MUNICIPALITY OF DINGALAN:
LOCAL CLIMATE CHANGE ACTION PLAN
(LCCAP) 2019-2028

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INTRODUCTION

BACKGROUND AND RATIONALE

The adverse impacts of climate change are becoming increasingly more prevalent in the Philippines. Climate change-related impacts in the Philippines include extreme weather events, precipitation variability, sea level rise, flooding, and droughts. These are all noticeable, local manifestations of global climate change. In response, rigorous local and global action is required to mitigate, respond, and adapt to climate change (Greig, 2014). At the national level, the Government of the Philippines has responded to climate change through the National Climate Change Action Plan 2011-2028 (NCCAP). In 2009, the Philippine Government passed the Climate Change Act (Republic Act 9729), which mandated all Local Government Units (LGUs) to prepare Local Climate Change Action Plans (LCCAPs) within their respective jurisdictions. The LCCAPs are an essential framework to guide local government's strategic response and action for climate change adaptation and mitigation. The purpose of this action plan is to provide background research support and a set of recommendations to assist the Municipality of Dingalan, Aurora in capacity building and action planning for climate change.

LEGAL MANDATE

Section 16, Article II of the 1987 Philippine Constitution states that, "The State shall protect and advance the rights of the people to a balanced and healthful ecology in accord with the rhythm and harmony of nature". In response to the urgency for action on climate change, the Philippines passed Republic Act 9729, also known as the "Climate Change Act of 2009". ***Section 2 states that "it is the policy of the State to afford full protection and the advancement of the right of the people to a balances and healthful ecology… to fulfill human needs while maintaining the quality of the natural environment for current and future generation."***

The Local Government Unit is mandated to exercise their inherent powers such a police power, as well as share with the national government the responsibility in the management and maintenance of ecological balance in their respective territorial jurisdiction as stated in Section 2a, 15, 3i of Republic Act 7160 or the Local Government Code of 1990. ***Section 14 of RA 9729, as amended by RA 10174, provides that, LGUs shall be the frontline agencies in the formulation, planning and implementation of climate change action plans in their respective areas, consistent with the provisions of RA 7160, the National Framework Strategy on Climate Change (NFSCC), and the National Climate Change Action Plan (NCCAP).***

The NCCAP outlines a set of strategic actions to be employed for climate change adaptation and mitigation and sustainable development within the Philippines. Broken down into seven priority areas, the NCCAP provides a comprehensive overview of key areas for adaptation and mitigation, these are: Food Security; Water Sufficiency; Ecological and Environmental Stability; Human Security; Climate Smart Industries and Services; Knowledge and Capacity Development.

DINGALAN CLIMATE CHANGE ACTION PLAN GUIDING PRINCIPLES

The municipality of Dingalan envisions a disaster-resilient community with healthy environment, and thriving and productive ecosystems. By building the adaptive capacity of communities and increase the resilience of natural ecosystem to climate change, and optimize mitigation opportunities will lead towards sustainable development. Thus, the principles of the National Framework Strategy on Climate Change 2010-2022 serves as guide in the formulation of the Dingalan Local Climate Change Action Plan (LCCAP 2019-2029) as indicated below:

- Take precautionary measures to anticipate, prevent or minimize the causes of climate change and its adverse effects. Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing such measures;
- The Plan is risk based, and strategies/ activities shall be formulated, with decisions made based on the causes, magnitude and impact of risks;
- Climate change knowledge is science-based, and shall be drawn from scientific contributions and best practices from communities taking into considerations local circumstances;
- Adaptation measures shall be based on equity, in accordance with common but differentiated responsibility; special attention must be given to ensure equal and equitable protection of the poor, women, children and other vulnerable and disadvantaged sectors;
- Even with inadequate scientific information, anticipatory adaptation measures should be undertaken to prevent or minimize the causes and potential impacts of climate change, whenever necessary;
- The LCCAP shall be sustainable that fulfill human needs while maintaining the quality of the natural environment for current and future generations;
- The principle of complementation shall be observed to ensure that climate change initiatives by one sector do not restrict the adaptation of the other sector;
- It shall recognize the value of forming multi-stakeholder participation and partnerships in climate change initiatives, including with civil society, private sector and other marginalized groups most vulnerable to climate change impacts; and,
- Policies and incentive mechanisms to facilitate private sector participation in addressing adaptation and mitigation objectives shall be promoted and supported.

Table 1 provides the priority areas and outcomes for the municipality of Dingalan.

Table 1. Priorities and Outcomes

Priorities	Outcomes
Food security	- Availability, stability, accessibility and affordability of safe and healthy food amidst climate change.
Water sufficiency	- Resiliency of major water resources and infrastructures; - Efficient management of water supply and demand; - Effective management of water quality promotion and conservation.
Environmental and Ecological Stability	- Achieved resilient ecosystem and environmental stability; - Attained protection and rehabilitation of critical ecosystems, and restoration of ecological services.
Human Security	- Reduced risks for women and men; children, senior citizens, people with disabilities and other vulnerable sector to climate change and disasters.
Climate-Friendly Industries and Services	- Prioritized creation of green and eco-jobs; - Attained sustainable consumption and production.
Sustainable Energy	- Prioritized the promotion and expansion of energy efficiency and conservation; - Achieved development of sustainable and renewable energy; environmentally sustainable transport; and climate-proofing and rehabilitation of energy systems infrastructures.
Knowledge and Capacity Development	- Enhanced knowledge on the science of climate change; - Enhanced capacity for climate change adaptation, mitigation and disaster risk reduction at the local and community level; and - Established gendered climate change knowledge management accessible to all sectors at the national and local levels.

SECTION 1. BACKGROUND

BRIEF HISTORY

Early settlers recounted that Dumagat tribes inhabited the territory now known as Dingalan. The names of most landmarks and places in this municipality were said to have been given by the aborigines. It is believed that the name "Dingalan" is a Dumagat word which means "by the River of Galan" because the territory straddles fifteen (15) rivers and streams which show the abundance of water.

In the early 1900s, settlers from Quezon, Nueva Ecija, and Ilocos started to migrate to Dingalan. They were generally lowland cultivators in search of arable land. In-migration heightened in the 1930s when Don Felipe Buencamino started his logging and sawmill operations. Soon after, inter-marriages among Tagalogs, Ilocanos, Pampangos and Bicolanos enriched the cultural stock of settlers.

During World War II, Dingalan was occupied by the Japanese imperial forces. The Japanese took over the operation of sawmills and cut timber to construct their barracks and garrisons. The Dingalan-Gabaldon highway was originally built (1942-1945) as a logging road. On the verge of defeat in 1945, the Japanese used Dingalan Bay as an "exit point" when they retreated.

The strategic location of Dingalan Bay for military purposes was rediscovered after the RP-US Mutual Defense Treaty of 1951, when the municipality became the Training Ground in 1957 for the South East Asia Treaty Organization (SEATO) as well as the United States Seventh Fleet. Dingalan also became a site of the RP-US Balikatan Military Exercises for three (3) consecutive years from 1982-1984.

Dingalan was recognized as a municipal district on June 16, 1956 under Republic Act 1536 with an initial population of 2,000 residents. Prior to that, Dingalan was merely a sitio of Barrio San Luis, Municipality of Baler, Tayabas (now Quezon) Province. Dingalan became a regular municipality on June 16, 1962 by virtue of Republic Act No. 3490.

According to the 2007 Ecological Profile of the Municipality of Dingalan, from the 1930s to 1990s, logging was the main driver of Dingalan's economy and the principal magnet to migrants. In the 1970s, three logging companies operated in Dingalan namely; Dingalan Wood Industries Corporation (DWICO), South Eastern Timber Corporation (SETIC) of Mr. Roberto Gopuansoy, and Inter-Pacific Forest Resources Company. They obtained a combined allowable cut of 169,416 cubic meters of lumber per annum, roughly equivalent to 4,500 fully loaded ten-wheeler trucks each year.

Because of relentless logging between 1930 and 1995, Dingalan today has only 2% of its original old growth dipterocarp forest. More than 10% of the area is denuded or devoid of trees. Its rate of deforestation is faster than the country's average of 1.4% per year. The brownish color of Dingalan's river channels reveals the extent of soil erosion and siltation resulting from the loss of adequate tree cover upstream.

GEOGRAPHICAL LOCATION

The Municipality of Dingalan, Aurora is a typical tropical community richly endowed with lush forest growth, crystal clear seas and rivers as essential water sources, attractive areas for marine development, agricultural development potentials, accommodating people and energetic leadership.

Dingalan is at the southernmost part of the province of Aurora. Its geographic center lies at approximately 121°23.548¨E longitude and 15° 23.313¨N latitude. The municipality is situated approximately 183 kilometres north-east of Manila. It is bounded on the north by San Luis, west by Gabaldon and General Tinio (Nueva Ecija) and Doña Remedios Trinidad (Bulacan), south by General Nakar (Quezon), and east by the Philippine Sea (Figure 1).

Dingalan is a third income class municipality of the province of Aurora. The municipality's total land area is approximately 39,994.90 hectares accounting for about 23.64% of the province's total land area.

The municipality has a total of 11 barangays, three (3) of which are classified as urban and eight (8) are rural. The total land area of urban barangays is 1079.03 ha representing 2.70% while the rural barangays have a total area of 38,915.87 ha or 97.30% of the total land area. The National Statistical Coordination Board (NSCB) Resolution No. 9, Series of 2003 was used to classify the barangays of Dingalan.

The largest barangay is Barangay Umiray with an area of 20,529.66 ha which is equivalent to about 51.33% of the total land area of Dingalan. The smallest, in turn, is Barangay Poblacion with only 41.11 ha or only 0.10% of the municipality's total land area. The table 2 shows the land areas, percent to total, and PSA classification of each barangay.

Table 2. Barangay Land Areas

Barangay	Area (ha)	Percent to Total	NSCB Classification
Aplaya	44.09	0.11	Urban
Paltic	993.83	2.48	Urban
Poblacion	41.11	0.10	Urban
Butas Na Bato	377.90	0.94	Rural
Caragsacan	2,086.34	5.22	Rural
Davil-Davilan	2,116.53	5.29	Rural
Dikapanikian	1,568.07	3.92	Rural
Ibona	5,819.03	14.55	Rural
Matawe	3,142.88	7.86	Rural
Tanawan	3,275.45	8.19	Rural
Umiray	20,529.66	51.33	Rural
Total	**39,994.90**	**100.00**	

Source: LGU- Dingalan

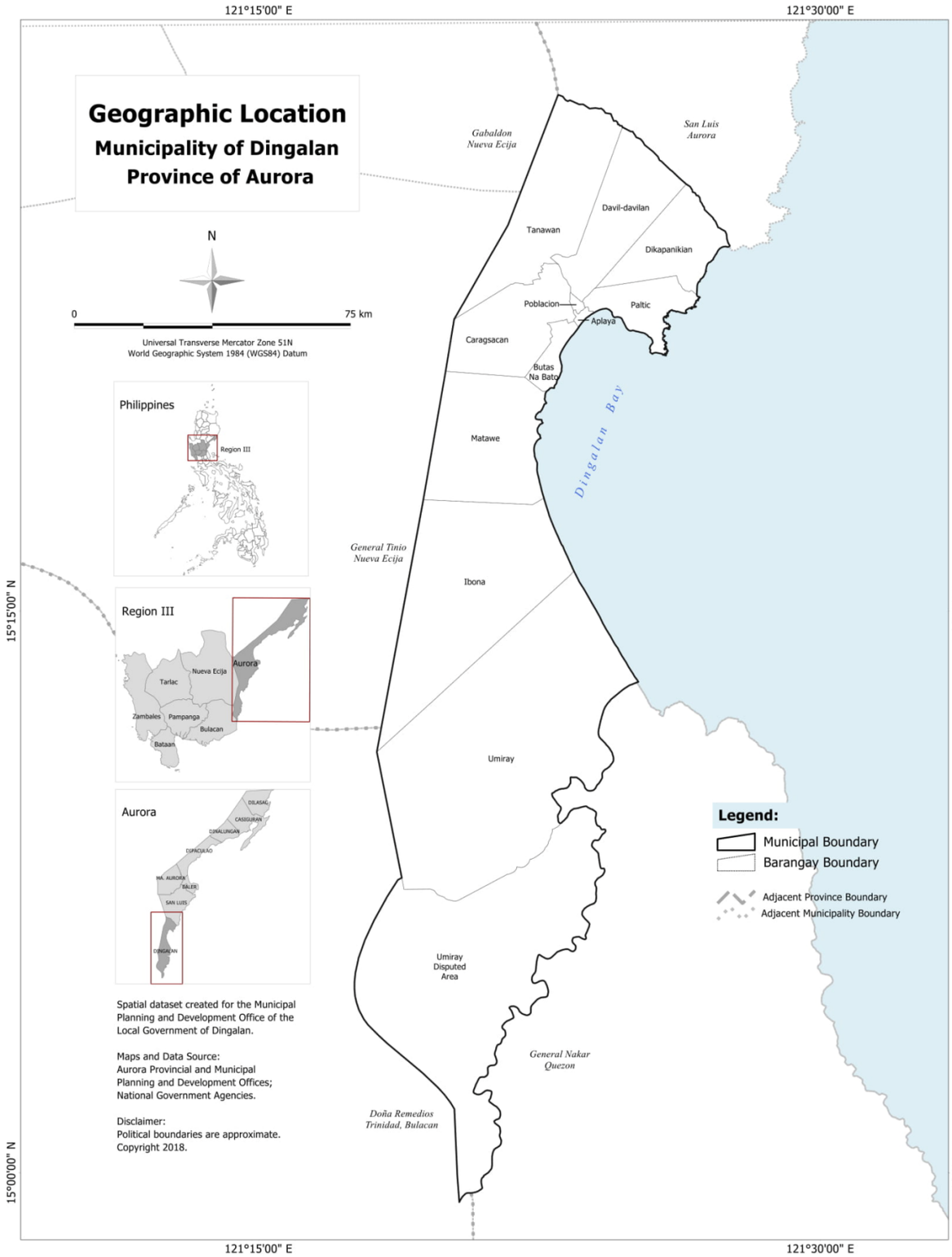


Figure 1. Administrative Boundary of Dingalan, Aurora

DEMOGRAPHIC TRENDS

The population of Dingalan prior to 1956 used to be counted as part of San Luis. Today, Dingalan's population constitutes about twelve percent (12%) of the province of Aurora. The average growth rates display some spikes and falls which are attributed to the various disasters and calamities in the past and the suspension of logging operations in 1978-79, in 1995, and again in 2004.

The growth of logging business between 1960 and 1970 has almost doubled the population despite the town's relative inaccessibility, remoteness and isolation. In June 1956, Dingalan became a municipality under RA 1536 with an estimated population of 2000. Table 3 shows the historical increasing population trend of Dingalan from 1956-2015. In 1970, the population rose to 6,616 with 9.6% annual growth rate.

In 2007, the population posted at 21,236 at 1.21% growth rate while in 2010 it increases to 23,554 with 2.53 % annual growth rate (Philippine Statistics Authority, 2015).

Table 3. Population Growth Trend of Dingalan, Aurora

Year	Total Population Dingalan	Annual Growth Rate, Dingalan	Total Population Aurora Province	Annual Growth Rate, Aurora
1903	-	-	4,484	-
1918	-	-	5980	-
1939	-	-	18,280	-
1956	2,000	-	22,825	-
1960	3,368	-	42,827	7.3%
1970	6,616	9.6%	80,459	8.8%
1975	7,591	2.9%	90,060	2.92%
1980	8,766	2.8%	107,145	3.79%
1990	16,465	8.9%	139,573	2.68%
1995	19,325	5.56%	159,621	2.55%
2000	20,157	0.91%	173,797	1.84%
2007	21,236	1.21%	187,802	1.07%
2010	23,554	2.53%	201,233	2.55%
2015	25,482	1.51%	214,336	1.21%

Source: PSA, 2015

Dingalan's 2010 Population accounts for 11.70% of the total population of the Province of Aurora. With a population count of 25,482 in 2015, Dingalan ranks as the fifth most populated municipality within the province, next to municipalities of Maria Aurora, Baler, Dipaculao and San Luis. In terms of growth rate, Dingalan ranks third next to

Baler and San Luis. This reflects the accessibility and attractiveness of the three (3) municipalities for in-migration and settlement.

Table 4. Population of the Municipalities of the Province of Aurora, 2010-2015

Municipality	Population		% p.a.
	2015	2010	
Baler	39,562	36,010	+1.81%
Casiguran	24,313	23,865	+0.35%
Dilasag	15,835	15,683	+0.18%
Dinalungan	11,322	10,988	+0.57%
Dingalan	25,482	23,554	+1.51%
Dipaculao	29,736	27,729	+1.34%
Maria Aurora	40,734	38,128	+1.27%
San Luis	27,352	25,276	+1.51%

Source: PSA, 2015

Present Population and Trend of Growth

Based on the 2015 PSA census, the population of Dingalan posted a total population of 25,482 with 1.51% and a population density of 84/km^2 (220/sq mi). In 2016 Elections, the Commission on Elections has total registered voters of 14,728.

The overall annual growth rate (AGR) of Dingalan reflected a series of sudden decline intermittent increase since 1970. Between 1970 and 1980, the AGR of 9.6% has dropped to 2.9% in 1975 and 2.8 in 1980. The decline was anchored on the suspension of the operations of logging companies in the rural areas located at the foot of Cordillera Mountains. However, the 1990 AGR reflected an increase rate of 8.9% manifesting an increase in the economic activity of the municipality, in-migration of people and population growth. Furthermore, from 1995- 2000, AGR posted a decline of 4.65% and from 2000-2007; a slight increase of .3% was noted. From 4,743 households in the 1990 Census, there were only 4,115 households in 2000 and 4,343 households in 2005. The logging ban in 1995 and the catastrophic landslide of 2004 have certainly slowed down Dingalan's population, as high birth rates were offset by significant emigration or out-migration.

Table 5 and Figure 2) shows the distribution of population per barangay from 1990-2015. Out of the eleven (11) barangays, six (6) (Aplaya, Butas na Bato, Cabog, Caragsacan, Ibona and Tanawan) have consistently increased in population from 1990-2015 while the five (5) remaining barangays have reflected fluctuations between 1995-2007.

Table 5. Population Distribution per Barangay in Dingalan, 1990-2015

BARANGAY	1990	1995	2000	2007	2010	2015
Aplaya	850	1,014	1,155	1,493	1,619	1,802
Butas na Bato	513	626	688	751	813	909
Cabog (Matawe)	1,629	2,114	2,542	2,812	3,090	3,356
Caragsacan	673	899	1,181	2,523	2,729	2,992
Davildavilan	779	1,061	1,043	898	992	1,036
Dikapanikian	227	515	419	331	387	404
Ibona	2,750	2,839	2,849	3,099	3,185	3,624
Paltic	3,530	4,532	5,156	4,431	5,029	5,075
Poblacion	931	1,181	1,112	1,011	1,091	1,084
Tanawan	101	209	219	691	656	820
Umiray (Malamig)	2,492	4,335	3,793	3,952	3,963	4,380
TOTAL	**14,475**	**19,325**	**20,157**	**21,992**	**23,554**	**25,482**

Source: PSA, 2015

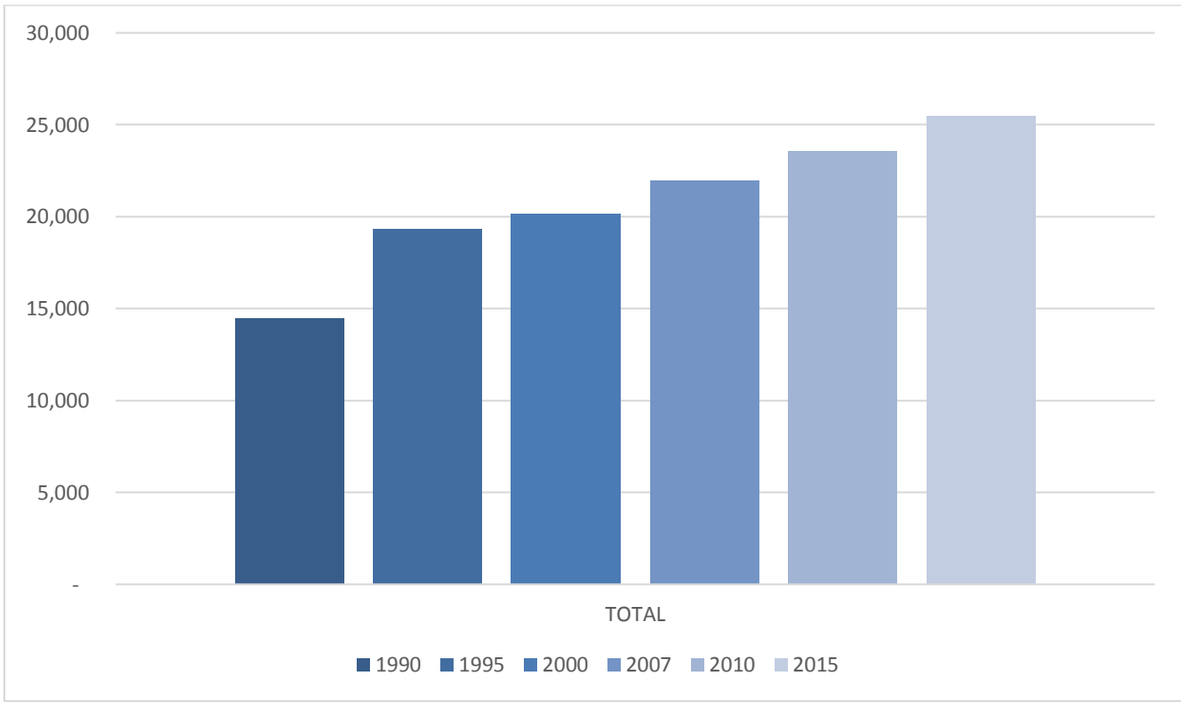


Figure 2. Population Distribution per Barangay in Dingalan, 1990-2015

However, in terms of AGR, Table 6 reflected that most barangays have experienced substantial decline in their annual growth rates between the periods 1990-2000 and 2000-2005. In fact, four barangays with negative AGRs – Poblacion, Paltic, Dikapanikian, and Davil-davilan -- showed obvious signs of depopulation. In contrast, Brgy Caragsacan and Brgy Tanawan have the two highest growth rates (2000-2005) partly because they are sites of new shelter projects / relocation areas for victims of natural disaster.

Table 6. Population Distribution and Growth Rate in Dingalan, Aurora, 1990-2015

Barangay	NSO Census		LGU Barangay Survey			Average Growth Rate		
	1990	2000	2003	2005	2015	1990-2000	2000-2005	2005-2015
Aplaya	850	1,155	1,394	1,337	No data	3.58	3.15	No data
Butas na Bato	513	688	808	725	No data	3.41	1.07	No data
Cabog (Matawe)	1,629	2,531	2,252	2,911	No data	5.53	3.0	No data
Caragsasacan	673	1,167	1,136	1,641	No data	7.34	8.12	No data
Davildavilan	779	1,043	997	854	No data	3.4	-3.6	No data
Dikapanikian	227	419	434	317	No data	8.45	-4.86	No data
Ibona	2,750	2,847	2,861	3,234	No data	0.35	2.71	No data
Paltic	3,530	5,156	5,209	4,094	No data	4.60	-4.11	No data
Poblacion	931	1,112	1,120	795	No data	1.94	-5.70	No data
Tanawan	101	219	313	325	No data	11.68	9.6	No data
Umiray (Malamig)	2,492	3,793	4,486	5,003	No data	5.22	6.38	No data
Total	**16,465**	**20,157**	**21,010**	**21,236**	**No data**	**2.24**	**1.07**	**No data**

Source: NSO Census in 1990 and 2000; LGU Barangay Surveys in 2003, 2005, and 2017

In 2015, Brgy Paltic ranks the highest in terms of population with 5,075 residents with Barangay Umiray as second and Brgy Ibona as third with 4,380 and 3,624 residents, respectively. Table 7 shows that Barangay Ibona, which serves as the town's breadbasket was the biggest population center in 1980 while Brgy. Paltic was the most populous barangay since 1990, but decreased when it was directly hit by the catastrophic landslide of 2004.

A significant segment of population in 2000 (2,959 persons or 15%) did not belong to households, indicating the number of temporary/transient residents and possibly homeless population.

Table 7. Number of Households per Barangay in Dingalan, 1980-2016

Barangay	Data from MPDO					CBMS 2016	
	1980	1990	2000	2003	2005	2010	2016
Aplaya	148	157	235	246	288	No data	383
Butas na Bato	60	102	145	152	158	No data	183
Cabog (Matawe)	177	309	538	474	594	No data	729
Caragsasacan	85	128	239	250	381	No data	550
Davildavilan	101	160	223	224	204	No data	196
Dikapanikian	88	44	80	84	40	No data	75
Ibona	325	509	580	580	632	No data	794
Paltic	278	664	1,042	1,042	788	No data	926
Poblacion	153	197	259	259	206	No data	195
Tanawan	22	20	55	55	135	No data	144
Umiray (Malamig)	106	463	902	902	836	No data	934
Total	**1,542**	**4,743**	**4,115**	**4,268**	**4,262**	**No data**	**5,109**

Source: Municipal Planning Development Office for 1980 to 2005 data; CBMS 2016 for 2010 and 2016 data

Generally, there was a cumulative loss of household units despite the addition of an average of 100 new marriages each year. This loss is not due to deaths but to net out-migration, due to the waning of logging operations after the government's log ban took effect in 1995, as well as to the catastrophic landslide of 2004. Local households tend to have around 5 members.

Table 8 shows the number of household population by urban and rural per Barangay in Dingalan in 2016. Out of 11 barangays, three barangays namely Aplaya, Paltic and Poblacio are considered as urban areas with 1,504 household members and total of 7,174 populations. Rural barangays has 3,605 housholds with 16,034 houhold population

Table 8. Household Population by Urban and Rural Barangays in Dingalan

Barangay	Household Number	Household Population	Household Size	Annual Growth
URBAN	**1,504**	**7,174**		
Aplaya	383	1,798	5	5
Paltic	926	4,495	5	5
Poblacion	195	802	4	4
RURAL	**3,605**	**16,034**		
Butas na Bato	183	821	4	4
Cabog	729	3,227	4	4
Caragsacan	550	2,287	4	4
Davildavilan	196	863	4	4
Dikapnikian	75	392	5	5
Ibona	794	3,383	4	4
Tanawan	144	642	4	4
Umiray	934	4,319	5	5

Source: CBMS 2016

LGU Classification and Its Economic Base

The Municipality of Dingalan is one of the 3rd class municipalities in the Province of Aurora. It generated a total income of 98.63 million pesos in 2016, which comprises the revenues from taxes (i.e. community tax, real property tax, business permits). This section will give a glimpse of the economic sector of the town for the past seven years.

The economic profile shall discuss the following sub-sectors: Agriculture and Fisheries, Commerce and Industry, and Services. This section will only focus on the sub-sectors which have noticeable performance over the past years.

A. Agriculture and Fisheries Sector

Palay, corn, cassava, vegetable and banana are the common agricultural crops grown in the municipality of Dingalan. The details of agriculture sector are discussed below.

1. Palay Production

The municipal agriculture office reports about 1,170 hectares of land being utilized for palay production. From 2011 to 2016, an annual average of 3,899.25 MT of palay was harvested by the town's farmers. The table below (Table 9) shows a consistent upward trend on palay production, except in year 2014 when the town experienced a prolonged season of drought. The yield per hectare also improved significantly through the years, starting from 2.83 MT per hectare in 2011 to 3.66 MT per hectare in 2016. The national average for palay production in 2015 is 3.90 MT per hectare (4.31 for irrigated and 2.96 for rainfed). A major factor for this development is the continuous research and

development conducted by Philrice in partnership with the Nueva Ecija University of Science and Technology – Gabaldon Campus as well as the support of the national government in farm mechanization and modernization programs.

Table 9. Palay Production - Area Harvested, Total/Average Production, and Farmers Trained in Dingalan, 2011-2016

	Classification	2011	2012	2013	2014	2015	2016	2017
Area Harvested (Ha.)	**Irrigated**	1035	1035	1035	1035	1060	1060	No data
	Rainfed	110	110	110	40	110	110	No data
	Total	**1145**	**1145**	**1145**	**1075**	**1170**	**1170**	No data
Total Production (MT)	**Irrigated**	2963.75	3706	3753	3363.75	3933	3952	No data
	Rainfed	275	330	339	120	330	330	No data
	Total	**3238.75**	**4036**	**4092**	**3483.75**	**4263**	**4282**	No data
Annual Yield Per Hectare (MT/Ha.)		**2.83**	**3.52**	**3.57**	**3.24**	**3.64**	**3.66**	No data
Farmers trained		250	150	250	120	122	122	No data

Source: Municipal Agricultural Office 2011-2016

2. Corn Production

The corn program in Dingalan has strengthened in recent years through the continuous support of the Department of Agriculture Region 3. This is evident in the increase in area utilized for corn planting starting in 2015 for the High Yielding Variety (HYV) Corn and year 2016 for yellow and white corn. From 2011-2016, the average annual yield per hectare for HYV and white corn was consistent at around 3 MT/Ha (Table 10). The total volume of production still increased by five times for HYV (2014 to 2015) by 40 percent for white corn (2015 to 2016) and by more than double for yellow corn from 2015 to 2016.

Table 10. Corn Production - Area Harvested, Total/Average Production, and Farmers Served in Dingalan, 2011-2016

	2011	2012	2013	2014	2015	2016
Yellow Corn						
Area Harvested (Ha.)	No data	No data	No data	5.5	No data	150.6
Production (MT)	20	29.75	57	22	85	202.0
Average Yield Per Hectare	No data	No data	No data	4	No data	1.34
High Yielding Variety Corn						
Area Planted (Ha.)	9.5	19	9.5	9.5	50	No data
Production (MT)	28.5	57	28.5	28.5	150	No data
Average Yield Per Hectare	3	3	3	3	3	No data
Farmers Served	15	15	15	15	30	No data
White Corn						
Area Planted (Ha.)	16	17	17	10	10	25
Production (MT)	No data	54	30 54	38	30	50.0
Average Yield Per Hectare	No data	3.18	3.18	3.8	3	2
Farmers Served	32	22	22	31	10	No data

Source: Municipal Agricultural Office 2011-2016

3. Cassava Production

Cassava production continues to rise due to the increasing demand in the market. In addition, members of the Integrated Farmers Association receive continuous trainings and exposure such as the Lakbay Aral in Pampanga and Tarlac cassava plantations, where they learn about new methods such as the use of high yielding varieties. Table 11 shows an increase in total production from 2011 to 2016 as well as better average yield per hectare in 2015 and 2016.

Table 11. Cassava - Area Harvested, Total/Average Production, and Farmers Served in Dingalan, 2011-2016

	2011	2012	2013	2014	2015	2016
Area Planted (Ha.)	No data	38	100	60	25	25
Production (MT)	14.75	16.5	18	20.5	25.5	31.25
Average Yield Per Hectare	No data	0.43	No data	0.34	1.02	1.25
Farmers Served	No data	67	100	65	No data	No data

Source: Municipal Agricultural Office 2011-2016

4. Vegetable Production

In 2016, a Farmers Field School for vegetable production technology was established at Barangay Caragsacan thru the assistance of the Agricultural Training Institute and in 2017 in Barangay Ibona. This shows the continuous commitment of the government in improving vegetable production in Dingalan. An average of around 47has has been harvested with leafy vegetables among trained farmers (Table 12)

Table 12. Leafy Vegetables, Area Harvested, Total/Average Production, and Farmers Trained in Dingalan, 2011-2016

	2011	2012	2013	2014	2015	2016
Area Harvested (Ha.)	21	46.4	83	46	55	35
Production (MT)	No data	No data	No data	No data	No data	18.5
Average Yield Per Hectare	No data	No data	No data	No data	No data	0.53
Farmers Trained	180	83	93	92	No data	No data

Source: Municipal Agricultural Office 2011-2016

Planting of root crops and root vegetables such as potatoes, squash, pumpkin, bottle gourd (upo) and tomatoes is a significant part of the town's agricultural program. However, as shown in Table 13, the total production went down drastically after year 2013, from 250 MT down to 12 MT and from 10 MT/ha aas well as average yield per hectare which went down from 10MT per hectare to 0.4MT per hectare.

Table 13. Root Crops - Area Harvested, Total/Average Production, and Farmers Served in Dingalan, 2011-2016

	2011	2012	2013	2014	2015	2016
Area Harvested (Ha.)	25	25	25	30	30	30
Production (MT)	250	250	250	12	12	12
Average Yield Per Hectare	10	10	10	0.40	0.40	0.40
Farmers Served	30	30	30	50	50	50

Source: Municipal Agricultural Office 2011-2016

Banana is considered as one of the best agricultural products of Dingalan. The Department of Agriculture continues to assist the town in strengthening its banana industry through the Saba Production Expansion Project. Almost 1300 hectares are being utilized for banana plantation, with an average yield per hectare of 6.26 (MT) from 2011 to 2015 (Table 14).

Table 14. Banana - Area Harvested, Total/Average Production, and Farmers Organization in Dingalan, 2011-2016

	2011	2012	2013	2014	2015	2016
Area Harvested (Ha.)	1068	1068	10681298	1168	1298	1068
Production (MT)	6408	6408	6408			6408
Average Yield Per Hectare	6	6	6 4.5	8.8	4.5	6
Farmers Organization		11 (645 members)				11 (645 members)

Source: Municipal Agricultural Office 2011-2016

Another project that has already been started in 2016 is the 262-hectare Cacao plantation in Barangay Umiray. This was initiated by the Department of Agriculture Region 3 in collaboration with Philmech. A cacao processing facility shall also be constructed which will be managed by the Mabunga Cacao Planters Association.

5. Livestock and Poultry

The Aurora Provincial Veterinary Office helps the LGU in its livestock and poultry program such as animal dispersal, artificial insemination, and animal health control. Daily meat inspection in 2015 and 2016 revealed an average of 1,027 heads of swine and 58 heads of cattle slaughtered every day.

Table 15. Livestock (Daily Meat Inspection) in Dingalan, 2011-2016

	2011	2012	2013	2014	2015	2016
Swine Slaughtered (Heads)	No data	No data	No data	No data	1027	1027
Weight (Kg)	No data	No data	No data	No data	70,656	70,656
Cattle (Heads)	No data	No data	No data	No data	58	58
Liveweight (Kg)	No data	No data	No data	No data	8,599	8,599

Source: Municipal Agricultural Office 2011-2016

6. Fisheries

As defined in the Philippine Fisheries Code of 1998, fishery refers to all activities relating to the act or business of fishing, culturing, preserving, processing, marketing, developing, conserving and managing aquatic resources and the fishery areas, including the privilege to fish or take aquatic resources. There are two classifications of this sector that are being monitored: (a) Commercial fisheries; and, (b) Inland Municipal fisheries.

a. Commercial Fisheries Production

The Bureau of Fisheries and Aquatic Resources (BFAR) Region 3 through the Municipal Agriculture Office implements various programs and projects to enhance the fishing industry of Dingalan. In addition, the Municipal Fisheries and Aquatic Resources Council formulates local policies and provides support to this program.

From a yearly fish catch of 342 MT in 2011 and 2012, production almost doubled from 2013 to 2015 with an annual average of 575 MT (Table 16). A slight dip in commercial fishing occurred in 2016 with 436 MT. Tuna is among Dingalan's popular local fish products.

Table 16. Fish Catch Production - By Method, in Dingalan, 2011-2016

	2011	2012	2013	2014	2015	2016
MOTORIZED	291	291	No data	No data	No data	323
NON-MOTORIZED	52	52	No data	No data	No data	103
TOTAL (MT)	**343**	**343**	**605**	**520.35**	**600**	**426**
FISHERFOLKS	936	936	No data	No data	No data	No data

Source: Municipal Agricultural Office 2011-2016

Among the recent projects that would strengthen the fishing industry of the town is the construction of a fish processing center (tinapa) and establishment of a fish sanctuary in year 2015, the provision of smoke house and solar dryers, and the operation of the Municipal Community Fish Landing Center in Brgy. Paltic on Oct 11, 2016.

b. Inland Fisheries: Tilapia Production

The municipal agriculture office and BFAR also support fishpond operators located in some barangays such as Barangay Umiray and Paltic. The total fishpond area is relatively small and has decreased in size since 2015. From 2011 to 2015, average tilapia production was measured at 5.2MT per year.

Some of the notable projects for inland fishery is the fish cage project in Barangay Paltic in 2012 and the 3 demo farms (10 x 10 square meters each) for mud crab production in Barangay Umiray in 2015.

Table 17. Inland Fish (Tilapia) Production in Dingalan, 2011-2016

	2011	2012	2013	2014	2015	2016
Fishpond Area (Has.)	7.32	3.59	5	5	2	2.87
Production (MT)	**5.98**	**5.41**	**3**	**5.4**	**6.2**	No data
Farmers Served	No data	26	25	26	30	20

Source: Municipal Agricultural Office 2011-2016

A Ten Meter Municipal Ice Plant started operation in 2013. In its first three years of operation, it generated an average annual income of 2.56 million pesos, with an average daily production of 108 ice blocks.

