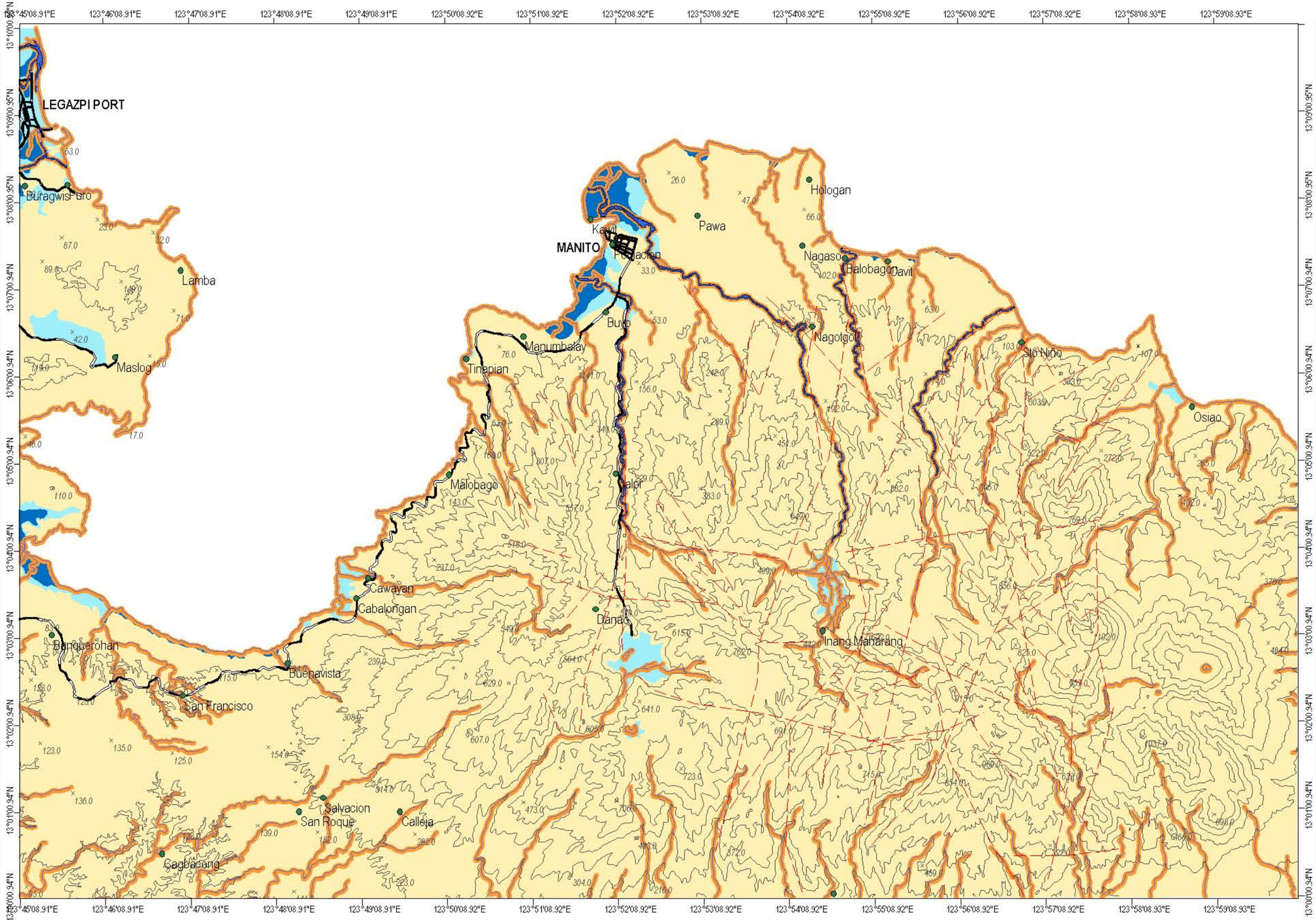
FLOOD HAZARD MAP OF MANITO QUADRANGLE



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
- fault
- river
- road

EXPLANATIONS:

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

Regularly to Frequently Flooded Areas:
Areas that are frequently flooded. Moderate to heavy rains of 1 to 2 days could bring about flooding in these areas. Moderate to strong typhoons could submerge these areas 0.5 to 2 m. in flood water for a few days to a few weeks. Reugular lfooding occurs on swamps, backswamps and fuvial basins and on abandoned river channels. Development of residential and urban settlements in these areas is not recommended.

