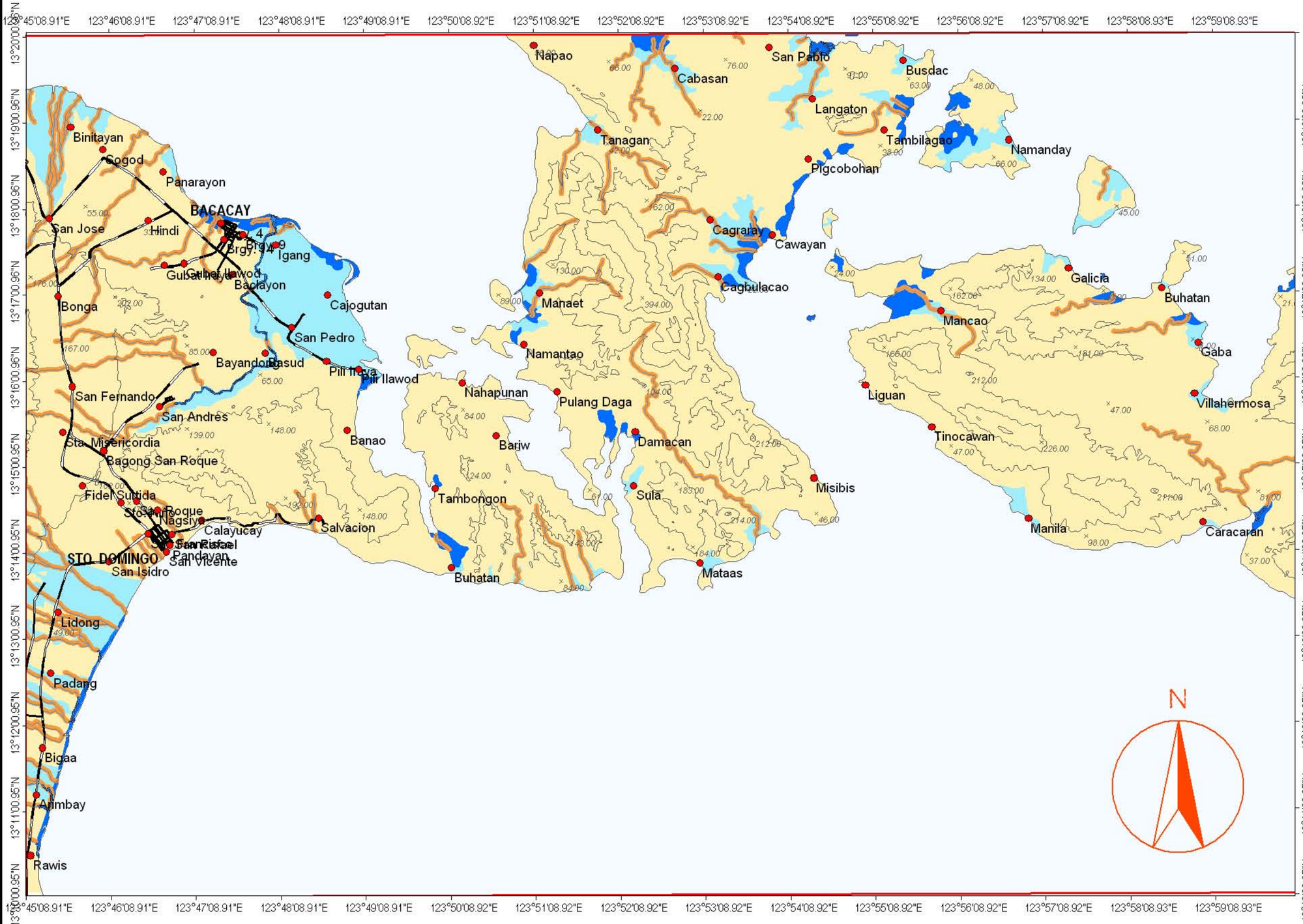
FLOOD HAZARD MAP OF BACACAY QUADRANGLE



MAP LEGEND:
Flood Hazard Zones:

- Regularly to frequently flooded areas
- Occasionally to rarely flooded areas
- Non flood prone areas
- Areas prone to riverbank erosion
- contour
- river
- road

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. Intermittent moderate to heavy rains of 1 to 2 days could bring about flooding in these areas. Moderate to strong typhoons accompanied by heavy rains could submerge these areas 0.5 to 2.0 m in flood water for a few days to a few weeks. Development of urban settlements in these areas is not recommended.