Table 18. Ice Production and Annual Income in Dingalan, 2011-2016

	2011	2012	2013	2014	2015	2016
Production of Ice Blocks Per Day	No data	No data	108	108	108	No data
Annual Income	No data	No data	1,434,860	3,273,169	2,980,610	1,810,190 (6 months)

Source: Municipal Agricultural Office 2011-2016

Table 19. Farm Mechanization and Post-Harvest Facilities in Dingalan, 2012-2014

Facility/Equipment	Number of Units	Recipient Barangay	Year constructed/ provided
Shallow Tube Well (STW)	11	No data	2014
4-wheel mini tractor	1	No data	2014
Combine harvester	1	No data	2014
Thresher	1	Ibona	2014
Hand tractor	1	Caragsacan	2014
Shallow Tube Well (STW)	8	No data	2014
Multi-Purpose Drying Pavement	3	Umiray (2) Ibona (1)	2013
Palay shed	3	Caragacan Ibona Umiray	2013
Hand Tractor	1	Ibona	2013
4 Wheel Mini-Tractor	1	Ibona	2013
Warehouse facility	1	Umiray	2013
Collapsible dryers	4	No data	2013
Vermi-composting facility	1	Umiray	2013
Barangay-based food depo and distribution system (Barangay Food Terminal)	2	Ibona and Umiray	2013
Rice reaper	1	Ibona	2012
Multi purpose dying pavement	1	Caragsacan	2012

Source: Municipal Agricultural Office 2012-2014

Table 20. Bottom-Up Budgeting (BUB) for Agricultural Infrastructure Projects in Dingalan, 2015-2016

Infrastructure or Equipment	Barangay	Year constructed/ Provided
Fish cage for Bangus Production	No data	2015
Fish Sanctuary	No data	2015
Rice Milling Equipment: Mobile Cono	No data	2016
Motorized Banca with Fishing Net	No data	2016

Source: Municipal Agricultural Office 2015-2016

B. Commerce and Industry, and Services.

1. Manufacturing and Industry

This sector refers to industries and activities that manufactures finished goods and products from the output of the primary sector (raw materials). It is often categorized into light, medium, and heavy industry. These establishments are popularly known as factories, manufacturing and processing plants.

a. Manufacturing (Industrial Establishments)

Table 21. List of Industrial Estates, Location, Area, and Number of Locators in Dingalan, 2018

	Name	Location	Area	No. of Locators
1.	No data	No data	No data	No data
2.				
3.				

Source: Business Permits and Licensing Office

Table 22. Manufacturing and Processing Establishments, by Nature, Location, and Number of Workers in Dingalan, 2018

	Name of Company	Nature	Workers	Location
1.	Matawe ARB's Small Farmers Marketing Cooperative	Bana Processing (Banana Chips, Coconut Jam)	13	Matawe
2.	Ibona Small Coconut Multipurpose Cooperative	Food processing (coconut jam)	10	Ibona

Source: Business Permits and Licensing Office

Employment, Income, and Livelihood

The results of the Community Based Monitoring System (CBMS) conducted in 2016 show that more than half (67.6 percent) of the households in Dinglalan are below the poverty threshold and 51.9 percent are below the food threshold. This is despite of the low unemployment rate of only 11.4 percent. This can be explained by the nature of livelihood that majority of the residents are engaged in.

Table 23 shows that Barangays in the Poblacion and its immediate vicinity are mostly employed, while the rest of the barangays are into agriculture or other types of jobs that do not give a steady or sufficient source of income to meet their basic daily requirements.

Table 23. Income and Livelihood Indicators in Dingalan, 2016

Indicator	Households		Population	
	Magnitude	Proportion	Magnitude	Proportion
HH with income below the poverty threshold	3453	67.6	16746	72.7

HHs with income below the food threshold	2654	51.9	13159	57.1
HHs who experienced hunger due to food shortage	249	4.9	1302	5.7
Unemployment rate (15 years old and above)	525	11.4	602	7.6

Source: CBMS 2016

Table 24. Major Sources of Livelihood by Barangay in Dingalan, 2016

Barangay	Major Sources of Livelihood
Name of barangay	
All Barangays	Employment
All Barangays	Government and Private Employee
All Barangays	Employment
All Barangays	Employment and Agriculture
Paltic, Poblacion, Davil-Davilan,	Employment and Laborer
Paltic, Aplaya, Umira, Ibona, Matawe	Farming and Fishing
All barangays	Agriculture, Employment, Construction and Sabutan Crafts
Umiray, Ibona, Matawe, Caragsacan	Palay, Corn, Vegetables and Coconut Farming
All Barangays	Agriculture, Employment, Construction and Sabutan Crafts
Umiray, Ibona, Matawe	Coconut and Rice Farming
Umiray, Aplaya, Paltic, Poblacion	Fishing, Tourism (Surfing), and Commercial Establishments
All Barangays	Employment(Government/Private), Farming and Self- Employment Business
All Barangays	Fishing, Farming, Sabutan Weaving,Nipa Making,Laborers, Government and Private Employees

Source: CBMS 2016

LCCAP TIME FRAME

The implementation of programs/projects/activities included in the Local Climate Change Action Plan (LCCAP) is considerably feasible in 10 years from 2019-2028.

KEY RESPONSIBLE PERSON OR OFFICE REGARDING THE LCCAP

Table 25 summarizes the key responsible officers/persons or offices to contact/coordinate for concerns relating to the LCCAP in the municipality.

Table 25. Key Responsible Person or Office to Contact/Coordinate for Concerns Relating to the LCCAP

Office/Agency	Name of Head of Office	Office Number/ Hotline Number	Personal Number
Municipal Mayor	Hon. Shierwin H. Taay	09209232686	
MPDC	Engr. Reymond B. Domingo	09084461027	
MDRRM	Christian June N. Dagasdas	09480318252	
MSWDO	Ma. Edwina L Miranda	09255692139	
MHO	Dr. Lani Veronica Cebedo	09088932697	
OIC Municipal Agriculturist	Mina S. Dicen	09285510182	
Municipal Engineer	Engr. Ken Anthony B. Borreo	09269894687	
MBO	Marilene W. Tolentino	09478557048	
Municipal Tourism Officer	Mary Divina L. Francisco	09997993461	
MLGOO	Hannah Marie O. Agas	09281850320	
District Supervisor, DepEd	Ernesto Dela Torre		
OIC-COP	PCPT. Eduardo S. Mendoza	09989673170	
OICMunicipal Fire Marshall	SFO1 Benjamin P. Rodolfo	09989673170	
MCLB	President Victor E. Maneja	09288266639	
CENRO	Nicomedes P. Claudio		
Philippine Army	Lt. Jonemar Suarez	09778078617	
Philippine Coast Guard	PO3 Lordjin Aragon	09178190197	
PAMANA	Henry Habulin		
Knight of Columbus	Conrado De Guzman Jr.	09155794129	
KALIPI	Ma. Eva P. Valdez	09284074188	
Rice Farmers Irrigators Association	Jimmy Abraham		
Samahan ng NagkakaisangAngkan	Danny Astrera	09422507483	
Samahan ng Mangingisda ng Matawe	Marcus Romantico		
4P‘s	Amalia Ramos	09094174000	
Small Coconut Farmers Association	Rosendo De Guia	09098665503	
Eatery Association	Helen Fabros	09186079456	

LGU DEVELOPMENT VISION AND GOALS

Vision

A global transshipment hub, with a stable economy, disaster-resilient community, healthy environment, disciplined and empowered citizens with the guidance of God-fearing leaders, healthy environment, disciplined and empowered citizens with the guidance of God-fearing leaders.

Goals and Objectives

To achieve the stated goal, the following are the objectives of the environmental management sector:

a. Improve Environmental Quality for a Cleaner, Safer and Healthier Environment

The Municipality will ensure that a cleaner, safer and healthier environment is established through improvements in environmental quality. This will be achieved by formulating and effectively implementing its 10-year Ecological Solid Waste Management Plan in compliance with RA 9003, attaining Class AA freshwater quality standard based on the Guidelines for Water Quality Guidelines and General Effluent Standards (DENR DAO 2016-08) and meeting acceptable groundwater quality standard values based on Philippine National Standard for Drinking Water (DOH DAO 2007-0012).

Strategies for the attainment of this goal include intensifying and/or instigating local action plans/enabling ordinances in support to relevant regulations on clean water and solid waste management, establishment/ completion of solid waste management facilities, monitoring/review of the locality‘s compliance to applicable environmental regulations and enhancing capacity building, institutional strengthening and IEC campaign.

Programs and projects to improve the environmental quality of Dingalan include MRF construction, integrated waste management project, barangay solid waste management strengthening and support program, Waste-to-Win project, IEC campaign on relevant environmental issues especially on solid waste management and water quality management.

Siltation from the wastes could also occur. To prevent these from happening, it is recommended that the municipality minimizes the improper solid waste disposal methods (like burning of wastes). Instead, the municipality should increase the coverage area of the waste collection service, extending to the other barangays not currently in range of the service.

b. Enhance Adaptive Capacities of the Local Community and Ecosystems to Natural Hazards

The Municipality will ensure that the local community and existing ecological systems have enhanced capacity to undertake adjustments, to cope with impacts or to take new opportunities in order to sustain and improve its performance in view of natural hazards. This will be achieved by reducing the risks/ hazards by addressing the sources of vulnerability and strengthening coordination on disaster risks reduction (DRR) and climate change and adopting and/or enhancing plans and technologies to mitigate the impacts of natural disasters.

Strategies for the attainment of this goal include increasing the drainage capacity, clearing of waterways of obstructions, prevent further residential development along flood-prone areas, enhancing DRR-CCA measures, strict implementation of national building, sanitation and/or water codes, conduct of a comprehensive risk/ vulnerability assessment and sustaining capacity building, institutional strengthening and IEC campaign.

Programs and projects to enhance the adaptive capacities of the local community and ecosystems in Dingalan to natural hazards include clean-up, maintenance, repair of existing canals/drainage network/ expansion of drainage system, relocation of residential community located in flood-prone areas, river clean-

up, application of suitable buffer zones and landscaping scheme along river banks with indigenous and water-resistant plant types, and real-time water level monitoring.

c. Enhance Conservation, Protection and Rehabilitation of Natural Resources

The Municipality will ensure that the forest, agricultural, watershed, coastal and marine and other natural resources of Dingalan are conserved, protected and rehabilitated. This will be achieved by managing, protecting/ developing natural forest, established plantation and economically important non-timber forest, encouraging communities to enhance protection and sustain productivity of upland areas, minimizing the use of pesticides, encouraging organic farming, preserving agricultural lands and conserving groundwater resources.

Strategies for the attainment of this goal include: the Municipality to issue and create/enhance the protection of forests through policy instruments that would preserve the remaining forest vegetation as protection forests and instigate suitable buffer zones, strictly implement and enforce of environmental laws, rules, regulations and ordinances regarding environmental concerns, and strengthen MENRO and MAO since they are the two (2) major departments of the LGU concerned in the conservation and proper utilization of natural resources

Programs and projects to conserve, protect and/or rehabilitate the natural resources of Dingalan include community tree planting programs, multi-stakeholder participation and partnership in natural resources management and governance and sustained capacity building, institutional strengthening and IEC campaign.

For the conservation, protection and management of coastal and marine resources, the municipality should create an MPA management body that will be responsible in carrying the programs and projects of its MPAs.

1. Environmental Sector

Goal: Inclusive environmental management towards ecological conservation and preservation.

a. Temperature Increase

- To expand access to potable and tap water and sustain the water resource during prolonged drought and dry condition
- To prevent occurrence, slash and burn cultivation and grassfire, in fire prone areas especially with upland area.
- To preserve wildlife habitat especially for Haring Ibon.
- Reforestation to produce more oxygen and to increase carbon dioxide sequestration.

b. Heavy, Prolonged Rainfall

- To increase density of forest cover by 10 per cent in 5 years in timberland and watershed area.
- To bring back soil stability and reduce impacts of soil erosion and landslides.

2. Infrastructure Sector

Goal: Sustainable and resilient infrastructure development against climate change effects

a. Heavy/Prolonged Rainfall

- To design more strategic and adaptive flood control facilities to target flooding caused heavy/prolonged rainfall
- To collect and convert rainwater as potential resource

b. Extreme Events

- To ensure that designs for roads, bridges and other infrastructure are complaint with the updated national standards (National Building Code and National Structural Code)
- To provide more advanced and technology-based Early Warning Systems
- To ensure climate-resilient communications infrastructure

c. Extreme Events

- To promote and support low carbon emission development
- To improve air quality

3. Economic Sector

Goal: Food Sufficiency and Production, Resource Conservation and Economic Resilience

a. Temperature Increase

- To conserve water diligently during dry season
- To shift to a more climate-adaptive and resilient crops
- To use organic fertilizers and feeds to lessen carbon emission

b. Heavy/Prolonged Rainfall

- To minimize effects of heavy rainfall on crops and plants especially the fruit bearing ones.
- Minimize soil erosion on farm land
- To minimize surface run-off

c. Extreme Events

- Increase resilience of businesses and households to climate change impacts
- Maximize participatory meeting with stakeholders and business sector
- Promote strong business investment engaged in renewable energy resources, commercial establishments and eco-tourism developments.
- Provision of insurance to the farmers and fisherfolks during calamity

4. Social Sector

Goal: A harmonious community with utmost capacity to deter the effect of natural and man-made hazards and other calamities that threatens the general welfare, health and safety of the population and particularly woman, children and the differently-abled city residents;

a. Temperature Increase

- Enhance preparedness and responsiveness of health care providers and facilities to the effects of climate change
- Reduce susceptibility to diseases among populace caused by increased temperatures in congested area.
- Reduce incidents of heat-related diseases and problems especially among elderly, children, and all marginalized and vulnerable sectors

b. Heavy/Prolonged Rainfall

- Provide relocation area for the vulnerable community
- To fast track the provision of basic services
- Reduce incidents of water-borne diseases and problems especially among elderly, children, and all marginalized and vulnerable sectors
- Reduce the effects flooding thru construction of flood-control facilities

c. **Extreme Events**
   - Provide Child-minding Facilities especially for those parents who are temporarily unavailable for their children because of the engagement in livelihood
   - To provide decent and humane life condition among the residents of the municipality
   - To maintain peace and order

5. Institutional Sector

Goal: Just and equitable governance that addresses the needs of the vulnerable/marginalized sectors brought about by Climate Change

a. **Temperature Increase**
   - To enhance participative mechanisms between government and the public
   - Capacitate NGOs, POs and Civil Society Groups for better communication

b. **Heavy/Prolonged Rainfall**
   - Provide relocation area for the vulnerable community
   - To fast track the provision of basic services

c. **Extreme Events**
   - Enhance participatory, transparency and accountability of officers and officials especially in cases of extreme events
   - To attend to the immediate needs and services of the vulnerable groups during calamities

SECTION 2. CLIMATE INFORMATION AND SITUATIONAL ANALYSIS

OVERVIEW OF CLIMATE CHANGE

This section overviews the climate change and climate change-related definitions based on the Climate Change Act of 2009 in order for any planning to be consistent with the Philippine National Climate Change Action Plan.

What is Climate Change?

According to the National Geographic Society, climate change is the long-term alteration of temperature and normal weather patterns within a certain area, or to the planet as a whole. It refers to a change of climate that is attributed directly or indirectly to human activity that alters the composition of the gloal atmosphere and that is in addition to natural climate variability observed over comparable time periods (UNFCCC).

Climate change should be understood as the long-term, persisting changes in the climate of an area. These changes can happen because of natural causes such as volcanic and solar activity, but can also be expedited by human activity through the emissions of carbon dioxide and other greenhouse gases into the Earth's atmosphere.

Global climate change is felt locally in the Philippines through impacts that include extreme weather events, precipitation variability, sea level rise, flooding, and droughts. As a result, climate change is and will be affecting daily life for all Filipinos both today and in the future. Climate Change Changes in the mean and/or variability of its properties and that persists for an extended period typically decades or longer, whether due to natural variability or as a result of human activity.

Climate Change Adaptation and Mitigation

Climate change adaptation is adjustments made in natural systems or in human activities to respond to the changing climate (Food, 2012). Climate change adaptation is a necessary part of the global population's continued survival. The ability of Filipinos to seek new methods of adaptation is demonstrative of their climate resiliency.

Some examples of adaptation include:

- Farmers changing their crops to better align with a new cropping schedule;
- Farmers planting new crops in response to the changing climate;
- Relocation of informal settlements from flood prone areas.

Climate change mitigation is when human intervention takes place to address the role of human beings in accelerating climate change. The ultimate objective of mitigation is to lessen the effects of climate change (Food, 2012).

Mitigation measures include strategies to decrease greenhouse gas emissions such as the implementation of solid waste management programs or better land use and transportation planning. Adaptive Mitigation Using mitigation measures as an integral part of adaptation that integrates adaptation and mitigation into core business policies and operations. The NCCAP recommends seeking out opportunities for adaptive mitigation whenever possible.

Adaptation vs. Coping Strategies

Adaptation and coping are often used interchangeably in disaster management; however, in climate change planning, it is important to distinguish between the two:

- Coping strategies are short-term and associated with managing or enduring stressful conditions; and,
- Adaptation strategies are long-term adjustments to change. Adaptation strategies offer strategic and proactive approaches in planning for climate change. Without a clear understanding of how these concepts differ, opportunities for adaptation may be compromised by short-term, unplanned, coping tactics.

VULNERABILITY ASSESSMENT AND ADAPTATION ANALYSIS

Climate Information

Climate change information consist of projected changes in seasonal temperatures; projected changes in seasonal rainfall; and projected frequency of extreme events.

The seasonal variations are as follows: the DJF (December, January, February or northeast monsoon locally known as “amihan”) season; the MAM (March, April, May or summer) season; JJA (June, July, August or southwest monsoon locally known as “habagat”) season; and SON (September, October, November or transition from southwest to northeast monsoon) season.

On the other hand, the extreme events are defined as follows:

- Extreme temperature (assessed as number of days with maximum temperature greater than 35C, following the threshold values used in other countries in the Asia-Pacific region);
- Dry days (assessed as number of dry days or days with rainfall equal to or less than 2.5 mm/day), following the World Meteorological Organization standard definition of dry days used in a number of countries); and
- Extreme rainfall (assessed as number of days with daily rainfall greater than 300 mm, which for wet tropical areas like the Philippines is considerably intense and could trigger disastrous events).

The data presented in this section is based on the climate projections of Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA) under the medium-range emission scenario. It is to be noted that all the projected changes are relative to the baseline (1971-2000) climate.

For example, a projected 1.0 °C-increase in 2020 in a province means that 1.0 °C is added to the baseline mean temperature value of the province as indicated in the table to arrive at the value of projected mean temperature. Therefore, if the baseline mean temperature is 27.8 °C, then the projected mean temperature in the future is (27.8 °C + 1.0 °C) or 28.8 °C.

In a similar manner, for say, a +25%-rainfall change in a province, it means that 25% of the seasonal mean rainfall value in the said province (from table of baseline climate) is added to the mean value. Thus, if the baseline seasonal rainfall is 900mm, then projected rainfall in the future is 900mm + 225mm or 1125mm.

This means that we are already experiencing some of the climate change shown in the findings under the mid-range scenario, as we are now into the second decade of the century.

1. Year 2020 and 2050 Temperature Projections

Historically, the lowest mean temperature occurs in DJF with 24.5C, while the highest mean temperature occurs in JJA with 27.9C.

The data on projected temperature change for 2020 indicates that there would be an increase of 0.9C for months of DJF and MAM while the months of JJA and SON will see an increase of 1C.

By 2050, the projected temperature for the months of DJF is expected to increase by 1.9C. For the other months, the projected temperature is expected to increase by 2.0C compared to the baseline.

Table 26. Projected Temperature Change (2020 and 2050)

Climate Variable	Observed Baseline (1971-2000)				Change in 2020 (2006-2035)				Change in 2050 (2036-2065)			
Seasons	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON
Seasonal temperature increases (°C)	24.5	27.1	27.9	26.7	0.9	0.9	1.0	1.0	1.9	2.0	2.0	2.0

Source: PAGASA, 2015

2. Year 2020 and 2050 Rainfall Projections

Historically, the highest mean rainfall was recorded in SON which receives 1,151.1 mm of rain, while the lowest mean rainfall was recorded on MAM which receives only 546.4 mm of rain.

The data on projected rainfall change for 2020 indicates that there will be a slight decrease in rainfall during DJF months while there will be a larger decrease in rainfall during the MAM months. The JJA and SON months will be expected to receive a small increase in rain.

By 2050, the projected rainfall for the months of DJF and JJA is expected to increase while the MAM and SON months will be expected to have a decrease in rainfall. However, the MAM months will be expected to increase a large decrease in rainfall compared to the baseline.

Table 27. Projected Rainfall (2020 and 2050)

Climate Variable	Observed Baseline (1971-2000)				Change in 2020 (2006-2035)				Change in 2050 (2036-2065)			
Seasons	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON
Seasonal rainfall change (%)	615.7	546.4	768.7	1151.1	-0.3%	-17.1%	6.7%	5.8%	8.7%	-29.2%	7.4%	-5.7%

Source: PAGASA, 2015

3. Year 2020 and 2050 Frequency of Extreme Events

For the frequency of extreme events, Aurora province had a total of 397 days where the temperature exceeded 35C. It also had 1,295 dry days and 12 days with extreme rainfall. These events were observed during the 30-year period from 1971 – 2000.

For the 2006-2035 period (centered at 2020) under a medium-range emission scenario, the number of days with a maximum temperature greater than 35 degrees Celsius is expected to increase from 397 to 819. Similarly, the estimated number of dry days is expected to increase from 1,295 to 6,176. Lastly, the number of days with rainfall greater than 200 mm is expected increase from 12 to 43 days.

For the 2036-2065 period (centered at 2050) under a medium-range emission scenario, the number of days with a maximum temperature greater than 35 degrees Celsius is expected to increase from 397 to 2,008. Similarly, the estimated number of dry days is expected to increase from 1,295 to 6,161. Lastly, the number of days with rainfall greater than 200 mm is expected increase from 12 to 43 days.

Table 28. Projected Frequency of Extreme Events (2020 and 2050)

Climate Variables	Observed Baseline (1971-2000)	Change in 2020 (2006-2035)	Change in 2020 (2036-2065)
No of days with Temp >35^{O}C	397	819	2,008
No. of dry days (rainfall < 2.5mm)	1,295	6,176	6,161
No of days with Extreme Rainfall > 300mm	12	43	43

Source: PAGASA, 2015

Vulnerability Assessment to Climate Change

The framework below is used in analyzing the vulnerbality of Dingalan to climate change.

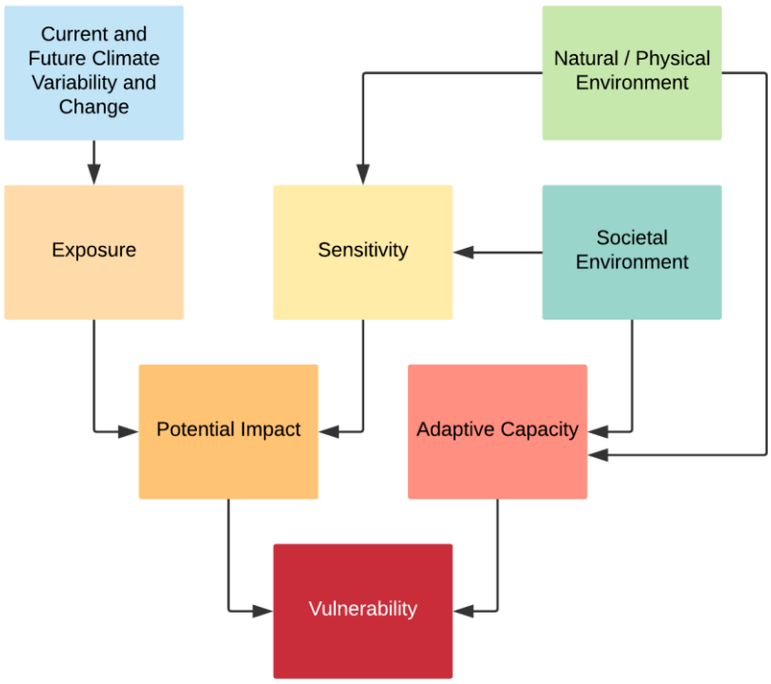


Figure 3. Vulnerability assessment framework

Source: Adelphi and European Academy of Bozen, 2014

Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity (Hinkel, 2014). Based on this definition, vulnerability has four key components that determine whether, and to what extent, a system is susceptible to climate change:

1. Exposure,
2. Sensitivity,
3. Potential Impact, And
4. Adaptive Capacity

The potential impacts to climate change are determined to system exposure and sensitivity. However, vulnerability to that impact also depends on the system's adaptive capacity.

Of all the components which contribute to vulnerability, exposure is the only one directly linked to climate parameters, that is, the character, magnitude, and rate of change and variation in the climate. Typical exposure factors include temperature, precipitation, evapotranspiration and climatic water balance, as well as extreme events such as heavy rain and meteorological drought. Changes in these parameters can exert major additional stress on systems.

Sensitivity is typically shaped by natural and/or physical attributes of the system including topography, the capacity of different soil types to resist erosion, land cover type. But it also refers to human activities which affect the physical constitution of a system, such as tillage systems, water management, and resource depletion as well as population pressure.

Exposure and sensitivity in combination determine the potential impact of climate change. For instance, heavy rain events (exposure) in combination with steep slopes and soils with high susceptibility to erosion (sensitivity) will result in erosion (potential impact). Climate change impacts can form a chain from more direct impact (e.g. erosion) to indirect impact (e.g. reduction in yield, loss of income) which stretches from the biophysical sphere to the societal sphere.

These concepts constitute an impact chain analysis, a tool that helps better understand, systemize, and priorities the factors that drive vulnerability in the system under review.

The threat level is based on the combined assessment of exposure or magnitude of hazards and drivers of sensitivity.

Adaptive capacity, on the other hand, is based on the combined indicators of wealth, information, infrastructure, institutions and social capital.

1. Impact chain analysis for temperature increase

For the temperature climate stimuli, the selected System of Interest includes farmers, fisherfolks, women, traders, fish vendors, and consumers.

The potential bio-physical impacts include higher fish mortality and stunted growth of Tilapia. Potential socio-economic impacts, on the other hand, include decreased production, lack of food security, very low supply of fish, and low collection of market fees, disrupted market activities, and displaced fisherfolks.

In order to address the said impacts, there is a need to increase the adaptive capacity of the affected individuals, such as by rehabilitation programs, provision of fish fingerlings, crop rotation and farm management strategies, and culturing of species suitable for water with high salinity.

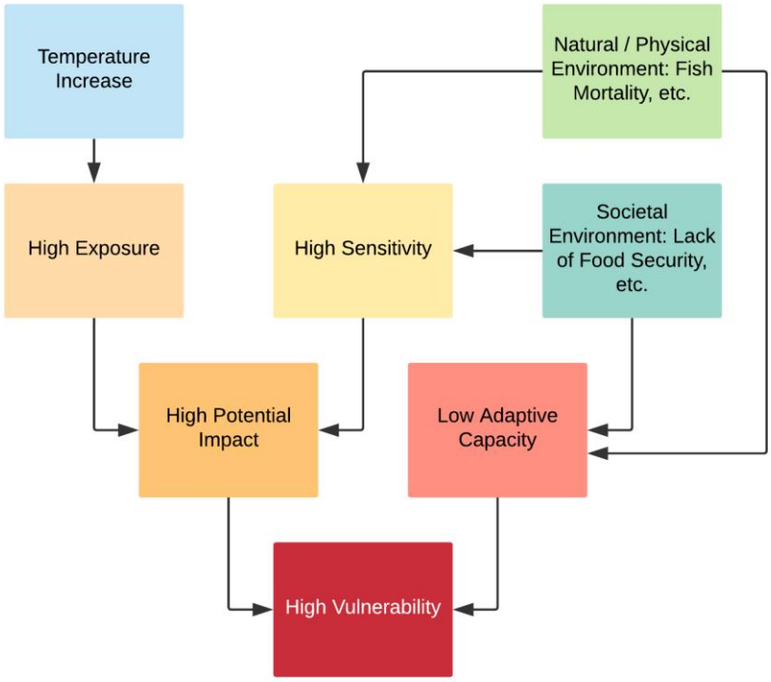


Figure 4. Vulnerability assessment for temperature increase

Identified adaptation measures include include the introduction of resilient fish species (can adapt to high salinity), offering technical courses to fisherfolks, enhancement of research and development of aquaculture, development of sustainable livelihood programs, skills development and other trainings and seminars, provision of water quality testing and purifying equipment, and establishment of a fish health laboratory.

2. Impact chain analysis for rainfall increase

For the extreme rainfall climate stimuli, the selected system of interest includes fish farmers or fisherfolks, women, traders, and fish pond workers or caretakers.

The potential bio-physical impacts include damaged fish pond facilities such as dikes, gates, and caretaker's hut, loss of stock, economic displacement, and inundation of fishpond (high tide coinciding with heavy rains). Potential socio-economic impacts, on the other hand, include low production yield, loss of capital investment, and other economic losses.

The said impacts signal the need for the following measures as to increase adaptive capacity: rehabilitation programs, provision of soft loans to fish farmers and fish pond operators, and the planting of mangroves for dike protection.Identified adaptation measures include dredging of main waterways, engineering intervention (such as using dredged materials for the strengthening of dikes), riprapping, and provision or facilitation of soft loans.

3. Impact chain analysis for typhoon increase

For the Typhoon Climate Stimuli, the selected System of Interest include barrio folks, children, pregnant women, the elderly, and PWDs.

The Potential Bio-Physical Impacts include mortality, morbidity, malnutrition, and increased number of diseases. Potential Socio-Economic Impacts, on the other hand, include scarcity of food, health deterioration, and decrease in family income, destroyed properties as well decreased harvest output, and poor access to transportation routes.

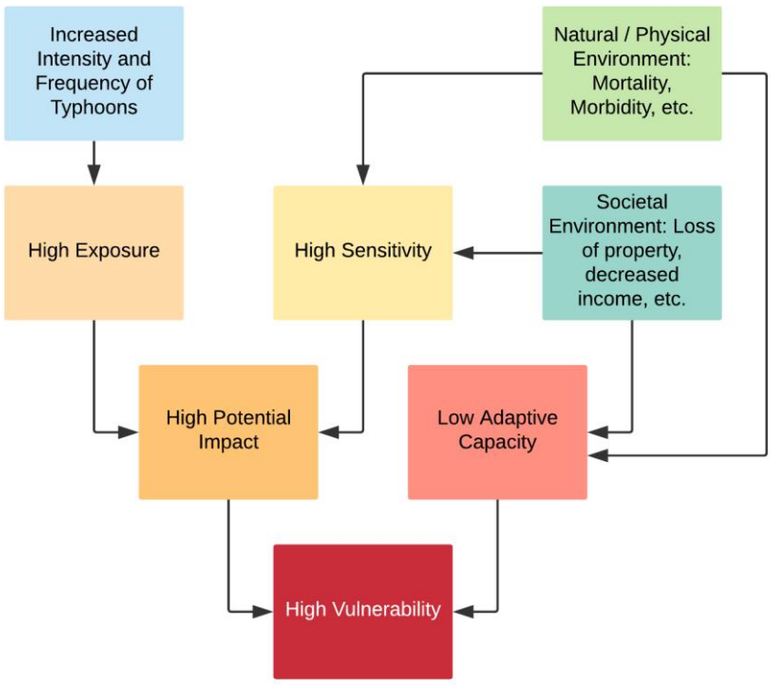


Figure 5. Vulnerability assessment for typhoons

The potential bio-physical and socio-economic impacts signal the need for the following measures in order to increase adaptive capacity: drafting a Local Climate Change Action Plan (LCCAP), presence of doctors, barangay health workers and BNS, increase in MDP and BDP, allocation of DRRM fund, additional rescue equipment, and additional medicines.

Identified adaptation measures include additional doctors for coastal barangays, additional health facilities and evacuation centers, additional funds for disaster risk reduction and management, finalized, approved, and implemented LCCAP and DRRM Plan, availability of medicine, and emergency communication devices.

CLIMATE CHANGE PROJECTIONS & HAZARD INFORMATION

The Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), the University of the Philippines National Institute of Geological Sciences (UP NIGS), the Department of Agriculture (DA) through the Philippine Rice Research Institute (PhilRice), the National Economic and Development Authority (NEDA), the Food and Nutrition Research Institute (FNRI), and the Community Based Monitoring System (CBMS) forged a joint project with the Food and Agriculture Organization's (FAO) Analysis and Mapping of Impacts under Climate Change for Adaptation and Food Security (AMICAF), and the University of Cantabria in Spain, to create the latest climate change projections for the Philippines as of 2014. Results from the project were compiled and processed by PAGASA, together with Japanese scientist consultants, to create projected climate scenarios from 2011 to 2040 (PAGASA 2014).

Three global circulation models (GCMs) were used for the 2014 climate change projections. These are the Bergen Climate Model Version 2 (BCM2), Centre National de Recherches Météorologique (CNRM) Climate Model Version 3 (CNCM3), and Max Planck Institute ECHAM Version 5 (MPEH5). The Bergen Climate Model, developed by Furevik et al. (2003) of the Bjerknes Centre for Climate Research in Bergen, Norway, uses a coupled atmosphere-ocean-sea-ice general circulation model. The second model, CNCM3, is an ocean-atmosphere model initially developed at the Centre of Basic and Applied Research Specialized in Modelling and Numerical Simulation (CERFACS) in Toulouse, France, and later on, regularly updated at the Center National Weather Research (CNRM). CNCM3 was developed by Salas-Melia et al. (2005) from CNRM. Finally, MPEH5 was developed by Roeckner et al. (2003) of the Max Planck Institute for Meteorology in Germany, which is also used by various papers on climate change research.

Each of the three GCMs has its strengths and weaknesses, and has been determined by PAGASA to collectively assess projected climatic conditions in the Philippines. Overall, the trend analysis made by PAGASA showed that the observed mean temperature in the Philippines has increased by 0.64 ºC during the last 60 years (1951-2010). Daytime maximum temperatures have increased by 0.36 ºC, while minimum temperatures increased by 1 ºC during the last 60 years.

For the projections, guidelines from the Housing and Land Use Regulatory Board (HLURB) for crafting local government unit (LGU) climate and disaster risks assessments (CDRA), suggest the use of the A1B storyline of the Intergovernmental Panel on Climate Change (IPCC).

This indicates "a future world of very rapid economic growth, with the global population peaking in mid-century and declining thereafter and there is rapid introduction of new and more efficient technologies with energy generation balanced across all sources" (PAGASA, 2011). This CDRA likewise utilizes this medium-range scenario for determining future climate scenarios and for planning necessary adaptation strategies.

Seasonal Minimum Temperatures Seasonal minimum temperatures for December, January and February will increase by 2011-2040. Based from three GCMs, minimum temperatures will increase around 0.6 to 1.4 degrees Celsius. For March, April and May, temperature will also increase by 2011-2040. Based from three GCMs, minimum temperatures will increase 0.4 to 1.1 degrees Celsius. June, July and August temperatures will increase by 2011-2040. Based from three GCMs, minimum temperatures will increase 0.2 to 0.7 degrees Celsius. Finally, temperatures for September, October and November will increase by 2011-2040. Based from three GCMs, minimum temperatures will increase 0.7 to 0.9 degrees Celsius (Table 2-4).

Table 29. Projected Change in Minimum Seasonal Temperature in Dingalan, 2011-2014

Minimum Temperature Observed Baseline (1971-2000)						Specific Change Expected by 2011-2040 (2014 PAGASA Projection)								
						% change	BCM2 Projection		% change	CNCM3 Projection		% change	MPEH5 Projection	
19.6	°C during DJF (BCM2 baseline)	19.7	°C during DJF (CNCM3 baseline)	19.6	°C during DJF (MPEH5 baseline)	5.0%	20.6	°C during DJF (BCM2 baseline)	7.0%	21.1	°C during DJF (CNCM3 baseline)	3.0%	20.2	°C during DJF (MPEH5 baseline)
21.3	°C during MAM (BCM2 baseline)	21.5	°C during MAM (CNCM3 baseline)	21.4	°C during MAM (MPEH5 baseline)	2.0%	21.8	°C during MAM (BCM2 baseline)	4.0%	22.3	°C during MAM (CNCM3 baseline)	5.0%	22.5	°C during MAM (MPEH5 baseline)
22.4	°C during JJA (BCM2 baseline)	22.4	°C during JJA (CNCM3 baseline)	22.4	°C during JJA (MPEH5 baseline)	2.0%	22.8	°C during JJA (BCM2 baseline)	1.0%	22.7	°C during JJA (CNCM3 baseline)	3.0%	23.1	°C during JJA (MPEH5 baseline)
21.7	°C during SON (BCM2 baseline)	21.8	°C during SON (CNCM3 baseline)	21.8	°C during SON (MPEH5 baseline)	3.0%	22.4	°C during SON (BCM2 baseline)	4.0%	22.7	°C during SON (CNCM3 baseline)	3.0%	22.4	°C during SON (MPEH5 baseline)

Source: PAGASA, 2014

Seasonal Maximum Temperatures

Seasonal maximum temperatures for December, January and February will increase by 2011-2040. Based from three GCMs, maximum temperatures will increase around 0.6 to 1.1 degrees Celsius. For March, April and May, maximum temperatures will also increase by 0.9 to 1.2 degrees Celsius. June, July and August maximum temperatures will increase by 0.3 to 0.9 degrees Celsius. Finally, temperatures for September, October and November will increase by 0.6 to 1.8 degrees Celsius.

