CLASSIFICATION OF VOLCANIC EFFECTS

All infrastructure within Rabaul was affected by one or more volcanic hazards resulting from the eruption. It was important to understand these hazards, as it would set the parameters for mitigating their effects in the Engineering Plan. A summary of the findings is detailed below:

Building Damage. Most of the initial structural damage was caused by ashfall. It had been found that most buildings collapsed under 300mm of ash corresponding to an approximate live load of 5.4kN/m^2. Over two thirds of the town was exposed to ash depths greater than 300mm.

Mudflows and flashfloods quickly destroyed buildings within the flow paths. The momentum and destructive power of the ash-laden water was intensive even at shallow depths of less than 0.5m. In February 1994, during a 70mm rainfall, standing waves up to 1m high were recorded indicating velocities of several metres per second.

Some 24 hours after the initial eruption a sequence of small, localized earthquakes were experienced in Rabaul. At this time a significant amount of the ashfall had already been deposited across the town. Therefore, the combination of the ash loadings and horizontal seismic loadings, even though of small magnitude, accelerated the rate of structural failures within Rabaul.

The tsunami caused only minor damage in Rabaul, however 30 houses at Matupit Island were destroyed and timber wharves in the port area were damaged.

Road and Stormwater Drainage Networks. The eruption quickly inundated stormwater drains with volcanic debris. A combination of ash fall and subsequent mudflows swamped roads up to 2m deep. Today, more than 65 percent of the original road and drainage networks remain covered with volcanic debris. Whilst the covered roads and drains are not functional they remain relatively protected from erosion and the effects of lack of maintenance.

Water Supply System. The water supply transmission and distribution lines remained intact. This was rather surprising considering the intense earthquake activity prior to and during the eruption. Historically, the Waterboard has found that the network has survived earthquakes possibly due to the construction or nature of the soils. Similarly to previous seismic events, the performance of the bores and aquifers would have been affected. However, the main impact was the destruction of most reservoirs and three pump stations.

Wastewater System. The wastewater system was small and serviced less than one quarter of the town. The system survived relatively intact. There was some ingress of ash into the lines and the two pump stations and the sewerage treatment plant (Imhoff Tank) were damaged and decommissioned.

Photo 4 Town Centre - pre-eruption

Photo 5 Town Centre - post eruption

Telecommunications. The roof of the telephone exchange collapsed and the equipment was completely destroyed. The underground cabling network appeared to survive relatively intact although most cross-connection units were damaged or destroyed. The underground cables were installed in conduits and the cable joints are sealed with a waterproof heat shrink sleeve. It was determined that the majority of cables could be reused even in the most damaged areas of the Town.

Power Supply and Reticulation. The Rabaul Power Station suffered little damage from the eruption, however the station was decommissioned and the diesel generators removed. Falling trees and buildings damaged large sections of the reticulation system. Some transformers were damaged by the effects of the eruption. Currently about 40% of the original 47 transformers are in operation. Although most of the poles in Rabaul are steel, and exposed to corrosion, most have remained intact and could be reused.

Corrosion. Corrosion is an ubiquitous problem and continues to be the ongoing volcanic hazard affecting all infrastructure. Sulphates and chlorides in the ash were found to be particularly destructive, even on metals not normally susceptible to a high rate of corrosion such as zinc and anodised aluminium.