**Climate Change Adaptation and**

**Disaster Risk**

**Reduction**

Chapter 8

**CLIMATE CHANGE PROFILE**

The Municipality of Mangaldan is a low-lying land town located in Central Pangasinan. It is divided into 30 barangays nestled in sprawling 4,847.78 hectares. Mangaldan has an actual census population of 106,331 in 2015.

As the Philippines lies in the typhoon belt and in the western segment of the Pacific Ocean Ring of Fire, understandably the town is exposed to natural hazards such as tropical cyclones, flooding, erosion, earthquakes, drought, fire and ash falls as well.

Disaster and environmental management deals with the various hazards and risks confronting the community. These are either natural or human-induced events. Global warming, disease outbreaks, garbage disposal problem, drug addiction and even stampede are among these concerns.

In 1998 to 2012, the town incurred an estimated direct damages of P1.07 billion. The indirect and secondary impacts such as loss of livelihood opportunities and business interruption further increase this cost. Over 93,000 people were affected by these disasters and consequently were provided relief assistance by the local relief agencies, despite the limited capacity of the government.

As the town glides towards economic development, there are emerging human-induced hazards such as fire / conflagration, disease outbreaks, garbage problem, pollution, drug addiction including chemical and hazardous material spills. These continue to pose threats to the people and the environment. These could be attributed to population growth, urbanization, conflicting land uses and even poverty.

Other human-induced events such as New Year’s Day, Town Fiesta, religious gatherings/celebrations, all Saints Day and other similar crowd-drawing community assemblies also have to be reckoned with.









***Natural Risk Areas***

Mangaldan is located in the Central Plain of Luzon specifically on the northern part of Pangasinan and forms part of the southern shores of the Lingayen Gulf. The plain is bounded by a ring of inactive volcanoes to the south, some of which have been active within recorded history. There is a theoretical possibility that any of these may become active again but this is highly unlikely and too remote to justify being incorporated in these planning considerations. Mount Pinatubo that lies 95 km to the south and erupted in 1991 and 1992 ensued light ash fall in the municipality.

The Cayanga-Patalan River System between Mangaldan and San Fabian is one of the Allied River that discharges into the Lingayen Gulf. This river system carries sediments from mine tailings and eroded top soils from the highlands to the Lingayen Gulf. It has been noted that many fishponds become dry during the summer months. It is believed that siltation of the river beds is the cause of this problem.

Most of the area along the riverbanks is underlain by quaternary alluvial deposits, composed of sand, gravel and clay. The accumulation of sands and gravel are the result of repeated flooding and meandering of the rivers.

Ground deformations caused by the Luzon Earthquake of July 16, 1990 affected only the areas in Mangaldan along the river banks. A number of residential buildings were tilted at various degrees due to the liquefaction of their foundation soil. While in other cases, structural damages were also observed. The magnitude of the earthquake was 7.8 on the Ritcher scale. Not only were the loose alluvial deposits subjected to liquefaction during earthquakes but also the uncompacted man-made fills, placed in the fishponds and swampy areas. The liquefaction produced sand boils which were the most common evidence for the liquefaction phenomenon. Witnesses observed sand and water fountains a meter high or even greater.

Another considered natural risk areas are the flood and erosion prone areas along the northern most and eastern portions of the town which is being traversed by the Angalacan River and the Old Mangaldan River. Affected areas are 17 barangays namely: Inlambo, Pogo, Palua, Salaan, Macayug, Tebag, Nibaliw, Embarcadero, Guiguilonen, Navaluan, Osiem, Landas, Guesang, Bantayan, Talogtog, Bateng and Maasin. The most affected of these are Barangays Inlambo, Macayug and Guesang as they become isolated during floods.

