NATURAL DISASTERS – FIJI EXPERIENCE

INTRODUCTION

Fiji lies between latitudes 15 degrees and 22 degrees south of equator and longitudes 176 degreees and 178 degrees E.(See Map in Fig.1) Because of its geographical position, Fiji is affected by hurricanes and floods and, to a lesser extent, earthquakes,tidal waves,droughts and landslides. The islands are occasionally traversed by tropical cyclones during the hurricane season (November-April) with attendent violent winds,heavy rainfall,landslides,flooding and storm surge with greatest frequency around January and February. Fiji is hit by a cyclone annually and a very strong cyclone causing severe damages every 4-5 years. Fiji is within the "Pacific Rim of Fire," the zone of earthquakes and volcanoes which surrounds the Pacific ocean. However there are no volcanoes in Fiji and the number of earthquakes is somewhat less than for the most active areas around the Pacific. Earthquakes and tidal waves are relatively infrequent but, like hurricanes,may cause major disasters. Hurricane Bebe in 1972, was the most destructive hurricane in Fiji's history in recent years,it took 20 lives, made 3,000homeless,put 50,000 under the government's relief distribution scheme and caused damage estimated at $20m. Natural disasters has had a significant impact on the economy causing major setbacks to the development process. The Government's Emergency Services and Relief and Rehabilitation Committees serviced by the Ministry of Fijian Affairs and Rural Development are responsible for the coordination and implementation of emergency,relief and rehabilitation work in times of national emergency resulting from natural disasters.

2.0 TROPICAL CYCLONES

2.1 Tropical cylones are the most destructive of all natural disasters affecting the country and indeed have had a significant impact on the socio and economic development of the country. A feature of cyclones and hurricanes which have struck Fiji since independence in 1970 has been the regularity of their visits. In the ten years from 1980 - 1990 15 tropical cyclones have struct the country with different intensities ranging from moderate to hurricane force winds. Tracks of tropical cyclone affecting Fiji during the period are shown in Fig 2.

2.2 The most destructive cyclone of recent times was Cyclone BEBE in 1972, which devastated the whole country. Relief, rehabilitation and reconstruction work went on for years which led to the establishment of a full-time Relief and Rehabilitation Committee. The disaster was a major setback to the national development programmeand it took years to restore the economy to pre 1972 levels.

2.3 Current efforts by Government towards mitigating the effects of tropical cyclone on life and property such as the recent drawing up of a Building Code and its enforcement to ensure buildings are cyclone resistant,adoption of appropriate farming methods,systems and practices and improving public state of readiness underlines the importance Government attaches to the impact of disaster on the country.

3. CYCLONE DETECTION AND PREDICTION

3.1 The Regional Tropical Cyclone Warning Centre at Nadi serviced by the Fiji Meteorological service is responsible for the detection and prediction of tropical cyclones for the area between the Equator and 25 degrees South latitude, and from 160 degrees East to 12- degrees West longitude. It provides regular forecast,warning,and advisory services for 13 countries of the region namely Fiji,Tonga,Niue,Northern and Southern Cooks, Western Samoa, Tokelaus, Tuvalu, Kiribati, Wallis, Futuna, Vanuatu and Solomon Islands.

3.2 To meet this role, the Centre operates on a 24-hour basis receiving,exchanging and processing vast amounts of meteorological data from both within and outside the region. Surface and upper air observations,reports from ships,drifting buoys and aircrafts,and data from meteorological satellites and radars are analysed every 3 to 6 hours and provide input towards preparation and update of warnings and forecasts for marine,aviation and general public use.

3.3 The Aeronautical Fixed Telecommunication Network (AFTN) of the International Civil Aviation Organisation (ICAO),telex and telefax are used to disseminate most of the products and provide essential channels of communication.

4.1 *USE OF SATELLITE INFORMATION*

The Centre requires data essentially from the Japanese Geostationary Satellite,GMS, and the American Geostationary Observational and Environmental Satellite,GOES-W,for its requirements. Unfortunately,the GOES-W satellite,is no longer capable of providing such service due to its malfunction some time ago.

4.2 Prior to 1986,the Centre could receive only low resolution imagery at 3 hourly intervals from the GMS satellite. However, towards the middle of 1986 a South Pacific Severe Storm Detection and Warning System project by NASA/USAID was implemented at Nadi,which provided the Centre with appropriate hardware and software to receive and process high resolution satellite data from the same satellite.

