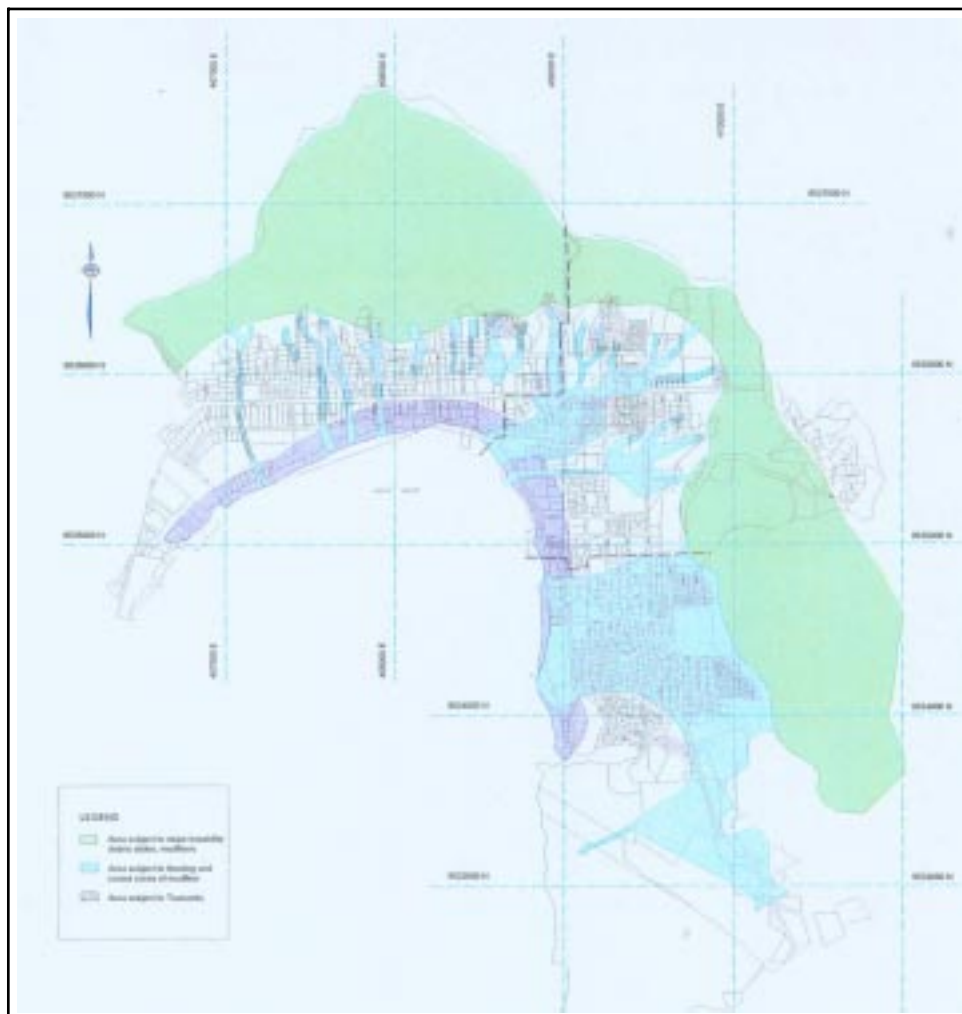


## ASSESSMENT OF HAZARDS AND RISKS

Prior to the eruption Rabaul town had an excellent port, a developed industrial and commercial sector, comprehensive infrastructure, offices of National and Provincial Departments, and community facilities such as a public library, swimming pool and orchid gardens. In general, this was a modern town that was able to provide all of the services expected of a larger city.

The eruption of 1994 demonstrated in catastrophic terms the physical damage and destruction of public and private property. The volcanic hazards, identified in the course of the project that produced most of the damage in Rabaul during and after the eruption were:

- ashfalls
- mudflows and flash floods
- mudfills
- earthquakes
- tsunamis
- corrosion.



**Figure 1 Hazards Map**  
Illustrates existing and future hazards

## **Rebuilding Rabaul**

**Ashfalls.** Ash up to 3 metres deep was deposited over the entire town imposing severe live loads to structures, smothering roads and services, and blocking stormwater drainage. The ash was able to adhere to steep surfaces greater than 45 degrees as the initial ashfalls were wet. Subsequent layers bonded to this initial layer and also became saturated due to incessant rain. Some roof structures were exposed to ash loads of up to 5.4 kN/sq.m. Consequently, the immense ashfall loads caused most of the initial wide spread damage.

**Mudflows and Flash Floods.** The volcanic eruption generated its own micro-climate as a result of the thick ash plumes reaching a height of 5km. This caused constant torrential rain for weeks after the initial eruption. The steep slopes of the caldera wall and the high intensity rainfall resulted in mudflows and flash flooding throughout most of the town. The drainage system had already been inundated with ash and debris, therefore the mudflows and flash floods travelled in an indiscriminate manner and caused significant damage to infrastructure and property.

**Mudfills.** Initial ashfalls were saturated, fine-grained material. Under the weight of subsequent layers of ash, this initial layer flowed into confined spaces such as locked rooms, stormwater pipes and telecommunication junction pits. Depths up to 300mm were reported and, once the mudfills dried and hardened, proved extremely difficult to excavate.

**Earthquakes.** The seismic activity that triggered and accompanied the volcanic eruption was of intensities up to 7 or 8 on the Modified Mercalli (MM) scale. Whilst little damage was caused by the initial earthquakes, it will be shown later that, subsequent seismic events contributed to wide spread damage.

**Tsunamis.** The eruption and pyroclastic flow from Vulcan generated a 2-3m tsunami and which reached up to 200m inland. Compared to other events, little damage was caused by this.

**Corrosion.** Volcanic ash contains compounds including sulphur and chlorides that can be highly corrosive. Corrosion of all types of metals, including aluminium alloys and zinc, started immediately and accelerated rates of corrosion continue today.

**Pyroclastic Flow.** A pyroclastic flow was generated by the sudden, massive eruption of Vulcan. Such a flow is produced by super-heated ash and gas falling down the tall volcanic column and rushing along at ground level at hundreds of kilometers per hour. Pyroclastic flow is considered the most dangerous volcanic hazard to life and property. Fortunately the pyroclastic flow produced by Vulcan was of low intensity and Rabaul Town was not seriously affected. However, the pyroclastic flow destroyed some buildings around Vulcan and a tsunami was also produced.

**Future Hazards.** The Rabaul Volcanological Observatory has predicted that there will be another eruption. The magnitude, the source(s) of the eruption, and when it will occur are essentially unknown. In a combined approach with the Observatory, Professor Russell Blong (Risk Advisor) was able to establish that based upon a limited documented history, it is expected that there will be another eruption within 40 years of the 1994 eruption and its magnitude will be less than or similar in size.

Apart from volcanic eruptions, planning the restoration of Rabaul had to take into account all present and future hazards. Rabaul has also been exposed to earthquakes, tsunamis and landslides that may not be directly connected to a volcanic eruption.

During the last eighty years there have been 12 seismic events of intensity 7 to 8 on the Modified Mercalli scale. Earthquakes of this magnitude have generally produced only minor structural damage.

Seven tsunamis have occurred in Rabaul over the last 110 years; two caused by volcanic eruptions in 1937 and 1994, four caused by tectonic earthquakes and one caused by a large avalanche from Ritter Volcano in West New Britain. All of these tsunamis ranged between 2-3m high within Simpson Harbour. These tsunamis have caused only minor damage but the recent disaster in Sandaun Province is a stark reminder of the danger of these natural events.