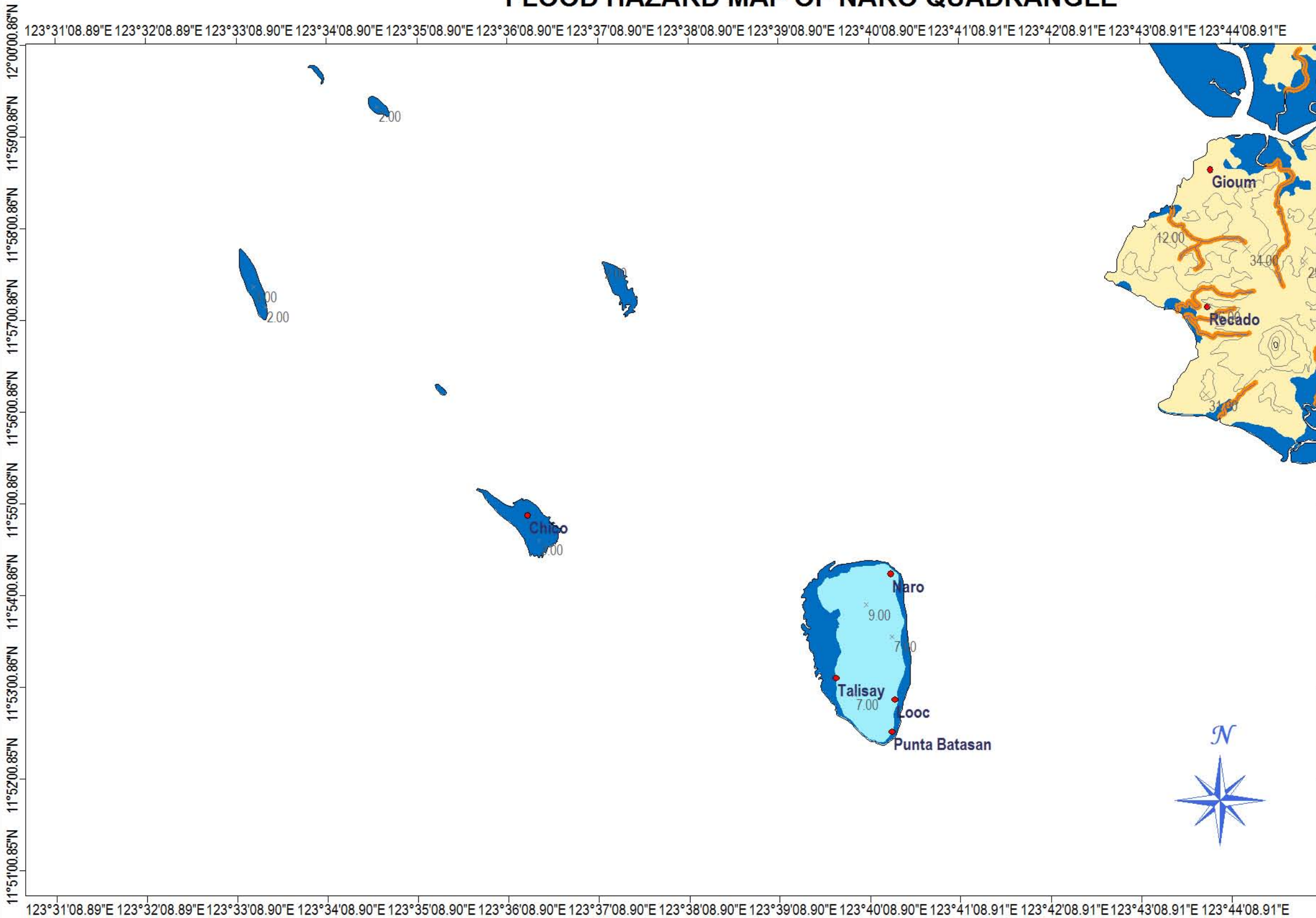


# FLOOD HAZARD MAP OF NARO QUADRANGLE



## MAP LEGEND

### Flood Hazard Zones:

- Areas Prone to Riverbank Erosion
- Non Flood Prone Areas
- Occasionally to Rarely Flooded Areas
- Regularly to Frequently Flooded Areas

- river
- contour

### EXPLANATIONS:

Flood hazard susceptibility zones were derived based on the geomorphological analysis of landforms and the fluvial system. Information on flood occurrences, flood depths, duration of inundation as well as topographic information supported the geomorphologically-based flood hazard mapping.