4.3 Towards the middle of 1988 an enhancement project was implemented which has enabled the Centre to received Stretched VISSR data at hourly or more frequent intervals from the GMS satellite. This basically means that the Centre has now access to very high quality satellite data,available at more frequent intervals than in the past,to utilize for the location and prediction of tropical cyclones and other weather systems. Consequently its cyclone detection and warning system has improved significantly.

4.4 Hopefully, with the launch of a new GOES satellite within 1 to 2 years from now the Nadi Centre will have access to such high quality data for the entire area of its responsibility.

5.0 *RADAR*

5.1 The Centre has only one 10cm wavelength,both windfinding and surveillance,radar. The range for useful surveillance is about 200nm which means thatthe radar can be used for monitoring systems which are only within this range. Though the radar is very old and unreliable,it gave excellent performance during the passage over Fiji of a recent tropical cyclone.

6. *WARNING*

6.1 There exist a two step system of advisories on cyclones,namely, Alert phase and Warning phase. Special weather bulletins are issued for Tropical Cyclone Alerts and Warnings to:

(a) alert the community to the developing threat of a tropical cyclone;

(b) give progress reports on its development; and

(c) provide warnings of tropical cyclones or other disturbances.

6.2 All special weather bulletins are kept under constant review and due to the periodic nature of satellite and synoptic data, substantial review is only possible at three hourly intervals.

6.3 The most effective and quick means of advising the public of a tropical cyclone threat is through radio broadcasts. The desirability of early advices to enable people to take appropriate measures is vital even at the risk of a false alarm.

7.0 FLOOD

7.1 Fiji experiences some 15 cyclones per decade. Associated with these cyclones are exceptionally intense rainfall that cause destructive floods. Steep slopes,and short streams are characteristic of the otherwise mountaneous islands of volcanic origin. Flood forecasting is therefore difficult, given the short time lapse between the rainfall and the rise in the rivers. Flood forecasts may be ineffective,unless a system or methodology is developed to use rainfall for forecasting floods. The traditional use of the river levels upstream locations for forecasting floods in the lower reaches may not be effective for a majority of river systems. Very heavy rainfall further complicates the severity of flash floods caused by cyclonic winds. Concentration of development along river banks and coastal flats adds to the vunerability of flood damage. Fiji does not have the capability to forecast quantitative rainfall,the only radar for severe weather forecasting centre in Nadi is over 24 years old, and does not have the capability to estimate quantitative rainfall.

7.2 The only flood forecasting system available is in the Rewa River,Fiji's largest catchment, which makes use of river levels up in the catchment to estimate/forecast the anticipated levels down at the delta. It comprises of six river level stations linked by radio to a computer (PC) located in the Hydrology Office.

7.3 The system uses a black box model to forecast floods in the delta using the river levels upstream. A lead time of some six hours is available to allow for preparedness measures such as driving livestock to higher ground and moving property to safety,it also gives time for evacuation if necessary. In the process the public is continually warned over the air of its progress and appropriate measures to take. This system, purchased from New Zealand, has been satisfactory but may not be applicable to other catchments which are smaller,and where there is a very short time difference between the rise in river levels in upstream locations and the more densely inhabited lower reaches. A system that uses a real time rainfall, and a microprocessor to simulate floods is necessary but unfortunately not available in Fiji.

8.0 DREDGING OPERATIONS

8.1 Flood disaster countermeasures are limited to dredging and the government has expended considerable resources to maintain waterways that are capable to cater for floods.

8.2 Fiji's experience of floods,which normally accompany hurricanes, highlighted the need for flood protection works to safeguard the rapid surburban growth of the coastal towns located along the major rivers,and the much more intensive,more capitalised and technically more advanced agricultural development on river flats.

8.3 Although it has been shown that floods in the short term could be mitigated by dredging and river bank diking to ensure that adequate channel freedom is maintained, to be more effective in the longer term however, these engineering works should be followed or accompanied by an appropriate watershed rehabilitation and management works which among other things will minimize the amount of sediment moving downstream.

8.4 River models are being studied and goverment has sought assistance from relevant international organisations to facilitate watershed management studies. Recommendations from this study is being gradually implemented in the hope that the impact of flood disasters are minimised.

