| Tsunami Wave | 2.6 | 0.6 |
| Total | 3.7 | 0.8 |

ANNEX

03

1  Cook Islands (CK), Federated States of Micronesia (FM), Fiji (FJ), Kiribati (KI), Republic of the Marshall Islands (MH), Nauru (NR), Niue (NU), Palau (PW), Papua New Guinea (PG), Samoa (WS), Solomon Islands (SB), Timor–Leste (TL), Tonga (TO), Tuvalu (TV), and Vanuatu (VU).

2  Note that these modeled loss estimates are based on USGS issued earthquake information obtained on February 8, 2013 at 18UTC (refer Appendix A). Estimated losses are rounded.

## Event Impacts

Of the 15 PICs, the Solomon Islands is the only PIC that was materially impacted by the earthquake event (see Figure 2 that shows an overlay of the exposure value on the ground shaking intensity associated with the event). As shown in Figure 2, the impact of this large magnitude 8.0 earthquake was mitigated by the fact that it occurred at a significant distance from the principal concentrations of assets and population. The impacts of the earthquake were concentrated in the Temotu province which accounts for less than 5 percent of the population of the Solomon Islands, and less than 2 percent of total asset values as modeled in the PCRAFI exposure database (see Appendix B). Based on felt reports from the USGS's "Did you feel it?" system, the ground shaking intensity in Honiara was reported as an MMI of 2 (weak), corresponding to a PGA of about less than 0.02g. In general, other provinces outside Temotu province experienced similar low intensities. The impact on Solomon Islands is discussed in further detail below, with a summary assessment of the other PICs following.

**Figure 2–**  Modeled physical exposure value for Solomon Islands overlaid on a footprint of peak ground acceleration estimates derived from the USGS Shakemap