#### Regularly to Frequently Flooded Areas:

Areas that are frequently flooded. Mere heavy rains of 1-2 days could bring about flooding in these areas. Moderate to strong typhoons could submerge these areas 0.5 to 3.0 m. in flood waters for a few days to a few weeks. Housing development in these areas is not recommended.

#### Occasionally to Rarely Flooded Areas:

Areas become inundated during moderate to strong typhoons. Flood depths vary from a few centimeters to 1 m. Floods last from a few hours to a few days.

#### Non Flood Prone Areas:

Areas with no reported flood occurrences except

Field data collection by: A. E. Dayao, JM. S. Laud, E.T. Avila, E. G. Basilan, MN. L. Miraballes, J. N. Malto

Geomorphological interpretation by: A. E. Dayao, E. G. Basilan

Digital cartographic processing by: E. G. Basilan, D. G. Zepeda

GIS processing by: A. E. Dayao, E. G. Basilan

Checked by: R.A. Juan

Approved by: R.A. Juan

Other sources of information:



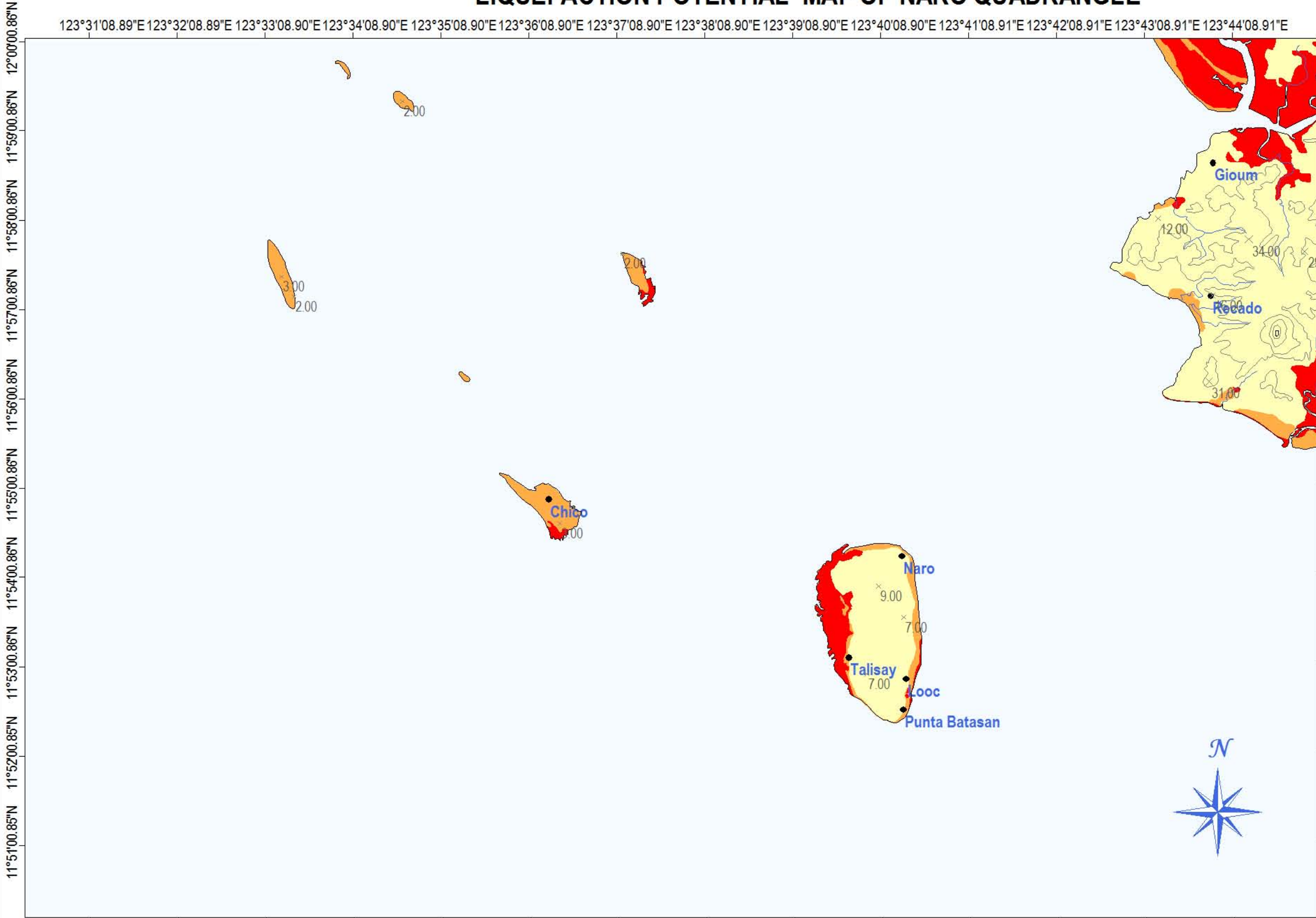
Published by:  
Department of Environment and Natural Resources  
MINES AND GEOSCIENCES BUREAU-RO5  
Rawis, Legazpi City, Albay  
2008