8.5 In the lower delta areas a programme of raising village levels as protection against flood is already underway.

9.0 EARTHQUAKE

9.1 Disastrous earthquakes experienced

Fiji is located on the geologically active Pacific rim and is subject to a moderately high level of earthquake risk. In one hundred years of history a damaging earthquake has occurred approximately every ten years in Fiji. However, with its rapid development and growing urban population,Fiji is increasingly vulnerable to the effects of strong earthquakes. The earliest report of earthquake activity in Fiji extends back to around 1850 when an earthquake near the island of Kadavu was 'so tremendous that it took a heavy toll on life and property.

The Suva earthquake of 1953 killed eight people,five by drowning from a tsunami, and caused damage estimated at about $50,000 to Government structures alone, Suva city had a population of 35,000 at the time. A similar earthquake near Suva today would cause widespread destruction and casualties,and incur substantial costs to Government.

9.2 History shows that Fiji is subject to earthquake activity but at what level, and to what extent should we go to protect ourselves? The 1953 Suva earthquake damaged roads,bridges and wharf facilities. In present day Suva,high rise buildings and major port facilities are also at risk, in addition to residences.

9.3 *Scientific and technological knowledge of countermeasures*

Buildings and infrastructure can be designed and built to withstand strong ground shaking from earthquakes but at a cost. In the past,with limited knowledge of the level of hazard in Fiji, there was probably some neglect in designing buildings to resist earthquakes. Certainly there was no uniformity in design stanndards. However,adequate design by itself is not enough. In addition, there is a need also to ensure that construction takes place according to set standards. To this end a Building Code had been drawn up to ensure buildings are cyclone resistant that would greatly minimised the effects of cyclone on buildings. The Code includes an earthquake hazard map of Fiji.

10. PREPAREDNESS

10.1 Efforts have been made to reach every child of school age in Fiji with educational material on earthquake hazard. The Mineral Resources Department (MRD) is coordinating this project. MRD operates the Fiji national seismographic network and monitors earthquake activity in Fiji.

11.0 WARNING

The Emergency Services Committee assumes responsibility for disaster safety measures related to an earthquake or tsunami. The Police and MRD are involved in earthquake and tsunami warning.

12.0 EXISTING PREDICTION/HAZARD ASSESSMENT

At the moment it is impossible to predict earthquake reliably but nonetheless statistical estimates can be made of the probability of an earthquake occurring,based on the earthquake history. MRD has begun projects to determine the level of hazard in Fiji. A preliminary map divides Fiji into zones of differing hazard.See Fig 3. A study currently underway is analysing the earthquake hazard in Fiji in greater detail.

13.0 RISK ASSESSMENT

Risk and vulnerability studies, that is, studies which predict the consequences and cost of a particular earthquake occurring in a particular place have not been done in Fiji. Hazard assessment is the first step in achieving this goal. In the future we aim toward making an integrated study for Suva which considers the risk from all types of natural disasters.

14.0 TSUNAMI

14.1 Tsunami (sea waves) which rarely occurs have been reported after two earthquakes in Fiji, that is, one as far back as 1881 and the one that followed the 1953 'Suva' earthquake. The one in 1881 was reportedly about 1.8m in height and did not cause concern,however the Suva waves were from 1.8 to 4.5m above low tide level causing minimal damage along water frontages.

14.2 The public is always warned to take appropriate measures in the event of an earthquake which is likely to generate sea waves which is considered a potential threat to lowlying islands.

15.0 DROUGHT

15.1 It normally occurs during the dry period of the year,that is, May to October. In addition to its effects on human lives, drought have had adverse effects too on agriculture and livestock and the economy generally. The severe drought following cyclone OSCAR in 1983 caused severe damage to the sugar cane crop. More than 14,000 cane farmers lost most of their crop and export losses for Fiji were estimated at over $70million. In addition more than 30,000 persons were provided with rations. The implications of such a sequence for the national economy are clearly very serious. The most recent extensive drought in 1987 which was associated with the El Nino Southern Oscillation (ENSO) phenomenon almost reached the level which would have warranted the declaration of a national emergency.

Overall, a total population of about 84,500 was supplied with emergency water during the drought period with a total cost of nearly $1 million. The lack of adequate rural water supply facilities further exacerbated the severe drought conditions though Government has steadily assisted rural communities in their water supply schemes. For the Northern Division alone a total population of 6,906 was issued food ration at a cost of $47,000.

15.2 IMPACT ON AGRICULTURE AND LIVESTOCK

15.3 Cane and other crops have been badly affected. On livestock farms number of stock mortalities has resulted from lack of feed and/or water and grazing toxic plants due to shortage of grass.