Occasionally to Rarely Flooded Areas:
Areas that become inundated during moderate to strong typhoons with long duration rains. Flood depths vary from a few centimeters to 1 m. Flood lasts 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.

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

Fileld data collection by: M.R.M. Rint
Geomorphological Interpretation by: M.R.M. Rint
GIS processing by: M.R.M. Rint
Digital cartographic processing by: M.R.M. Rint & B. Malto
Checked by: A.E. Dayao
Approved by: R.A. Juan

Other Sources of Information:
1:50,000 scale NAMRIA Topographic Map
1951 B/W Aerial Photograps scale 1:44,000

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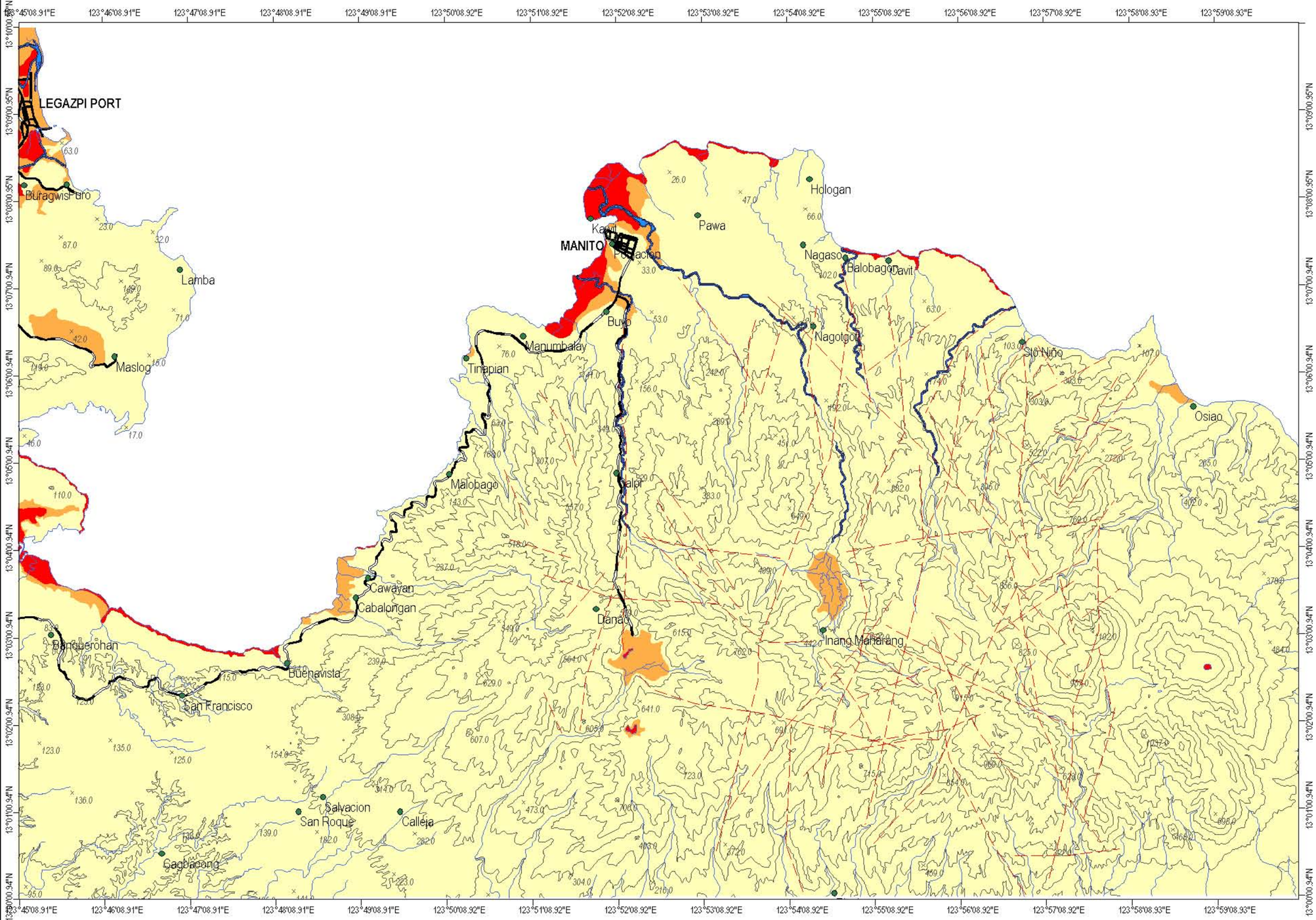
LIQUEFACTION POTENTIAL MAP OF MANITO QUADRANGLE