Occasionally to Rarely Flooded Areas:
Areas that become inundated during moderate to strong typhoons accompanied by heavy rains. 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 along low lying areas adjoining rivers and creeks but are unmappable in medium scale.

Areas Prone to Riverbank Erosion:
Areas 0 to 50 m from river banks that are prone to scouring and erosion.

Field data collection by: M.R.M. Rint
Geomorphological interpretation by: M.N.L.Miraballes
Digital cartographic processing by: R.Mapalad & M.N.L. Miraballes
GIS processing by: M.N.L.Miraballes
Checked by: A.E.Dayao
Approved by: R.A.Juan

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

Published by:
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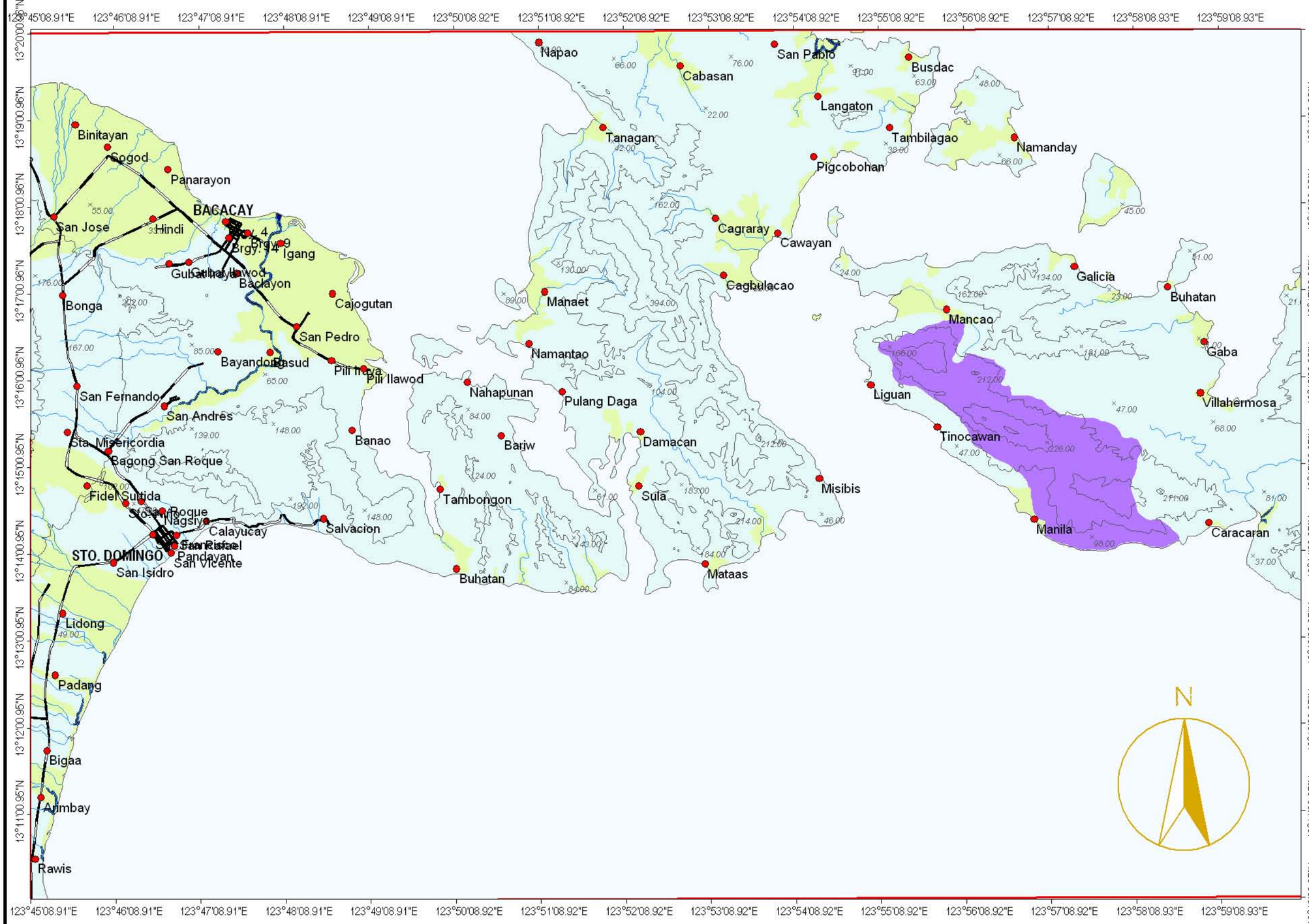
GROUND SETTELMENT AND GROUND SUBSIDENCE SUSCEPTIBILITY MAP OF BACACAY QUADRANGLE