**Table 6:** **VULNERABLE AREAS/POPULATION**

|  |  |  |  |
| --- | --- | --- | --- |
| **DESCRIPTION** | **AFFECTED AREAS** | **AFFECTED**  **POPULATION** | **RECOMMENDATIONS** |
| 1. Overflow of Flood  Water along the  Angalacan River | Guesang, David, Landas, Osiem, Embarcadero, Nibaliw, Salaan, Inlambo, Palua & Pogo | 28,000 | Periodic Dredging, Clearing; Embankment Protection |
| 2. Overflow of Flood  Water along Old  Mangaldan River | Poblacion, Salay, Lanas, Maasin Tebag, Salaan, Bantayan, Talogtog and Bateng | 32,000 | Periodic Dredging, Clearing; Embankment Protection |
| 3. Barangays which  have malnourished  children  (Rank 1-10 Priority) | Bateng, Tebag, Macayug, Landas,  Pogo, Inlambo,  Guesang, Navaluan, Lanas & Nibaliw | 205 | Supplemental Feeding  Nutrition Information Dissemination;  Backyard Gardening |
| 4.Banaoang  Controlled Dumpsite | Banaoang, Bari, Buenlag, Malabago | 15,000 | Implementation of RA 9003 |

Source: MDCC Secretariat

The typhoons Gading and Iliang in September and October 1998 respectively, had flooded all barangays due to heavy downpour of rain and release of water from Binga and Ambuklao Dams. The estimated costs of typhoon damages are presented in Table 7. Likewise, typhoon Feria in July 3, 2001 has brought an unprecedented depth of flood waters in Mangaldan. The ground floor of the new Municipal Building was soaked with flood waters. According to the random flood mark survey the inundation depth was generally 0.3 meter to 1.0 meter and flooding duration were 1 to 3 days. In the low-lying areas the water depth was 2 to 3 meters and the inundation lasted 10 to 20 days. It registered an estimated P91 million, as substantial cost of damages on crops, fishponds, livestock, public infrastructures and commercial/industrial establishments. Classes were suspended for a week due to heavily silted classrooms. Substantial quantity of textbooks school facilities and teaching aids were also destroyed.

Spur dikes have been constructed at the river banks but are still inadequate. The absence of a good drainage system and effective flood control projects cause the overflowing of the Angalacan and the Old Mangaldan Rivers.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **NATURE OF DAMAGES** | **DAMAGES (in million pesos)** | | | | | | |
| September,1998 | October, 1998 | July, 2001 | May, 2008 | October, 2009 | October,2010 | August, 2012 |
| (Typhoon Gading) | (Typhoon Iliang) | (Typhoon Feria) | (Typhoon Cosme) | (Typhoon Pepeng) | (Juan) | (Habagat) |
| **1. Agriculture** |  |  |  |  |  |  |  |
| Crop & Livestock damages | 61.5M | 15M | 12.0M | 16.35M | 99.632M | 30.294M | 470,750 |
| Fishpond losses | 4.94M | 5M | 10M | 7.2M | 15.548M | 0.450M |  |
| **2. Public Infrastructures** |  |  |  |  |  |  |  |
| School Building damages | 12.2M | 8M | 6M | 55.10M | 3.7M | 1.922M |  |
| Roads washed out | 2.3M | 1.3M | 3.5M | 4.9M | 9.5M |  |  |
| Bridges | 17.3M | 10M | 7M |  | 58.3M | 400,000 |  |
| Water Supply | 1.0M | .350M | 0.5M |  |  |  |  |
| Drainage canal damages | 5M | 3M | 7M |  | 100.0M |  |  |
| Rivers/creeks siltation | 12M | 5M | 10M |  | 75.0M |  |  |
| Other Public Buildings | 2M | 1M | 5M | 25.80M |  | 140,000 |  |
| Other Infrastructures |  |  |  |  | 0.2M |  |  |
| **3. Government Properties** |  |  |  |  |  |  |  |
| Municipal Government |  |  |  |  | 14.0M |  |  |
| National agencies/ GOCCs Stationed in Mangaldan |  |  |  |  | 22.5M |  |  |
| Barangays (Brgy. Halls, Day Care Centers, Brgy. Health Centers) |  |  |  |  | 2.0M |  |  |
| **4. Private Businesses** |  |  |  |  |  |  |  |
| Mangaldan Public Market Area |  |  |  |  | 98.0M |  |  |
| Central Business District & All Barangays |  |  |  |  | 220.0M |  |  |
| **5. Private Properties** |  |  |  |  |  |  |  |
| Houses |  |  |  |  | 65.14M |  |  |
| Private Properties(cars, vehicles, appliances, furnishing/fixtures/equipment) |  |  |  |  | 256.5M |  |  |
| **6. Commercial Establishments** | 10M | 15.0M | 30M |  | 318.0M |  |  |
| **7. Non- Infra** |  |  |  |  |  | 20,700 |  |
| **TOTAL** | **133.5M** | **59M** | **91M** | **109.35M** | **1.04B** | **41.11M** | **0.47M** |
| **Total Families Affected** | **3,284** | **4,204** | **10,970** | **7,934** | **18,580** | **807** | **60** |