MAP LEGEND:
Liquefaction Potential Zones:

- Areas where liquefaction is likely
- Areas where liquefaction is possible
- Areas where liquefaction is not likely

- contour
- fault
- river
- road

EXPLANATIONS:

There are no reported liquefaction occurrences 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 riverbeds, old or abandoned riverbeds and meanders, tidal flats and swamps. These areas are not very suitable for housing development. Multi-storey buildings should be required geotechnical studies addressing or mitigating the possible effects of liquefaction.

Areas where Liquefaction is Possible:
Pyroclastic plains and flood plains where groundwater table is relatively shallow and subsurface soils are silty to sandy are areas where liquefaction is possible. Buildings of 5 storeys or more should be required geotechnical stiudies to determine and mitigate possible effects of liquefaction.

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

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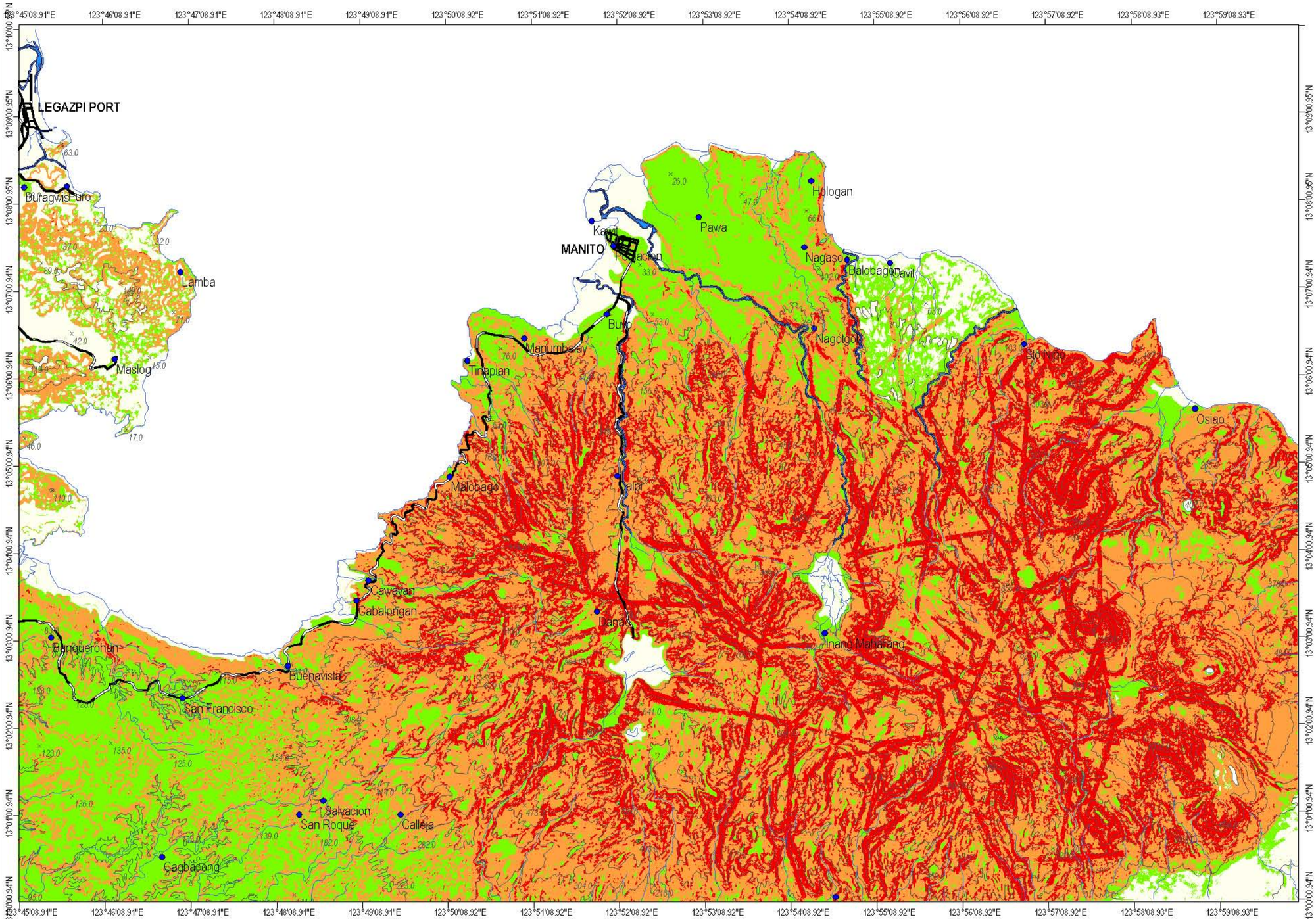
LANDSLIDE HAZARD SUSCEPTIBILITY MAP OF MANITO QUADRANGLE



MAP LEGEND:
Landslide Susceptibility Zones:

- High susceptibility to landslde
- Moderate susceptibility to landslide
- Low susceptibility to landslide
- Absent

- contour
- fault
- river
- road

EXPLANATIONS:

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

Areas with High Susceptibility to Landslides:
Areas with equally high probability of occurrence of mass movements particularly debris slides and debris flows. Very steep to extremely steep slopes along volcanic ravines and gullies are rated high susceptibility areas. Areas under high susceptibility are unsuitable for human settlement.

Areas with Moderate Susceptibility to Landslides:
Areas having moderate likelihood of occurrence of landslides. Any development should first undergo appropriate evaluation.

Areas with Low Susceptibility to Landslides:
Areas where the likelihood of landslide is low. These areas maybe used for habitation as long as other geologic hazards are rated absent or low.

Areas where Landslide Susceptiobility is Absent:
Areas where threat of landslide is absent