Table 30. Seasonal Maximum Temperatures

Maximum Temperature Observed Baseline (1971-2000)						Specific Change Expected by 2011-2040 (2014 PAGASA Projection)								
						% change	BCM2 Projection		% change	CNCM3 Projection		% change	MPEH5 Projection	
28.5	°C during DJF (BCM2 baseline)	28.4	°C during DJF (CNCM3 baseline)	28.5	°C during DJF (MPEH5 baseline)	4.0%	29.6	°C during DJF (BCM2 baseline)	8.0%	30.7	°C during DJF (CNCM3 baseline)	2.0%	29.1	°C during DJF (MPEH5 baseline)
30.4	°C during MAM (BCM2 baseline)	30.7	°C during MAM (CNCM3 baseline)	30.7	°C during MAM (MPEH5 baseline)	3.0%	31.3	°C during MAM (BCM2 baseline)	3.0%	31.6	°C during MAM (CNCM3 baseline)	4.0%	31.9	°C during MAM (MPEH5 baseline)
30.6	°C during JJA (BCM2 baseline)	30.7	°C during JJA (CNCM3 baseline)	30.5	°C during JJA (MPEH5 baseline)	1.0%	30.9	°C during JJA (BCM2 baseline)	0.0%	30.7	°C during JJA (CNCM3 baseline)	3.0%	31.4	°C during JJA (MPEH5 baseline)

29.7	°C during SON (BCM2 baseline)	29.9	°C during SON (CNCM3 baseline)	30.0	°C during SON (MPEH5 baseline)	4.0%	30.9	°C during SON (BCM2 baseline)	6.0%	31.6	°C during SON (CNCM3 baseline)	2.0%	30.6	°C during SON (MPEH5 baseline)

Source: PAGASA, 2014

Seasonal Rainfall

The projected rainfall change in 2036-2065 indicates a decrease during the southwest monsoon season (June, July and August) and the transition from northeast to southwest monsoon seasons (September, October and November). During the northeast monsoon season (December, January and February), the amount of rainfall will increase by 8.5% and increase by 6.8% during the dry season (March, April and May). The projected rainfall change in 2070-2099 shows a decrease of 14.5% during southwest monsoon. In general, there is a slight increase of rainfall during the northeast monsoon season and dry season, but will decrease during the southwest monsoon season, and during the transition from northeast to southwest monsoon seasons.

Table 31. Projected Change in Seasonal Rainfall (%) in 2011-2040 and observed baseline (1971-2000) in Dingalan

Rainfall Observed Baseline (1971-2000)						Specific Change Expected by 2011-2040 (2014 PAGASA Projection)								
						% change	BCM2 Projection		% change	CNCM3 Projection		% change	MPEH5 Projection	
238	mm during DJF (BCM2 baseline)	285.5	mm during DJF (CNCM3 baseline)	243.3	mm during DJF (MPEH5 baseline)	26.1%	300.6	mm during DJF (BCM2)	18.1%	337.2	mm during DJF (CNCM3)	21.1%	294.6	mm during DJF (MPEH5)
178	mm during MAM (BCM2 baseline)	178.5	mm during MAM (CNCM3 baseline)	154.7	mm during MAM (MPEH5 baseline)	13.6%	202.7	mm during MAM (BCM2)	17.0%	208.8	mm during MAM (CNCM3)	37.5%	212.7	mm during MAM (MPEH5)
321	mm during JJA (BCM2 baseline)	347.4	mm during JJA (CNCM3 baseline)	321.3	mm during JJA (MPEH5 baseline)	-0.8%	318.6	mm during JJA (BCM2)	25.2%	434.9	mm during JJA (CNCM3)	13.1%	363.4	mm during JJA (MPEH5)
306	mm during SON (BCM2 baseline)	317.3	mm during SON (CNCM3 baseline)	339.9	mm during SON (MPEH5 baseline)	17.1%	358.1	mm during SON (BCM2)	10.0%	349.0	mm during SON (CNCM3)	5.9%	360.0	mm during SON (MPEH5)

Source: PAGASA, 2014

Hot Days

While the previous three climatic projections were based from PAGASA's 2014 projections, projections for hot days, dry days, and extreme rainfall events were not included in the 2014 publication. Data used for hot days, dry days, and extreme rainfall were therefore based from PAGASA's 2011 projections. Using the 2011 data, temperature increase is seen to contribute to the number of days with temperature higher than 35°C. There will be an increase of 422 days of hot days in 2006-2035, indicating 27.3 hot days per year, as compared to 397 hot days in 1971-2000 (or 13.23 hot days per year). It will further increase to 2008 hot days in 2036-2065, or 66.93 hot days per year.

Dry Days

Based from PAGASA's 2011 projections, there will be an increase of dry days in 20062035, indicating 205.87 days with <2.5 mm of rain per year. This means that most of the year from 2006-2035, there will be more days with less rainfall. Dry days will very slightly decrease in 2036-2065 (about a day less compared to 2006-2035) to 205.37 dry days per year.

Table 32. Projected Change in the Frequency of Extreme Events under Medium-Range Emission Scenarios in 2020 and 2050, and Observed Baseline (1971-2000)

No. of Days w/ >35°C			**No. of Days w/ <2.5 mm of rain per year**		
1971-2000 (baseline)	2006-2035	2036-2065	1971-2000 (baseline)	2006-2035	2036-2065
397	819	2008	1,295	205.87	205.37

Source: PAGASA, 2011

Extreme Daily Rainfall Events

Using PAGASA's 2011 data, extreme daily rainfall events, or days with more than 200 mm of rain, will increase in 2006-2035 and 2036-2050 by 1.43 days per year, from the 0.4 day/year of wet days during 1971-2000. During the baseline of 1971-2000, 12 days were observed to have rainfall more than 200 mm. It is projected that from 20062035, and 2035-2065, each time period is projected to have 43 days of extreme daily rainfall events.

Sea Level Rise

Based from Kahana et al. (2016), sea levels in the Philippines are seen to increase by 0.48-0.69 meters by the end of 2100. Positive sea level rise will occur for the Philippines for Representative Concentration Pathway (RCP) 4.5 for 2080-2100 based from 5th IPCC Assessment Report (AR5). An RCP, in this case, RCP 4.5, is one of many models or pathways of how greenhouse gas emissions (under specific greenhouse gas emission rates) affect global climatic conditions. For a more comprehensive discussion of RCPs and its various implications to global climatic conditions, including projected sea levels, see van Vuuren et al. (2011).

HAZARD INVENTORY

The natural hazards in Dingalan to be included in the analysis are: flooding, rain-induced landslide, storm surge, ground shaking, liquefaction, earthquakeinduced landslide and tsunami. Detailed information of the following natural hazards are taken from the community risk assessment, participatory capacity, vulnerability assessment, geo-hazard assessment and hazard maps from Mines and Geosciences Bureau (MGB), PAG-ASA, and DOST Project NOAH (Nationwide Operation of Assessments and Hazards).

Table 33. Inventory of Areas Highly Prone to Natural Hazards

Barangay	Highly Vulnerable to Tsunami	Highly prone to Coastal Surges	Highly prone to Flooding and flashflood	Highly prone to Raininduced Landslide	Highly prone to Liquefaction	Highly prone to severe soil erosion	Areas with high to low vulnerability to six natural hazards
Aplaya	36.379	32.472	41	0.00	0.00	0.00	41.00
Butas Na Bato	146.473	130.148	42	404.751	0.00	305.293	440.002
Matawe	223.256	195.688	91	2299.747	229.649	422.441	2670.288
Caragasan	4.446	7.171	76	1806.541	0.00	750.144	2088.000
Davildavilan	0.00	0.00	14	2041.890	0.00	336.064	2117.004
Dikapanikian	131.278	37.241	44	1525.984	0.00	96.458	1622.00
Ibuna	234.714	141.597	253	2466.752	221.725	143.853	3416.833
Paltic	298.160	33.959	65	793.302	0.00	141.292	941.00
Poblacion	1.381	0.00	20	0.00	0.00	0.00	36.00
Tanawan	0.00	0.00	0	2898.811	0.00	559.087	3275.001
Umiray	392.162	233.904	543	3389.723	258.822	40.708	4,045.579
Total	**1,464.4**	**808.3**	**1,188.7**	**18,056.4**	**710.20**	**2,795.34**	**20,692.71**

GIS mapping reveals that 68% of Dingalan's territory is highly prone to at least six (6) natural hazards. Five (5) barangays have large areas exposed to geologic as well as hydro-meteorologic hazards. These are Aplaya, Dikapanikian, Paltic, Butas na Bato and Davil-davilan. Natural hazards become real "risks" when large numbers of people lie on their path; this makes Paltic and Davil-davilan the most vulnerable territories. Areas deemed "moderately prone" and "slightly prone" to hazards were temporarily bracketed for purposes of planning to widen flexibility for barangay-level planning and not unduly place large portions of villages under the shadow of danger.

Flood-Prone and Flashflood-Prone Areas

Flooding is the overflowing of water in land areas. It is a natural and recurring event which happens when a heavy or continuous rainfall exceeds the absorptive capacity of soil and the flow capacity of rivers, streams, and coastal area (The Official Website for the State of New Jersey). In cities or urban localities, flooding can be aggravated due to a lack of or poor sewerage system. Lands that are most subject to floods are called flood plains, or area situated near rivers and streams. Incidentally, the built-up areas in Dingalan are mostly floodplains, due to the 7 rivers and 8 creeks scattered throughout the locality.

Table 34. Flood-Prone and Flashflood-Prone Areas

Barangay	Hectarage		
	Official Land Area	High Risk	Moderate Risk
Aplaya	36	41	-
Butas na Bato	440	42	54
Caragsacan	2,088	76	131
Davildavilan	2,117	14	18
Dikapanikian	1,622	44	63
Ibuna	5,795	253	381
Matawe	3,130	91	268
Paltic	941	65	36
Poblacion	41	20	16
Tanawan	3,275	-	-
Umiray	10,970	543	284
Total	**30,455**	**1.189**	**1,251**

We can observe from the information above that majority of the settlement areas are highly or moderately prone to flooding. Among the barangays, Umiray is the most affected by flooding, followed by Ibuna, Tanawan, Butas na Bato, Matawe and Caragsacan are the barangays in least danger of flood. As mentioned earlier, flood occurs on floodplains or lands with a low elevation. With that in mind, it can be concluded that flood occurs on all areas of Dingalan with 0-8% slope, making the impact of the calamity very high.

The map below shows that most of the flood-prone areas are the coastal barangays, with highly susceptible areas (in red) in Aplaya, Butas na Bato, Davil-davilan, Ibona, Paltic, Poblacion, and Umiray; while moderately susceptible areas can be found in Dikapanikian, Ibona, and Matawe.

The occurrence of flood can seriously disrupt public and personal transport as well as communication links. It can cause sewage spills which are hazardous to health. The fast-flowing water can also ruin crops, agricultural areas, farmlands and building. The question that the planning study needs to answer regarding the constraint is the vulnerability of existing and proposed development activities that is and will be located in these flood prone areas. While some action can be designed to decrease the effects of flooding, many current practices especially those related to urbanization can increase the flood risk.

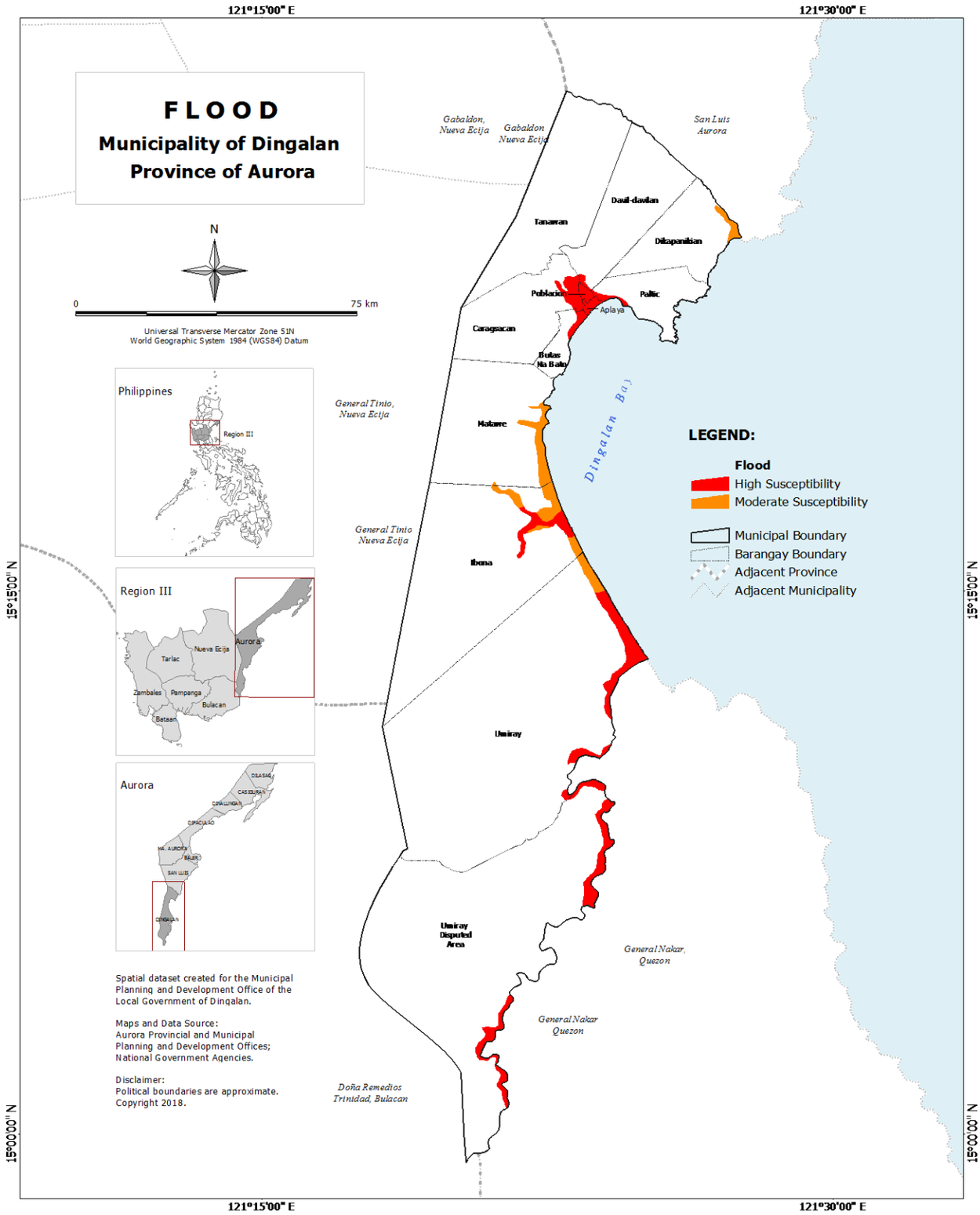


Figure 6. Flood Map for the Municipality of Dingalan

Landslide-Prone Areas

A landslide is a geological occurrence that includes a wide range of ground movement such a falling of rocks, deep failure of slopes and shallow debris flows. Although gravity is the primary reason for landslides, natural calamities like heavy rains, earthquakes and volcanic eruptions also affect original slope stability. Man likewise contributes to landslides through blasting, vibrations from machinery, constructions and the removal of deep-rooted vegetation that binds the colluviums to bedrock. The information given below focuses particularly on landslides caused by storm or rain. It also important to note that what is shown in the map is not natural erosion but due to negligent human activities that went on for decades like logging and slash and burn farming or "kaingin."

Table 35. Rain-Induced Landslide-Prone Areas

Barangay	Hectarage		
	Official Land Area	High Risk	Moderate Risk
Aplaya	36		
Butas na Bato	440	404.751	
Caragsacan	2,088	1806.541	171.084
Davildavilan	2,117	2041.890	43
Dikapanikian	1,622	1525.984	44.835
Ibuna	5,795	2466.752	524.17
Matawe	3,130	2299.747	86.238
Paltic	941	793.302	95.853
Poblacion	41		
Tanawan	3,275	2898.811	376.2
Umiray	10,970	3389.723	91.76
Total	**30,455**	**17.628**	**1,433**

At present, virtually the whole town of Dingalan is highly at risk of landslides – as evidenced by the map below, which is almost entirely red (highly susceptible) – with Aplaya and Poblacion being the only barangays spared from this danger. The rest of the barangays are at highly prone areas, with a strong possibility of it creating damage to all of their lowland (0-8% slope). As a whole, Dingalan is 62.8% affected by landslide with 57.8% of its area highly at risk.

Landslides are, without a doubt, very dangerous. There is no better example of its tragic effect than the occurrence before the end of the year 2004 when many houses, establishments and lives were ruined by the landslide caused by super typhoons "Violeta", "Winnie" and "Yoyong". The challenge now for the people of Dingalan is how to unite themselves in restoring their forests, especially the watershed, to prevent a similar strategy from happening in the future

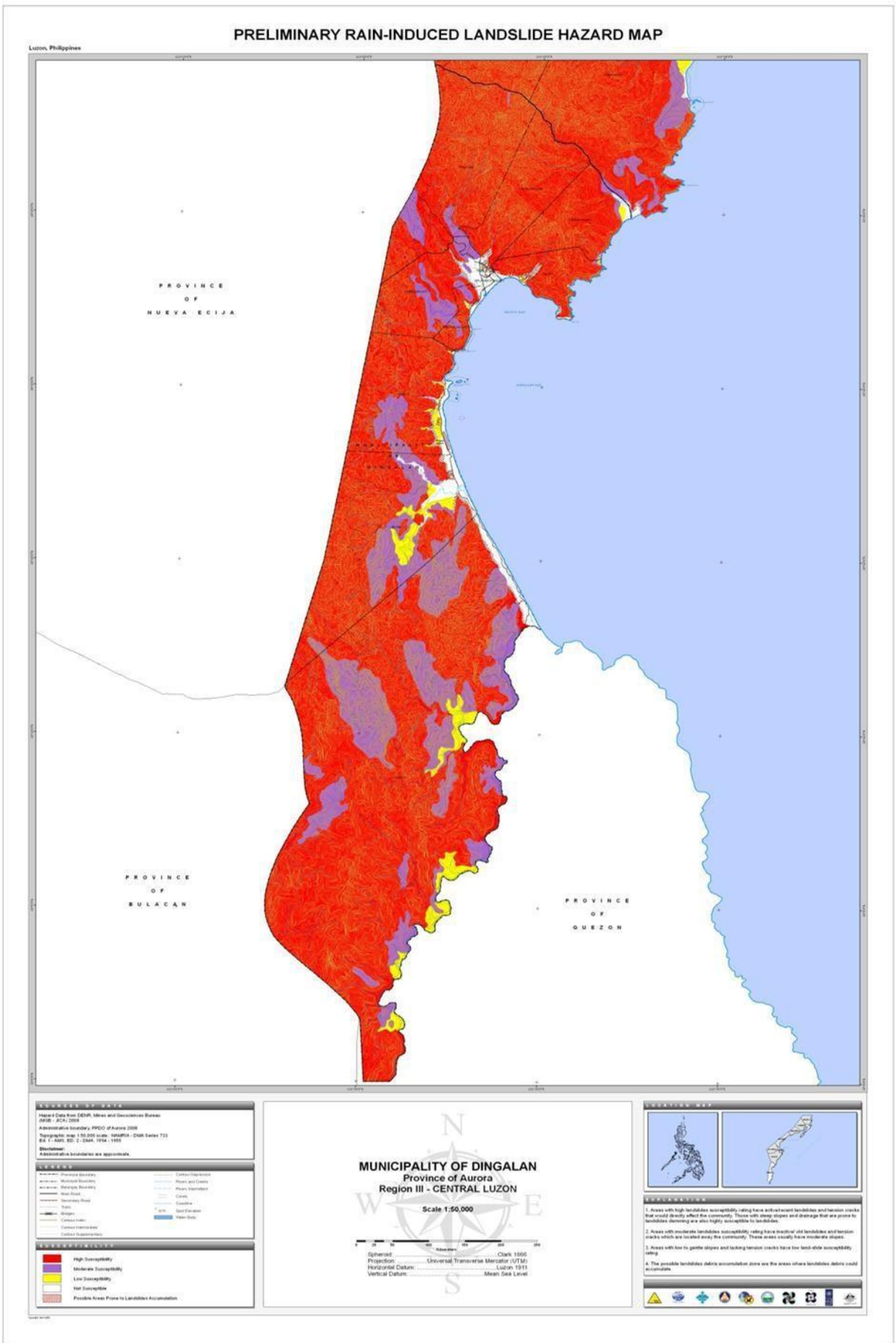


Figure 7. Rain-Induced Landslide Hazard Map for the Municipality of Dingalan

Storm Surge-Prone Areas

A storm surge is a strong or heavy pouring of rainwater over a land area, usually as a result of low pressure weather and high winds moving towards the sea surface. Since the town of Dingalan is located near the Pacific Ocean, it is frequently threatened by storms (also called typhoon and tropical cyclone). This phenomenon is unfavourable to Dingalan because it causes other hazards such as flood and landslide, not to mention the disruption and damage that it causes to property and persons. The table below shows the impact of storm surges on each barangay based on inundation of rainwater. With the exception of Davildavilan, Tanawan, Poblacion, all barangays are highly at risk from typhoon.

The map illustrates that typhoon on a worst-case scenario will affect around 1,474 hectares areas or 4.8% of Dingalan, and that most of the affected areas are those near the coastline – namely, Barangays Aplaya, Butas na Bato, Caragsacan, Dikapanikian, Ibona, Matawe, Paltic, and Umiray. If the computation will be based on the 1,940 hectares with slope 0-8%, the impact of the typhoon will be an astounding 76%.

Table 36. Storm Surge-Prone Areas

Barangay	Hectarage		
	Official Land Area	High Risk	Moderate Risk
Aplaya	36	32.5	3.5
Butas na Bato	440	130	32
Caragsacan	2,088	7.2	2.8
Davildavilan	2,117		
Dikapanikian	1,622	37.2	37.6
Ibuna	5,795	141.6	186
Matawe	3,130	195.7	108
Paltic	941	34	6.7
Poblacion	41		
Tanawan	3,275		
Umiray	10,970	234	285
Total	**30,455**	**812.2**	**661.68**

Since storm surge is a natural calamity, there is nothing that the people of Dingalan can do to stop it from occurring a few times every year. Instead, the effort must focus on disaster preparedness. Simply put, the natural environment must have enough forest cover to prevent or minimize landslide and flooding. Structures must be well-built to withstand strong winds and rain, a decent sewerage system must be present, etc. Dingalan must be able to adjust top this problem if it wants to attract a lot of tourist, investors and immigrants.

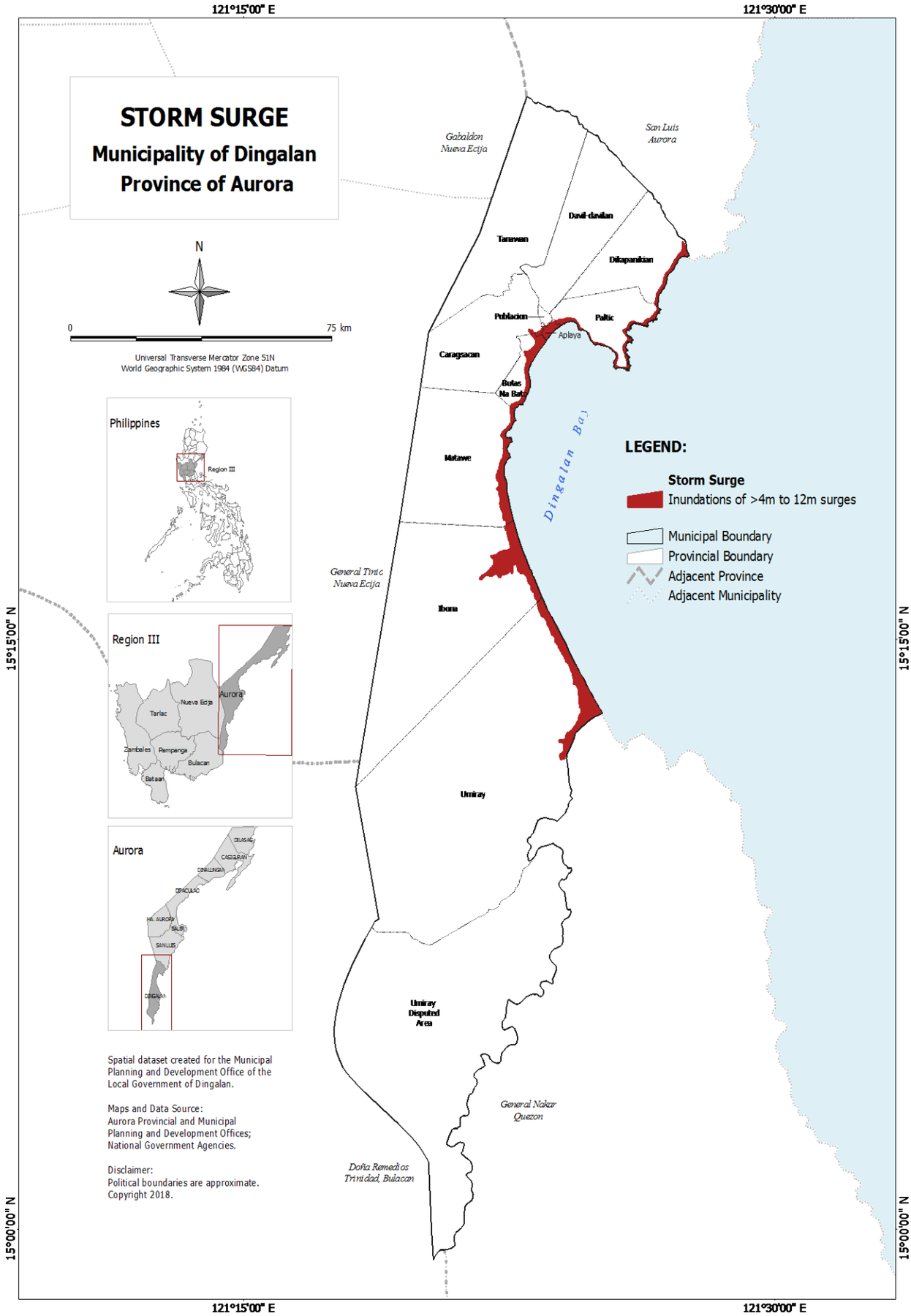


Figure 8. Storm Surge Map for the Municipality of Dingalan

Ground Rupture

Ground rapture is a deformation on the ground that marks the intersection of the fault plane with the earth's surface. The most common manifestation is a long fissure or cracks extending from a few kilometres to tens of kilometres, although ground rupture may also occur as a series of discontinuous crack, mounds of expressions. The length of ground rupture and the width of the zone of deformation generally increase with the magnitude and type of earthquake.

The ground rupture hazard map illustrates three fault lines: the Gabaldon fault, the Digdig fault and unverified active fault traces. The Gabaldon Fault (traced in red line) can be seen from Barangay Aplaya, then passing through Caragsacan, Pinamalisan, Pantoc and Malinao. The Digdig Fault (traced in violet line) can be found from mountains adjacent to Caragsacan going down to the Pinamalisan then then making a slight curve to the left to reach Bantug and Macasandal. Meanwhile, unverified active fault traces are identified in the mountains of Umiray up to Butas na Bato. Another can be seen from Pinamalisan up to Camachili. Finally, a fault line is also drawn along the Pacific Ocean, just a few kilometres adjacent to the shores of Umiray up to Cabog.

Liquefaction-Prone Areas

Liquefaction is a phenomenon in which the strength and stiffness of a soil is reduced by earthquake shaking or rapid loading of heavily materials on the ground. It occurs in saturated soils, that is, soils which are "soaked in water." The presence of too much water particles in the soil causes the ground to be soft and weak. Prior to an earthquake, the water pressure is relatively low. However, earthquake shaking can cause the water pressure to rise up, making the soil unstable. In these cases, the soil will be no strength and will behave more like a liquid than a solid. Liquefaction as a result worsens the amount of damage of future earthquake.

Table 37. Liquefaction-Prone Areas

Barangay	Hectarage		
	Official Land Area	High Risk	Moderate Risk
Aplaya	36		35
Butas na Bato	440		130.5
Caragsacan	2,088		50.9
Davildavilan	2,117		0.2
Dikapanikian	1,622		
Ibuna	5,795	221.7	
Matawe	3,130	229.6	
Paltic	941		170.2
Poblacion	41		8.4
Tanawan	3,275		
Umiray	10,970	258.8	
Total	**30,455**	**710.1**	**395.2**

Because Dingalan is located near the ocean and is enriched with many rivers and creeks, it is not surprising to find out that many of its areas are identified in liquefaction prone. The Liquefaction Hazard Map shows that liquefaction is predominant on areas with 0-8% slope. In areas with 0-8% slope, Dingalan is 20.7% moderately at risk and 36.6% highly at risk of liquefaction. Those barangays which are highly at risk of this phenomenon are Ibona, Matawe, and Umiray; barangays moderately prone to liquefaction are Aplaya, Butas na Bato, Caragsacan, and Paltic; while those with low susceptibility are barangays Butas na Bato, Caragsacan, Dikapanikian, Patic, Poblacion, and Umiray.

Liquefaction-induced soil movements are very destructive because it can push foundations of structures such as buildings, roads and bridges out of place. Therefore, it is important to take note of these places so that

future structures will not be located there. If it is necessary to construct on liquefaction susceptible soil because of space restrictions, favourable location, or other reasons, it may be possible to make the structure liquefaction resistant by designing the foundation elements to resist the effects of liquefaction.

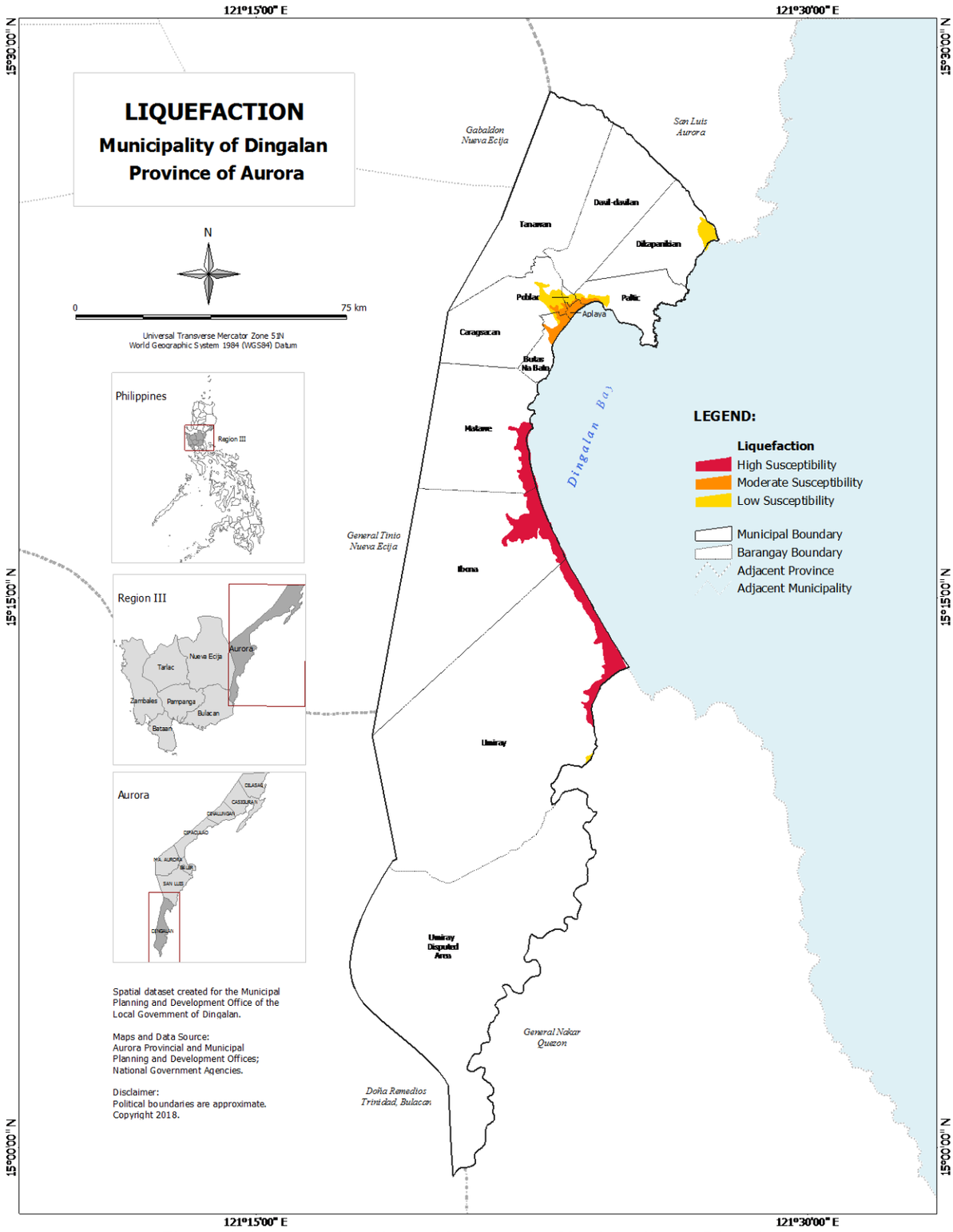


Figure 9. Liquefaction Hazard Map for the Municipality of Dingalan

Earthquake-Induced Landslides

The earthquake-induced landslides susceptibility map reveals that land areas with 0-8% slope will be more affected by the hazard as compared to the occurrence within the mountains. The map also shows that landslide is concentrated on Barangay Umiray, Ibuna, Poblacion, Aplaya and some parts of the rest of the barangays except Tanawan, which is not affected at all.

It is important to note that outside the territory of Dingalan but the main road network going to Gabaldon and Nueva Ecija is heavily prone to earthquake induced landslides.

Earthquake-Prone Areas

An earthquake is a weak shaking to intense trembling of the ground produced by the sudden displacement of rocks or rocks materials below the earth's surface. Sudden displacements along fault cracks in the hard and firm layer of the earth cause tectonic earthquake. Those provoke by rising lava or magma below active volcanoes create volcanic earthquake.

The occurrence of an earthquake result to other hazards such as ground shaking, ground rapture, landslides, liquefaction, and tsunami. The said hazards will be discussed in the succeeding pages.

Ground Shaking

Ground shaking can be plainly described as trembling or shaking of the ground. Intense ground shaking can cause tremendous damage to houses and buildings, foundation of roads and bridges, water pipes, dams and other utility installations. Worse, it can also claim a lot of human casualties. The reference point used for ground shaking analysis was taken from the earthquake incidence on November 30, 1645 (Magnitude 7.9, 15.65oN 121.25oE) and on July 18, 1880 (Magnitude 7.6, 14.90oN 121.50oE).

Based on the two maps, it can be observed that ground shaking is strongest on level surface or those near the coastline. Earthquakes with intensity 8.5 have occured in Barangay Poblacion, Aplaya, Matawe, Ibuna, Umiray and a small part of Dikapanikian and Paltic. Meanwhile, intensity 8.0 to 8.25 was experienced in Barangay Caragsacan, Butas na Bato and some parts of Davildavilan. The mountains surrounding the town are also affected by intensity 7.25 to 8.00.

Tsunami-Prone Areas

Tsunami, also called seismic sea waves or tidal waves, is a series of travelling ocean waves of extremely long length generated by disturbances associated primarily with earthquakes occurring below or near the ocean floor. Underwater volcanic eruptions can also generate tsunamis. Tsunami is a threat to life and property to anyone living near the ocean. In extreme cases, water level can rise to more than 50 feet for tsunamis of distant origin and over 100 feet for tsunami waves generated near the earthquake's epicentre. The flooding can extend inland by 1000 feet or more, covering large expanses of land. All oceanic regions of the world can experience tsunamis, but in the Pacific Ocean there is a much more frequent occurrence of large, destructive tsunamis because of the many large earthquakes associated with the series of mountain chains, deep ocean trenches and island arcs (sometimes called the "ring of fire") surrounding the ocean.

Table 38. Tsunami-Prone Areas

Barangay	Hectarage	
	Official Land Area	High Risk
Aplaya	36	36
Butas na Bato	440	146.5
Caragsacan	2,088	4.4
Davildavilan	2,117	
Dikapanikian	1,622	131.3
Ibuna	5,795	234.7
Matawe	3,130	223.3
Paltic	941	298.2
Poblacion	41	1.4
Tanawan	3,275	
Umiray	10,970	292.2
Total	30,455	1,468

Based on the information from the table above, Barangay Tanawan and Davildavilan will not be in danger in case of tsunami, mainly because it is far away from the ocean. Caragsacan and Poblacion are slightly at risk of this hazard. The rest of the barangays, with respect to the 0-8% slope, are 100% prone to tsunami.

As for the hazard map, it shows that coastal barangays – namely, Aplaya, Butas na Bato, Caragsacan, Dikapanikian, Ibona, Matawe, Paltic, Poblacion, and Umiray – have high susceptibility to tsunamis.