**Table 7: Selected Typhoon Damages, 1998-2012**

Source: MDRRMC Secretariat

**DISASTER REDUCTION MANAGEMENT PROFILE**

Our country is the third world’s most-exposed country to disasters and hazards based on the 2011 World Risk Report published by the United Nations University and the Institute of Environment and Human Security, due to its geography and geology including the presence of internal disputes in some areas. The Philippines is located in the western rim of the Pacific Ocean (referred to as the Western Segment of the Pacific Ring of Fire). This is said to be the most active part of the earth and is characterized by a belt of active volcanoes and earthquake generators (faults); hence, we are prone to various natural hazards including typhoons, flooding, storm surges, earthquakes, tsunamis and volcanic eruption. The occurrence of such disasters is further aggravated by epidemics or complex emergencies and by the global warming phenomenon. These are compelling reasons why LGUs like Mangaldan, should adopt Disaster Risk Reduction and Management (DRRM) and Climate Change Adaptation (CCA).

Tropical cyclones and its sequential effects of rain, strong winds as well as floods are the most prevalent types of hydro-meteorological hazards in the country. Between 1997 and 2007, eighty-four (84) tropical cyclones entered the Philippine Area of Responsibility (PAR). Based on the data of the National Disaster Risk Reduction and Management Council (NDRRMC), these typhoons resulted in 13,155 human casualty and more than 51 million families were affected. Economic losses in agriculture, infrastructures and private properties were estimated to reach more than Php 152 billion. Some of the most devastating floods and landslides within this period were triggered by these typhoons. Denuded forests aggravate flood risks. Since the deforestation in the 1930s, the effects of loose soil and reduced forest coves are being felt in frequent landslides and severe flooding in most lowlands of the country. In 2011, increased rainfall caused massive flash flooding in areas which do not normally experience such. Typhoon Sendong alone caused the lives of more than 1,000 people and damaged properties in billions of pesos.