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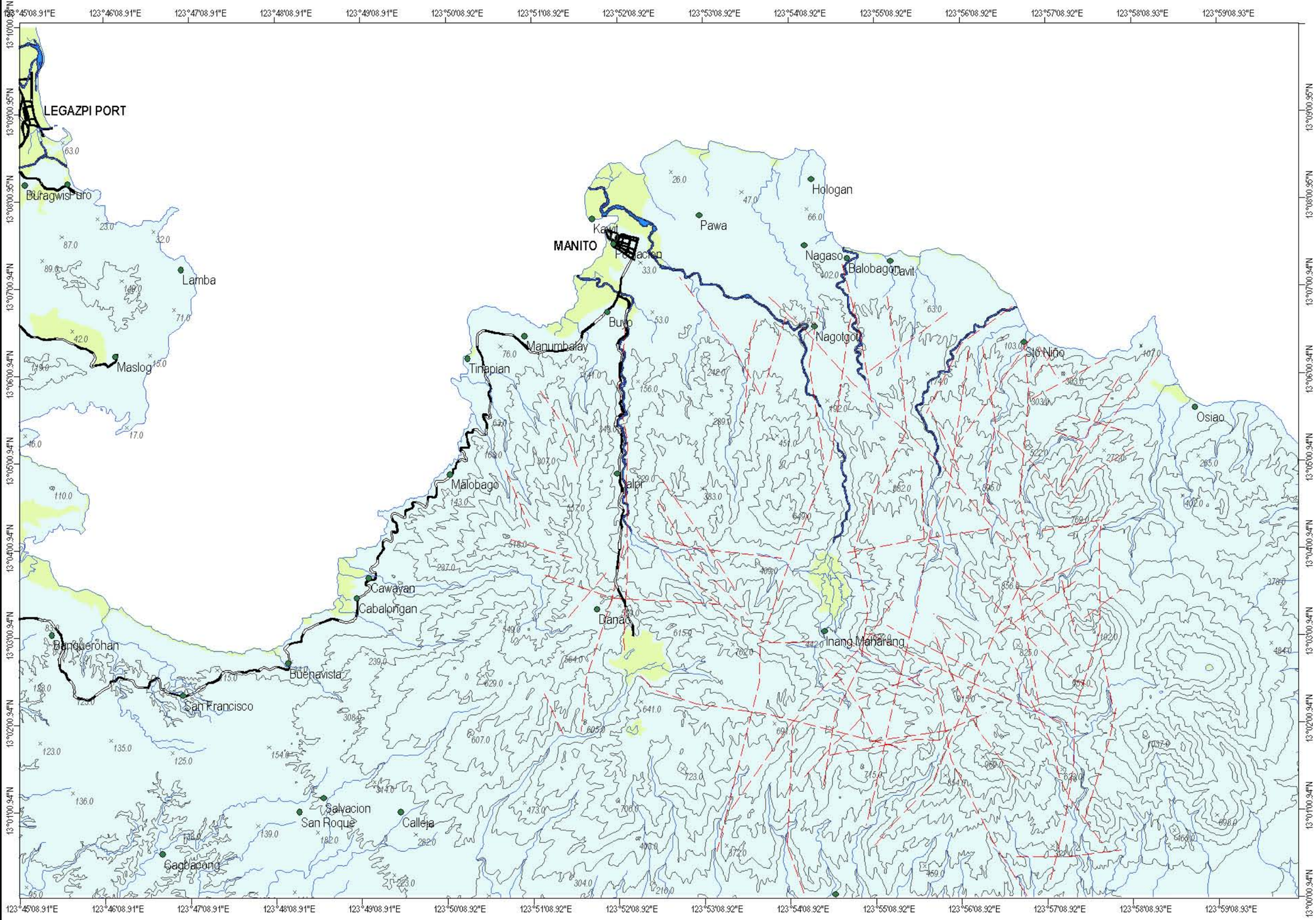
GROUND SETTLEMENT AND GROUND SUBSIDENCE SUSCEPTIBILITY MAP OF MANITO QUADRANGLE



MAP LEGEND:
Ground Settlement Suceptibility Zones:

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

EXPLANATIONS:

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 fluvioc-deltaic sands, silts and clyas coupled with shallow ground water table are sites of possible ground settlement. Ground settlement maybe reduced through appropriate foundation design. Buildings having 3 storeys or more should be tested for settlement and/or consolidation. Buildings having 5 storeys and more should undergo detailed geotechnical studies.

Areas not Susceptible to Ground Settlement
Areas where the possibility of ground settlement is low or absent but still, buildings of 5 storeys or more should undergo geotechnical studies.

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