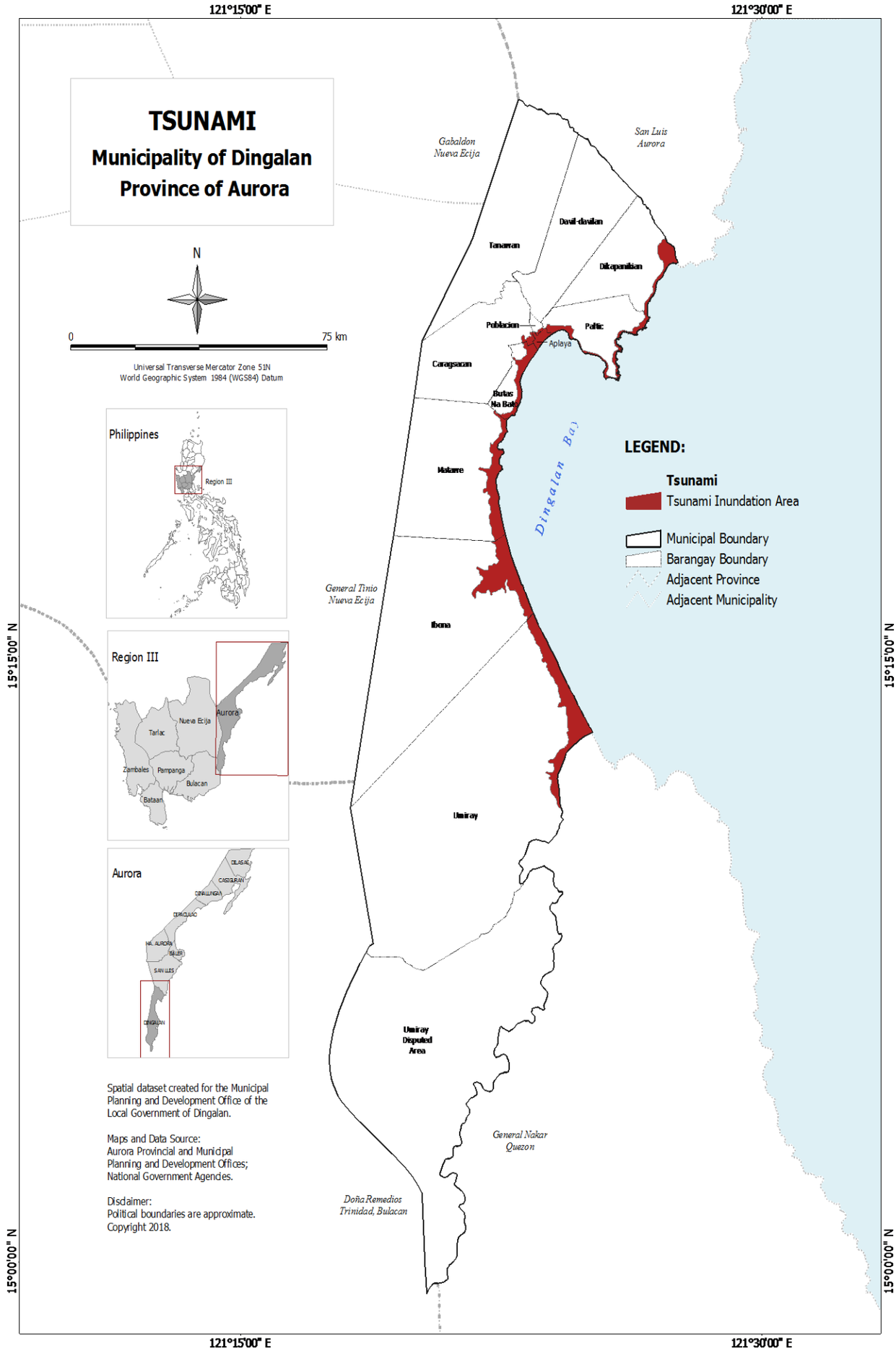


Figure 10. Tsunami Hazard Map for the Municipality of Dingalan

Severe Soil Erosion

Soil erosion is naturally occurring process on all land. The agents of soil erosion are water and wind, each contributing a significant amount of soil loss. Soil erosion may be a slow process that continuous relatively unnoticed, or it may occur at an alarming rate causing serious loss of topsoil. The loss of soil from farmland may be reflected in reduced crop production potential, lower surface water quality and damage drainage networks.

The map shows that severe soil erosion occurs near the mountainside and affects 2,663 hectares of land or 8.74% of Dingalan. Caragsacan has the most area prone to severe erosion with 806 hectares followed by Tanawan with 388 hectares and Davildavilan with 352 hectares.

Table 39. Areas with Severe Soil Erosion

Barangay	Hectarage	
	Official Land Area	High Risk
Aplaya	36	
Butas na Bato	440	281.14
Caragsacan	2,088	806.27
Davildavilan	2,117	352.14
Dikapanikian	1,622	96.13
Ibuna	5,795	262.15
Matawe	3,130	275.33
Paltic	941	147.42
Poblacion	41	
Tanawan	3,275	388.31
Umiray	10,970	54.16
Total	**30,455**	

Soil movement by rainfall (raindrop splash) is usually greatest and most noticeable during short-duration, highly intensity thunderstorms. Runoff can occur whenever there is excess water on a slope that cannot be absorbed into the soil or trapped on the surface. Generally, soils with faster infiltration rates, higher levels of organic matter and improved soil structure have a greater resistance to erosion. Sand, sandy loam and loam textured soils tend to be less erodible than silt, very find sand, and certain clay textured soils.

Tillage and cropping practices which lower soil organic matter levels, cause poor soil structure, and result of compacted contribute to increases in soil erodibility. Soil erosion potential is increased if the soil has no or very little vegetative cover of plants and/or crop residues. Plant and residue cover protect the soil from raindrop impact and splash, tends to slow down the movement of surface runoff and allows excess surface water to infiltrate.

Geo-Hazard Prone Areas

After combining the areas prone to storm surge, flash flood, rain-induced landslide, erosion, liquefaction and tsunami, the result is what we call the “composite geo-hazard prone areas”. Unfortunately, the exact measurement of areas susceptible to ground shaking, ground rupture, earthquake induced landslide was not included because of the limitation of the maps that were available.

Based on this information, we can see that a large portion (67/9%) of Dingalan is either moderately or highly prone to the aforementioned disasters. Barangay Aplaya, Butas na Bato, Caragsacan, Davildavilan, Dikapanikian, Paltic, Poblacion and Tanawan are 100% prone to hazards while Matawe (85.3%), Ibuna (59%) and Umiray (36.9%) are safe from hazards in some areas. Of course, these percentages would be deceptive

if taken as is. We must consider the fact that storm surge, flashflood, landslide, liquefaction and tsunami affect mostly the land areas with 0-8% slope, meaning damage is primarily on places where infrastructures are located and where people reside, work and move around everyday.

Table 40. Areas Prone to Geo-Hazards

Barangay	Hectarage		
	Official Land Area	Geo-hazard	No Geo-hazards
Aplaya	36	36	0
Butas na Bato	440	440	0
Caragsacan	2,088	2,088	0
Davildavilan	2,117	2,117	0
Dikapanikian	1,622	1,622	0
Ibuna	5,795	3416.8	2,378
Matawe	3,130	2,670.3	460
Paltic	941	941	0
Poblacion	41	41	0
Tanawan	3,275	3,275	0
Umiray	10,970	4045.6 6	925
Total	**30,455**	**20**	**692.7 9**

DISASTERS AND THEIR IMPACTS

Typhoons experienced by the municipality which brought about damages and destruction were Kading (October 1978) and Unding (November 1979) and typhoon Saling (October 1991) wherein damages were estimated at 90% to both public and private properties.

The place also suffered damages during the 1990 earthquake and PHIVOLCS identified the southernmost part of the Municipality included as fault zone area. Flash flood were also experienced in Barangay Paltic, Cabog, Caragsacan and Ibuna in 1992 but brought minimal damages.

The worst calamity that Dingalan experienced was the flash flood on November 23, 2004 and November 30, 2004 when three typhoons Violeta, Winnie and Yoyong though Signal no. 1 in nature brought heavy and continuous rains for almost a week which caused landslide and flooding. These two phenomena's have brought tragedy in the area that causes loss of lives and damages to properties both public and private. The debris that accompanied these buried many houses, agricultural lands, and major infrastructure facilities. The severly affected barangays were Umiray, Paltic, Davil Davilan and Poblacion.

Table 41. Records of Disaster and Their Impacts for the Last Five Years in Dingalan

Year	Type of Disaster	No. of Affected	Damages	Casualties
2012	Typhoon Ofel	275 Families	**Crops** Rice – 60 has. Banana – 84has. Pestil Rosal/ White Corn/ Yellow Corn, Green Grass – 80 bundles **Livestock** Carabaos – 9 heads (5males, 4 females) **Infrastructure** Partial – Umiray Mini-Diversion Dam Riprap – Purok Almaciga, Brgy. Paltic Riprap with gabion – Brgy. Dikapanikian Line Canal – Brgy. Dikapanikian, Municipal and Brgy Road at Brgy. Paltic	None
2013	Typhoon Santi	429 Families	**Houses** Brgy. Tanawan, Brgy. Aplaya and Brgy. Paltic (Partially – 184, Totally – 7) **Roads** Southern Brgys not passable – Brgy. Ibona, Brgy. Matawe, Brgy. Umiray **Crops** Rice (Rain fed) – 105 has. Rice (Irrigated) – 20 has. Banana – 850has. Coffee – 5has. Cacao – 6has. Fishing Boats – 6, Trolley/Pangulong – 3 Interrupted Power Supply	None
2014	Typhoon Glenda	500 Families, 2,500 Individuals	**Houses** Brgy. Matawe (Partially - 28, Totally – 1) **Crops** Banana – 3has. Cacao - 2has. Cassava -1.2has. Corn 0.25 has. Fishing Boats (Partially – 6)	None
	Typhoon Kabayan	169 Families, 845 Individuals	**Houses** 101 Flooded Houses (approx. 2 ft.) at Brgy. Aplaya and Brgy. Caragsacan **Crops** Rice – 15has. Corn – 1.5 has. **Fisheries** (Partially -39, Totally -17) **Infrastructure**	None

			(30mts. Riprap at Purok I Butas na Bato)	
	Typhoon Lando	3,726 Families, 18,630 Individuals	**Houses** All Barangays (Partially – 1,939, Totally – 201) **Crops** Banana – 1,268 has. Rice – 295 has. Cacao – 25 has. Cassava – 10 has. Yellow Corn/ White Corn – 17.5 has. Ampalaya – 1.5 has. Eggplant – 4.75 has. String Beans – 7.75 has. Tomato – 3 has. Watermelon – 1.5 has. Sili Panigang – 2has. **Fisheries** Inland Aqua – 2 has. Marine – 5 motorized banca, 22 non-motorized banca (Brgy. Paltic, Brgy. Dikapanikian, Brgy. Aplaya, Brgy. Umiray, Aqua Silvi at Brgy. Umiray) **Livestock** Carabao – 2 heads Cattle – 6 heads Goat – 20 heads Fowl – 100 heads Swine – 6 heads **Infrastructure** Brgy. Matawe (Partially) - Approach at Amutan Creek, Approach at Ablog Spillway, Approach at Agusis box culvert; Brgy. Davildavilan gabion; Brgy. Tanawan (Partially); Multi-purpose bldg/evacuation center; Drainage/Canal (Totally); Brgy. Ibona (Partially) – Gym, FTMR, Abungan Creek, Setic Creek, Ibona Bridge, INHS, IES; Brgy. Aplaya (Totally) – gabion; Brgy Butas Na Bato (Partially) – FTMR, gabion, box culvert, riprap; Brgy. Dikapanikian (Partially) – Riprap; Brgy. Paltic (Partially) – Gym;	None

			Brgy Poblacion (Partially) – Gym, basketball ring; Brgy. Umiray (Partially) – Multi purpose hall, school bldg., mini diversion dam	
	Typhoon Nona	3,650 Families, 10,920 individuals	**Houses** Partially -2, Totally – 14 **Roads** Brgy. Ibona to Brgy. Umiray not passable **Crops** Rice 4 has. Assorted Vegetable 5 has. 11 Farmers Seedbed Hybrid 22 Farmers Seedbed Certified **Infrastructure** Brgy. Caragsacan (Partially) – Gabion (50m), sanitary landfill; Brgy. Paltic (Partially) – Bridge Approach (Mag-asawang Tulay), gabion; Brgy. Matawe (Partially) – Line canal, water system, box culvert Brgy. Umiray (Partially) – Hanging Bridge, Overflow (Yapit), Overflow (Malamig), Overflow (Malakawayan), Umiray Bridge; Brgy. Davildavilan (Partially) – Gabion; Brgy. Ibona (Partially) – Ibona Bridge; Brgy. Butas Na Bato (Partially) – Amutan Bridge, box culvert, riprap	None
2016	Typhoon Karen	2,097 Families, 7,038 Individuals	**Houses** (Partially) 87 **Crops** Rice – 100 has. Banana – 306.5 has. Corn – 40 has Vegetables – 16.6 has. Cassava – 6.3 has **Infrastructure** Brgy. Paltic (Partially) – Riprap, gabion; Langawan River Detour (Totally)	None
	Typhoon Lawin	2,492 Families, 8,230 Individuals	**House** (Partially) 4 **Crops** Banana – 11.1 has. Rice – 10 has. **Fishing Boats** Brgy. Aplaya 3 (Partially) **Infrastucture** Brgy. Matawe (Partially) – Public Market, Water system	None

Hazard Susceptibility

The hazard susceptibility inventory matrix shows a summary of barangays having been affected by several hazard categories based on the hazard maps developed by the concerned agencies. Matrices are presented below for the different hazards.

Table 42. Hazard Susceptibility Inventory Matrix for the Municipality of Dingalan

Barangay	Flood	Rain-Induced Landslide	Storm Surge	Drought	Sea Level Rise	Earthquake induced landslide	Liquefaction / Sinkhole	Ground shaking	Ground Rupture	Tsunami	Volcanic Eruption
A	B	C	D	E	F	G	H	I	J	K	L
Aplaya	/	x	/	x	/	/	x	/	/	/	x
Butas Na Bato	/	/	/	x	/	/	/	/	/	/	x
Caragsacan	/	/	x	/	x	/	/	/	/	x	x
Davil-Davilan	/	/	x	x	x	x	/	/	x	x	x
Dikapanikian	/	/	/	x	/	x	/	/	x	/	x
Ibona	/	/	/	x	/	x	/	x	/	/	x
Matawe	/	/	/	/	/	x	/	x	/	/	x
Paltic	/	/	/	x	/	x	/	x	x	/	x
Poblacion	/	x	x	x	x	x	x	x	x	x	x
Tanawan	x	/	x	x	x	/	x	/	/	x	x
Umiray	/	/	/	/	/	x	/	x	x	/	x

Climate change impacts

“Impact” is used to refer to the effects on natural and human systems of physical events, of disasters, and of climate change – IPCC. HLURB describes these impacts chains as follows: Impact chains provide the most important chains of cause and effect leading to the potential impacts relevant in the planning area. This can help identify the key development areas/sectors where climate change and disasters will likely impact and guide the detailed study of establishing the level of risks and vulnerabilities of the area ll. In the municipality of Dingalan, the major areas affected due to extreme rainfall brought by climate change are agriculture, population, human health and infrastructures.

Extreme rainfall triggers flash flood directly damaged the crops, livestock and fisheries. A secondary impact in this area includes loss or decrease of agricultural yields and productions, insufficient food supplies and increase of demands and prices of the prime commodities. While under the areas of population, the major concern is the human displacement with secondary impacts such as increase poverty level and high cost of living, increase demands of employment and livelihood. The following effects when the government and tourism related infrastructures were damaged are interruption in the delivery of basic social services, interruption of human mobility, and the decrease of tourist arrival and income. Effects such as the increase

in water-bourne related diseases brought about by flooding may increase the morbidity and mortality rate of the municipality.

Impact Chain Diagram

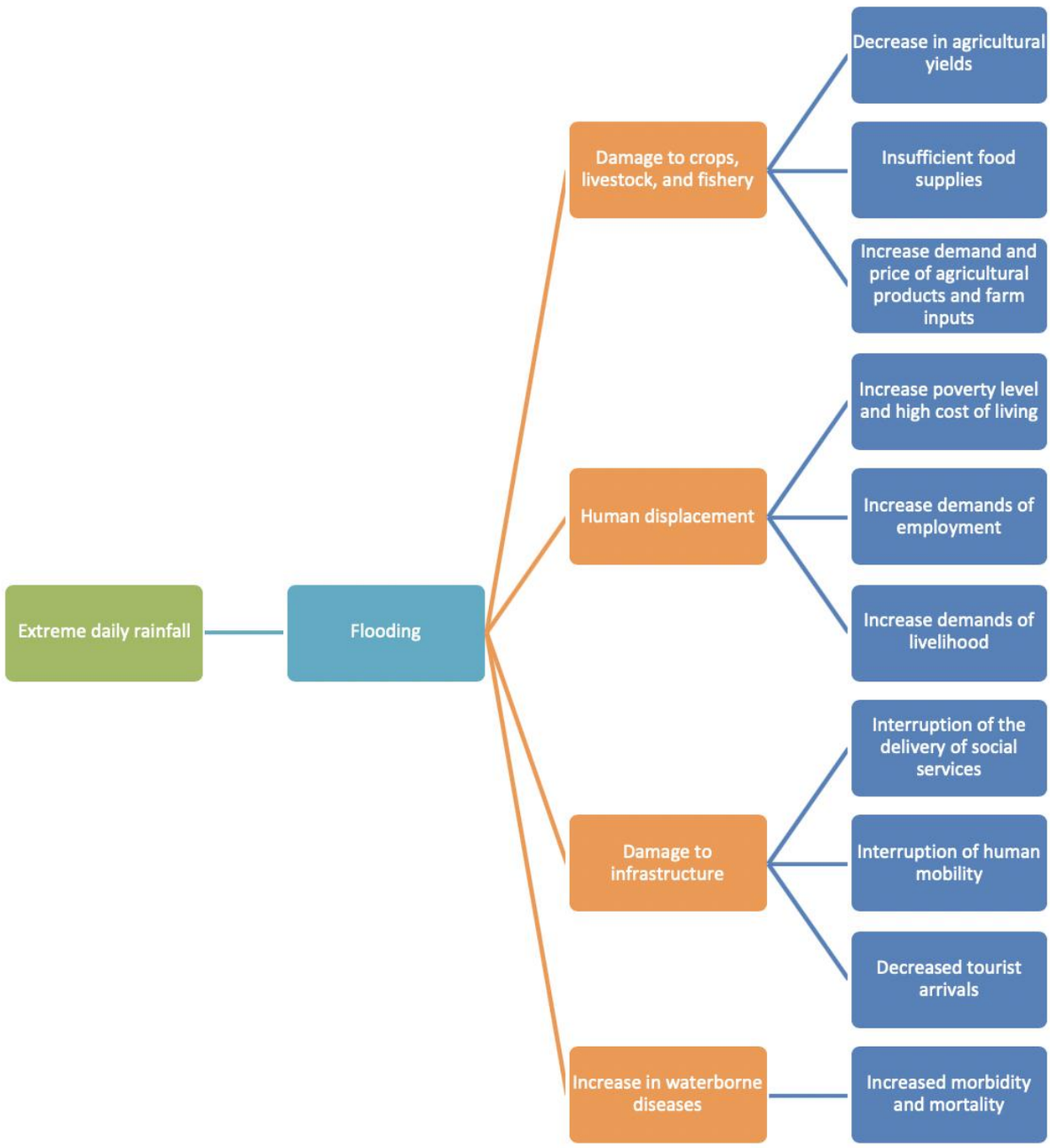


Figure 11. Impact Chain Diagram of climate related extreme events

Table 43. Climate change impacts in Dingalan

A	B	C	D	E	F
Climate Variable	Describe impacts to population	Describe impacts to natural Resource-based production areas	Describe impacts to critical point facilities	Describe impacts to urban use areas	Describe impacts to lifelineutilities

Future Temperature Trends	Increase the level of stress, upper respiratory infections, dehydration, infectious diseases, skin infection, poverty and malnutrition, heat stroke, hypertension	Decrease in crop production due to low crop absorption of nutrients Altered ecosystem due to migration of important species Decrease in fish population due to coral bleaching caused by increase in temperature Decrease in poultry and livestock population due to heat stress Decrease in inland fishery production due to drying of ponds	Damage to concrete roads Water supply shortage	Reduced availability of potable water supply to sustain urban use areas	Drought, damage to crops, water shortage, revenue loss
Future Rainfall Trends	Increase level of diarrhea, parasitism, dengue fever, skin infection, measles, influenza, malnutrition, pneumonia, leptospirosis Suspension of classes	Decrease in crop production due to submersion and siltation Destruction of upland farm due to heavy/continuous rainfall	Damage to properties, flooding, inaccessibility	Reduced availability of potable water supply to sustain urban use areas	Reduced potable & tap water availability
Future Number of Hot days	Heat stroke, hypertension, dehydration, malnutrition, pneumonia, skin infection, acute conjunctivitis, respiratory infections, acute gastroenteritis	Decrease in crop production due to low crop absorption of nutrients Altered ecosystem due to migration of important species Forest and grass fire	Damage to concrete roads, water supply shortage	Increased temperatures in urban area, increased energy consumption for cooling	Drought, damage to crops, water shortage, revenue loss
Future Number of Dry days	Skin infection, resperatory tract infection, hypertention, malnutrition, diarrhea and Parasitism	Decrease in crop production Heat stress of inland fishes	Damaged to concrete roads, water supply shortage	Drought, damaged to crops, water shortage	None

Future Extreme Rainfall Events	Increased incidence of diarrhea, parasitism, dengue fever, skin infection, measles, influenza, malnutrition, pneumonia. suspension of class	Flooding, debris flows, health Ppoblems, damage to crops	Damage to properties, flooding	Damage to properties, severe flooding,	Potential damages or disruption of key transportation infrastructure affecting area access and linkages Potential damage and disrution of distribution networks and services
Future Sea Level Changes	Displacement of habitation area, migration to affected land area, land accretion	Decrease in production due to intrusion of saline water to agricultural production area	Damage to properties due to accretion of land	Decrease in land area along coastal area	Damaged to infrastructure especially those along coastal area
Future Typhoon/Supertyphoon Occurrences	Malnutrition, diarrhea, pneumonia, measles, gastroenteritis, dehydration, sepsis and death	Low food production – both fishery and agricutural products	Damage to properties	Damage to properties, disruption of economic activities, incovenience	Damaged to properties and utilities

HAZARD EXPOSURE DATABASE

The Exposure Database provides baseline information pertaining to the systems of interests in Dingalan, Aurora. Systems of interests, as defined by the HLURB (2015), are population, natural resources, critical facilities, urban use areas, and lifeline utilities. They are defined as follows:

- Population refers to elements of the human population residing in the area, including assets, demographic characteristics, and related activities which may affect a population's adaptive capacity.
- Natural resources refer to areas used for agricultural, fisheries, and other land- or water-based production.
- Critical Facilities are physical infrastructures crucial for deliviering various socioeconomic activities in the locality, except those directly related to transportation, communications, water, and electricity. They include schools, health centers, gymnasiums, and other public and government infrastructures.
- Urban Use Areas are land use areas in the area, as well as the related activities characterizing each land use area, including variables affecting its adaptive capacities.
- Lifeline Utilities are infrastructures related to transportation, communications, and the delivery of water and electricity.

Population Exposure Database

In determining the sensitivity of exposed population characteristics in Dingalan, the distribution of settlements in Dingalan was mapped. Additionally, data regarding households living in dwelling units with walls made from light to salvageable materials, information about the number of elderly, young dependents or children 0-12 years old, and persons with disabilities (PWDs).

1. Population exposure attribute information

Table 44 the attribute information for the exposed units of population is summarized below:

Table 44. Population Exposure Attribute Information

Barangay	Exposure			Sensitivity			
	Area (ha)	Population (2015)	Population Density (persons/ha)	Children (0-5 yrs old)	Disadvantaged Families	PWDs	Elderly (60 YO and above)
Aplaya	36	1,802	50	178	No data	11	120
Butas na Bato	440	909	2.07	84	No data	19	55
Caragsacan	2,088	2,992	1.43	225	No data	76	250
Davildavilan	2,117	1036	.49	70	No data	18	100
Dikapanikian	1,622	404	.25	40	No data	6	22
Ibuna	5,795	3,624	.63	370	No data	58	307
Matawe	3,130	3,356	1.07	330	No data	36	241
Paltic	941	5,075	5.4	437	No data	57	375
Poblacion	41	1,084	26.43	64	No data	11	110
(Dugnar)	No data	No data	No data	No data	No data	No data	No data
Tanawan	3,675	820	0.22	59	No data	12	51
Umiray (Malamig)	10,970	4,380	0.4	429	No data	67	301
Total				**2,286**	No data	**371**	**1932**

Table 45. Adaptive Capacity Related to Population Exposure Attributes

Wealth	Information	Infrastructure	Technology	Institution and Governance	Social Capital

LGU funds, DRRM funds External sources are DOT and BFAR Majority of the affectedfamilies belongto low-incomefamilies	Tsunami, fire and earthquakedrill in allestablishments (1- 2 times/year), CBDRRM, first aid training	Construction of flood control facilities and proper drainage system	Radio communication, emergency siren, hotline numbers, EWS in place	Ordinance: pre-emptive and forced evacuation should be strictly implemented Established active BDRRMC Solid Waste Ordinance should be strictly implemented BDRRM Plan, Contingency Plan and EvacuationPlan	Conduct of capability buidling programs, in coordination with CSOs, POs, and NGOs

Table **46**. Population Attributes Exposed to Hazards in Dingalan

Barangay	Exposure Indicators			Sensitivity Indicators							
	Residential Area (ha)	Population	Population Density in Residential Areas (person/ha)	No. of Informal Settlers	% of InformalSettlers	No. of Population Living in Dwelling Units with Walls Made from Light to Salvageable Materials	% of Population Living in Dwelling Units with Walls Made from Light to Salvageable Materials	No. of Elderly (60 years old and above)	% of Elderly (60 years old and above)	No. of Young Dependents (Children, 0-12 years old)	% of Young Dependents (Children, 0-12 years old)
Aplaya	36.00	1,802	50.05555556	34.00	2%	27	1%	120	7%	374	21%
Butas Na Bato	440.00	909	2.065909091	18.00	2%	16	2%	55	6%	178	20%
Cabog (Matawe)	3,130.00	3,356	1.072204473	7.00	0%	0	0%	241	7%	691	21%
Caragsacan	2,088.00	2,992	1.432950192	13.00	0%	13	0%	250	8%	488	16%
Davildavilan	2,117.00	1,036	0.489371752	10.00	1%	3	0%	100	10%	157	15%
Dikapanikian	1,622.00	404	0.249075216	1.00	0%	1	0%	22	5%	83	21%
Ibona	5,795.00	3,624	0.625366695	5.00	0%	4	0%	307	8%	750	21%
Paltic	941.00	5,075	5.393198725	145.00	3%	4	0%	375	7%	909	18%
Poblacion	41.00	1,084	26.43902439	13.00	1%	6	1%	110	10%	147	14%
Tanawan	3,275.00	820	0.250381679	4.00	0%	6	1%	51	6%	135	16%
Umiray (Malamig)	10,970.00	4,380	0.399270738	41.00	1%	114	3%	301	7%	882	20%

Table 47. Adaptive Capacity Related to Population Attributes

Barangay	# of PWDs	% of Persons with Disabilities	# of Households Living Below the Poverty Threshold	# of Malnourished Individuals	% of Malnourished Individuals	Wealth	Information	Infrastructure	Technology	Institution and Governance	Social Capital
						Economic/ financial capability of households to adapt to experienced impacts	Level of information known by households on how to adapt to experienced impacts	Condition of housing structures to adapt to experienced impacts	Households possess necessary technologies to adapt to experienced impacts	Government mechanisms in place to adapt to experienced impacts	Level of social networks in barangay to adapt to experienced impacts
Aplaya	11	1%	246	22	1%	Low	Medium	Good	Medium	Medium	Medium
Butas Na Bato	19	2%	129	12	1%	Low	Medium	Good	Medium	Medium	Medium
Cabog (Matawe)	36	1%	515	4	0%	Low	Medium	Good	Medium	Medium	Medium
Caragsacan	76	3%	390	24	1%	Low	High	Good	Medium	Medium	Medium
Davildavilan	18	2%	124	4	0%	Low	Medium	Good	Medium	Medium	Medium
Dikapanikian	6	1%	64	9	2%	Low	Medium	Good	Low	Medium	Low
Ibona	58	2%	512	9	0%	Low	Medium	Good	Low	Medium	Medium
Paltic	57	1%	684	77	2%	Medium	Medium	Good	Medium	Medium	Medium
Poblacion	11	1%	86	3	0%	Medium	Medium	Good	Medium	Low	Medium
Tanawan	12	1%	99	6	1%	Low	Medium	Good	Medium	Medium	Medium
Umiray (Malamig)	67	2%	604	95	2%	Low	Medium	Good	Low	Medium	Medium

Barangay Paltic has the highest population with 5, 075 individuals while Barangay Dikapanikian has the lowest with only 404 individuals. Relatively, they also have the highest number of informal settlers with 145 families. In terms of population living in dwelling units with walls made from light to salvageable materials, Umiray has the highest number of households which is 3% (114 households of the total barangay population).

Poblacion has 110 elderly individuals, which comprise 10% of its total population of 1,084; while Davildavilan has 100 elderly individuals, which also correspond to 10% of the barangay's totdal population. As for the young dependents, Barangays Aplaya, Cabog, and Ibona have children aged 0-12 years which make up 21% of their respective total populations. The number of people with disabilities (PWDs) is highest in Caragsacan, since 3% of its total population consists of differently-abled people.

It should be noted that Paltic has the highest number of households living below the poverty threshold (684 households), while 2% of the respective total populations of Barangays Dikapanikian, Paltic, and Umiray have been diagnosed as malnourished.

With regards to adaptive capacity, Paltic and Poblacion were deemed to have medium financial capability to adapt; Caragsacan was the only barangay found to have a high level of information on how to adapt to experienced impacts; all twelve barangays have housing structures of satisfactory conditions; Barangays Aplaya, Butas na Bato, Cabog, Caragsacan, Davildavilan, Paltic, Poblacion, and Tanawan reportedly had medium access to technology; all the barangays, with the exception of Poblacion, have government mechanisms relevant to adaptation; and all the barangays aside from Dikapanikian were deemed to have medium levels of social networks.

2. Exposure Maps for Hazards

Most of the households (represented by blue dots) are clustered by the coast and along major thoroughfares. The following maps present data regarding the population of Dingalan, and how they may be affected by potential hazards such as the following:

- **Rain-induced landslides** – Majority of the barangays are highlighted in orange, which represents high susceptibility to the said hazard, with some areas in green (moderate susceptibility) interspersed in between. Given thus, almost all of the households – with the exception of a few in Umiray – are potentially impacted by rain-induced landslides.
- **Liquefaction** – Areas highly prone to liquefaction (highlighted in red) can be found in Matawe, Ibona, and Umiray. Clusters of households within the said barangays are potentially affected by this hazard.
- **Tsunamis** – Areas susceptible to tsunamis are mostly along the coast, such as Dikapanikian, Paltic, Ibona, and Umiray. Households located in the said areas are highly prone to tsunamis.
- **Storm surges** – Similar to tsunamis, areas highly prone to storm surges are also located along the coast, such as Dikapanikian, Ibona, and Umiray. Given thus, households along the coast can be severely affected by storn surges.
- **Ground shaking** – Faultlines pass through all of the barangays, with the exception of Poblacion. This makes them vulnerable to ground shaking.