Note that USGS data is provided only for a certain distance from the epicenter and the mean loss calculations under PCRAFI are based on a model generated event footprint that covers a much larger spatial extent)
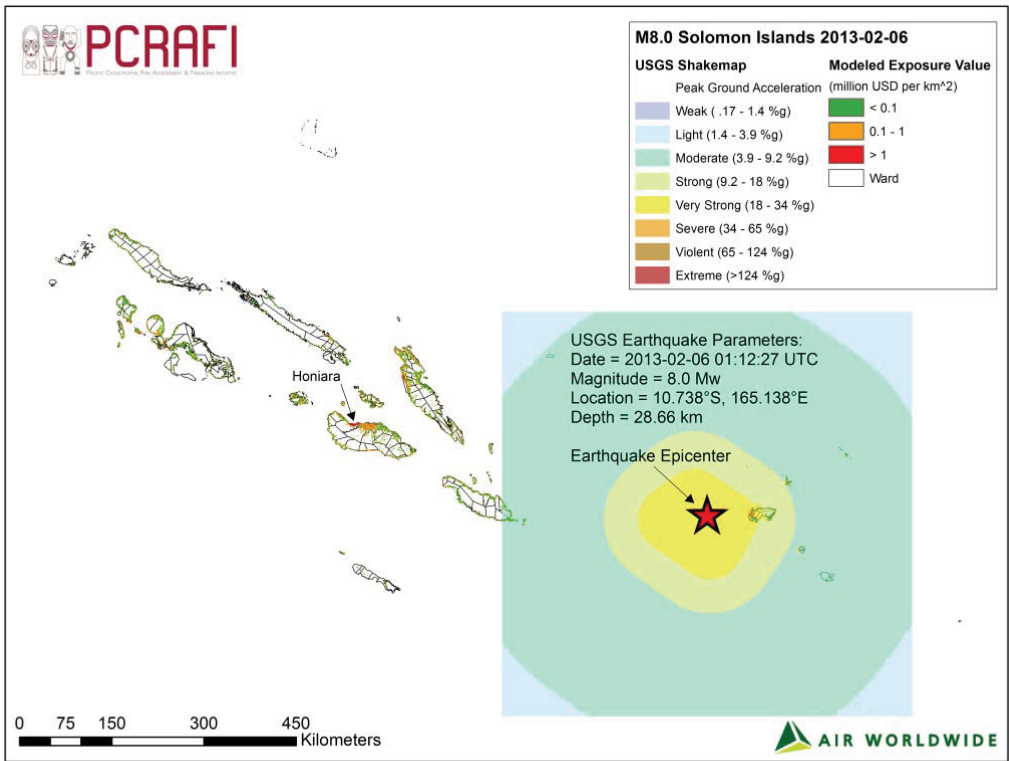
**Figure 3–** Damage in Venga Village, Nendö Island (Photo: Matt Anderson/DFAT/AusAID)
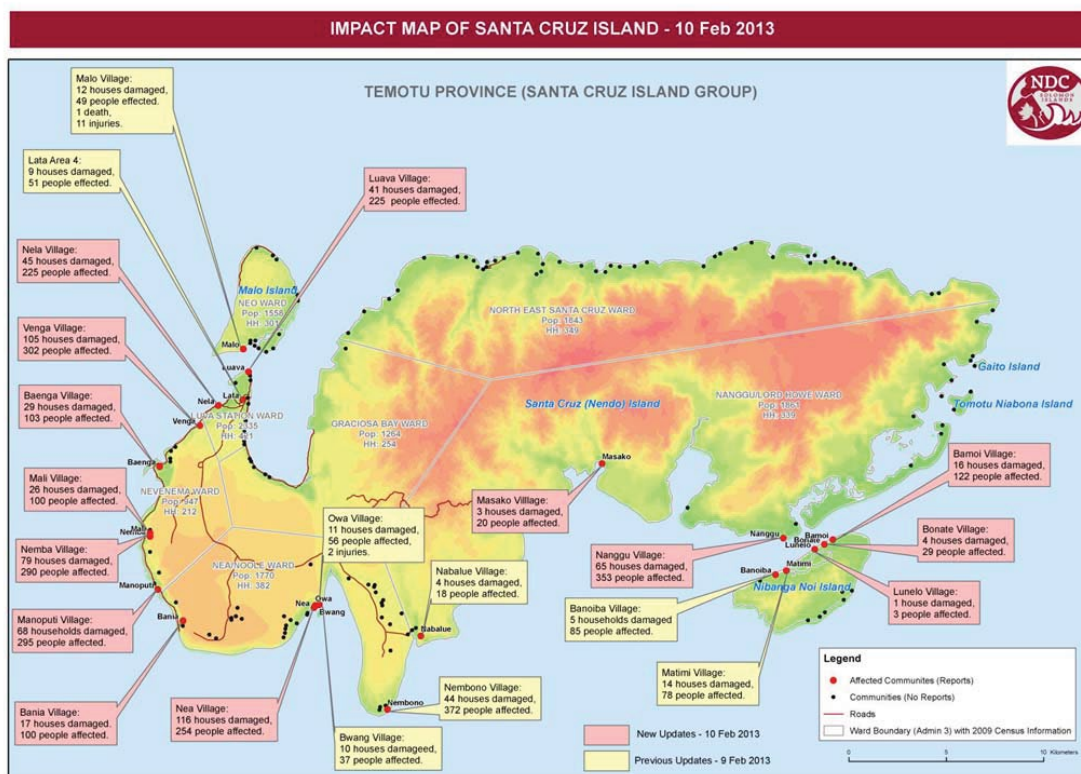


## Affected Countries: Solomon Islands

The maximum ground shaking intensity, based on an average of three reported human observations at Lata on Nendö Island, i.e., the "felt" intensity, was MMI 8 (severe), according to the USGS "Did You Feel It?" system. According to the NOAA/WDC Tsunami Event Database, tsunami wave heights of 1.5 meters and 3.0 meters were observed (from eye-witness accounts) on Nendö Island. Based on current assessments3, a number of villages in the Solomon Islands' southeastern province of Temotu (approximate population of 20,000) have suffered extensive damage (e.g., see Figures 3 and 4). As of February 20th the Initial Damage Assessment from the Government of the Solomon Islands reported 581 houses destroyed, 479 houses partially damaged and 4486 people affected by the earthquake and tsunami. The National Disaster Management Office confirmed

10 fatalities following the disaster. The water supply infrastructure in Lata was significantly damaged, affecting the entire population. The Lata airport and wharf both sustained significant damages. Relevant hazard and exposure data are presented in Figure 5.