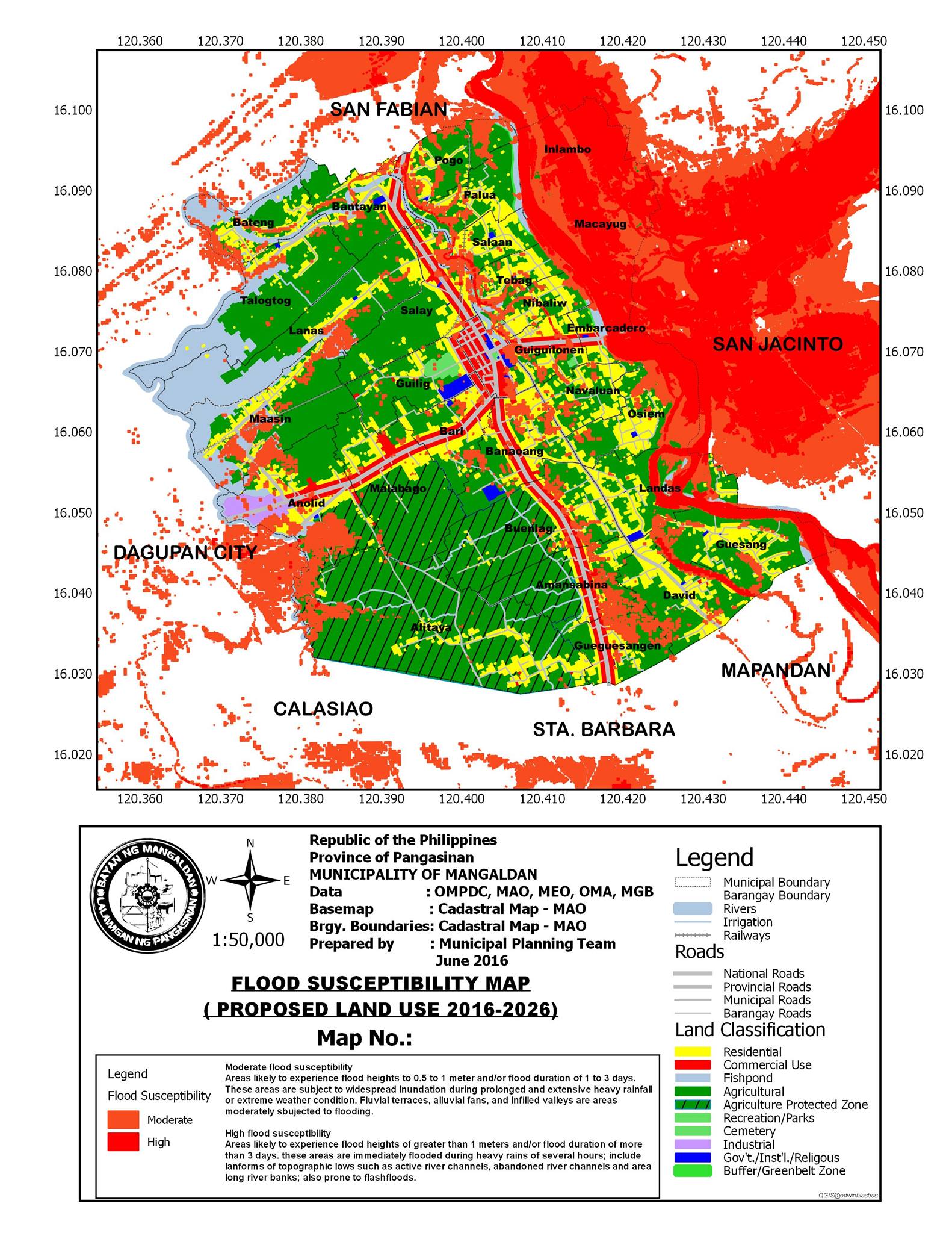
The data from the Pangasinan DRRMC revealed that the frequent occurrences of typhoons from the period of May to November, brings more than 90% of the annual rainfall of 3,000 mm pose threats to the province. The heavy rains cause the Agno River, Allied Rivers and their tributaries to overflow in the low lying areas of Pangasinan. Super typhoons accompanied by strong winds and floodwaters had caused severe damages to agriculture/aquaculture, infrastructures, environment and claimed people’s lives and properties. Typhoon “Cosme” (May 17, 2008) left the province with forty one (41) fatalities and about Php 8.88 billion in total damages. Typhoon “Emong” (May 07, 2009) has recorded forty five (45) persons dead and about Php2.2 billion in total damages. Likewise, Typhoon “Pepeng” (October 6-9, 2009) registered sixty three (63) persons dead and about Php 7.7 billion in total damages and Typhoon “Juan” (October 18, 2010) with fourteen (14) persons dead and about Php2.4 billion in total damages.

The towns and cities traversed by the Agno River System get inundated ranging from less than 1 meter to as high as 3 meters. Flooding in these towns and cities was reduced with the completion of the San Roque Dam in August 2002 and the Agno and Allied Rivers Rehab Project Phase I. During typhoons the water released by Binga and Ambuklao Dams are impounded and regulated in the San Roque Dam for power production and irrigation system. Dredging, widening of river beds and the construction of cut-off channels hastened the accommodation of more volume of water and the flow of water to the Lingayen Gulf.