MAP LEGEND:
Ground Settlement and Ground Subsidence Zones:

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

EXPLANATIONS:

Susceptibility map for ground subsidence due to karst or solution processes was primarily derived from the lithologic map of the study area. 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 Settlement:
Areas where fluviatile and fluvio-marine sands, silts and clays coupled with shallow ground water table are sites 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 Susceptible to Ground Subsidence:
Areas that are underlain by limestone, calcarenites and calcareous siltstones and shales are prone to ground cavitation, sinkhole formation and ground subsidence.

Areas not Prone to Ground Settlement/Subsidence:
Areas where the possibility of occurrence of ground settlement or ground subsidence is unlikely.

Field data collection by: M.R.M. Rint
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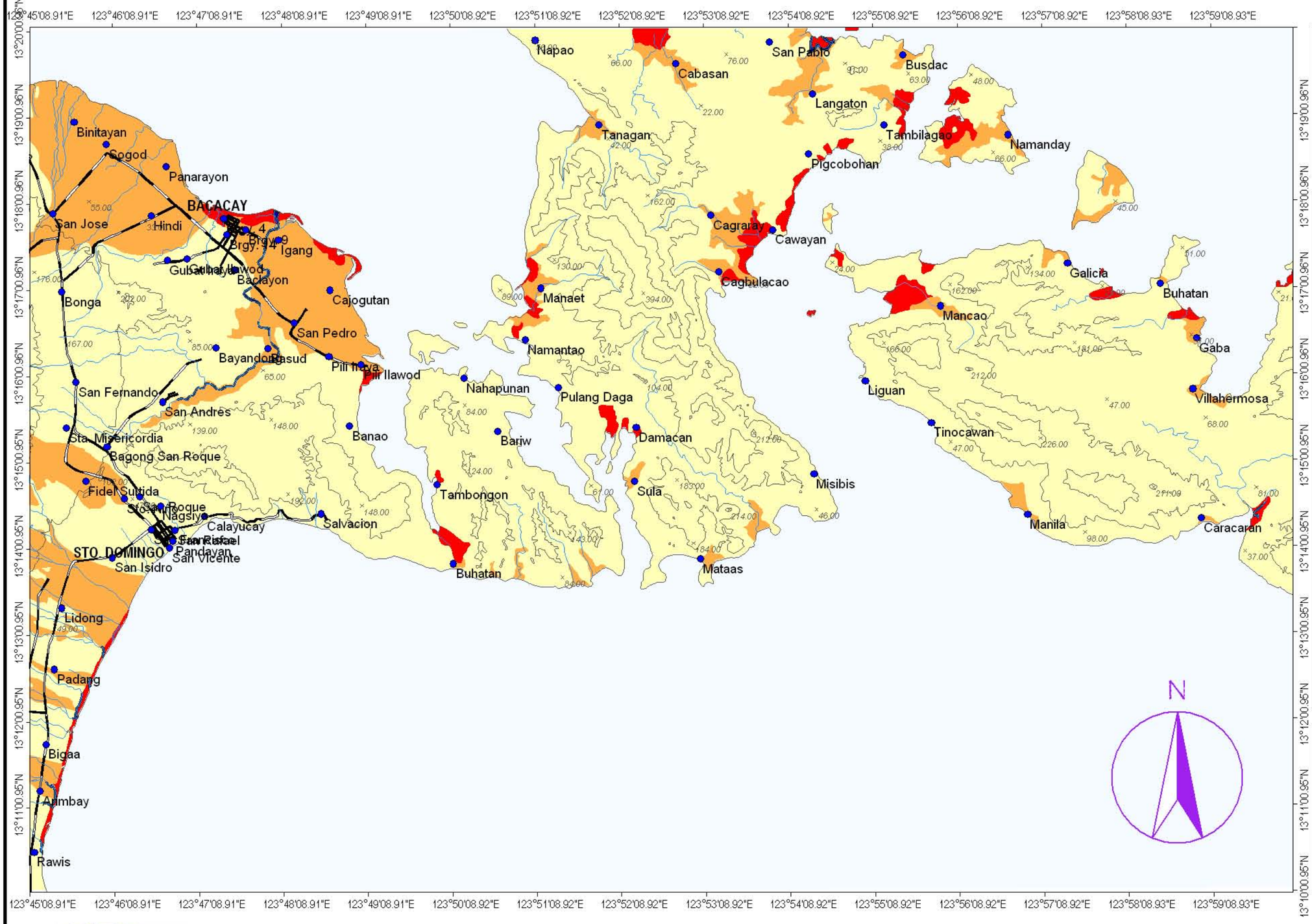
LIQUEFACTION POTENTIAL MAP OF BACACAY QUADRANGLE