Government estimates of damage costs and losses are currently not available, although detailed sector assessments are underway. The NOAA/WDC Tsunami Event Database currently estimates the damage from the tsunami at approximately one to five million USD. The modeled mean ground-up loss estimate presented above from the PELC of $3.7 million is driven by damage in the residential sector which accounts for the majority of the total modeled loss. Damage to public assets is the second largest contributor, although this accounts for less than a quarter of the modeled total. Damage occurring through other sectors, including commercial buildings and infrastructure, accounts collectively for less than 10 percent of the modeled total.
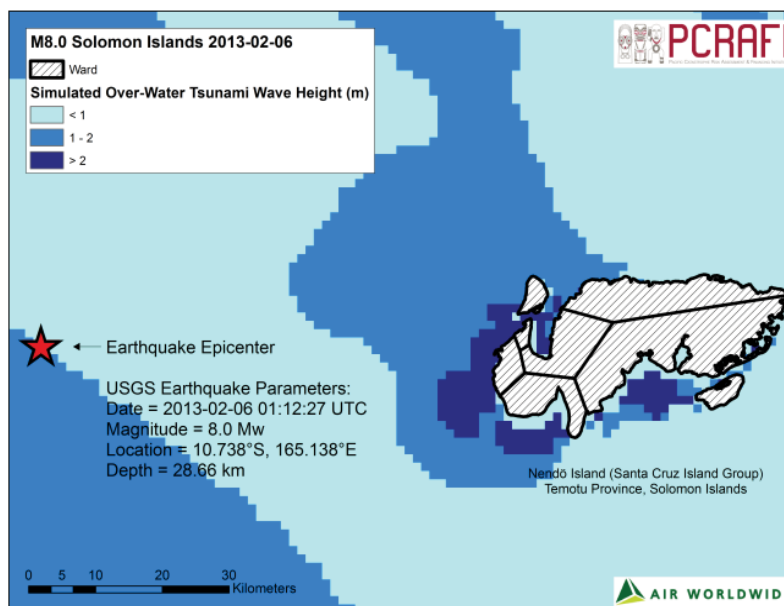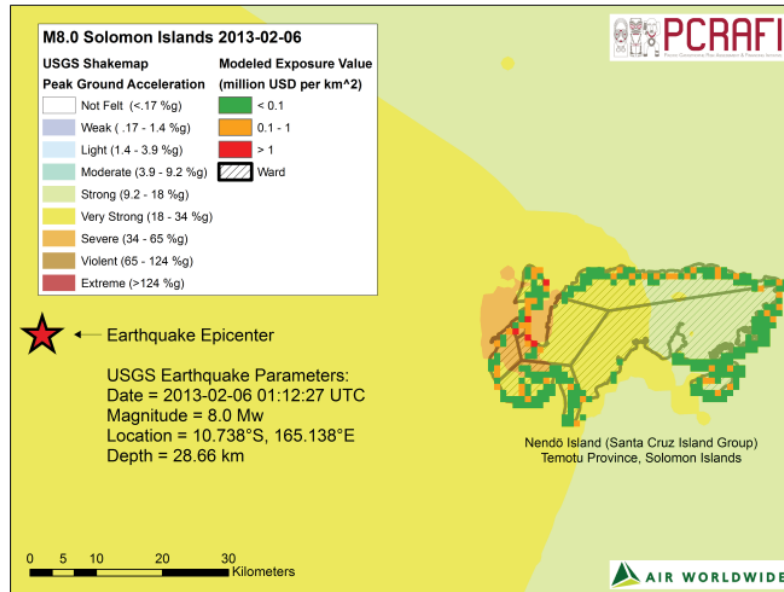
ANNEX