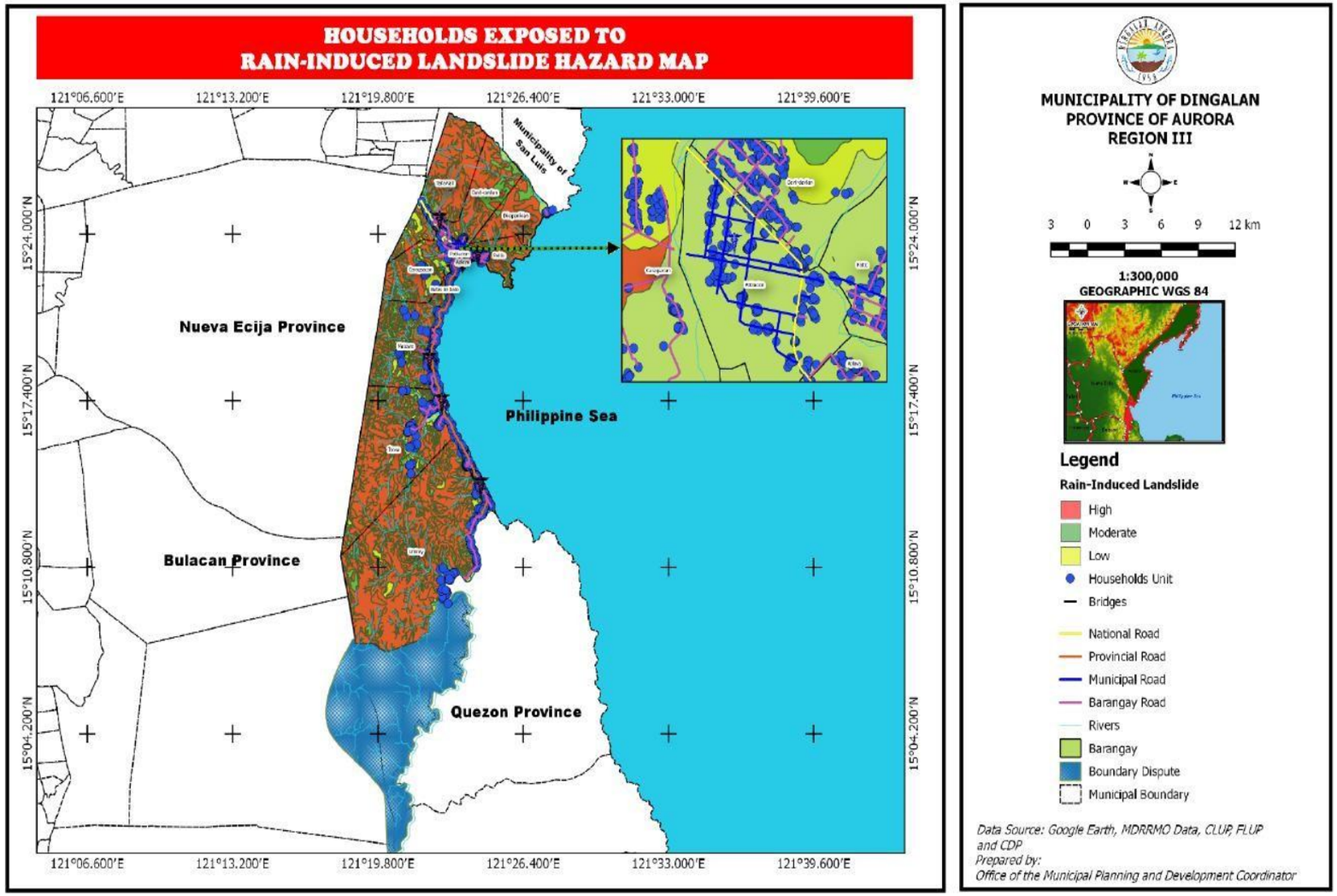


Figure 12. Households Exposed to Rain-Induced Landslide Hazard Map

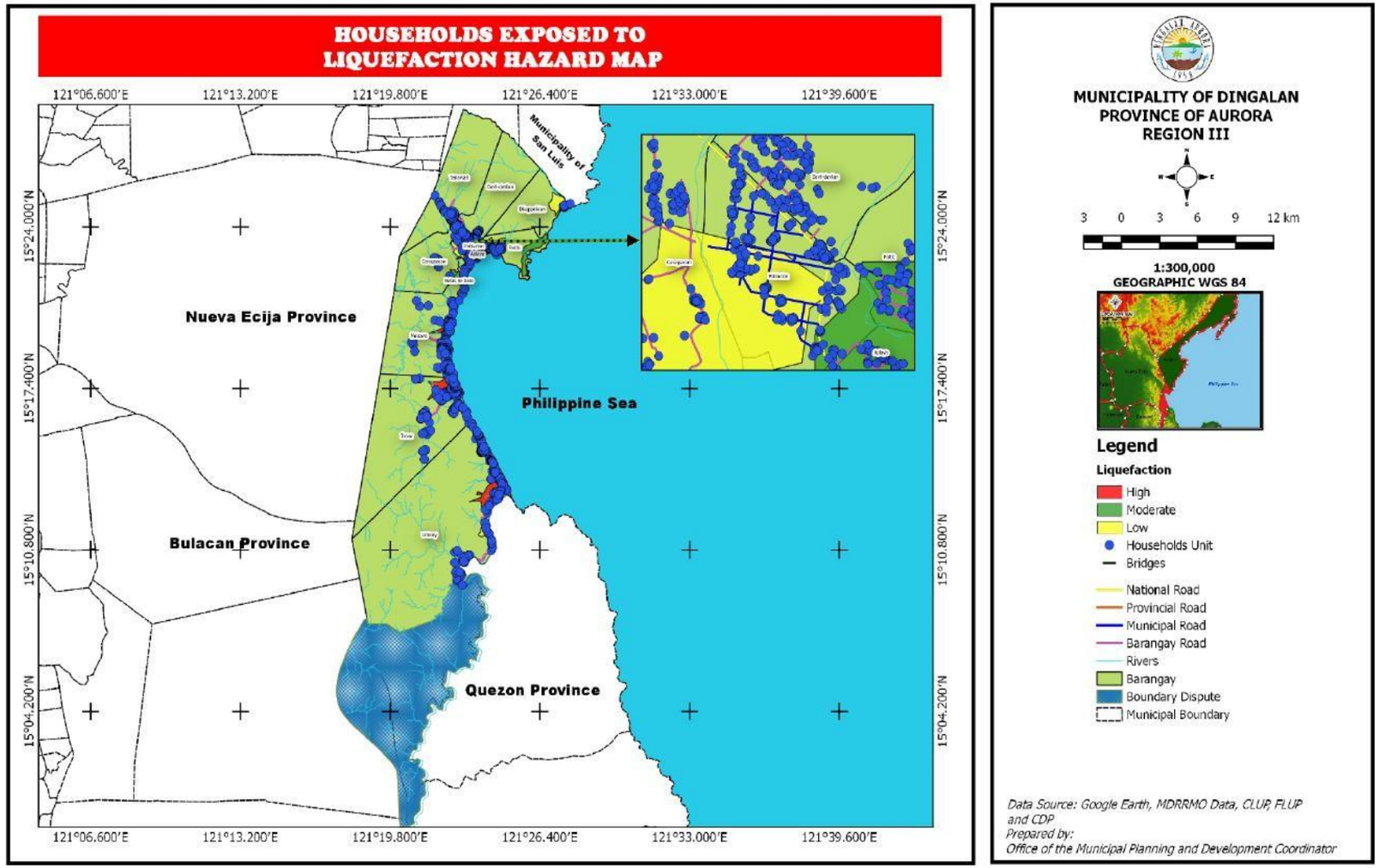


Figure 13. Householeds Exposed to Rain-Induced Landslide Hazard Map

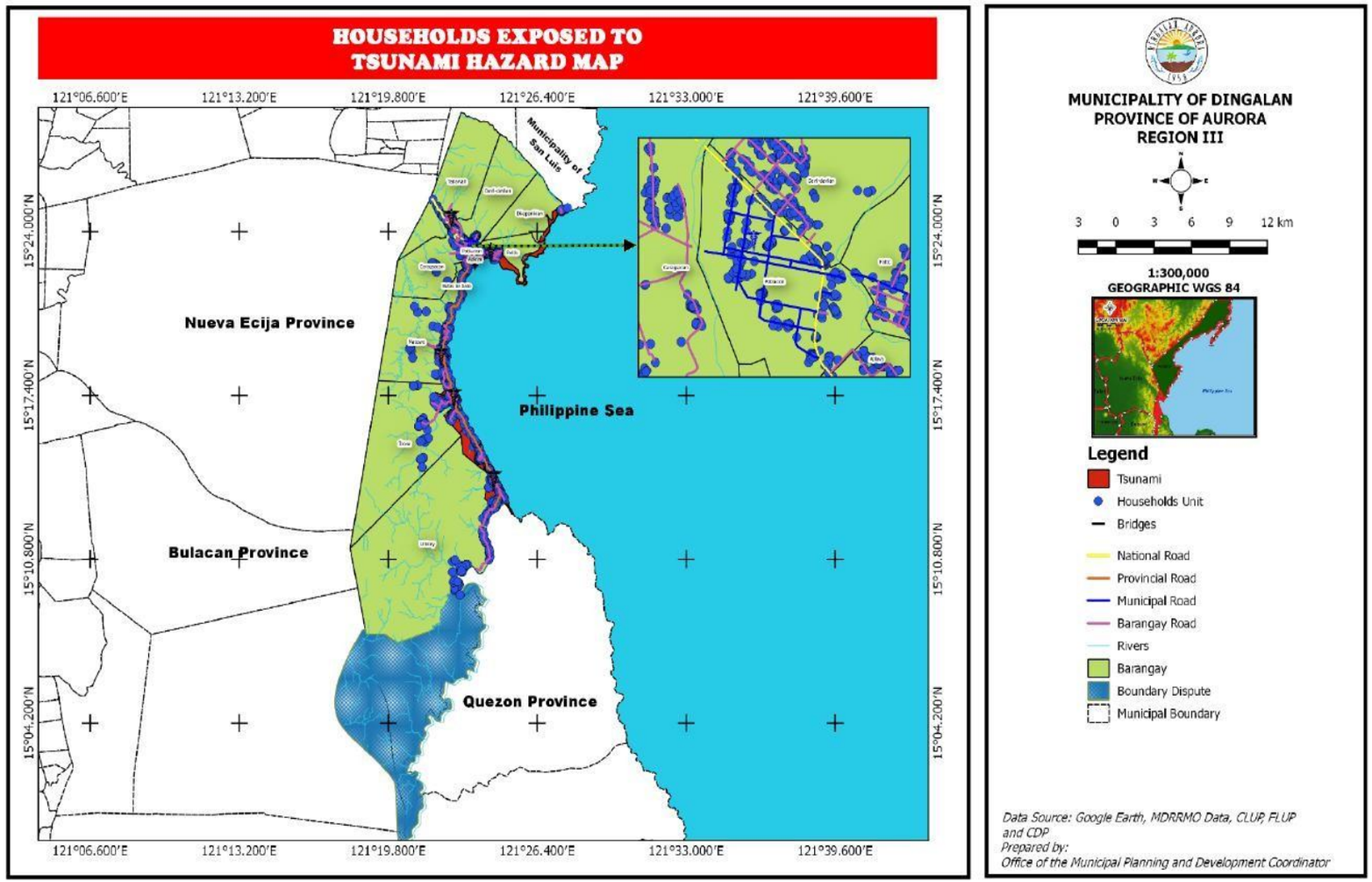
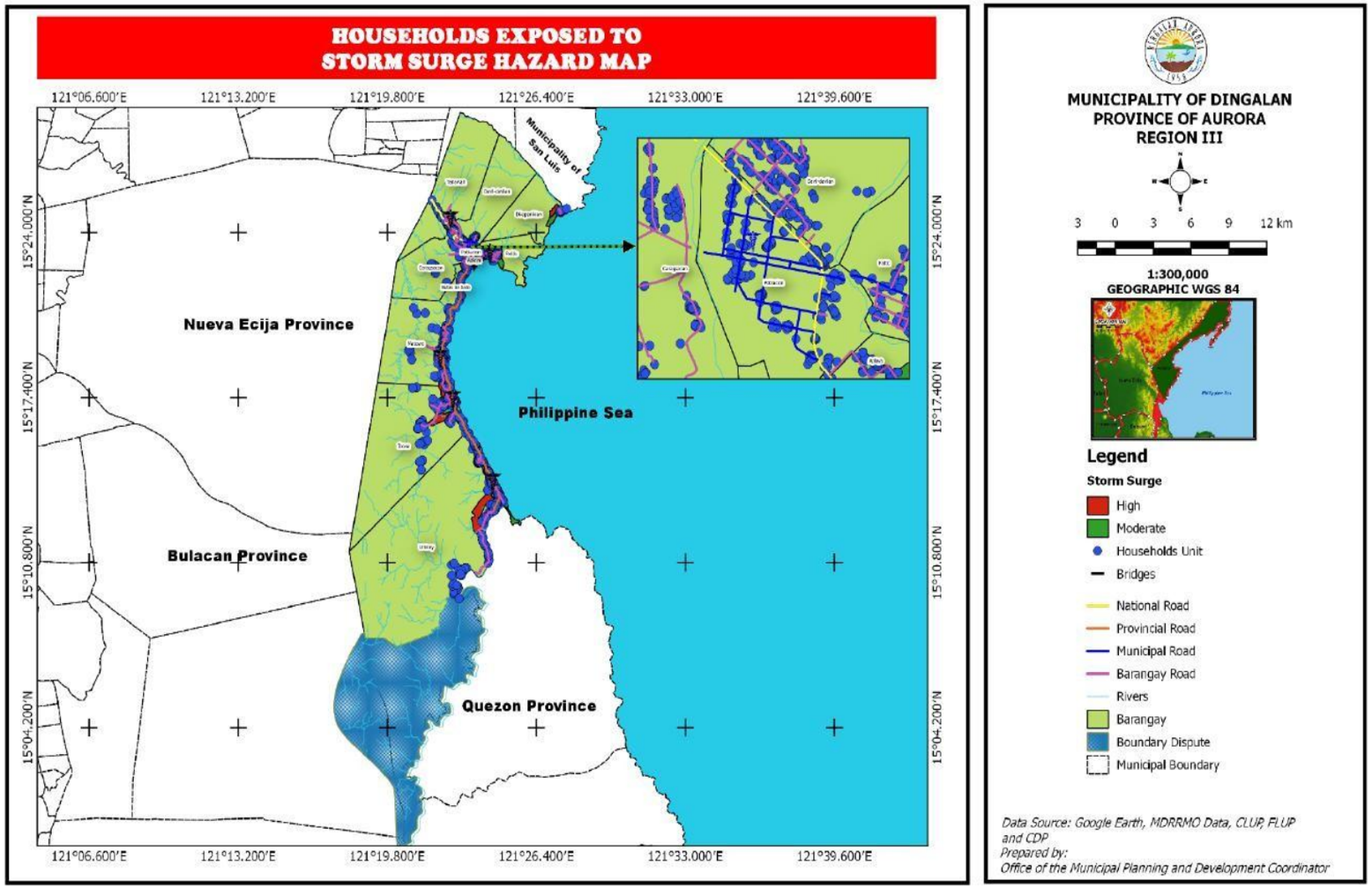


Figure 14. Households Exposed to Tsunami Hazard Map


HOUSEHOLDS EXPOSED TO
STORM SURGE HAZARD MAP
121°06.600'E
121°13.200'E
121°19.800'E
121°26.400'E
121°33.000'E
121°39.600'E
15°24.000'N
15°17.400'N
15°10.800'N
15°04.200'N
Municipality of San Luis
Nueva Ecija Province
Philippine Sea
Bulacan Province
Quezon Province

MUNICIPALITY OF DINGALAN
PROVINCE OF AURORA
REGION III
3 0 3 6 9 12 km
1:300,000
GEOGRAPHIC WGS 84
Legend
Storm Surge
High
Moderate
Households Unit
Bridges
National Road
Provincial Road
Municipal Road
Barangay Road
Rivers
Barangay
Boundary Dispute
Municipal Boundary
Data Source: Google Earth, MDRRMO Data, CLUP, FLUP and CDP
Prepared by:
Office of the Municipal Planning and Development Coordinator

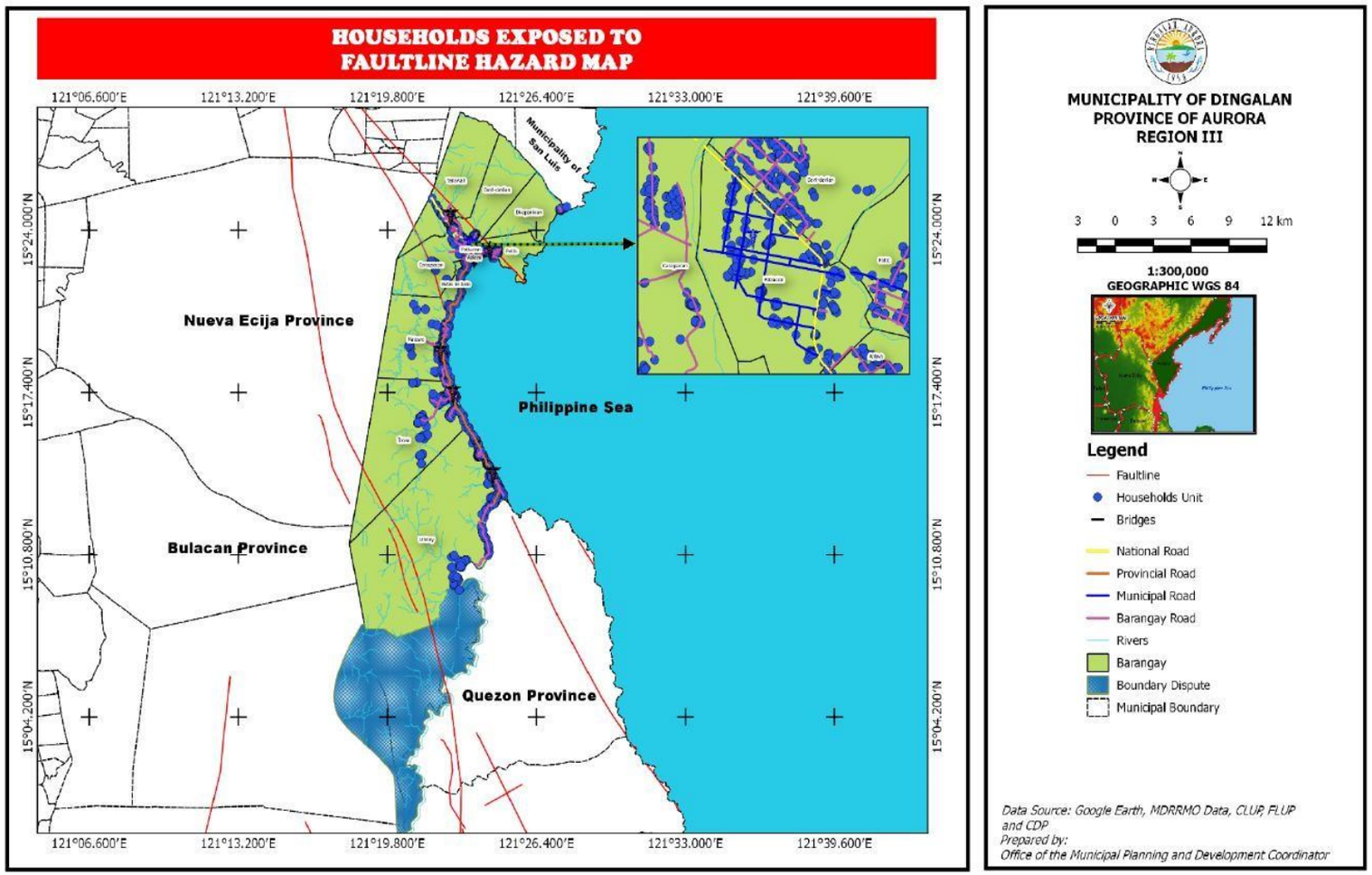


Figure 16. Households Exposed to Faultline Hazard Map

Natural Resources Exposure Database

Existing natural resources within the Municipality – such as areas allotted for agriculture, aquaculture, and livestock raising – should be mapped out and studied in order to properly mitigate potential disasters. Available data regarding such exposed elements are discussed in this chapter.

1. Natural Resources Exposure Attribute Information

Table 48. Natural Resources Exposure Attribute Information

Barangay	Exposure indicators						Sensitivity indicators						
	Number of Crop-based Farming Dependent Households	Number of Fishing-Dependent Households	Number of Livestock & Poultry-Dependent Households	Total Area Allocation for Agriculture (ha)	Total Area Allocation for Aquaculture (ha)	Dominant/ Major Crops/ Varieties of Produce	Average Output Per Hectare of Major Produce (PhP)	Average Income of Land-Based Farming Dependent Household per Month (PhP)	Average Income of Fishing-Dependent Household per month (PhP)	Average Income of Livestock/ Poultry-Dependent Household per month (PhP)	Estimated % of Farming Families Using Sustainable Production Techniques	Estimated % of Production Area with Irrigation Coverage	Estimated % of Areas with Water Impoundment
Aplaya	10	850	82	3	0	fishing	₱300.00	₱3,000.00	₱2,500.00	₱1,500.00	40.00%	0.00%	0.00%
Butas Na Bato	123	83	88	283	0	coconut & banana	₱300.00	₱3,000.00	₱2,500.00	₱1,500.00	40.00%	0.00%	0.00%
Cabog (Matawe)	181	199	98	364	0	coconut & banana	₱300.00	₱3,000.00	₱2,500.00	₱1,500.00	55.00%	0.00%	0.00%
Caragsacan	36	50	136	72	1.272	coconut, rice & banana	₱300.00	₱3,000.00	₱2,500.00	₱1,500.00	55.00%	3.80%	3.20%
Davildavilan	30	0	45	42.25	0.372	coconut & banana	₱300.00	₱3,000.00	₱2,500.00	₱1,500.00	30.00%	0.00%	0.00%
Dikapanikian	28	28	3	46	0	coconut & banana	₱300.00	₱3,000.00	₱2,500.00	₱1,500.00	20.00%	0.00%	0.00%
Ibona	494	80	152	988	2.2941	coconut & banana	₱300.00	₱3,000.00	₱2,500.00	₱1,500.00	60.00%	4.28%	3.80%
Paltic	38	1,587	285	45.5	0.09	coconut & fishing	₱300.00	₱3,000.00	₱2,500.00	₱1,500.00	0.00%	0.00%	0.00%
Poblacion	3	0	34	0.75	0	commercial	₱300.00	₱3,000.00	₱2,500.00	₱1,500.00	0.00%	0.00%	0.00%
Tanawan	10	0	44	15.5	0.11	ornamental farming	₱300.00	₱3,000.00	₱2,500.00	₱1,500.00	25.00%	0.00%	0.00%
Umiray (Malamig)	403	568	184	1,047	1.5084	coconut	₱300.00	₱3,000.00	₱2,500.00	₱1,500.00	60.00%	3.50%	3.20%

Table 49. Adaptive Capacity Related to Natural Resource Attributes

Barangay	Wealth	Information	Infrastructure	Technology	Institution and Governance	Social Capital
	Percentage of Production Areas Covered with Insurance and Micro-financing	Percentage of Farmers with Access to Hazard Information	Agricultural-related Infrastrcutures' Capacity to Withstand Disaster Events	Presence of Early Warning Systems	Presence of Policies to Safeguard Natural Resources	Presence of Farmer Associations/ Cooperatives
Aplaya	70%	100%	Low	Yes	Yes	Yes
Butas Na Bato	65%	80%	Low	Yes	Yes	Yes
Cabog (Matawe)	64%	85%	Low	Yes	Yes	Yes
Caragsacan	13%	90%	Medium	Yes	Yes	Yes
Davildavilan	25%	100%	Low	Yes	Yes	Yes
Dikapanikian	21%	50%	Low	Yes	Yes	Yes
Ibona	17%	80%	Medium	Yes	Yes	Yes
Paltic	40%	100%	Medium	Yes	Yes	Yes
Poblacion	0%	100%	Medium	Yes	Yes	Yes
Tanawan	0%	100%	Low	Yes	Yes	Yes
Umiray (Malamig)	26%	80%	Medium	Yes	Yes	Yes

Ibona has the highest number of crop-based farming dependent households (494 families), while Paltic has the highest number of fishing-dependent households (1,587 families), possibly due to the presence a feeder port in the barangay. As for livestock and poultry-dependent households, Paltic has the highest number, with 285 families.

With regards to areas allotted for agriculture, Umiray has the largest with 1,047 has. while Ibona has the largest areas designated for aquaculture (2.2941 ha). Coconut is the main product of the Butas na Bato, Cabog, Caragsacan, Davildavilan, Dikapanikian, Ibona, Paltic, and Umiray; banana, meanwhile, is mostly produced the aforementioned barangays, except for Paltic and Umiray. Generally, Paltic and Aplaya are known for fishing, while Tanawan is famed for ornamental farming.

The following should also be sufficiently noted:

- Ibona and Umiray have the highest estimated percentage of farming families using sustainable production techniques;
- Caragsacan, Ibona, and Umiray have the largest estimated percentage of production areas with irrigation coverage;
- Aplaya has the highest percentage of production areas covered with insurance and micro-financing;
- All the farmers of Aplaya, Davildavilan, Paltic, and Tanawan have access to hazard information;
- Agriculture-related infrastructure in Caragsacan, Ibona, Paltic, Poblacion, and Umiray are of medium-level strength;
- All barangays have early warning systems and policies to safeguard natural resources; and
- All barangays with the exception of Dikapanikian have farmers assocations and/or cooperatives.

2. Exposure Maps for Hazards

The following maps present data on the location of crops (such as rice, vegetables, bananas, coconuts, and other fruits), fishponds, and mangroves, as well as how they may be affected by the following potential hazards:

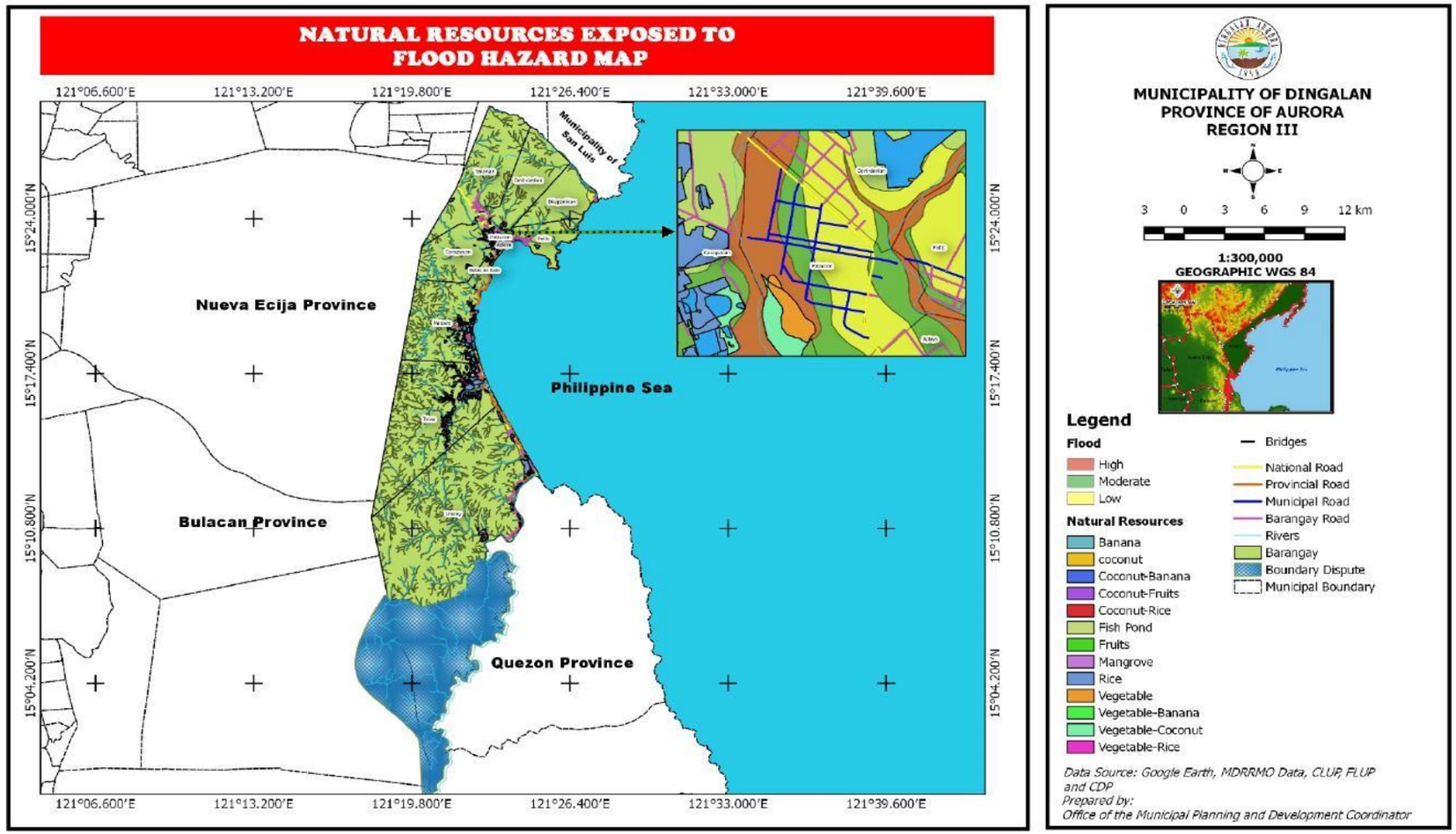


Figure 17. Natural Resources Exposed to Flood Hazard Map

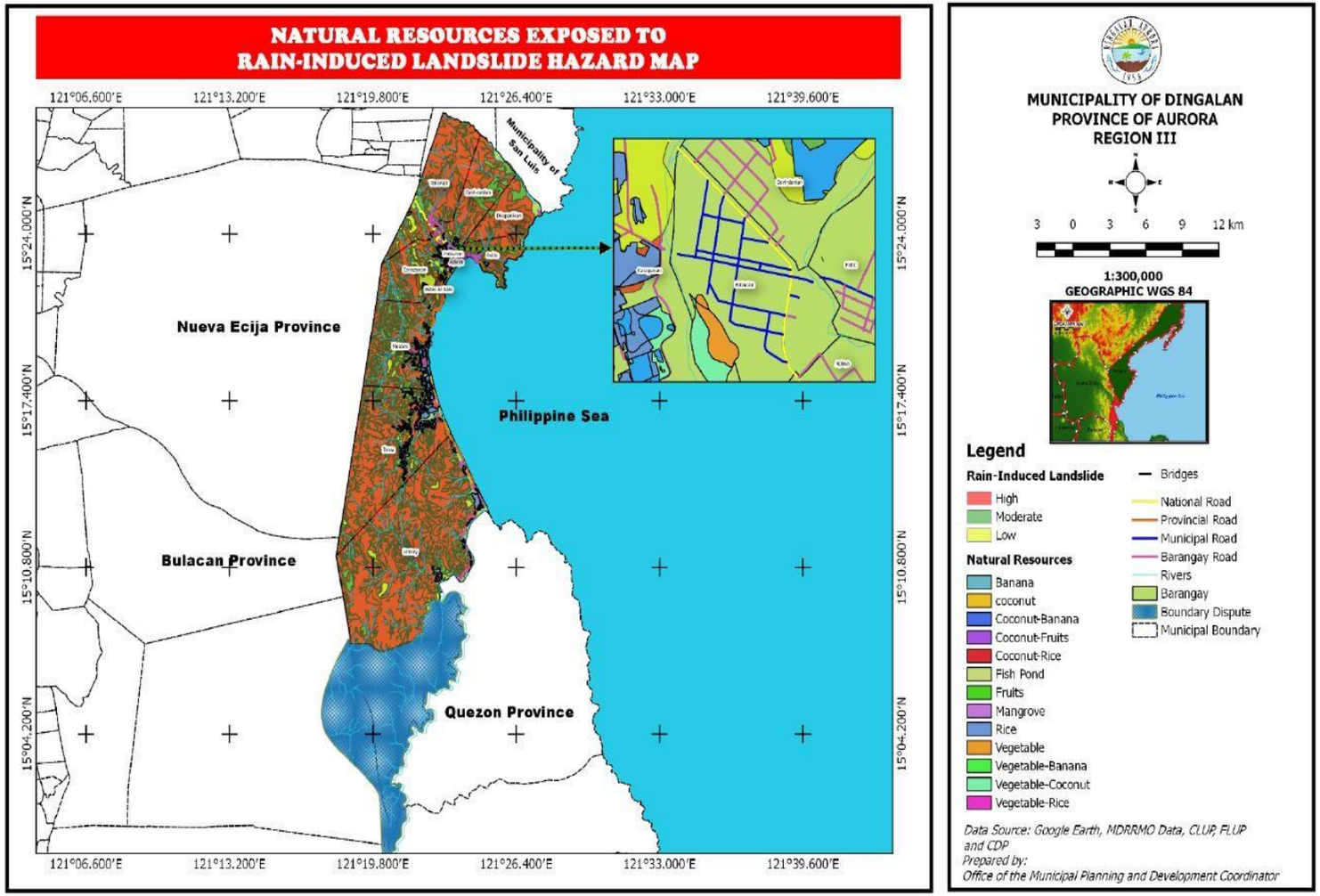


Figure 18. Natural Resources Exposed to Rain-Induced Landslide Hazard Map

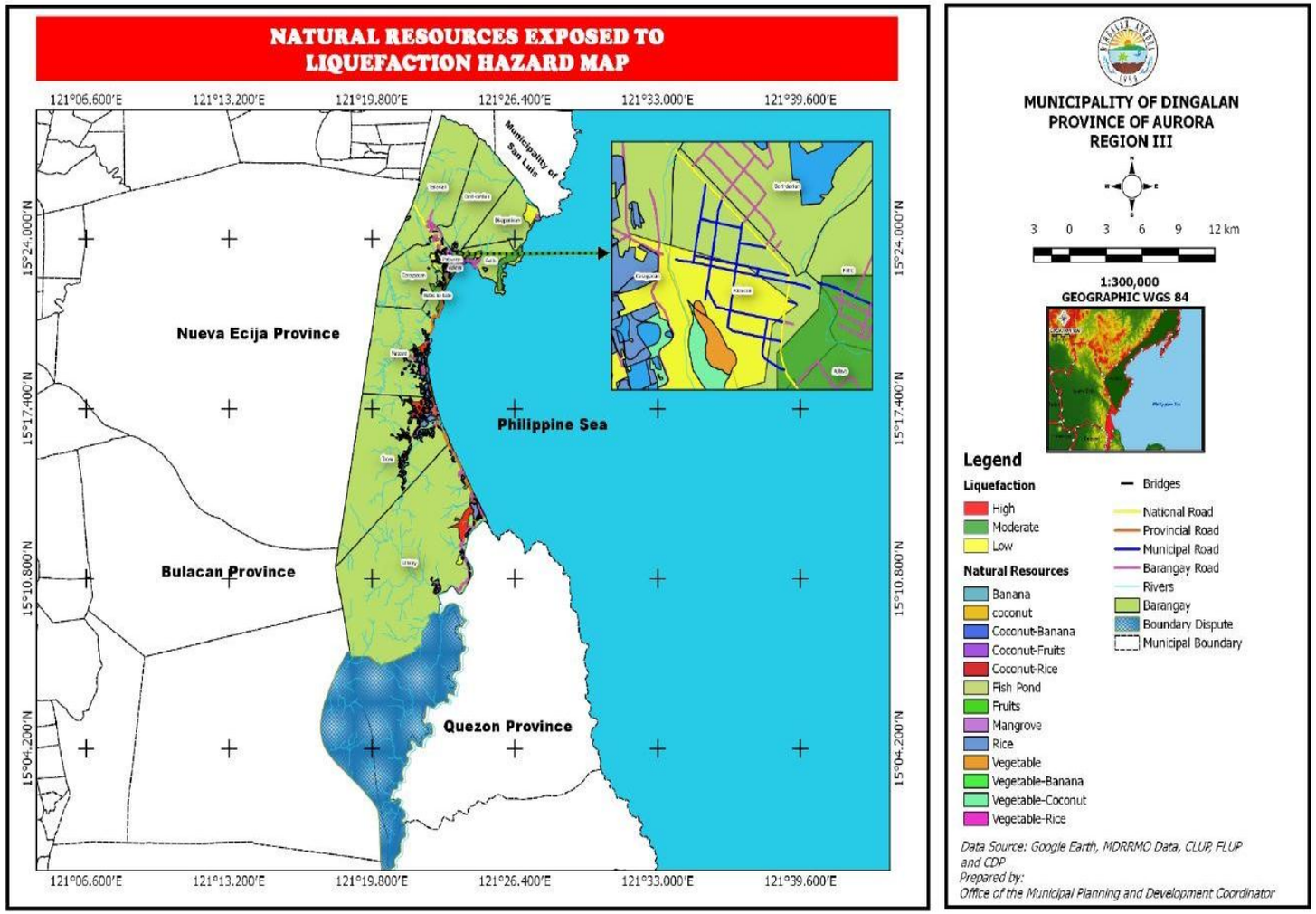


Figure 19. Natural Resources Exposed to Liquefaction Hazard Map

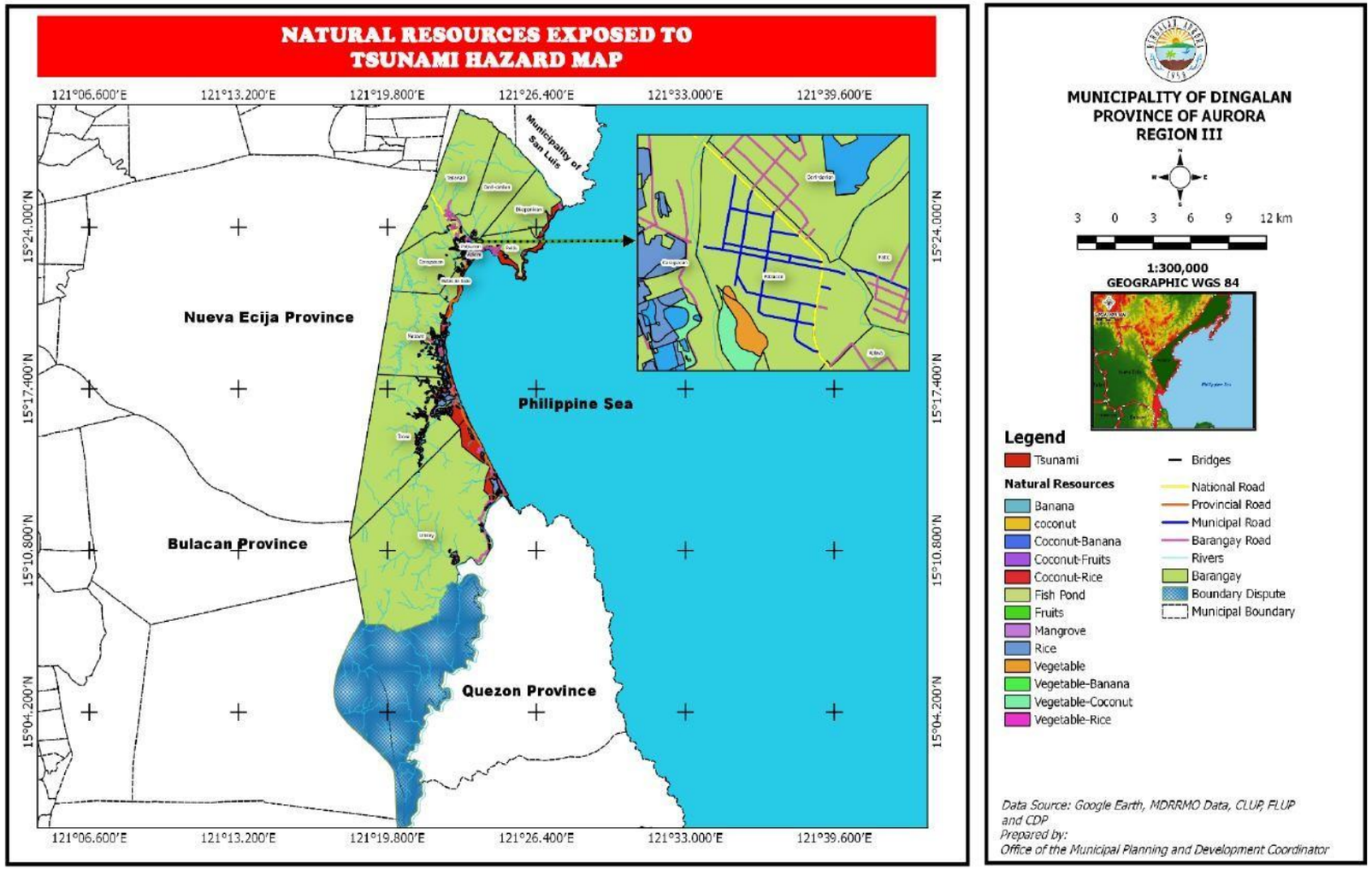

NATURAL RESOURCES EXPOSED TO TSUNAMI HAZARD MAP
121°06.600'E
121°13.200'E
121°19.800'E
121°26.400'E
121°33.000'E
121°39.600'E
15°24.000'N
15°17.400'N
15°10.800'N
15°04.200'N
Municipality of San Luis
Nueva Ecija Province
Philippine Sea
Bulacan Province
Quezon Province
MUNICIPALITY OF DINGALAN
PROVINCE OF AURORA
REGION III
3 0 3 6 9 12 km
1:300,000
GEOGRAPHIC WGS 84
Legend
Tsunami
Natural Resources
Banana
coconut
Coconut-Banana
Coconut-Fruits
Coconut-Rice
Fish Pond
Fruits
Mangrove
Rice
Vegetable
Vegetable-Banana
Vegetable-Coconut
Vegetable-Rice
Bridges
National Road
Provincial Road
Municipal Road
Barangay Road
Rivers
Barangay
Boundary Dispute
Municipal Boundary
Data Source: Google Earth, MDRRMO Data, CLUP, FLUP and CDP
Prepared by:
Office of the Municipal Planning and Development Coordinator

Figure 20. Natural Resources Exposed to Tsunami Hazard Map

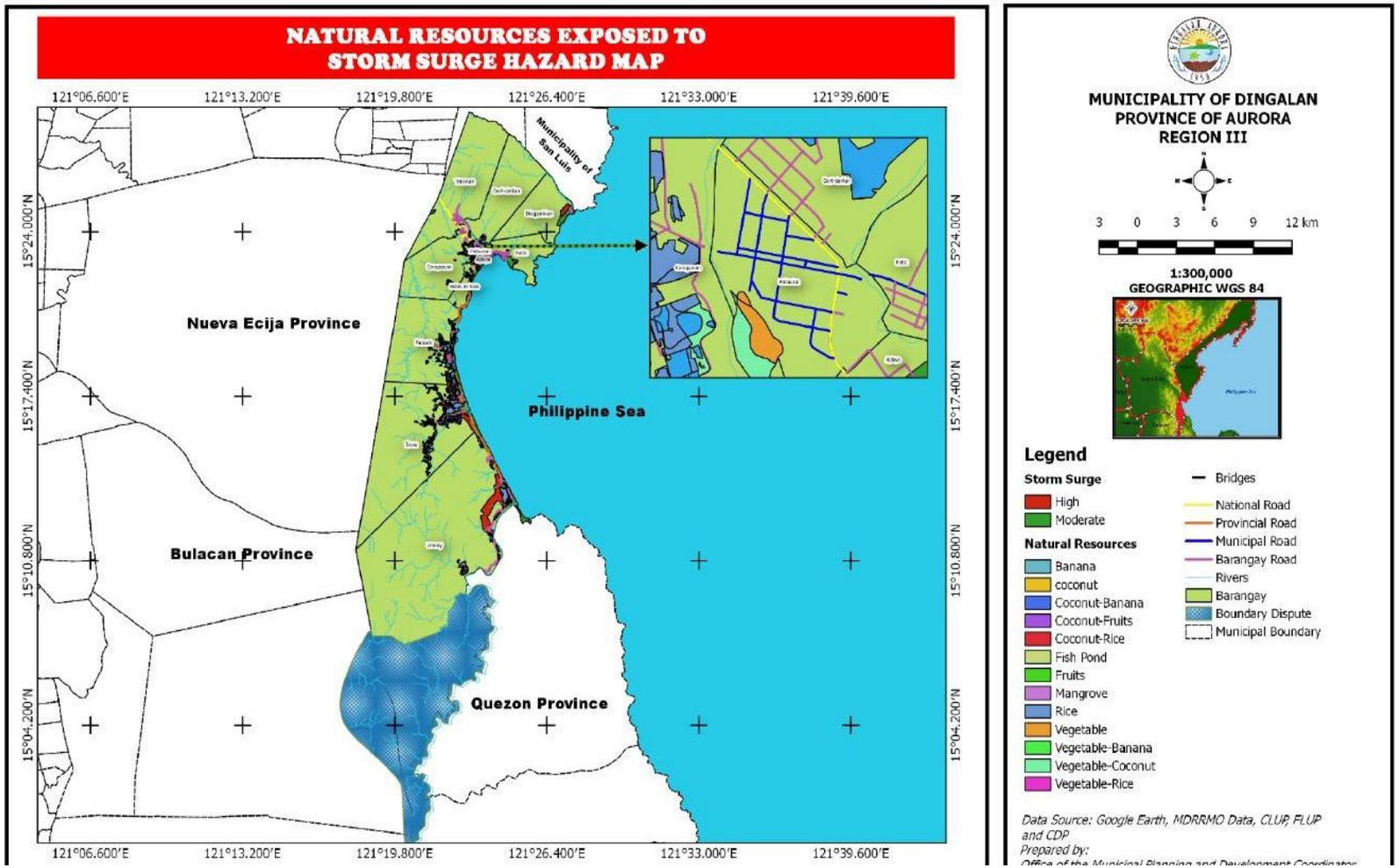


Figure 21. Natural Resources Exposed to Storm Surge Hazard Map

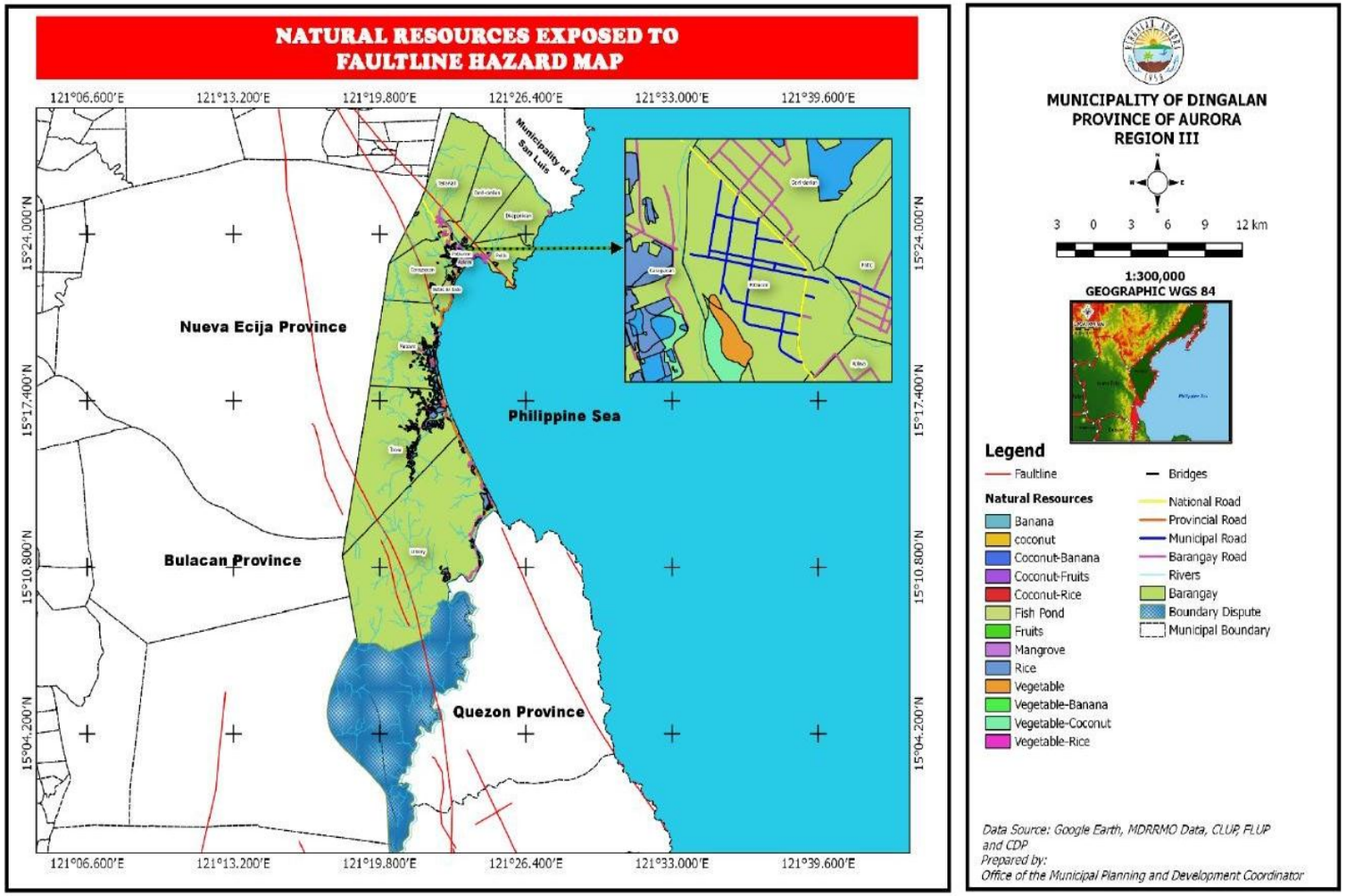


Figure 22. Natural Resources Exposed to Faultline Hazard Map

Critical Point Facilities Exposure Database

Educational facilities, health facilities, and other government buildings are considered as critical infrastructure, since these can function as evacuation areas. More importantly, health facilities – such as rural health units, and local hospitals – should not cease their operations in the event of a disaster. Available data regarding such exposed elements are discussed in this chapter.