1 : 85000  
0 4250  
UNIVERSAL TRANSVERSE MERCATOR PROJECTION  
Clarke 1866, Luzon Datum



# LIQUEFACTION POTENTIAL MAP OF NARO QUADRANGLE

123°31'08.89"E 123°32'08.89"E 123°33'08.90"E 123°34'08.90"E 123°35'08.90"E 123°36'08.90"E 123°37'08.90"E 123°38'08.90"E 123°39'08.90"E 123°40'08.90"E 123°41'08.91"E 123°42'08.91"E 123°43'08.91"E 123°44'08.91"E



**MAP LEGEND:**  
**Liquefaction Potential**  
**Zones:**  
■ Areas where Liquefaction is Likely  
■ Areas where Liquefaction is not Likely  
■ Areas where Liquefaction is Possible  
 river  
 contour

**EXPLANATIONS:**

There are no reported liquefaction occurrences in the mapped area based on several field interviews. However, zones of different liquefaction potential were derived based on the geomorphological analysis of the study area following previous studies made by Iwasaki and Yasuda.

**Areas where Liquefaction is Likely:**  
 Areas where liquefaction is likely include active/young tidal flats with nipa and mangrove, beach ridge and swale complex and spit. These areas are unsuitable for urban development. Multi-storey building should be required of geotechnical studies addressing or mitigating the effects of liquefaction.

**Areas Where Liquefaction is Possible:**  
 Coastal plains and the alluvial plains are areas where liquefaction is possible. Buildings having 5 stories or more should be required a full

Field data collection by: A.E. Dayao, J.M.S. Laud, E.T. Avila, E.G. Basilan, M.N.L. Miraballes, J.N. Malto  
 Geomorphological interpretation by: A.E. Dayao, E.G. Basilan  
 Digital cartographic processing by: E.G. Basilan, D.G. Zepeda  
 GIS processing by: A.E. Dayao, E.G. Basilan  
 Checked by: R.A. Juan  
 Approved by: R.A. Juan