03

3  IFRC, Information Bulletin n° 2, TS-2013-000015-SLB, 19 February 2013 and OCHA, Solomon Islands: Earthquake and Tsunami, Situation Report No. 6 (as of 21 February 2013)

**Figure 4–** An impact map of Santa Cruz, showing affected villages as at February 10th 2013



(Source: Government of the Solomon Islands)

**Figure 5–** Modeled physical exposure value overlaid on peak ground acceleration estimates derived from the USGS Shakemap (top) and PELC simulated over-water (not run-up) tsunami wave heights (bottom)

## Other Pacific Island Counties

Besides Solomon Islands, no other country was significantly impacted by the earthquake and tsunami. Due to the remoteness of the earthquake, damaging ground shaking is expected to have only occurred in the Temotu Province (e.g., the Santa Cruz Island Group) in the Solomon Islands. Table 2 shows the maximum observed tsunami run-ups in the other PICs as reported by the NOAA/WDC Tsunami Event Database.

**Table 2–** Summary of Modeled Exposure in To`nga (2010)

| Country | Maximum Water Height (m) | Measurement Type |
|---|---|---|
| Vanuatu | 0.33 | Tide-gauge measurement |
| Papua New Guinea | 0.17 | Deep ocean gauge |
| Kiribati | 0.12 | Tide-gauge measurement |
| Samoa | 0.07 | Tide-gauge measurement |
| Fiji | 0.06 | Tide-gauge measurement |
| Tonga | 0.04 | Tide-gauge measurement |
| Federated States of Micronesia | 0.02 | Deep ocean gauge |

ANNEX

03

## Appendix A

**Table A.1–** Summary of Earthquake Parameters Obtained from the USGS

| Pacific Earthquake Event Parameter | Value |
|---|---|
| Date | 2013-02-06 01:12:27 UTC |
| Moment Magnitude | Mw 8.0 |
| Centroid Location (latitude/ longitude) | 10.7377°S, 165.1378°E |
| Centroid Depth | 28.66 km |
| Strike Angle (Rupture Azimuth) | 308.0 degrees |
| Dip Angle | 18.0 degrees |
| Slip Angle (Rake) | 64.491 degrees (rounded) |
| Rupture Length and Width | Not given[4] |

Notes:

Parameters are obtained from the USGS-issued "Preliminary Finite Fault Results for the Feb 06, 2013 Mw 8.0 -10.7377,165.1378 Earthquake (Version 1)" with "Location and Magnitude contributed by: USGS, NEIC, Golden, Colorado (and predecessors)"

Page URL: http://earthquake.usgs.gov/earthquakes/eventpage/usc000f1s0 Page Last Modified: February 07, 2013 03:14:45 UTC

Page Accessed: February 08, 2013 18UTC

4  Rupture length and width are calculated from relationships outlined in the PELC protocol documentation.

## Appendix B

**Table B.1–** Modeled Distribution of Assets and Population for the Solomon Islands

| Province Name | Projected 2010 Population | Modeled Asset Value (2010 USD) |
|:---:|:---:|:---:|
| | *Percentage of Country Total* | *Percentage of Country Total* |
| Choiseul | 4.90% | 2.10% |
| Western | 15.30% | 16.60% |
| Isabel | 5.00% | 2.30% |
| Central | 5.30% | 3.80% |
| Rennell-Bellona | 0.60% | 0.40% |
| Guadalcanal | 14.70% | 19.60% |
| Malaita | 30.00% | 13.70% |
| Makira Ulawa | 7.60% | 2.70% |
| Temotu | 4.60% | 1.30% |
| Honiara | 12.00% | 37.5 |

Source PCRAFI 2012