1. Critical Point Facilities Exposure Attribute Information

Table 50. Critical Point Facilities Attributes Exposed to Hazards in Dingalan

Barangay	Exposure Indicators									Sensitivity Indicators							
	No. of Preschool Campuses	No. of Elementary School Campuses	No. of High School Campuses	No. of College/ Vocational School Campuses	No. of Hospitals	No. of RHUs	No. of Barangay Hall	No. of Gymnasiums	No. of other Government-owned or occupied Structures	No. of Preschool Buildings in Need of Extensive Repair	No. of Elementary School Buildings in Need of Extensive Repair	No. of High School Buildings in Need of Extensive Repair	No. of College Buildings in Need of Extensive Repair	No. of Hospital Buildings in Need of Extensive Repair	No. of RHU Buildings in Need of Extensive Repair	No. of Barangays Halls in Need of Extensive Reapir	No. of Gymnasiums in Need of Extensive Repair
Aplaya	1	0	0	0	0	1	1	1	2	0	0	0	0	0	0	No	0
Butas Na Bato	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	Yes	0
Cabog (Matawe)	2	2	1	0	0	1	1	1	1	0	0	0	0	0	0	Yes	0
Caragsacan	4	2	1	0	1	0	1	1	1	1	0	0	0	0	0	Yes	0
Davildavilan	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	Yes	0
Dikapanikian	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	Yes	0
Ibona	3	2	1	0	0	1	1	1	4	0	1	0	0	0	0	Yes	0
Paltic	3	1	1	1	0	1	1	2	2	0	0	0	0	0	0	No	0

Poblacion	1	3	0	0	1	1	1	2	8	0	1	0	0	0	1	No	0
Tanawan	1	1	0	0	0	1	1	0	1	0	0	0	0	0	0	No	0
Umiray (Malamig)	2	3	1	0	0	1	1	1	0	0	0	1	0	0	0	Yes	0

Table 51. Adaptive Capacity Related to Critical Point Facilities Attributes

Barangay	Wealth	Information	Infrastructure	Technology	Institution and Governance	Social Capital
	Overall Financial Capacity of LGU to Repair Infrastructures	Presence of Evacuation Procedures during Disasters	Ability of Infrastructures to Withstand Disaster Events	Presence of Early Warning Systems	Presence of Building Codes and Standards	Presence of Associations of Schools, Hospitals, and others
Aplaya	Low	Yes	High	Yes	Yes	Yes
Butas Na Bato	Low	Yes	High	Yes	Yes	Yes
Cabog (Matawe)	Low	Yes	Medium	Yes	No	Yes
Caragsacan	Low	Yes	Medium	Yes	No	Yes
Davildavilan	Low	Yes	High	Yes	Yes	Yes
Dikapanikian	Low	Yes	Medium	Yes	Yes	Yes
Ibona	Low	Yes	Medium	Yes	Yes	Yes
Paltic	Low	Yes	Medium	Yes	Yes	Yes
Poblacion	Low	Yes	High	Yes	Yes	Yes
Tanawan	Low	Yes	High	Yes	Yes	Yes
Umiray (Malamig)	Low	Yes	Medium	Yes	No	Yes

There are 20 preschool buildings in Dingalan, 16 elementary school campuses, 5 high school campuses, and one TESDA vocational school. Out of the aforementioned educational facilities, the following are in need of repair – one preschool building in Caragsacan, and two elementary school campuses in Ibona and Poblacion.

Out of the two hospitals and 9 rural health units (RHUs) located within the Municipality, only two RHUs – the ones in Butas na Bato and Poblacion – are in need of repair, so as to provide better medical service to the constituents.

As for government buildings, four barangay halls – located in Cabog, Caragsacan, Dikapanikian, and Umiray – are due for repairs. Based on the available data, it has been determined that the overall financial capacity of the Dingalan LGU to repair the aforementioned facilities is low.

All barangays have evacuation centers and government buildings are fitted out with early warning devices. However, most buildings in the Municipality – particularly those in Cabog, Caragsacan, and Umiray – are more than 30 years old, and thus may not comply with the revised building and structureal codes.

2. Exposure Maps for Hazards

The following maps pinpoint the location of educational facilities, health facilities, and other government buildings which may be potentially impacted by the following hazards:

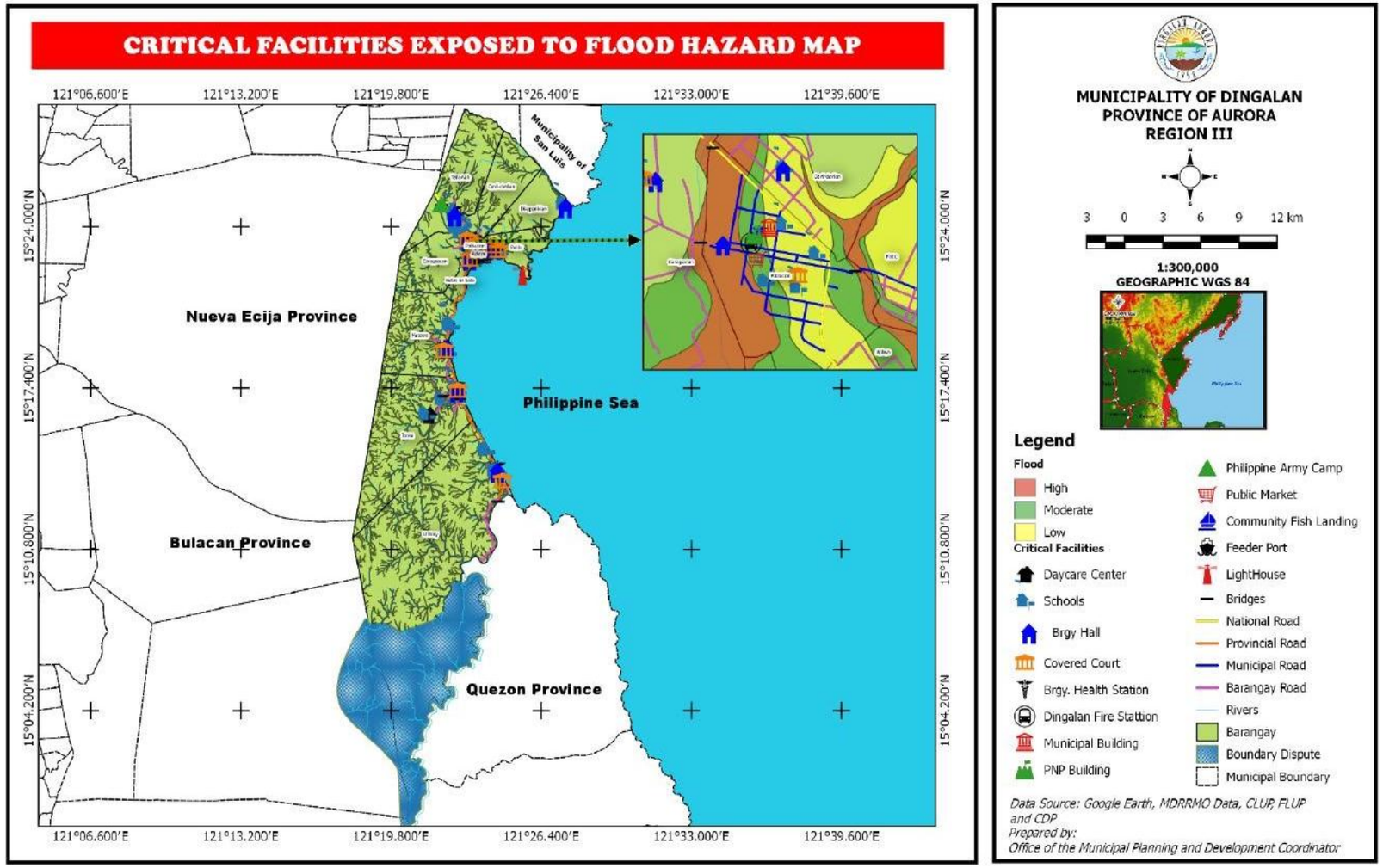


Figure 23. Critical Facilities Exposed to Flood Hazard Map

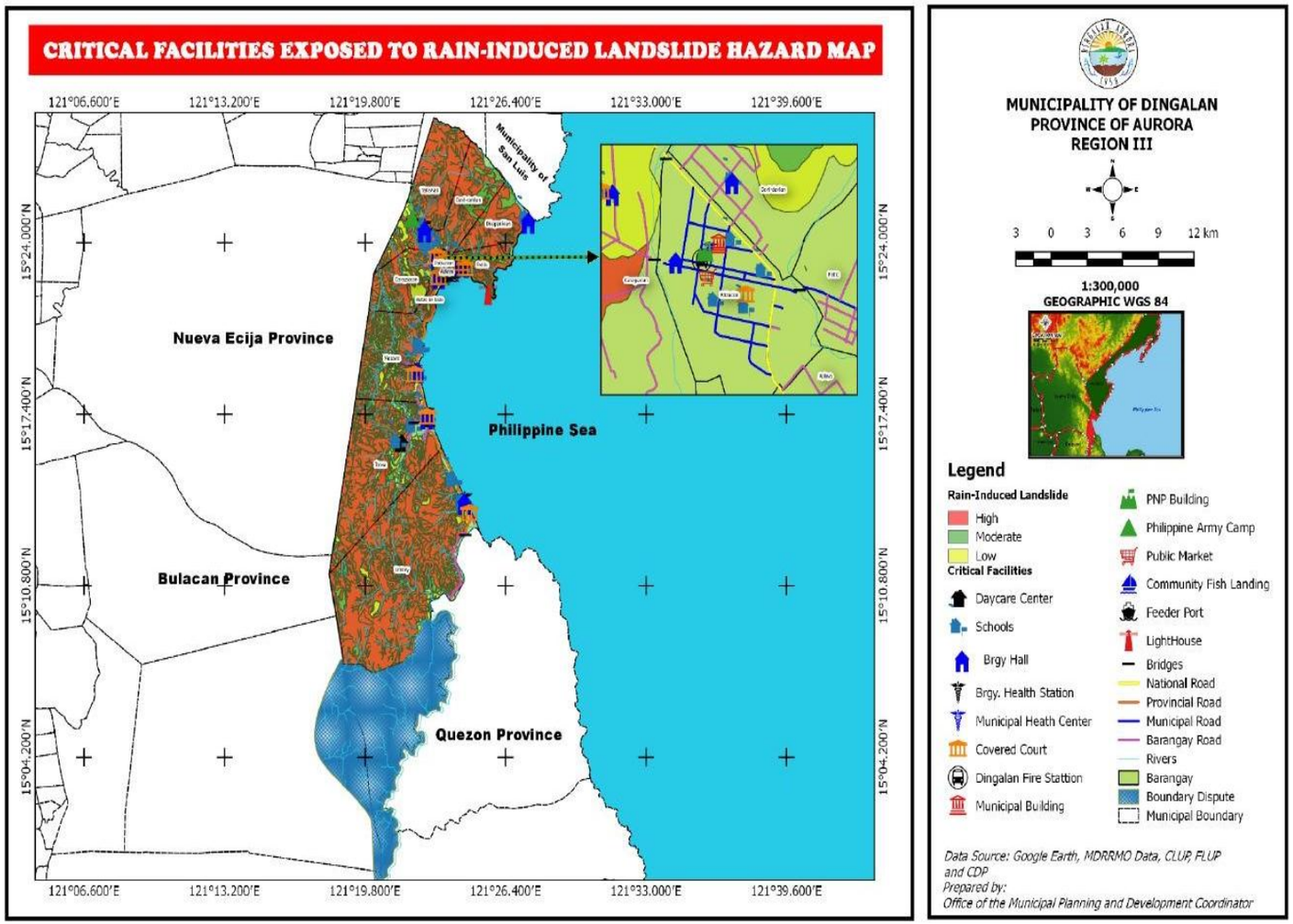
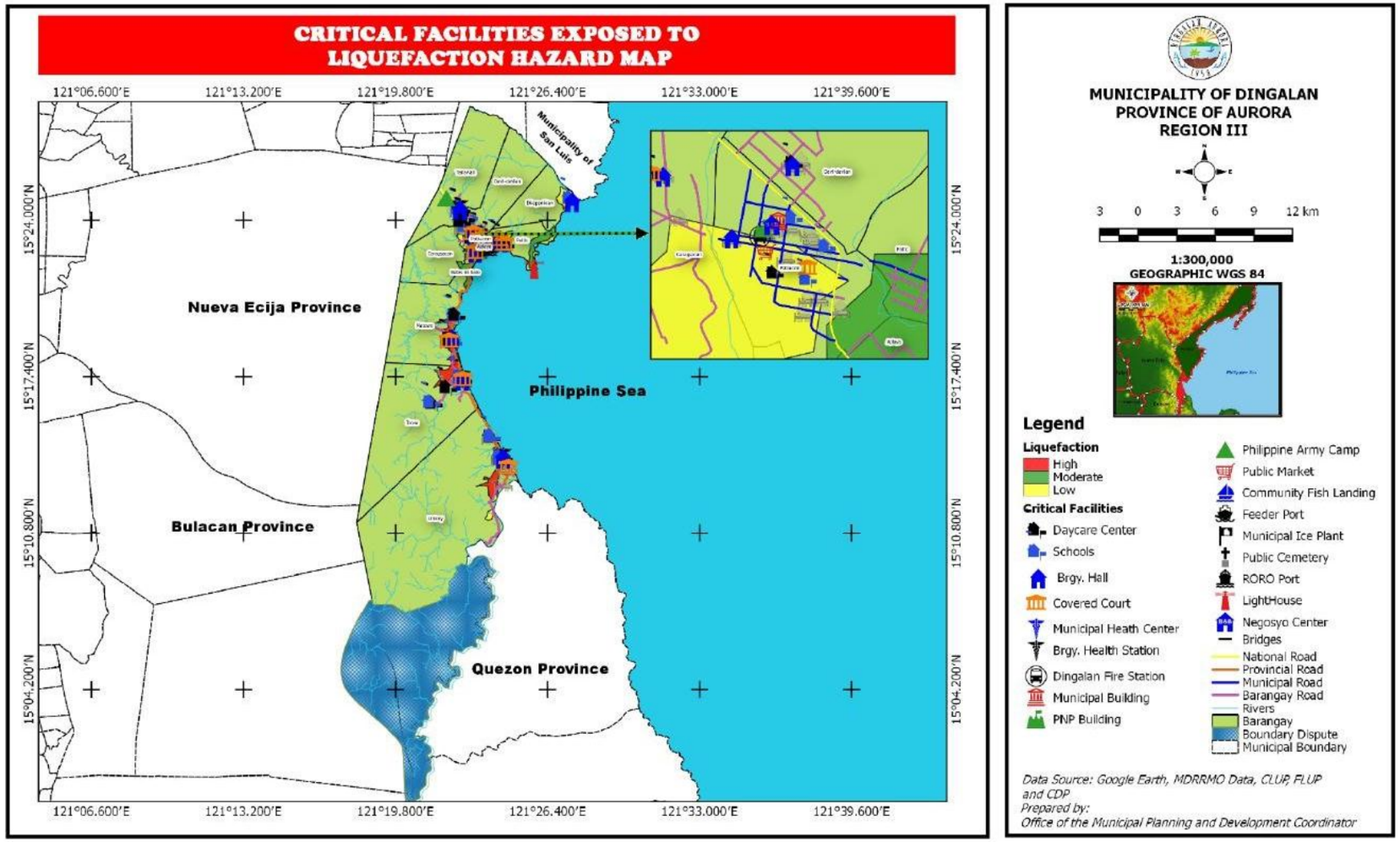


Figure 24. Critical Facilities Exposed to Rain-Induced Landslide Hazard Map


CRITICAL FACILITIES EXPOSED TO LIQUEFACTION HAZARD MAP
121°06.600'E
121°13.200'E
121°19.800'E
121°26.400'E
121°33.000'E
121°39.600'E
15°24.000'N
15°17.400'N
15°10.800'N
15°04.200'N
Municipality of San Luis
Nueva Ecija Province
Philippine Sea
Bulacan Province
Quezon Province
MUNICIPALITY OF DINGALAN
PROVINCE OF AURORA
REGION III
3 0 3 6 9 12 km
1:300,000
GEOGRAPHIC WGS 84
Legend
Liquefaction
High
Moderate
Low
Critical Facilities
Daycare Center
Schools
Brgy. Hall
Covered Court
Municipal Heath Center
Brgy. Health Station
Dingalan Fire Station
Municipal Building
PNP Building
Philippine Army Camp
Public Market
Community Fish Landing
Feeder Port
Municipal Ice Plant
Public Cemetery
RORO Port
LightHouse
Negosyo Center
Bridges
National Road
Provincial Road
Municipal Road
Barangay Road
Rivers
Barangay
Boundary Dispute
Municipal Boundary
Data Source: Google Earth, MDRRMO Data, CLUP, FLUP and CDP
Prepared by:
Office of the Municipal Planning and Development Coordinator

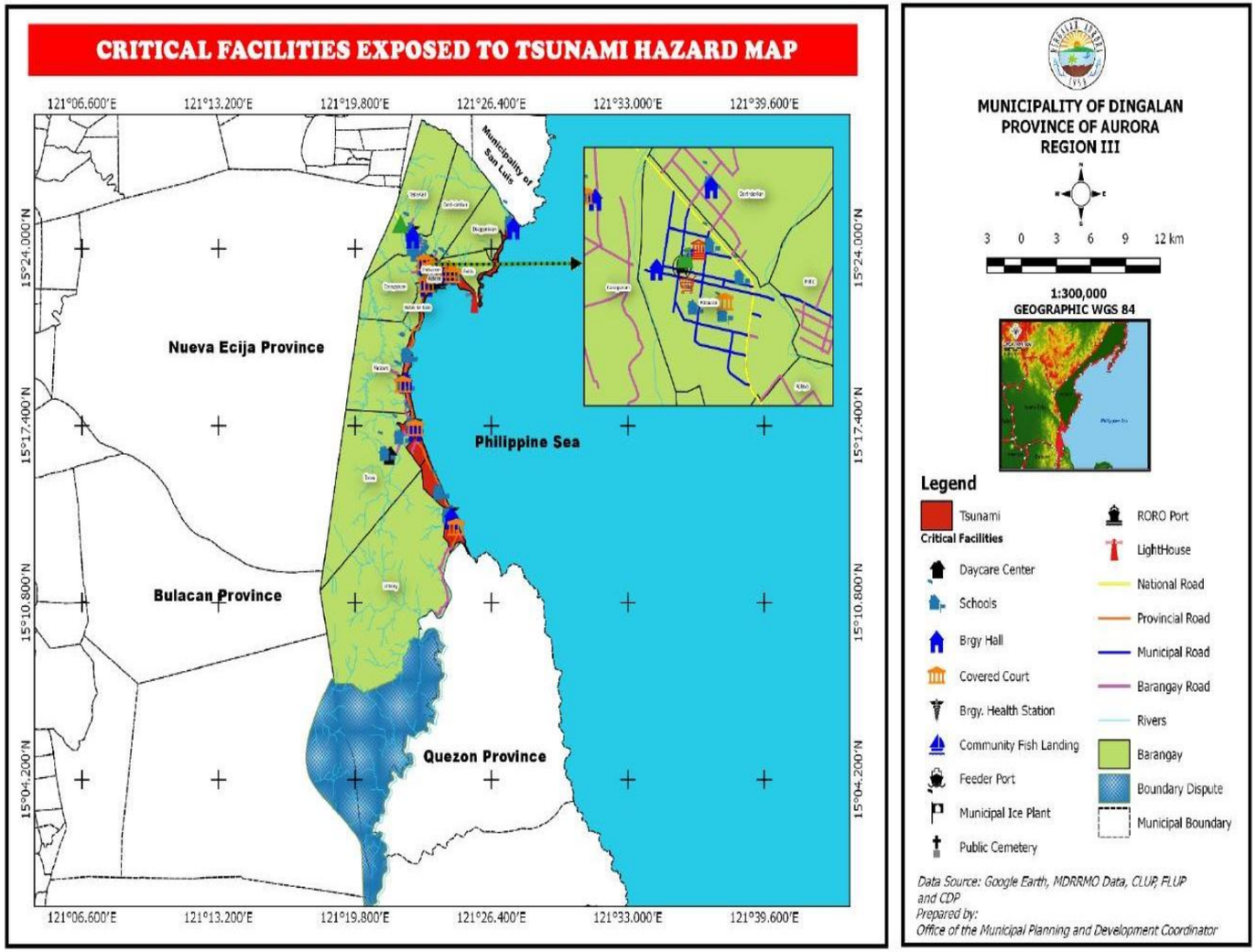

CRITICAL FACILITIES EXPOSED TO TSUNAMI HAZARD MAP
121°06.600'E
121°13.200'E
121°19.800'E
121°26.400'E
121°33.000'E
121°39.600'E
15°24.000'N
15°17.400'N
15°10.800'N
15°04.200'N
Municipality of San Luis
Nueva Ecija Province
Philippine Sea
Bulacan Province
Quezon Province
MUNICIPALITY OF DINGALAN
PROVINCE OF AURORA
REGION III
3 0 3 6 9 12 km
1:300,000
GEOGRAPHIC WGS 84
Legend
Tsunami
Critical Facilities
Daycare Center
Schools
Brgy Hall
Covered Court
Brgy. Health Station
Community Fish Landing
Feeder Port
Municipal Ice Plant
Public Cemetery
RORO Port
LightHouse
National Road
Provincial Road
Municipal Road
Barangay Road
Rivers
Barangay
Boundary Dispute
Municipal Boundary
Data Source: Google Earth, MDRRMO Data, CLUP, FLUP and CDP
Prepared by:
Office of the Municipal Planning and Development Coordinator

Figure 26. Critical Facilities Exposed to Tsunami Hazard Map

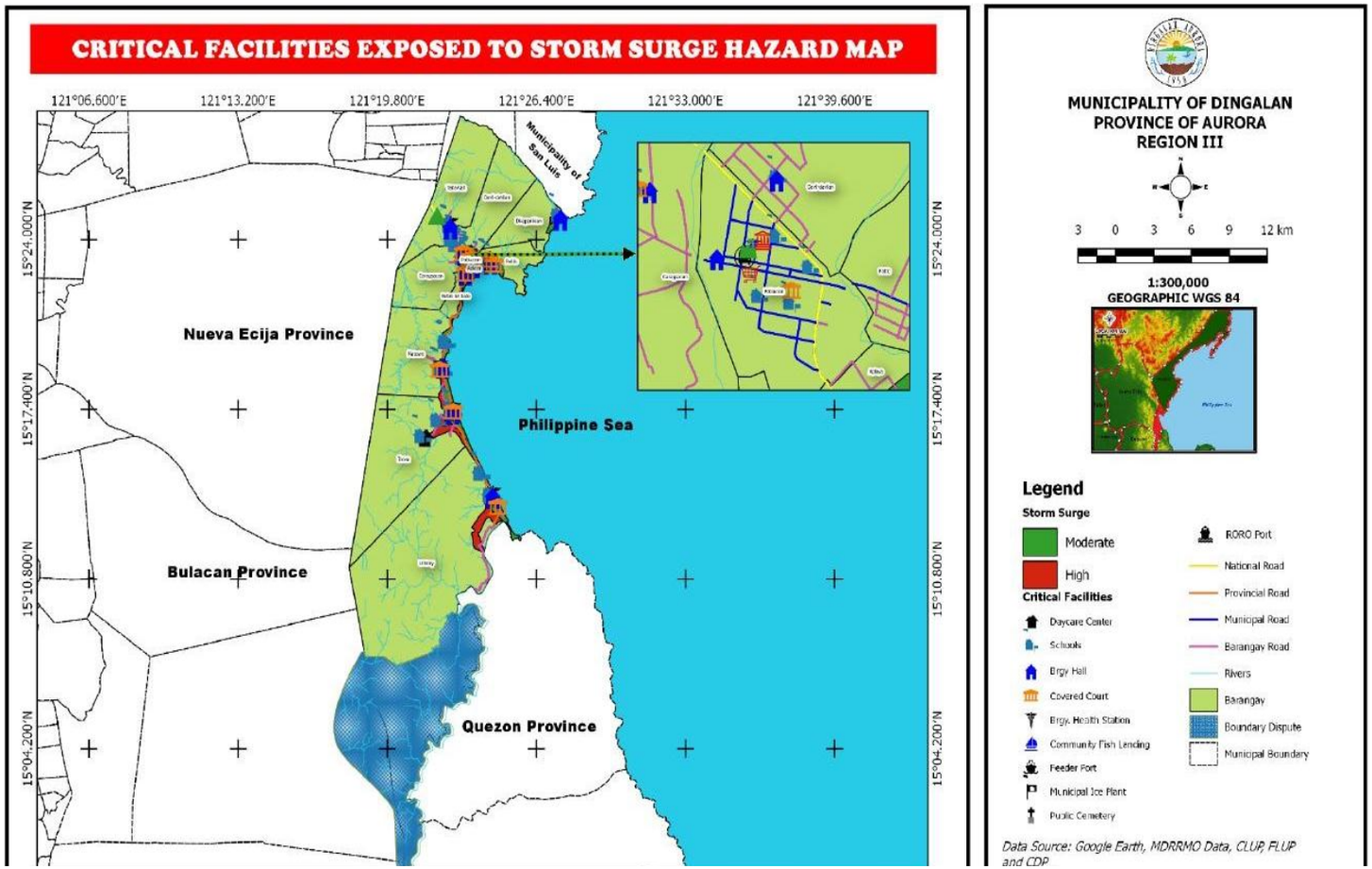


Figure 27. Critical Facilities Exposed to Storm Surge Hazard Map

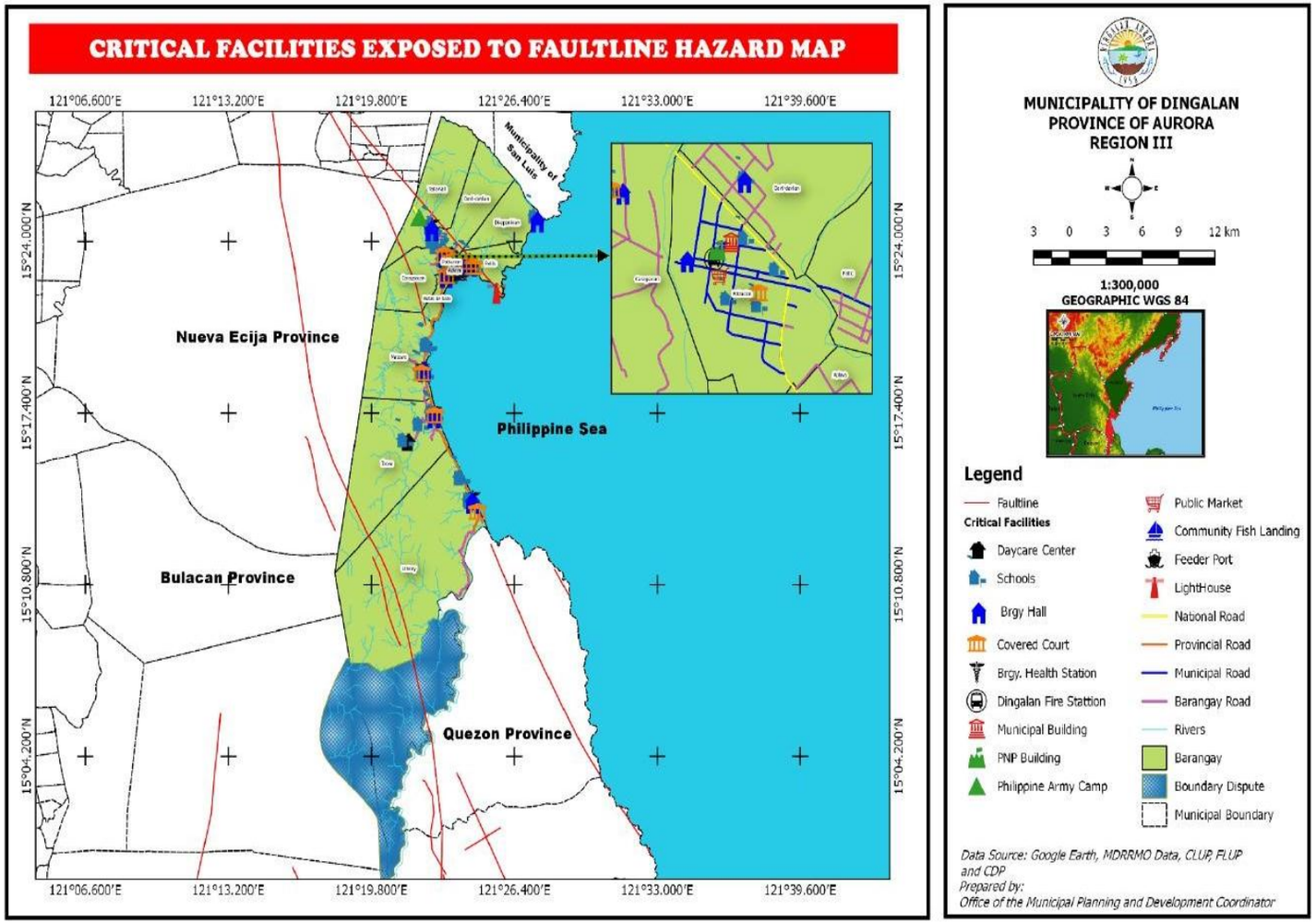


Figure 28. Critical Facilities Exposed to Faultline Hazard Map

Urban Use Exposure Database

This chapter shall discuss urban uses within the Municipality, and the corresponding activities that these land uses generate. Data regarding urban use exposure shall be presented in the tables below.

1. Urban Use Exposure Attribute Information

Table 52. Urban Use Attributes Exposed to Hazards in Dingalan

Barangay	Exposure Indicators							Sensitivity Indicators							
	Total Land Area (ha)	Description of Land Use Types	No. of Land Use Types	Land Use Type with Largest/ Major Area Occupied	Total Occupied Area of Major Land Use (ha)	Land Use Type with Least/ Minor Area Occupied	Total Occupied Area of Minor Land Use Type (ha)	% of Major Land Use Type in Barangay	Sensitivity of Major Land Use Type to Hazards	Describe Reason for Sensitivity of Major Land Use	% of Minor Land Use Type in Barangay	Sensitivity of Minor Land Use Type to Hazards	Describe Reason for Sensitivity of Minor Land Use	Amount of Collected Real Property Tax (PhP)	Percentage of Existing Infrastructures Covered by Property Insurance (%)
Aplaya	36	Urban	13	other crops	11	recreation	1.01	30.28%	Very sensitive	Prone to flood	2.81%	Moderately affected	Prone to flood & tsunami	₱288,354.00	0.00%
Butas Na Bato	440	Rural	13	forest	306	industrial	0.04	69.55%	Moderately	With history of	0.01%	Very sensitive, easily	Prone to flood, tsunami & landslide	₱133,408.44	0.00%
Cabog (Matawe)	3,130	Rural	17	military	2,185	ancestral	1.12	69.81%	Not easily		0.04%	Not easily affected		₱197,771.02	0.00%
Caragsacan	2,088	Rural	14	grassland	1,006	commercial	0.56	48.17%	Not easily		0.03%	Not easily affected		₱602,002.38	0.00%
Davildavilan	2,117	Rural	11	watershed	1,951	institutional	0.11	92.17%	Moderately	River bursts	0.01%	Moderately affected	River bursts easily due to heavy rainfall	₱189,506.80	0.00%
Dikapanikian	1,622	Rural	12	forest	780	Commercial	0.48	48.09%	Not easily		0.03%	Not easily affected		₱25,153.38	0.00%
Ibona	5,795	Rural	15	forest	4,193	Commercial	0.02	72.36%	Moderately	With history of	0.00%	Moderately affected	With history of landslides	₱761,786.74	0.00%

Paltic	941	Urban	20	forest	728	Lighthouse	3.82	77.32%	Very sensitive	With rain-	0.41%	Very sensitive, easily	With rain-induced landslisdes	₱279,599.10	0.00%
Poblacion	41	Urban	13	commercial	5	Bus Terminal	1.40	13.17%	Moderately	Prone to	3.41%	Moderately affected	Prone to flooding	₱373,874.60	0.00%
Tanawan	3,275	Rural	11	water reserve	2,122	recreation	1.40	64.79%	Not easily		0.04%	Not easily affected		₱218,884.80	0.00%
Umiray (Malamig)	10,970	Rural	15	forest	15	Commercial	14.70	0.13%	Moderately	With history of	0.13%	Moderately affected	With history of landslides	₱1,527,937.78	0.00%

Table 53. Adaptive Capacity Related to Urban Use Attributes

Barangay	Wealth	Information	Infrastructure	Technology	Institution and Governance	Social Capital
	Financial capacity of propertyowners to relocate or retrofit old systems	All Land Uses Conform with Assigned Land Use Zones	Presence of Infrastructures to Ensure Integrity of Land Use	Percentage of structures employing site preparation, hazard resistantand/or climate proofed design standards	Capacity to Enforce Land Use Zones	Number of Sectoral Organizations (includes NGOs, POs, CSOs)
Aplaya	Low	No	Yes	75%	Medium	tbd
Butas Na Bato	Low	No	Yes	75%	Medium	tbd
Cabog (Matawe)	Low	No	Yes	50%	Medium	tbd
Caragsacan	Low	No	Yes	80%	Medium	tbd
Davildavilan	Low	No	Yes	100%	Medium	tbd
Dikapanikian	Low	No	Yes	100%	Medium	tbd
Ibona	Low	No	Yes	80%	Medium	tbd
Paltic	Low	No	Yes	75%	Medium	tbd
Poblacion	Low	No	Yes	100%	Medium	tbd
Tanawan	Low	No	Yes	100%	Medium	tbd
Umiray (Malamig)	Low	No	Yes	67%	Medium	tbd

Out of the eleven barangays of Dingalan, three are considered as urban – namely, Barangays Aplaya, Paltic, and Poblacion. Notably, Paltic also has the highest number of land uses (20). The majority of the land area of the Municipality is classified as forest and water reserve.