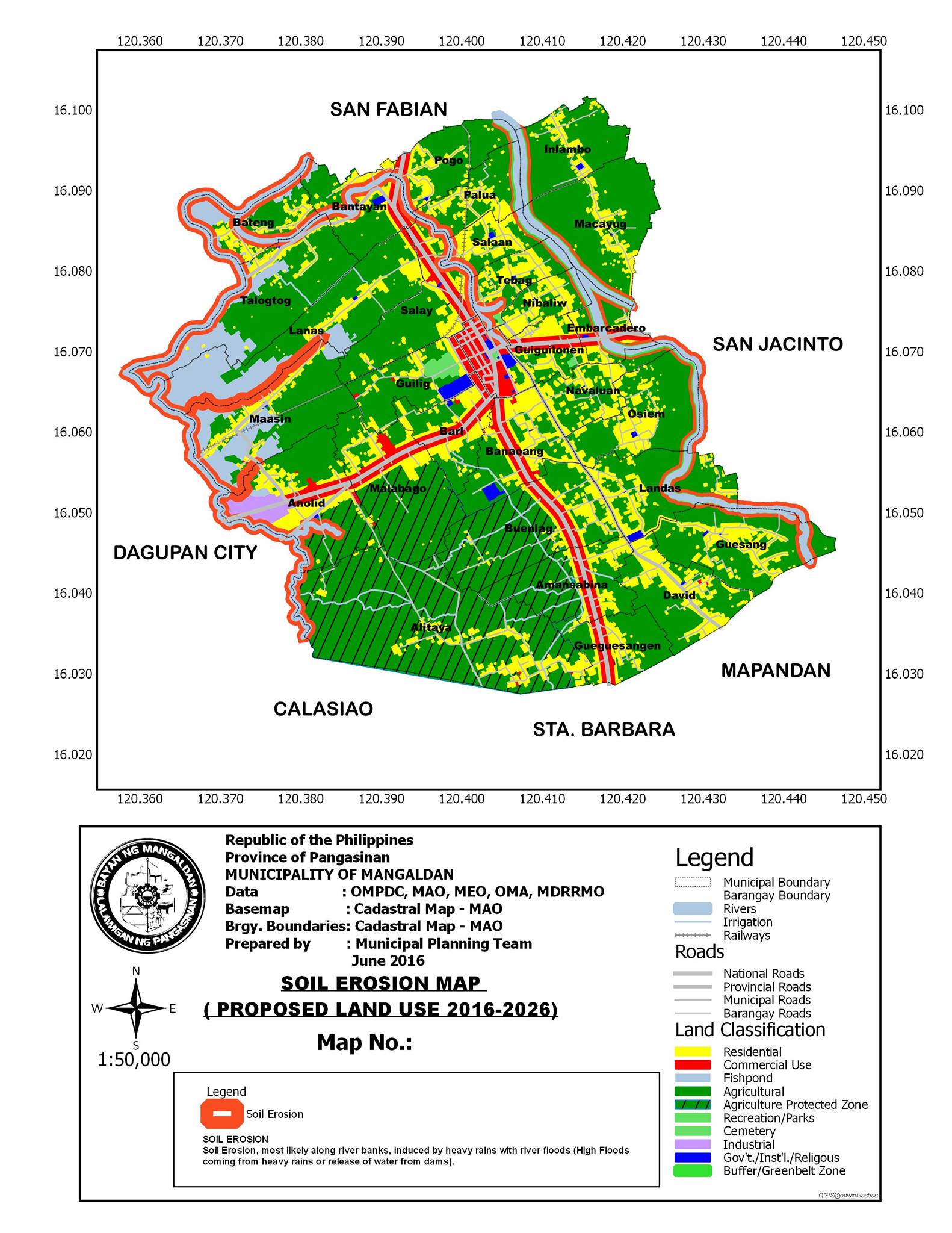
Rain waters coming from Mt. Ampucao fills up the Allied Rivers particularly the Cayanga-Patalan River and the Pantal-Sinocalan River System cause the perennial flooding problem in the low-lying areas of Sta. Barbara, Calasiao, Mangaldan, Binalonan and the two cities of Dagupan and Urdaneta. During flooding, these major rivers carry sediments (eg. mine tailings, soil erosion, quarrying within mountain slopes, dumping of solid wastes, agricultural run-off and lahar intrusion) downstream. The siltation level in the river channels varies from severe to slight. Various road lines and bridges were either washed out, eroded shoulders, cut-off approaches, rendered impassable and unsafe for the commuters and damaged irrigation system, flood control infra, public buildings, schools, health and day care centers and others.