15.4 AGRICULTURAL DROUGHT ASSISTANCE PROGRAMME

15.5 The programme is geared towards assisting livestock and crop farmers through the provision of supplementary feeds,planting material,manure,etc.

15.6 WATER RESOURCES

15.7 Because of the need to maintain adequate water supply especially in remote areas studies are currently underway to determine alternative sources of water supply,namely, boreholes and also the provisioning of adequate water tanks.

16.0 LANDSLIDES

16.1 Landslides are often occasioned by continuous heavy rainfall over a prolonged period. The most recent major landslide in Suva in 1986 claimed 4 lives. Apart from causing damages to crops , buildings and loss of human lives, roads and bridges have also sustained heavy damages where substantial sum of money were required to restore normal services.

16.2 Landslides has also been associated with poor landuse management.Deforestation and indiscriminate grazing of livestock are major contributing factors.

16.3 In addition to economic considerations, the government's reafforestation programme forms an important element of the national soil conservation programme.

16.4 The Department of Mineral Resources is currently undertaking a study on Landslide Hazard which hopefully will lead to the production of RISK Mapping on this hazard. It is difficult to predict or forewarn people of an impending landslide however the RISK Mapping exercise should provide useful guidance and direction to developers and people alike of areas which are considered vulnerable to landslide hazard.

17.0 RISK STUDY/MAPPING

17.1 Fiji does not have hazard or risk maps on natural disasters which are considered potential threat to the country to provide guidance and direction to developmental activities. Developers and investors however take into consideration the vulnerability of locations from local knowledge before any development takes place. However efforts are underway to secure the assistance of relevant international organisations and agencies to carry out risk study and risk mapping on natural disasters affecting the country.

FIG. 1


MICRONESIA
PACIFIC
MELANESIA
CORAL SEA
TASMAN SEA
AUSTRALIA
MARIANA ISLANDS
CAROLINE ISLANDS
MARSHALL ISLANDS
GILBERT ISLANDS
PHOENIX ISLANDS
TUVALU
TOKELAU
SOLOMON ISLANDS
SANTA CRUZ IS
NEW HEBRIDES
FIJI
TONGA
NEW ZEALAND
NEW GUINEA
PAPUA NEW GUINEA
BISMARCK ARCHIPELAGO
BISMARCK SEA
SOLOMON SEA
New Caledonia
LOYALTY IS
NORFOLK IS
KERMADEC IS
CHATHAM IS
Tasmania
Great Australian Bight
Tropic of Capricorn
International Dateline
Monday
Sunday
1:18 000 000
kilometres
nautical miles
New Zealand's Adjacent Islands are shown on Plate 6