Other sources of information:  
 1:50 000 NAMRIA Topographic Map

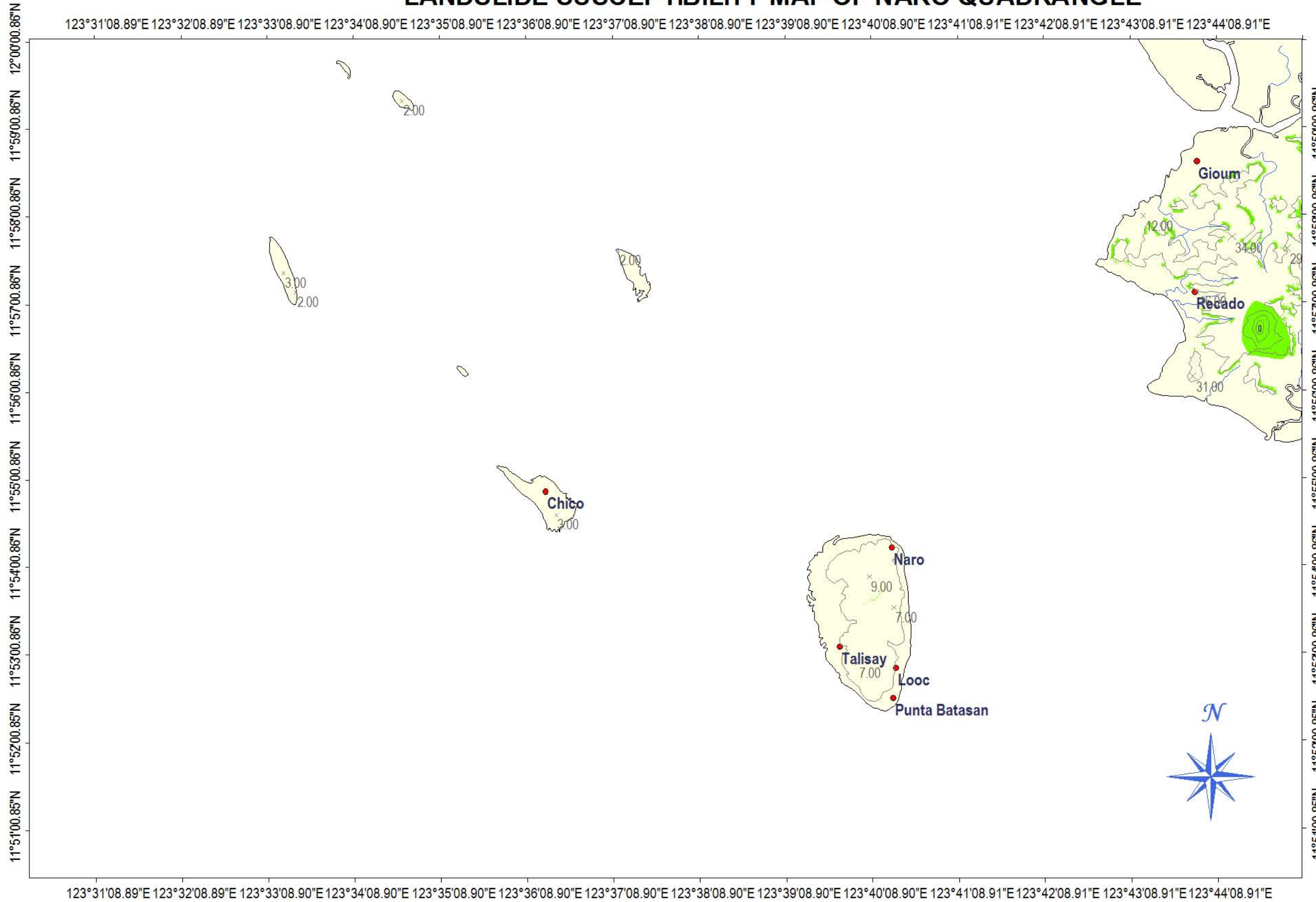
123°31'08.89"E 123°32'08.89"E 123°33'08.90"E 123°34'08.90"E 123°35'08.90"E 123°36'08.90"E 123°37'08.90"E 123°38'08.90"E 123°39'08.90"E 123°40'08.90"E 123°41'08.91"E 123°42'08.91"E 123°43'08.91"E 123°44'08.91"E

Published by:  
 Department of Environment and Natural Resources  
 MINES AND GEOSCIENCES BUREAU-RO5  
 Rawis, Legazpi City, Albay  
 2008