In addition, the country’s location in the highly seismic area lying along the Pacific Ring of Fire and is highly-prone to earthquakes. The country experiences an average of five (5) earthquakes a day according to the Philippine Institute of Volcanology and Seismology (PHIVOLCS). Earthquake disasters are not as frequent as the typhoons and flooding that take place in the country. However, the impacts generated by earthquakes on affected communities were usually massive and devastating. The 1990 Luzon Earthquake was the most devastating earthquake disaster that hit Pangasinan. Based on the data from the NDRRMC between 1990 and 2006, the annual direct damages caused by disasters amount to Php 20-Billion per year.

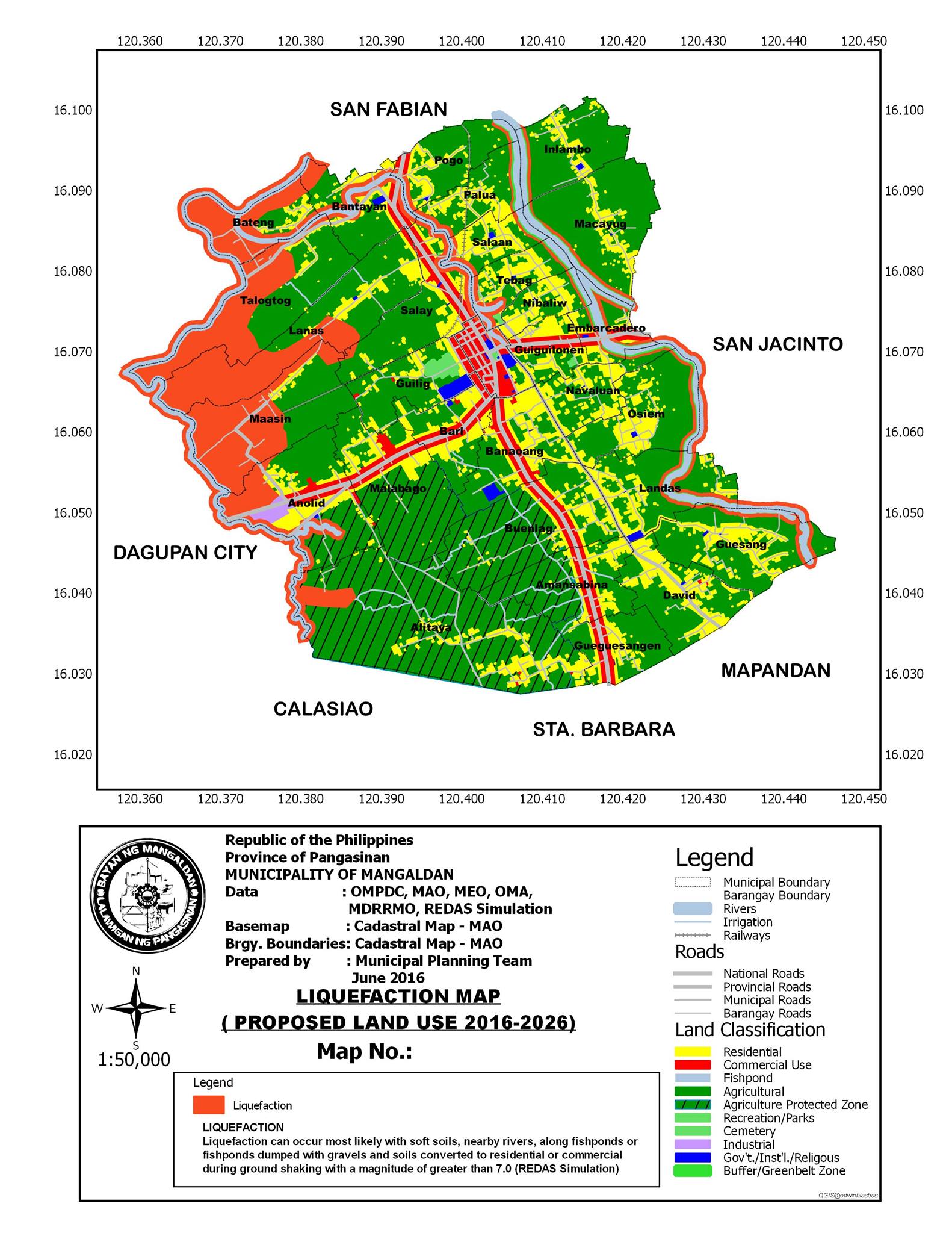
Hazards become disasters only if vulnerable people and resources are exposed to them. People living in poverty and adverse socio-economic conditions are highly vulnerable to disasters. Those living in river pathways, in low lying areas and along the most hazard-prone areas are highly vulnerable. This explains why some parts of Pangasinan and Mangaldan are more prone to specific hazards than others. Maps No. 21 to Map No. 24 show the various Hazards of the Municipality and Evacuation centers in the municipality shows in Map No. 25.