FIG. 3

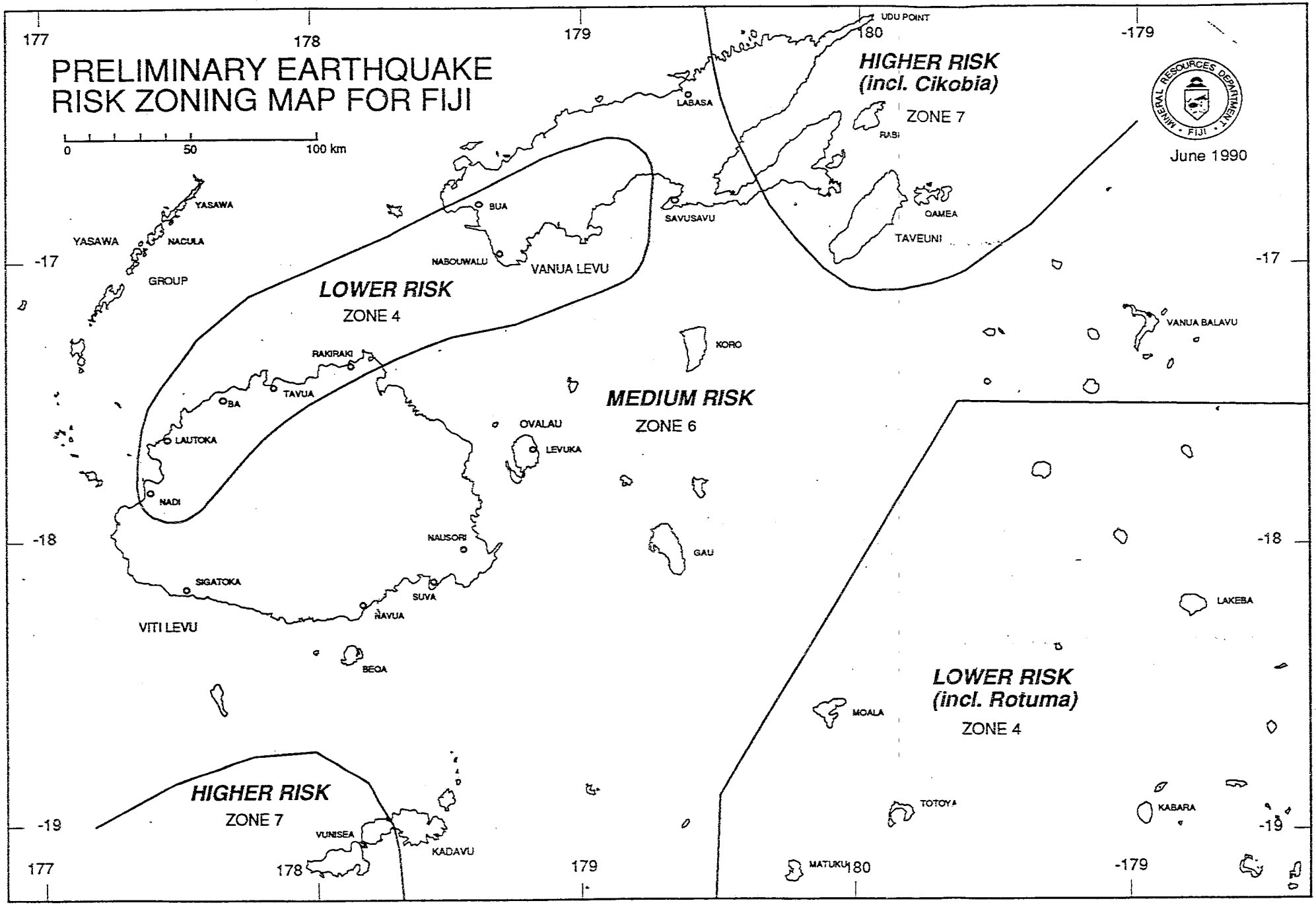
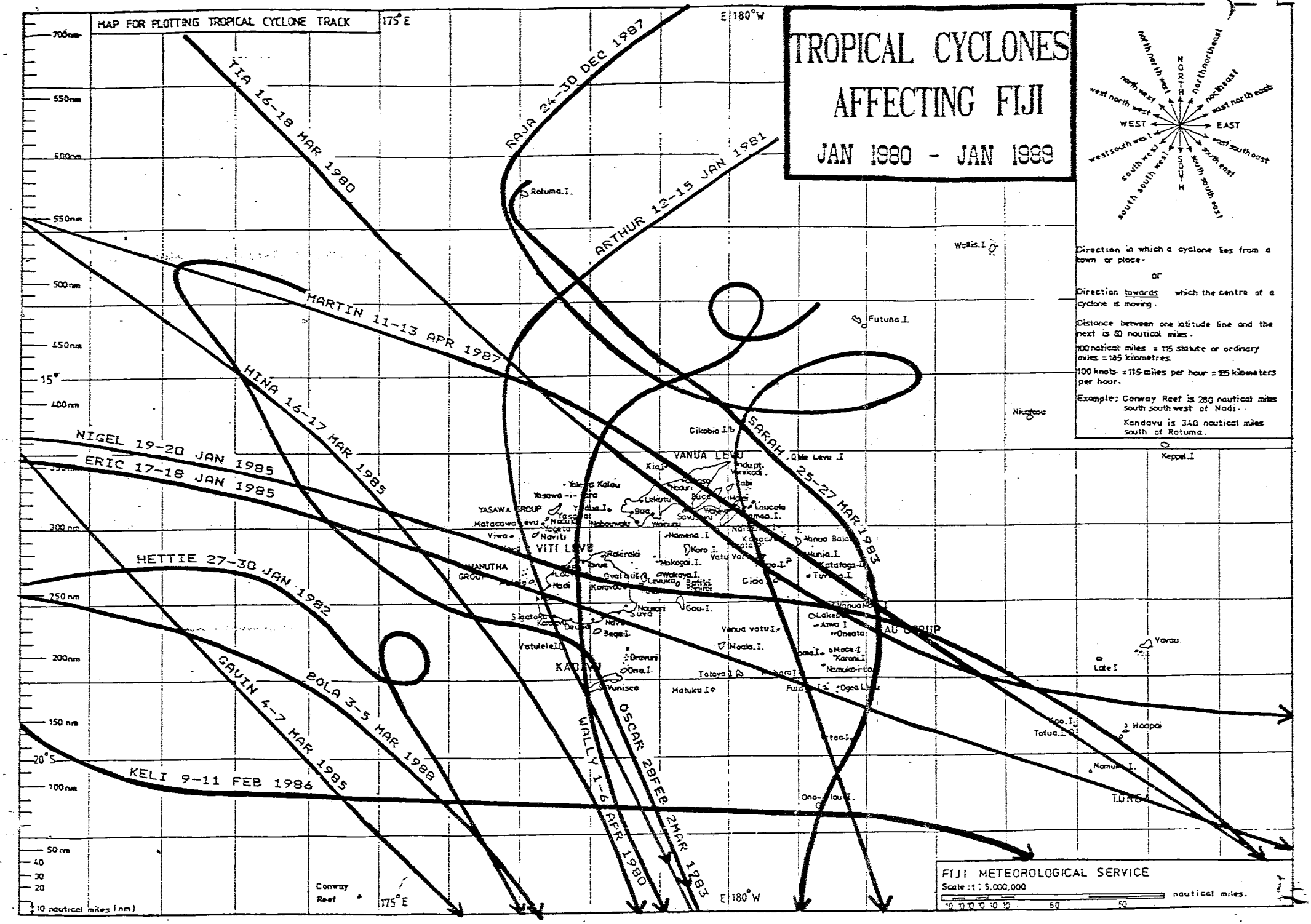