Poblacion has the highest percentage of minor land use types (3.41%), and is moderately prone to flooding as well. On the other hand, Ibona has the least percentage of minor land use types (0.1%), and is also moderately affected by hazards such as landslides. However, some assigned land use zones within the eleven barangays are of non-conforming use.

The real property tax (RPT) collection of Dingalan in 2018 has amounted to a total of PhP 4,598,279.04. Umiray has the highest RPT collection in the same year, with Php 1,527,937.78; while Dikapanikian has the least RPT collection, with Php 25,153.38.

2. Exposure Maps for Hazards

The following maps present the locations of urban uses – particularly commercial and tourism uses – within the Municipality, and how they may be affected by hazards such as flooding, rain-induced landslides, liquefaction, tsunamis, storm surges, and ground shaking.

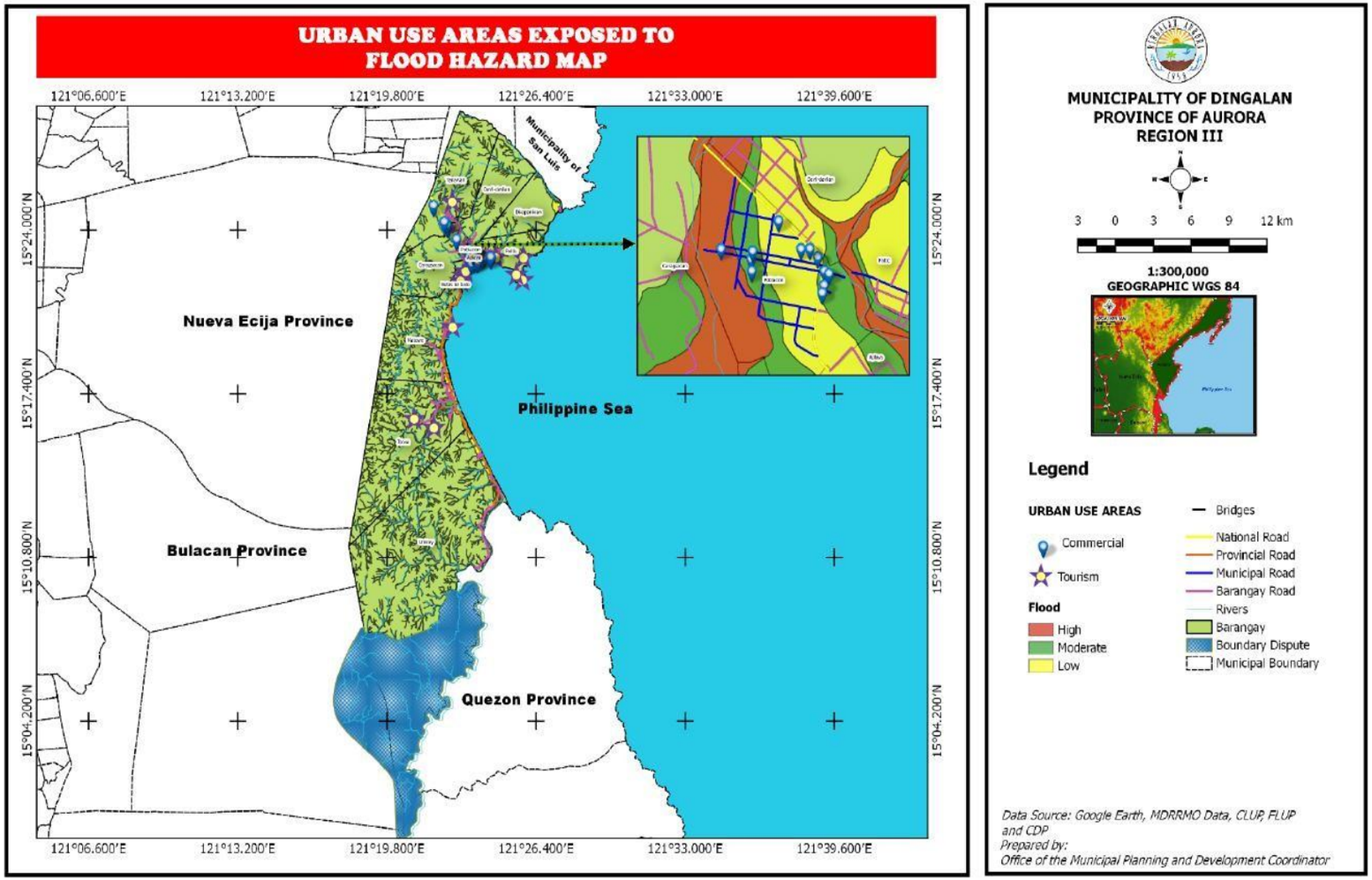


Figure 29. Urban Use Areas Exposed to Flood Hazard Map

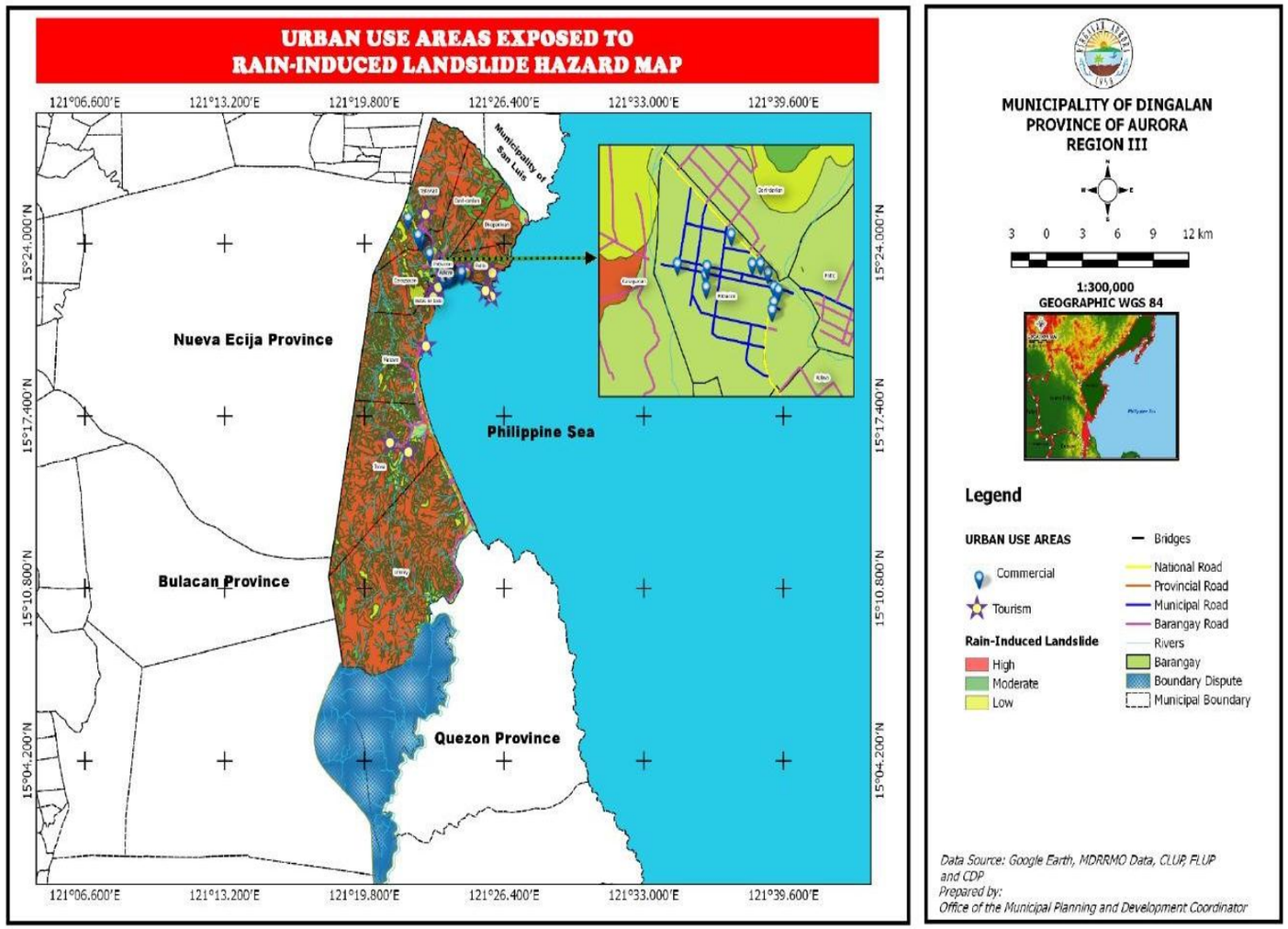


Figure 30. Urban Use Areas Exposed to Rain-Induced Landslide Hazard Map

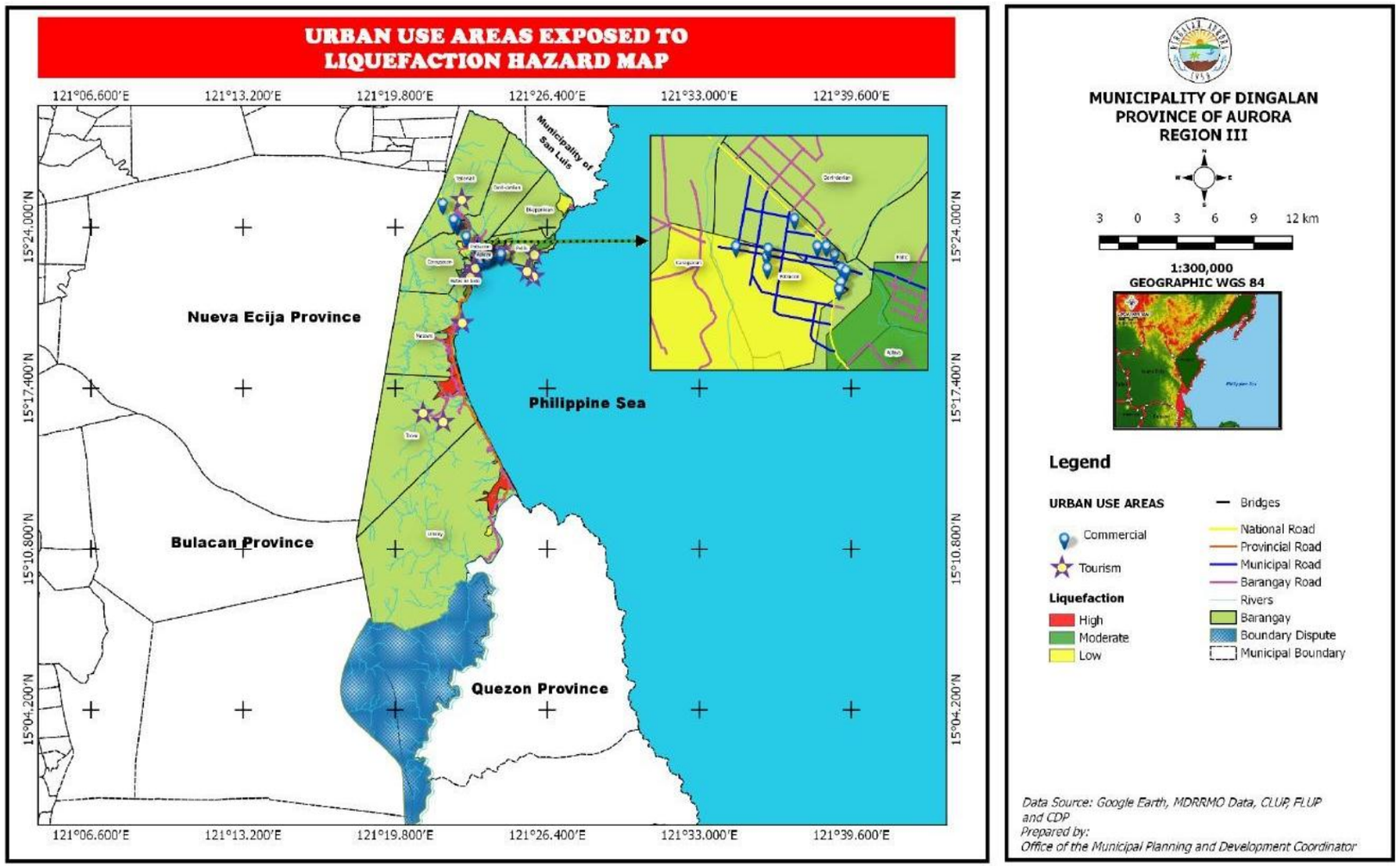


Figure 31. Urban Use Areas Exposed to Liquefaction Hazard Map

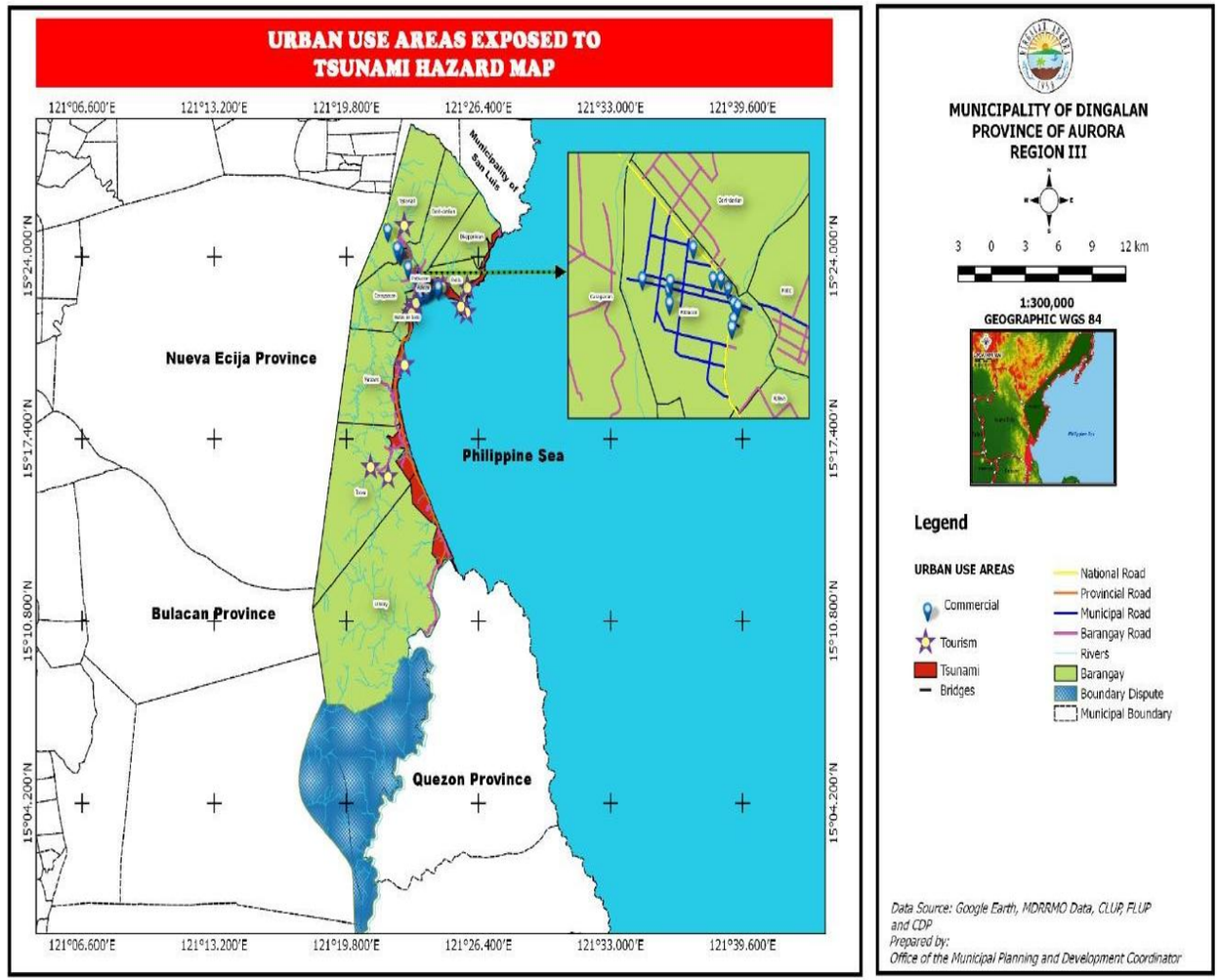


Figure 32. Urban Use Areas Exposed to Tsunami Hazard Map

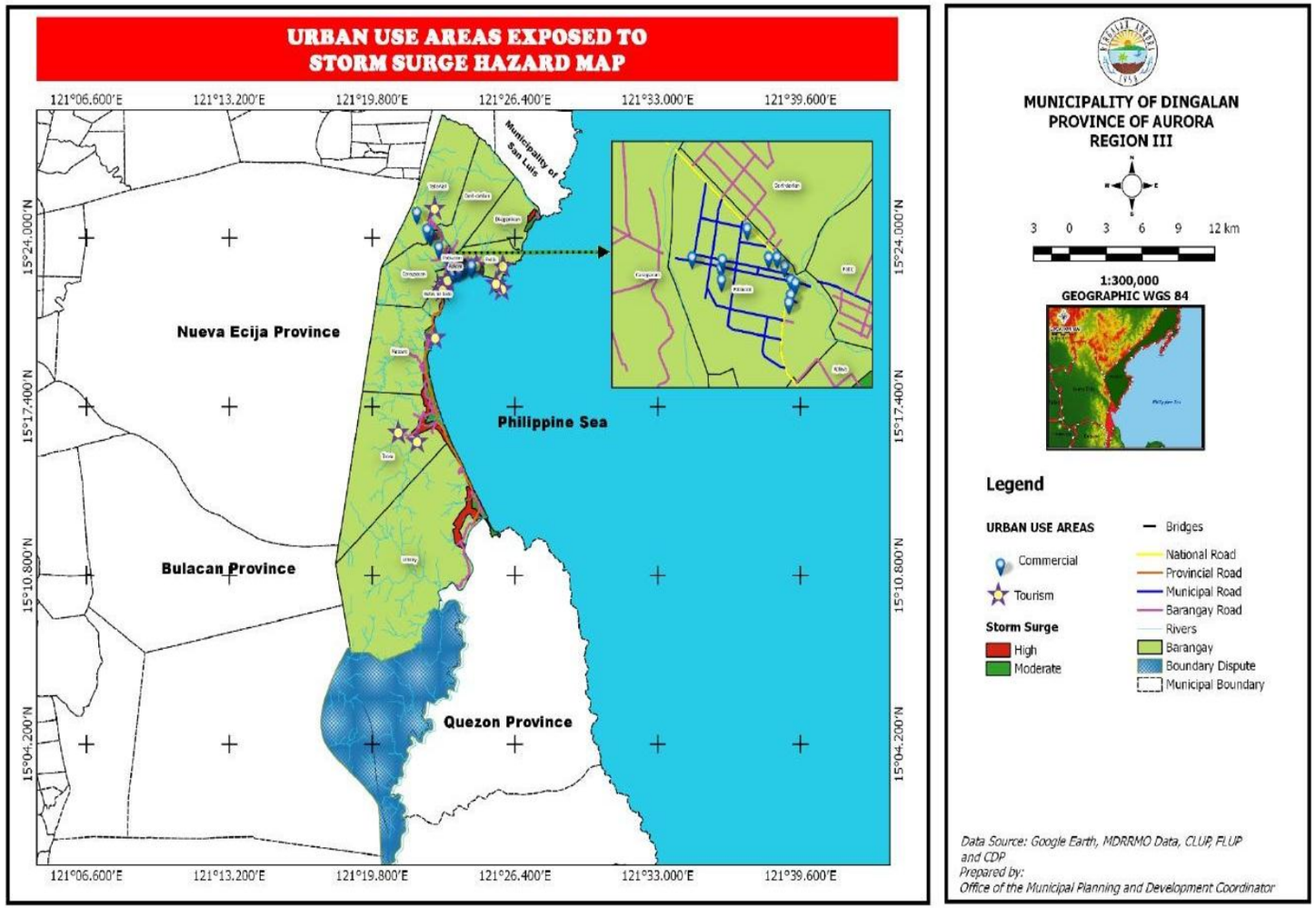


Figure 33. Urban Use Areas Exposed to Storm Surge Hazard Map

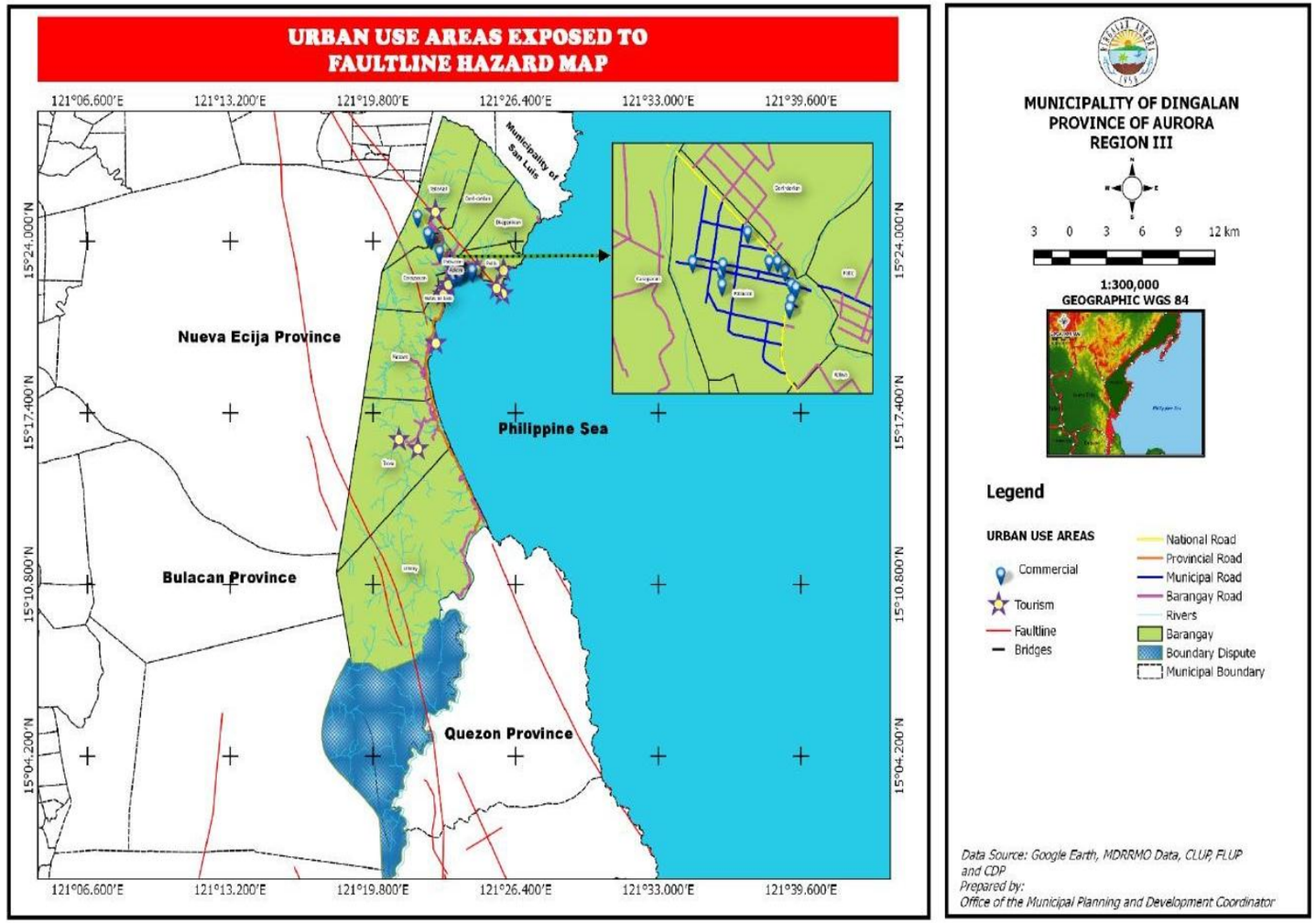


Figure 34. Urban Use Areas Exposed to Faultline Hazard Map

Lifeline Utilities Exposure Database

This chapter shall discuss urban uses within the Municipality, and the corresponding activities that these land uses generate. Data regarding urban use exposure shall be presented in the tables below.

1. Lifeline Utilities Exposure Attribute Information

Table 54. Lifeline Utilities Attributes Exposed to Hazards in Dingalan

Barangay	Exposure Indicators							Sensitivity Indicators									
	Road Length (km)	No. of bridges	Name of Largest Bridge in Barangay	Name of Lightest Capacity Bridge in Barangay	Water Utility Providers	Electric Utility Providers	Telecom Network Coverage Available	Estimated % Concreted Road	Replacement Cost (PhP) per Length of Concrete Road	Estimated % unpaved/ dirt road	Replacement Cost (PhP) per Length of Unpaved/Dirt Road	Replacement Cost (PhP) of Largest Bridge	Replacement Cost (PhP) of Lightest Bridge	% of HH with Access to Piped Water	% of HH with Access to Electricity	% of HH with Cellphone	% of area Covered by Available Telecom Network
Aplaya	3.64	1	Water Point Bridge	None		AURELCO	Globe and Smart	41.20%	14,000/m	58.80%	10,000/m	120,000,000.00	0	0.00%	100%	85%	100%
Butas Na Bato	5.37	0	None	None		AURELCO	Globe and Smart	52.50%	14,000/m	47.50%	10,000/m	0	0	0.00%	99%	70%	90%
Cabog (Matawe)	16.17	0	None	None		AURELCO	Globe and Smart	21.03%	14,000/m	78.97%	10,000/m	0	0	0.00%	96%	50%	90%
Caragsacan	12.57	2	Langawan Bridge	Bailey Birdge (detour)		AURELCO	Globe and Smart	54.97%	14,000/m	45.03%	10,000/m	200,000,000.00	30,000,000.00	0.00%	99%	80%	100%
Davildavilan	2.57	0	None	None	1	AURELCO	Globe and Smart	45.52%	14,000/m	54.48%	10,000/m	0	0	0.00%	94%	85%	100%
Dikapanikian	0.55	0	None	None		AURELCO	Globe/TM only	25.45%	14,000/m	74.55%	10,000/m	0	0	0.00%	88%	30%	10%
Ibona	15.05	2	Ibona bridge	Aves Bridge	1	AURELCO	Globe and Smart	12.23%	14,000/m	87.77%	10,000/m	150,000,000.00	50,000,000.00	0.00%	94%	50%	90%
Paltic	8.14	2	Subsub Bridge	Cabulao Bridge		AURELCO	Globe and Smart	23.01%	14,000/m	76.99%	10,000/m	70,000,000.00	30,000,000.00	0.00%	98%	90%	90%

Poblacion	4.54	0	None	None		AURELCO	Globe and Smart	96.70%	14,000/m	3.99%	10,000/m	0	0	0.00%	100%	90%	100%
Tanawan	8.21	1	Tanawan Bridge	None		AURELCO	Globe and Smart	33.86%	14,000/m	66.14%	10,000/m	50,000,000.00	0	0.00%	96%	70%	100%
Umiray (Malamig)	15.85	1	Umiray Bridge	None		AURELCO	Globe and Smart	2.50%	14,000/m	97.50%	10,000/m	360,000,000.00	0	0.00%	94%	50%	30%

Table 55. Adaptive Capacity Related to Lifeline Utilities Attributes

Barangay	Wealth	Information	Infrastructure	Technology	Institution and Governance	Social Capital
	Financial Capacity to Replace Lifeline Facilities	Available Information about Lifeline Utilities	Overall Condition of Lifeline Utilities	Lifeline Utilities with Hazard Resistant Design	Presence of Policies Related to Maintenance and Management of Lifeline Utilities	Presence of Inter-Agency/Organizati on Association of Lifeline Providers
Aplaya	Low	Complete	Good	Some	Yes	Yes

Butas Na Bato	Low	Complete	Good	Some	Yes	Yes
Cabog (Matawe)	Low	Complete	Good	Some	Yes	Yes
Caragsacan	Low	Complete	Good	Some	Yes	Yes
Davildavilan	Low	Complete	Good	Some	Yes	Yes
Dikapanikian	Low	Complete	Good	Some	Yes	Yes
Ibona	Low	Complete	Good	Some	Yes	Yes
Paltic	Low	Complete	Good	Some	Yes	Yes
Poblacion	Low	Complete	Good	Some	Yes	Yes
Tanawan	Low	Complete	Good	Some	Yes	Yes
Umiray (Malamig)	Low	Complete	Good	Some	Yes	Yes

Cabog is the barangay with the longest road network, since its 16.17 km comprises 17.45% of the Municipality's total road length of 92.66 km; while Dikapanikian has the shortest, with only 0.55 km (5.94%). Dingalan currently has six bridges – Water Point Bridge at Aplaya; Langawan Bridge at Caragsacan; Subsub Bridge at Paltic; and Ibona Bridge, Tanawan Bridge, and Umiray Bridge. Aside from these, the Municipality has three small capacity bridges – Bailey Bridge in Caragsacan; Aves Bridge in Ibona; and Cabulao Bridge in Paltic.

The Aurora Electric Cooperative (AURELCO) supplies electricity to Dingalan, and has achieved 100% electrification in Aplaya and Poblacion. Water via pipewater is not yet operational; consequently, portable water utility providers can be found within the Municipality, particularly in Davildavilan and Ibona.

It was reported that Paltic and Poblacion were the top two barangays with the highest percentage of households with cellphones. Aplaya, Caragsacan, Davildavilan, Poblacion, and Tanawan are 100% covered by Globe Telecom and Smart Communications.

Based on the provided data, the replacement cost per length of concrete road in every barangay is PhP 14,000 per meter. Umiray currently has the highest estimated percentage of unpaved/dirt road, with 97.50%; while Poblacion has the least estimated percentage, at 3.99%. The replacement cost per length of unpaved/dirt road in every barangay is PhP 10,000 per meter. The largest bridge in Umiray has incurred the replacement cost of PhP 360,000,000.00 while the lightest capacity bridges in Caragsacan and Paltic have only incurred replacement cost of PhP 30,000.000.00, respectively.

All barangays have low financial capacity to replace the lifeline facilities; however, the said facilities are in overall good condition.

CLIMATE CHANGE VULNERABILITY ASSESSMENT

The Climate Change Vulnerability Assessment (CCVA) involves the determination of the degree of impact of a particular climate change variable using three broad scales: — low, medium, and high. A low category has a score of 1, a moderate is scored 2, and a high degree of impact is 3.

Next, the adaptive capacity is determined, again using the aforementioned scales. For adaptive capacity, a low is scored 3, a moderate as 2, and a high as 1. To obtain the climate change vulnerability score, the degree of impact score is multiplied with the adaptive capacity score.

The resulting quotient is finally categorized into the following rubric: scores ranging 1-3 is a low climate change vulnerability, scores ranging 4-6 is a moderate climate change vulnerability, and scores ranging 7-9 is a high climate change vulnerability.

The CCVA of each system of interest (Population, Natural Resources, Critical Facilities, Urban Use, and Lifeline Utilities) will be determined per climate change variable, namely; (1) future temperature trends, (2) future rainfall trends, (3) future number of hot days, (4) future number of dry days, (5) future number of extreme rainfall events, (6) future sea level changes, and (7) future typhoons/supertyphoons. The CCVA for each climate change variable will then be averaged to determine the overall CCVA of a particular barangay.