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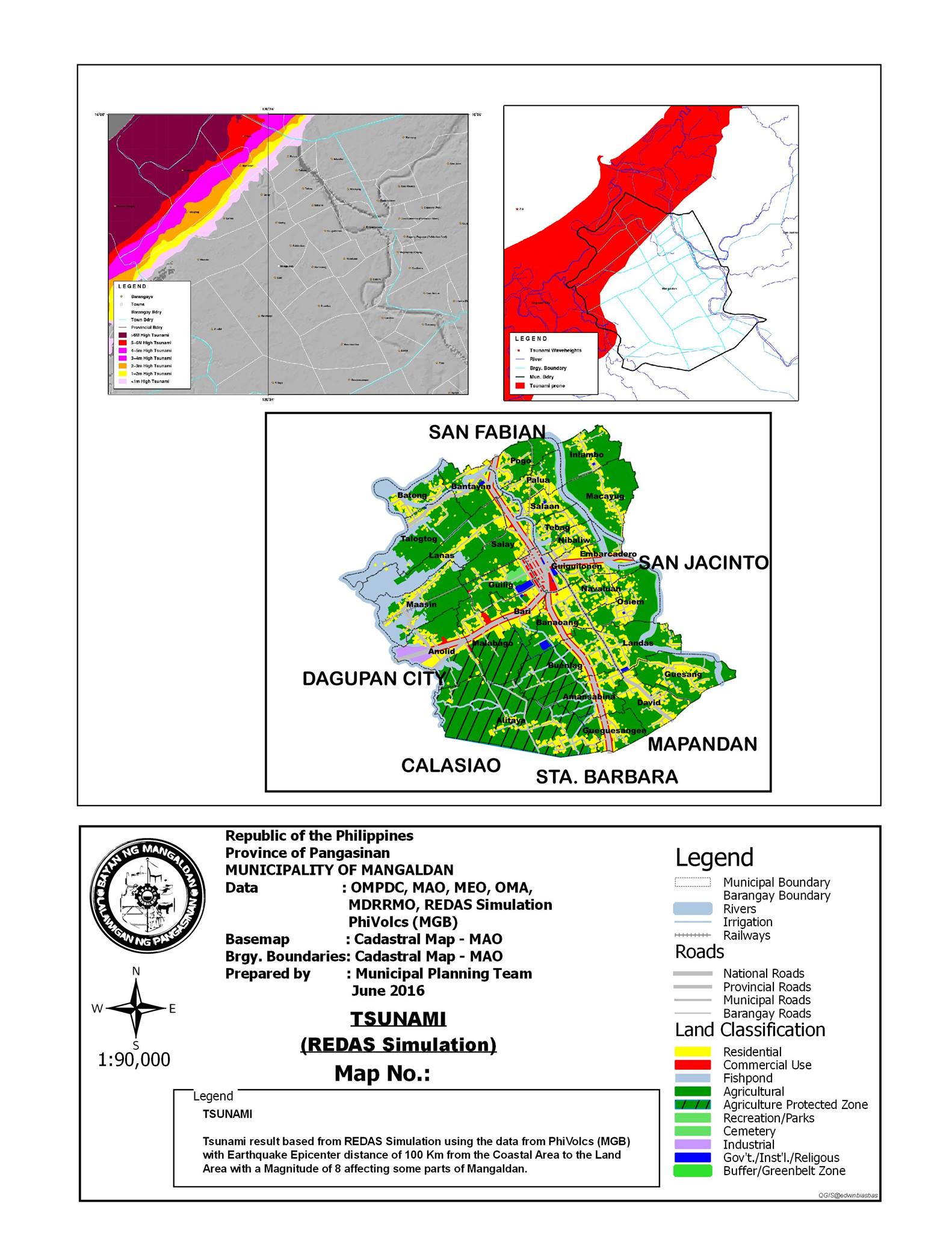