PRELIMINARY EARTHQUAKE
RISK ZONING MAP FOR FIJI
0
50
100 km
June 1990
MINERAL RESOURCES DEPARTMENT • FIJI •
177
178
179
180
-179
-17
-18
-19
UDU POINT
LABASA
RABI
HIGHER RISK
(incl. Cikobia)
ZONE 7
YASAWA
NACULA
YASAWA
GROUP
BUA
SAVUSAVU
OAMEA
TAVEUNI
NABOUWALU
VANUA LEVU
LOWER RISK
ZONE 4
KORO
VANUA BALAVU
RAKIRAKI
TAVUA
BA
LAUTOKA
NADI
OVALAU
LEVUKA
MEDIUM RISK
ZONE 6
GAU
NAUSORI
SIGATOKA
SUVA
NAVUA
VITI LEVU
BEQA
LAKEBA
MOALA
LOWER RISK
(incl. Rotuma)
ZONE 4
TOTOYA
KABARA
MATUKU
HIGHER RISK
ZONE 7
VUNISEA
KADAVU

FIG. 2


MAP FOR PLOTTING TROPICAL CYCLONE TRACK
175° E
E 180° W
TROPICAL CYCLONES AFFECTING FIJI
JAN 1980 - JAN 1989
TIA 16-18 MAR 1980
RAJA 24-30 DEC 1987
ARTHUR 13-15 JAN 1981
MARTIN 11-13 APR 1987
HINA 16-17 MAR 1985
NIGEL 19-20 JAN 1985
ERIC 17-18 JAN 1985
HETTIE 27-30 JAN 1982
GAVIN 4-7 MAR 1985
EOLA 3-5 MAR 1988
KELI 9-11 FEB 1986
WALLY 1-6 APR 1980
OSCAR 28 FEB-2 MAR 1983
SARAH 25-27 MAR 1983
NORTH
north north west
north west
west north west
WEST
west south west
south west
south south west
SOUTH
south south east
south east
east south east
EAST
east north east
north east
north north east
Direction in which a cyclone lies from a town or place-
or
Direction towards which the centre of a cyclone is moving.
Distance between one latitude line and the next is 60 nautical miles.
100 nautical miles = 115 statute or ordinary miles = 185 kilometres.
100 knots = 115 miles per hour = 185 kilometers per hour.
Example: Conway Reef is 280 nautical miles south south west of Nadi.
Kandavu is 340 nautical miles south of Rotuma.
VANUA LEVU
VITI LEVU
YASAWA GROUP
MANUTHA GROUP
KADAVU
LAU GROUP
TONGA
Rotuma.I.
Walis.I
Futuna.I.
Cikobia I.
Keppel.I
Niuafoou
Yavau
Hoopai
Late I
Conway Reef
FIJI METEOROLOGICAL SERVICE
Scale :1 : 5,000,000
nautical miles.
10 nautical miles (nm)