1 : 85000  
  
 UNIVERSAL TRANSVERSE MERCATOR PROJECTION  
 Clarke 1866, Luzon Datum

# LANDSLIDE SUSCEPTIBILITY MAP OF NARO QUADRANGLE

123°31'08.89"E 123°32'08.89"E 123°33'08.90"E 123°34'08.90"E 123°35'08.90"E 123°36'08.90"E 123°37'08.90"E 123°38'08.90"E 123°39'08.90"E 123°40'08.90"E 123°41'08.91"E 123°42'08.91"E 123°43'08.91"E 123°44'08.91"E



**MAP LEGEND:**  
**Landslide Susceptibility Zones:**

- Absent
- Low to Absent
- river
- contour

**EXPLANATIONS:**

Landslide hazard susceptibility zones were derived through qualitative map combination using lithology, geomorphology, slope gradient, road distance and fault distance. GIS was used in the map combination and subjective weights were assigned to each unit in the parameter map.

Areas with Absent or Low

Field data collection by: A.E. Dayao, J.M.S. Laud, E.T. Avila, E.G. Basilan, M.N.L. Miraballes, J.N. Malto  
 Geomorphological interpretation by: A.E. Dayao, E.G. Basilan  
 Digital cartographic processing by: E.G. Basilan, D.G. Zepeda  
 GIS processing by: A.E. Dayao, E.G. Basilan  
 Checked by: R.A. Juan  
 Approved by: R.A. Juan

Other sources of information:  
 1:50,000 NAMRIA Topographic Map

123°31'08.89"E 123°32'08.89"E 123°33'08.90"E 123°34'08.90"E 123°35'08.90"E 123°36'08.90"E 123°37'08.90"E 123°38'08.90"E 123°39'08.90"E 123°40'08.90"E 123°41'08.91"E 123°42'08.91"E 123°43'08.91"E 123°44'08.91"E

Published by:  
 Department of Environment and Natural Resources  
 MINES AND GEOSCIENCES BUREAU-RO5  
 Rawis, Legazpi City, Albay  
 2008

1: 85000  
 0 4250  
 UNIVERSAL TRANSVERSE MERCATOR PROJECTION  
 Clarke 1866, Luzon Datum



# GROUND SUBSIDENCE AND GROUND SUSCEPTIBILITY MAP OF NARO QUADRANGLE



**MAP LEGEND:**  
**Ground Subsidence and Ground Susceptibility Map**

- Areas not susceptible to ground subsidence/settlement
- Areas susceptible to ground settlement
- Areas susceptible to ground subsidence
- river
- contour

**EXPLANATIONS:**

Susceptibility map for ground subsidence due to karst or solution processes was primarily derived from the lithologic map of the study area. Field observations on sinkholes and ground subsidence observed on concrete roads and damaged houses supported the mapping. Areas of possible ground settlement were delineated through the analysis of the geomorphological lay of the study area, the sub-surface soils and the ground water levels.

**Areas Susceptible to Ground Subsidence:**  
 Areas that are prone to ground cavitation, sinkhole formation and ground subsidence in areas underlain by limestone and calcareous silts and shales.

**Areas Susceptible to Ground Settlement:**  
 Areas where fluvial sands, silts and clays coupled with shallow ground water tables are site of possible ground settlement. Ground settlement may be reduced through appropriate foundation design. Buildings having 3 storeys or more should be tested for settlement and/or consolidation. Buildings having 5 storeys or more should undergo detailed geotechnical studies.

**Areas not Prone to Ground Settlement/Subsidence:**  
 Areas where the possibility of ground settlement or ground subsidence is low or absent.

Field data collection by: A.E. Dayao, J.M.S. Laud, E.T. Avila, E.G. Basilan, M.N.L. Miraballes, J.N. Malto  
 Geomorphological interpretation by: A.E. Dayao, E.G. Basilan  
 Digital cartographic processing by: E.G. Basilan, D.G. Zepeda  
 GIS processing by: A.E. Dayao, E.G. Basilan  
 Checked by: R.A. Juan  
 Approved by: R.A. Juan

Other sources of information:  
 1:50,000 NAMRIA Topographic Map  
 1951 B/W Aerial photos

Published by:  
 Department of Environment and Natural Resources  
 MINES AND GEOSCIENCES BUREAU-RO5  
 Rawis, Legazpi City, Albay  
 2008