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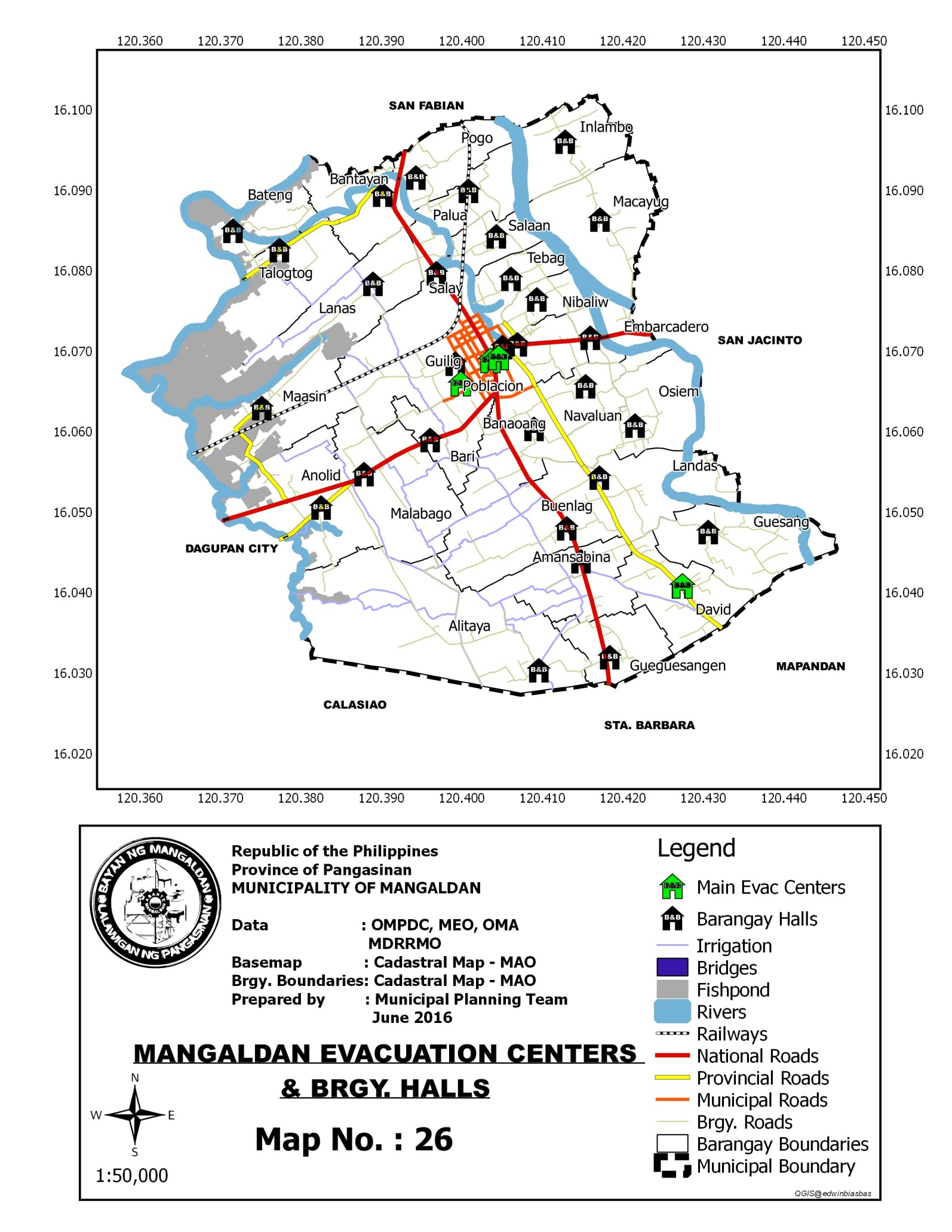
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