MAP LEGEND:
Liquefaction Potential Zones:

- Areas where liquefaction is likely
- Areas where liquefaction is possible
- Areas where liquefaction is not likely
- contour
- river
- road

EXPLANATIONS:

There were 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 methodologies used by Iwasaki and Yasuda.

Areas where Liquefaction is Likely:
Areas where liquefaction is likely include active/young tidal flats with nipa and mangroves, beach, spit and sand flat. These areas are unsuitable for urban settlement and housing development. Multi-storey buildings shoud be required of geotechnical studies addressing or mitigating the effects of liquefaction.

Areas where Liquefaction is Possible:
Coastal strip and plains, alluvial plains, flood plains, old tidal flats, old alluvial fan-deltas and lahar channels and fans are areas where liquefaction is possible. Buildings having 5 storeys or more should be required a full geotechnical study.

Areas where Liquefaction is not Likely:
Areas where the occurrence of liquefaction is unlikely.

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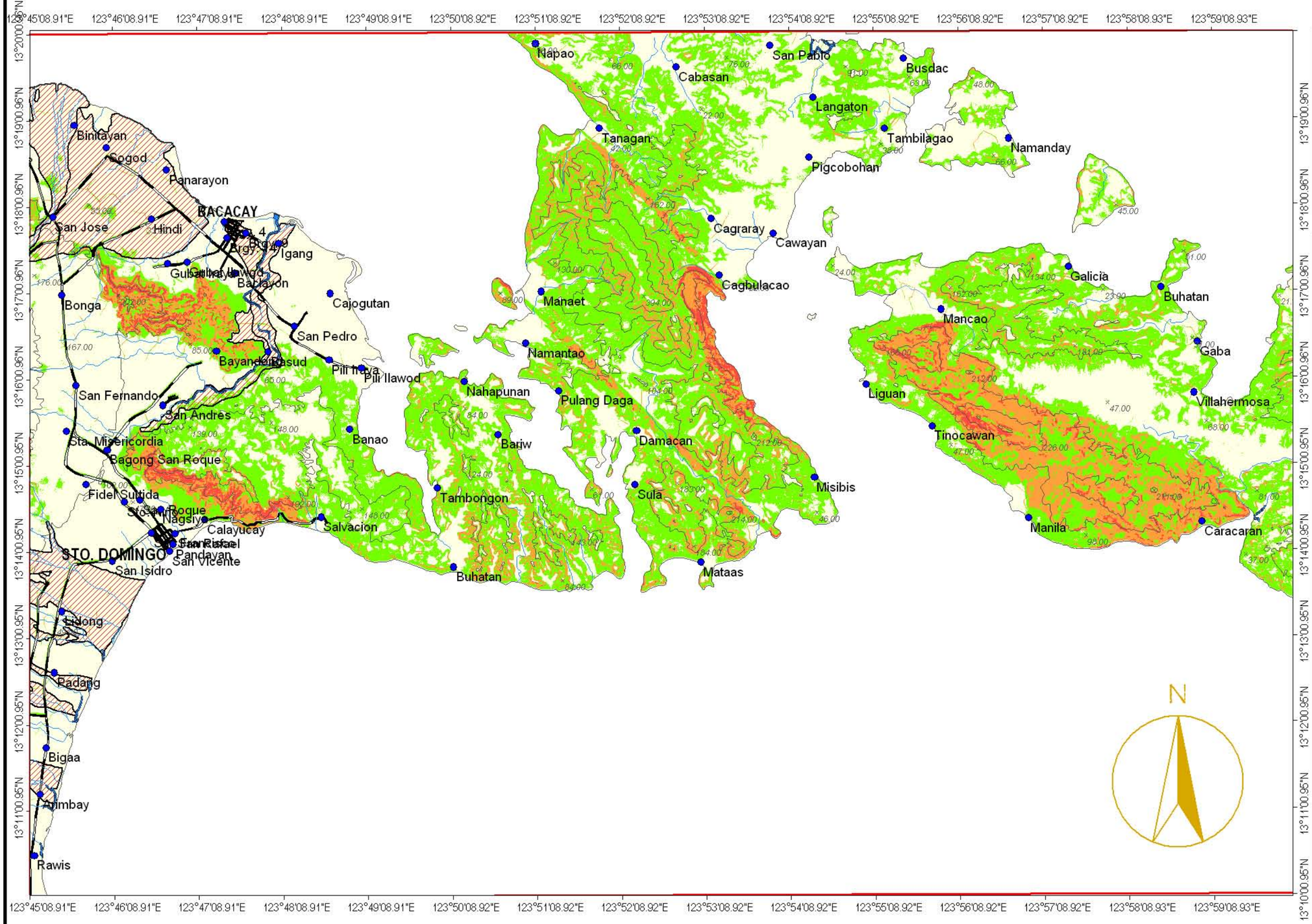
LANDSLIDE SUSCEPTIBILITY MAP OF BACACAY QUADRANGLE



MAP LEGEND:
Landslide Susceptibility Zones:

- Absent to Low
- Low Susceptibility
- Moderate Susceptibility
- High Susceptibility
- Debris Flow/Lahar Deposition Sites
- contour
- fault
- river
- road

EXPLANATIONS:

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

Areas with High Susceptibility to Landslides:
Areas having high probability of occurrence of mass movements particularly debris slides and slumps. Very steep to nearly vertical slopes and areas along faultlines are rated high susceptibility areas and are unsuitable for housing and human settlement. Detailed engineering geological and geohazard assessment is needed.

Areas with Moderate Susceptibility to Landslides:
Areas having moderate likelihood of landslide occurrence are recommended for a more detailed engineering geological and geohazard assessment prior to housing development.

Areas with Low Susceptibility to Landslides:
Areas where the likelihood of landslide occurrence is low.

Areas with Absent Susceptibility to Landslides:
Areas where the likelihood of landslide occurrence is absent.

Debris Flow/Lahar Deposition Sites:
Areas prone to debris and/or lahar flow deposits from Mayon Volcano.

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Field data collection by: M.R.M.Rint & E.T.Avila
Geomorphological interpretation by: M.N.L.Miraballes
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