CCVA for Population

1. Climate Change Vulnerability Assessment Tables

Table 56. Climate Change Vulnerability Assessment of Population in Dingalan

BARANGAY	FUTURE TEMPERATURE TRENDS										FUTURE RAINFALL TRENDS									
	Degree of Impact					Adaptive Capacity					Degree of Impact					Adaptive Capacity				
	To all barangay residents	To informal settlers	To houses made of light materials	To elderly and young children	To PWDs	Of all barangay residents	Of Informal Settlers	Of houses made with of light materials	Of elderly and young children	Of PWDs	To all barangay residents	To informal settlers	To houses made of light materials	To elderly and young children	To PWDs	Of all barangay residents	Of Informal Settlers	Of houses made of light materials	Of elderly and young children	Of PWDs
Aplaya	Low	Low	Low	Moderate	Low	Moderate	Low	Low	Low	Low	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Low	Low	Low	Low
Butas Na Bato	Low	Low	Low	Moderate	Low	Moderate	Low	Low	Low	Low	Low	Low	Moderate	Moderate	Low	Moderate	Low	Low	Low	Low
Cabog (Matawe)	Low	Low	Low	Moderate	Low	Moderate	Low	Low	Low	Low	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Low	Low	Low	Low
Caragsacan	Low	Low	Low	Moderate	Low	Moderate	Low	Low	Low	Low	Low	Low	Moderate	Moderate	Low	Moderate	Low	Low	Low	Low
Davildavilan	Low	Low	Low	Moderate	Low	Moderate	Low	Low	Low	Low	Low	Low	Moderate	Moderate	Low	Moderate	Low	Low	Low	Low
Dikapanikian	Low	Low	Low	Moderate	Low	Moderate	Low	Low	Low	Low	Low	Low	Moderate	Moderate	Low	Moderate	Low	Low	Low	Low
Ibona	Low	Low	Low	Moderate	Low	Moderate	Low	Low	Low	Low	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Low	Low	Low	Low
Paltic	Low	Low	Low	Moderate	Low	Moderate	Low	Low	Low	Low	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Low	Low	Low	Low
Poblacion	Low	Low	Low	Moderate	Low	Moderate	Low	Low	Low	Low	Low	Low	Moderate	Moderate	Low	Moderate	Low	Low	Low	Low
Tanawan	Low	Low	Low	Moderate	Low	Moderate	Low	Low	Low	Low	Low	Low	Moderate	Moderate	Low	Moderate	Low	Low	Low	Low
Umiray (Malamig)	Low	Low	Low	Moderate	Low	Moderate	Low	Low	Low	Low	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Low	Low	Low	Low

Table 57. Climate Change Vulnerability Assessment of Population in Dingalan (cont. 2)

BARANGAY	FUTURE NUMBER OF HOT DAYS										FUTURE NUMBER OF DRY DAYS									
	Degree of Impact					Adaptive Capacity					Degree of Impact					Adaptive Capacity				
	To all barangay residents	To informal settlers	To houses made of light materials	To elderly and young children	To PWDs	Of all barangay residents	Of Informal Settlers	Of houses made with of light materials	Of elderly and young children	Of PWDs	To all barangay residents	To informal settlers	To houses made of light materials	To elderly and young children	To PWDs	Of all barangay residents	Of Informal Settlers	Of houses made of light materials	Of elderly and young children	Of PWDs
Aplaya	Low	Low	Low	Low	Low	Moderate	Low	Low	Low	Low	Low	Low	Low	Low	Low	Moderate	Low	Low	Low	Low
Butas Na Bato	Low	Low	Low	Low	Low	Moderate	Low	Low	Low	Low	Low	Low	Low	Low	Low	Moderate	Low	Low	Low	Low
Cabog (Matawe)	Low	Low	Low	Low	Low	Moderate	Low	Low	Low	Low	Low	Low	Low	Low	Low	Moderate	Low	Low	Low	Low
Caragsacan	Low	Low	Low	Low	Low	Moderate	Low	Low	Low	Low	Low	Low	Low	Low	Low	Moderate	Low	Low	Low	Low
Davildavilan	Low	Low	Low	Low	Low	Moderate	Low	Low	Low	Low	Low	Low	Low	Low	Low	Moderate	Low	Low	Low	Low
Dikapanikian	Low	Low	Low	Low	Low	Moderate	Low	Low	Low	Low	Low	Low	Low	Low	Low	Moderate	Low	Low	Low	Low
Ibona	Low	Low	Low	Low	Low	Moderate	Low	Low	Low	Low	Low	Low	Low	Low	Low	Moderate	Low	Low	Low	Low
Paltic	Low	Low	Low	Low	Low	Moderate	Low	Low	Low	Low	Low	Low	Low	Low	Low	Moderate	Low	Low	Low	Low
Poblacion	Low	Low	Low	Low	Low	Moderate	Low	Low	Low	Low	Low	Low	Low	Low	Low	Moderate	Low	Low	Low	Low
Tanawan	Low	Low	Low	Low	Low	Moderate	Low	Low	Low	Low	Low	Low	Low	Low	Low	Moderate	Low	Low	Low	Low
Umiray (Malamig)	Low	Low	Low	Low	Low	Moderate	Low	Low	Low	Low	Low	Low	Low	Low	Low	Moderate	Low	Low	Low	Low

Table 58. Climate Change Vulnerability Assessment of Population in Dingalan (cont. 3)

BARANGAY	FUTURE NUMBER OF EXTREME RAINFALL EVENTS										FUTURE SEA LEVEL CHANGES									
	Degree of Impact					Adaptive Capacity					Degree of Impact					Adaptive Capacity				
	To all barangay residents	To informal settlers	To houses made of light materials	To elderly and young children	To PWDs	Of all barangay residents	Of Informal Settlers	Of houses made with of light materials	Of elderly and young children	Of PWDs	To all barangay residents	To informal settlers	To houses made of light materials	To elderly and young children	To PWDs	Of all barangay residents	Of Informal Settlers	Of houses made of light materials	Of elderly and young children	Of PWDs
Aplaya	High	High	High	Moderate	Moderate	Moderate	Low	Low	Low	Low	Moderate	Low	Low	Low	Low	Moderate	Moderate	Moderate	Moderate	Moderate
Butas Na Bato	High	High	High	Moderate	Moderate	Moderate	Low	Low	Low	Low	Moderate	Low	Low	Low	Low	Moderate	Moderate	Moderate	Moderate	Moderate
Cabog (Matawe)	High	Moderate	High	Moderate	Moderate	Moderate	Low	Low	Low	Low	Moderate	Low	Low	Low	Low	Moderate	Moderate	Moderate	Moderate	Moderate
Caragsacan	Moderate	Moderate	High	Moderate	Moderate	Moderate	Low	Low	Low	Low	Low	Low	Low	Low	Low	Moderate	Moderate	Moderate	Moderate	Moderate
Davildavilan	Moderate	Moderate	High	Moderate	Moderate	Moderate	Low	Low	Low	Low	Low	Low	Low	Low	Low	Moderate	Moderate	Moderate	Moderate	Moderate
Dikapanikian	Moderate	Moderate	High	Moderate	Moderate	Moderate	Low	Low	Low	Low	Moderate	Low	Low	Low	Low	Moderate	Moderate	Moderate	Moderate	Moderate
Ibona	High	High	High	Moderate	Moderate	Moderate	Low	Low	Low	Low	Moderate	Low	Low	Low	Low	Moderate	Moderate	Moderate	Moderate	Moderate
Paltic	High	High	High	Moderate	Moderate	Moderate	Low	Low	Low	Low	Moderate	Low	Low	Low	Low	Moderate	Moderate	Moderate	Moderate	Moderate
Poblacion	Moderate	Moderate	High	Moderate	Moderate	Moderate	Low	Low	Low	Low	Low	Low	Low	Low	Low	Moderate	Moderate	Moderate	Moderate	Moderate
Tanawan	Low	Low	High	Moderate	Moderate	Moderate	Low	Low	Low	Low	Low	Low	Low	Low	Low	Moderate	Moderate	Moderate	Moderate	Moderate
Umiray (Malamig)	Moderate	Moderate	High	Moderate	Moderate	Moderate	Low	Low	Low	Low	Moderate	Low	Low	Low	Low	Moderate	Moderate	Moderate	Moderate	Moderate

Table 59. Climate Change Vulnerability Assessment of Population in Dingalan (cont. 4)

BARANGAY	FUTURE TYPHOONS/ SUPERTYPHOONS										OVERALL VULNERABILITY OF POPULATION					
	Degree of Impact					Adaptive Capacity										
	To all barangay residents	To informal settlers	To houses made of light materials	To elderly and young children	To PWDs	Of all barangay residents	Of Informal Settlers	Of houses made with of light materials	Of elderly and young children	Of PWDs	Average Degree of Impacts	Count = 35	Average Adaptive Capacities	Count = 35	CC Vulnerability Index	CC Vulnerability Category
Aplaya	High	High	High	High	High	Moderate	Low	Low	Low	Low	1.69	35	2.69	35	4.53	Moderate
Butas Na Bato	High	High	High	High	High	Moderate	Low	Low	Low	Low	1.63	35	2.69	35	4.37	Moderate
Cabog (Matawe)	High	High	High	High	High	Moderate	Low	Low	Low	Low	1.66	35	2.69	35	4.45	Moderate
Caragsacan	High	High	High	High	High	Moderate	Low	Low	Low	Low	1.54	35	2.69	35	4.14	Moderate
Davildavilan	High	High	High	High	High	Moderate	Low	Low	Low	Low	1.54	35	2.69	35	4.14	Moderate
Dikapanikian	High	High	High	High	High	Moderate	Low	Low	Low	Low	1.57	35	2.69	35	4.22	Moderate
Ibona	High	High	High	High	High	Moderate	Low	Low	Low	Low	1.69	35	2.69	35	4.53	Moderate
Paltic	High	High	High	High	High	Moderate	Low	Low	Low	Low	1.69	35	2.69	35	4.53	Moderate
Poblacion	High	High	High	High	High	Moderate	Low	Low	Low	Low	1.54	35	2.69	35	4.14	Moderate
Tanawan	High	High	High	High	High	Moderate	Low	Low	Low	Low	1.49	35	2.69	35	3.99	Moderate
Umiray (Malamig)	High	High	High	High	High	Moderate	Low	Low	Low	Low	1.63	35	2.69	35	4.37	Moderate

The highest average degree of impact to population per barangay is 1.69 – mostly in Aplaya, Ibona and Paltic; while the least average degree of impact to population is barangay Tanawan (1.54). It should be noted that around 3.22% of the total population of Dingalan lives in Tanawan, which makes them moderately vulnerable to hazards.

The average adaptive capacity in all barangays is 2.69. The highest climate change vulnerability index is 4.53 – in Aplaya, Ibona and Paltic; while the least is for Tanawan, with 3.99. Overall, the climate change vulnerability of Dingalan with regards to its population is deemed to be moderate.

2. Hazard Maps for Households

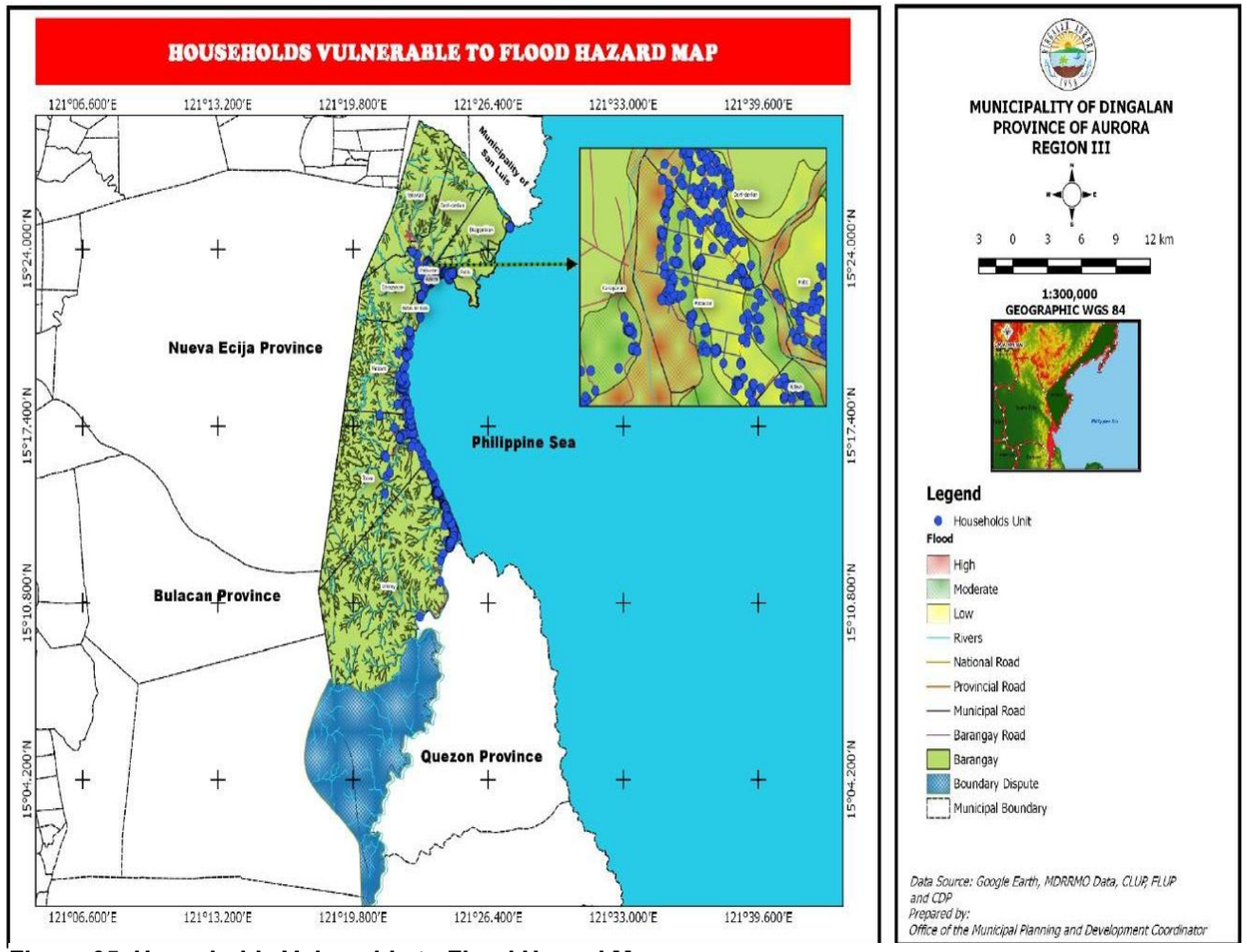


Figure 35. Households Vulnerable to Flood Hazard Map

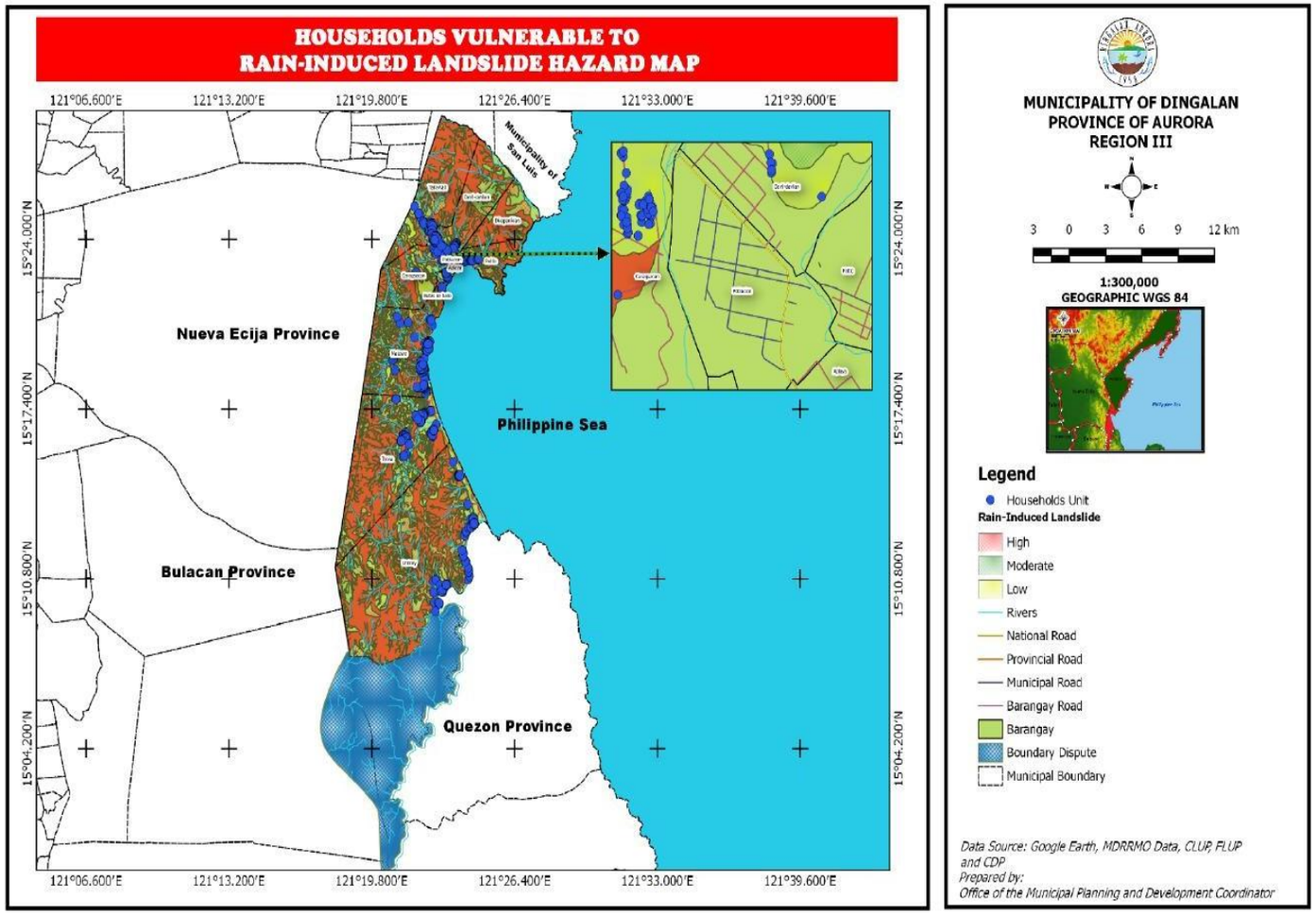


Figure 36. Households Vulnerable to Rain-Induced Landslide Hazard Map

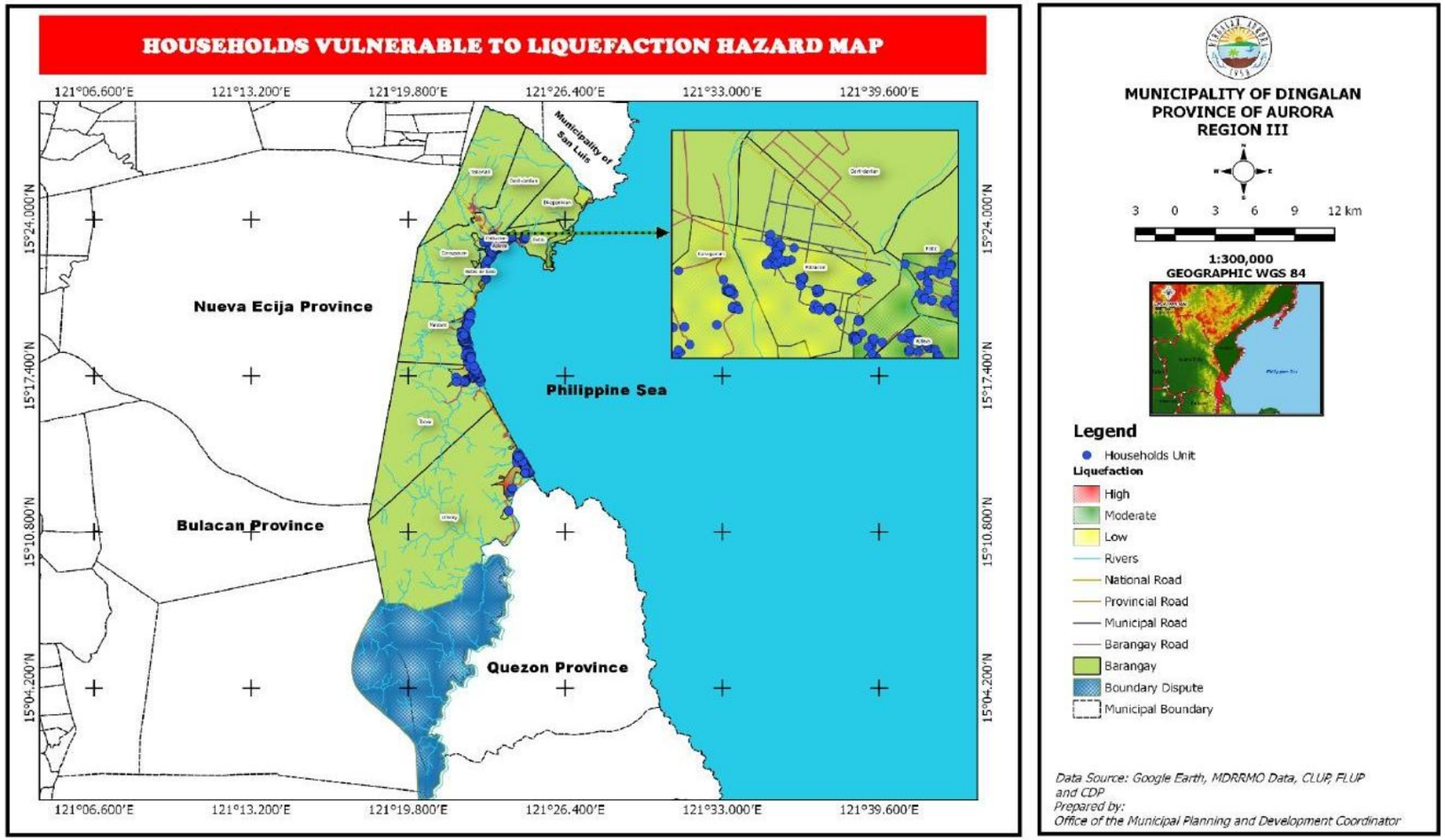


Figure 37. Households Vulnerable to Liquefaction Hazard Map

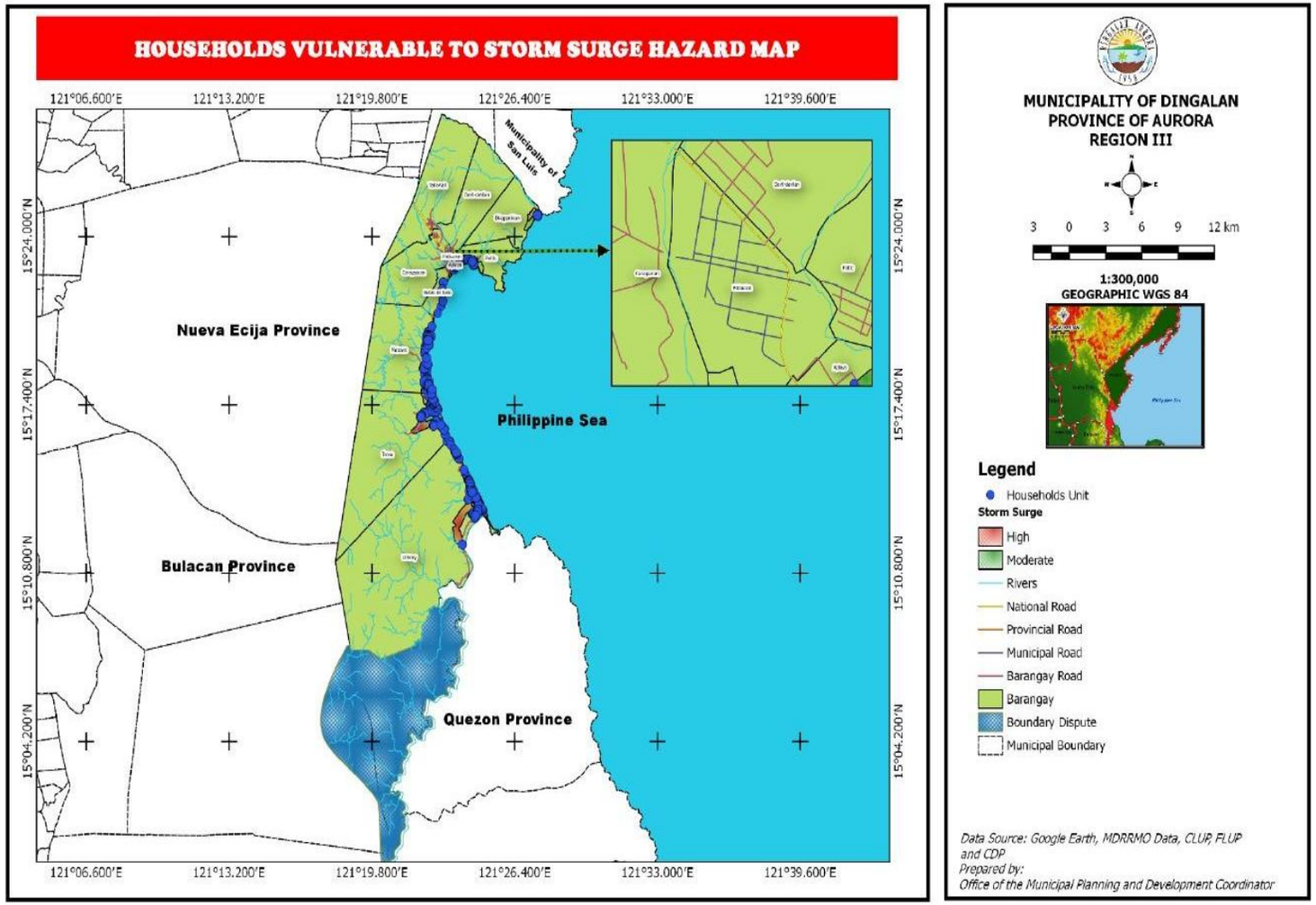


Figure 38. Households Vulnerable to Storm Surge Hazard Map

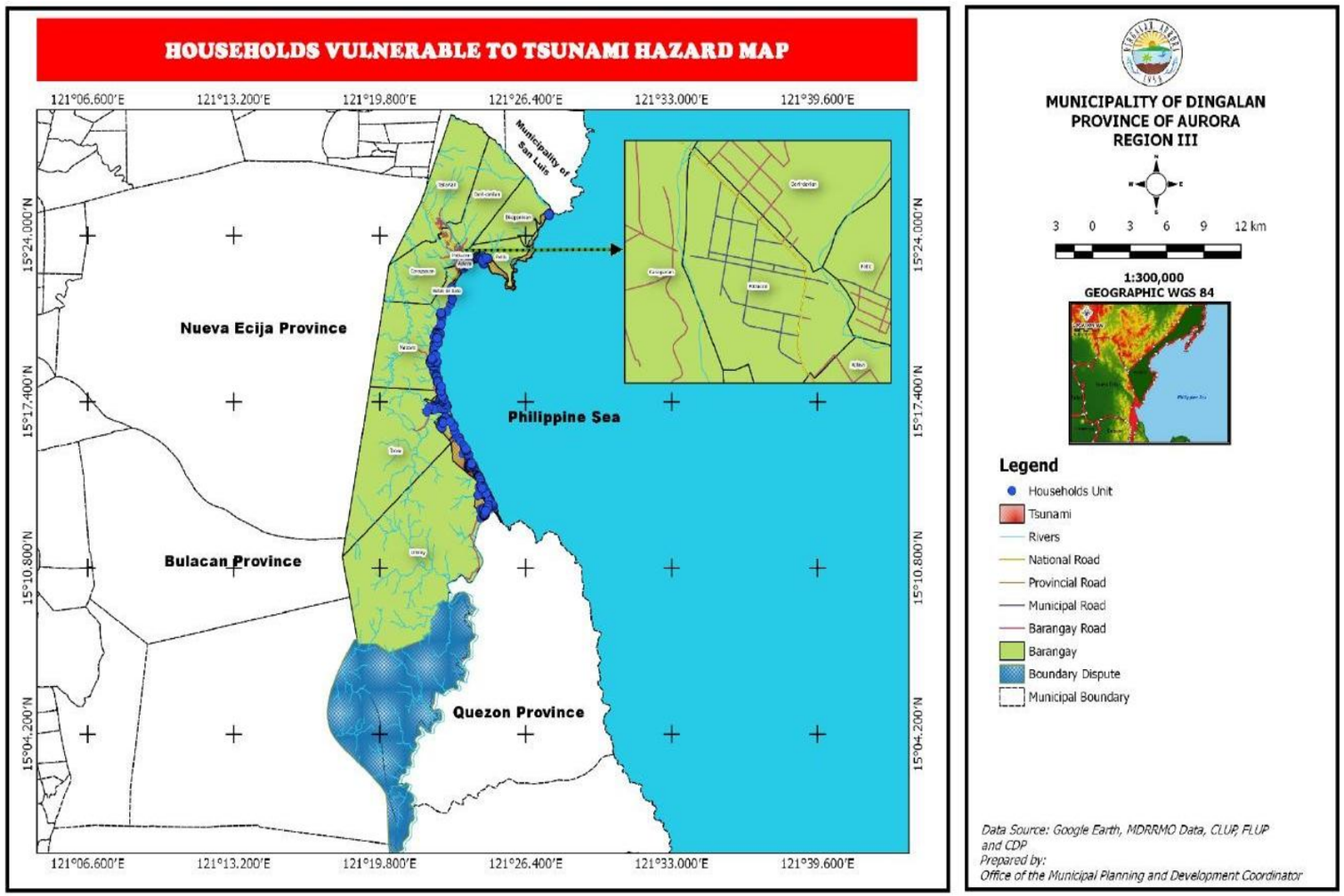


Figure 39. Households Vulnerable to Tsunami Hazard Map

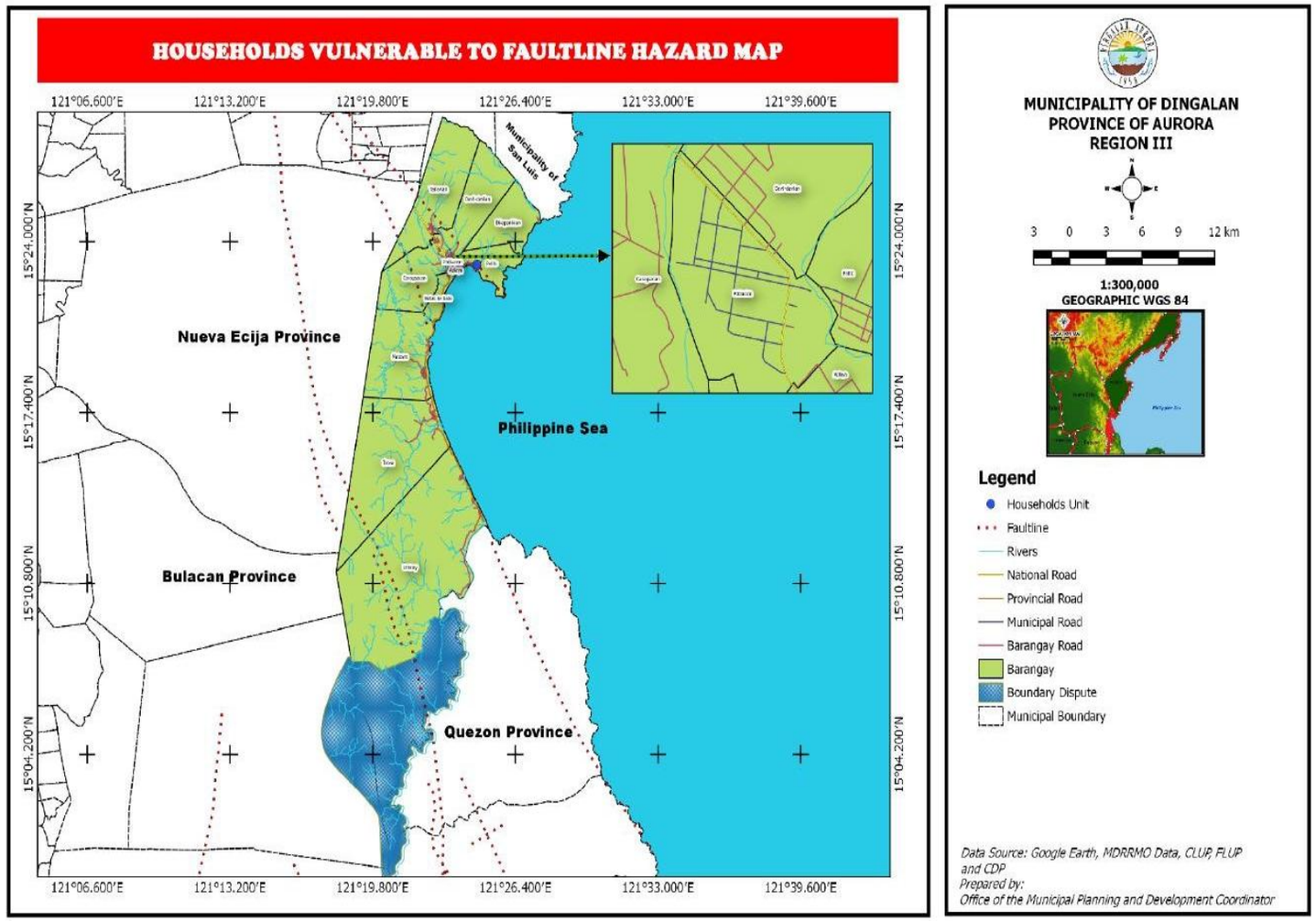


Figure 40. Households Vulnerable to Faultline Hazard Map

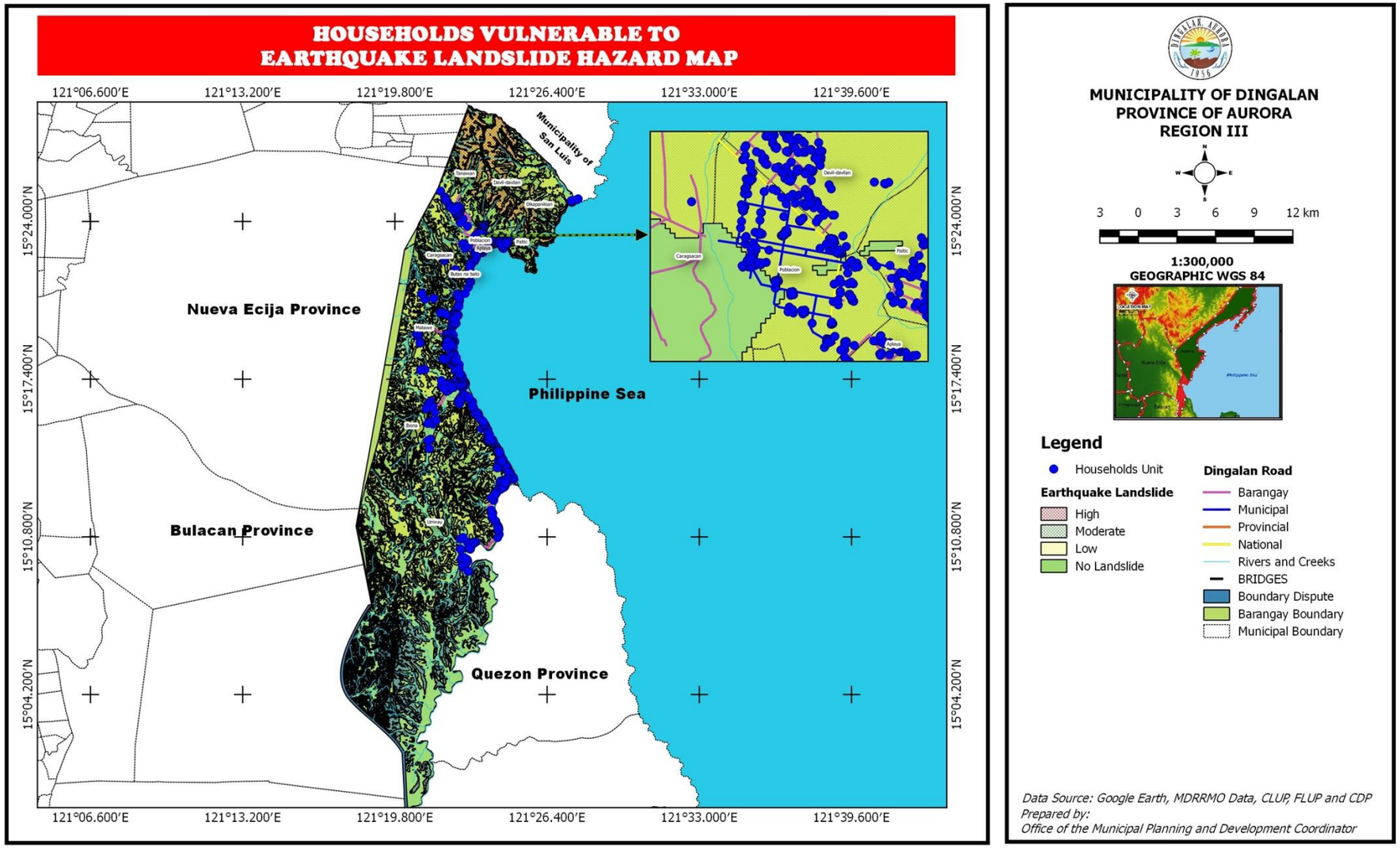


Figure Households Vulnerable to Earthquake Landslide Hazard Map

CCVA for Natural Resources

1. Climate Change Vulnerability Assessment Tables

Table 60. Climate Change Vulnerability Assessment of Natural Resources in Dingalan

BARANGAY	FUTURE TEMPERATURE TRENDS										FUTURE RAINFALL TRENDS									
	Degree of Impact					Adaptive Capacity					Degree of Impact					Adaptive Capacity				
	To crop-based farming areas	To aquaculture-based farming areas	To livestock/ poultry areas	To major crop production	To irrigation systems	Of crop-based farming areas	Of aquaculture-based farming areas	Of livestock/ poultry areas	Of major crop production	Of irrigation systems	To crop-based farming areas	To aquaculture-based farming areas	To livestock/ poultry areas	To major crop production	To irrigation systems	Of crop-based farming areas	Of aquaculture-based farming areas	Of livestock/ poultry areas	Of major crop production	Of irrigation systems
Aplaya	Low	Low	High	Low	Low	High	High	High	High	Low	Low	Low	High	Low	Low	Low	Low	High	High	Low
Butas Na Bato	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
Cabog (Matawe)	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
Caragsacan	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
Davildavilan	High	High	High	High	Low	High	High	High	High	Low	High	High	High	High	High	High	High	High	High	High
Dikapanikian	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
Ibona	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High
Paltic	High	Low	Low	Low	Low	High	Low	High	High	Low	High	Low	High	High	High	High	Low	High	High	Low
Poblacion	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	High	Low
Tanawan	High	Low	High	High	High	High	Low	High	High	High	High	High	High	High	High	High	High	High	High	High
Umiray (Malamig)	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High	High

Table 61. Climate Change Vulnerability Assessment of Natural Resources in Dingalan (cont.)

BARANGAY	FUTURE TYPHOONS/ SUPERTYPHOONS										OVERALL VULNERABILITY OF NATURAL RESOURCES					
	Degree of Impact					Adaptive Capacity										
	To crop-based farming areas	To aquaculture-based farming areas	To livestock/ poultry areas	To major crop production	To irrigation systems	Of crop-based farming areas	Of aquaculture-based farming areas	Of livestock/ poultry areas	Of major crop production	Of irrigation systems	Average Degree of Impacts	Count = 35	Average Adaptive Capacities	Count = 35	CC Vulnerability Index	CC Vulnerability Category
Aplaya	High	High	High	High	High	Moderate	Moderate	Moderate	Moderate	Moderate	2.11	35	1.89	35	3.99	Moderate
Butas Na Bato	High	High	High	High	High	Moderate	Moderate	Moderate	Moderate	Moderate	2.97	35	1.14	35	3.40	Moderate
Cabog (Matawe)	High	High	High	High	High	Moderate	Moderate	Moderate	Moderate	Moderate	2.97	35	1.14	35	3.40	Moderate
Caragsacan	High	High	High	High	High	Moderate	Moderate	Moderate	Moderate	Moderate	2.69	35	1.43	35	3.84	Moderate
Davildavilan	High	High	High	High	High	Moderate	Moderate	Moderate	Moderate	Moderate	2.63	35	1.49	35	3.91	Moderate
Dikapanikian	High	High	High	High	High	Moderate	Moderate	Moderate	Moderate	Moderate	2.97	35	1.14	35	3.40	Moderate
Ibona	High	High	High	High	High	Moderate	Moderate	Moderate	Moderate	Moderate	2.97	35	1.14	35	3.40	Moderate
Paltic	High	High	High	High	High	Moderate	Moderate	Moderate	Moderate	Moderate	2.49	35	1.60	35	3.98	Moderate
Poblacion	High	High	High	High	High	Moderate	Moderate	Moderate	Moderate	Moderate	1.29	35	2.80	35	3.60	Moderate
Tanawan	High	High	High	High	High	Moderate	Moderate	Moderate	Moderate	Moderate	2.63	35	1.49	35	3.91	Moderate
Umiray (Malamig)	High	High	High	High	High	Moderate	Moderate	Moderate	Moderate	Moderate	2.97	35	1.14	35	3.40	Moderate

Barangays with the highest average degree of impact to natural resources are Butas na Bato, Cabog, Dikapanikian, Ibona and Umiray (2.97), due to the presence of mountains and the ocean; while the barangay with the least average degree of impact is Poblacion (1.29), because of its location in the lowlands. However, floods due to heavy rainfall occur often, especially when the two major rivers – Langawan River and Subsub Creek – overflow. On the other hand, the barangay with the highest average adaptive capacity is Poblacion (2.80); while the barangays with the lowest scores are Butas na Bato, Cabog, Dikapanikian, Ibona, and Umiray (1.14).

Aplaya has the highest score for the climate change vulnerability index; while Barangays Butas na Bato, Cabog, Dikapanikian, Ibona, and Umiray all have the lowest score. Overall, the climate change vulnerability of Dingalan with regards to its natural resources is deemed to be moderate.

2. Hazard Maps for Natural Resources

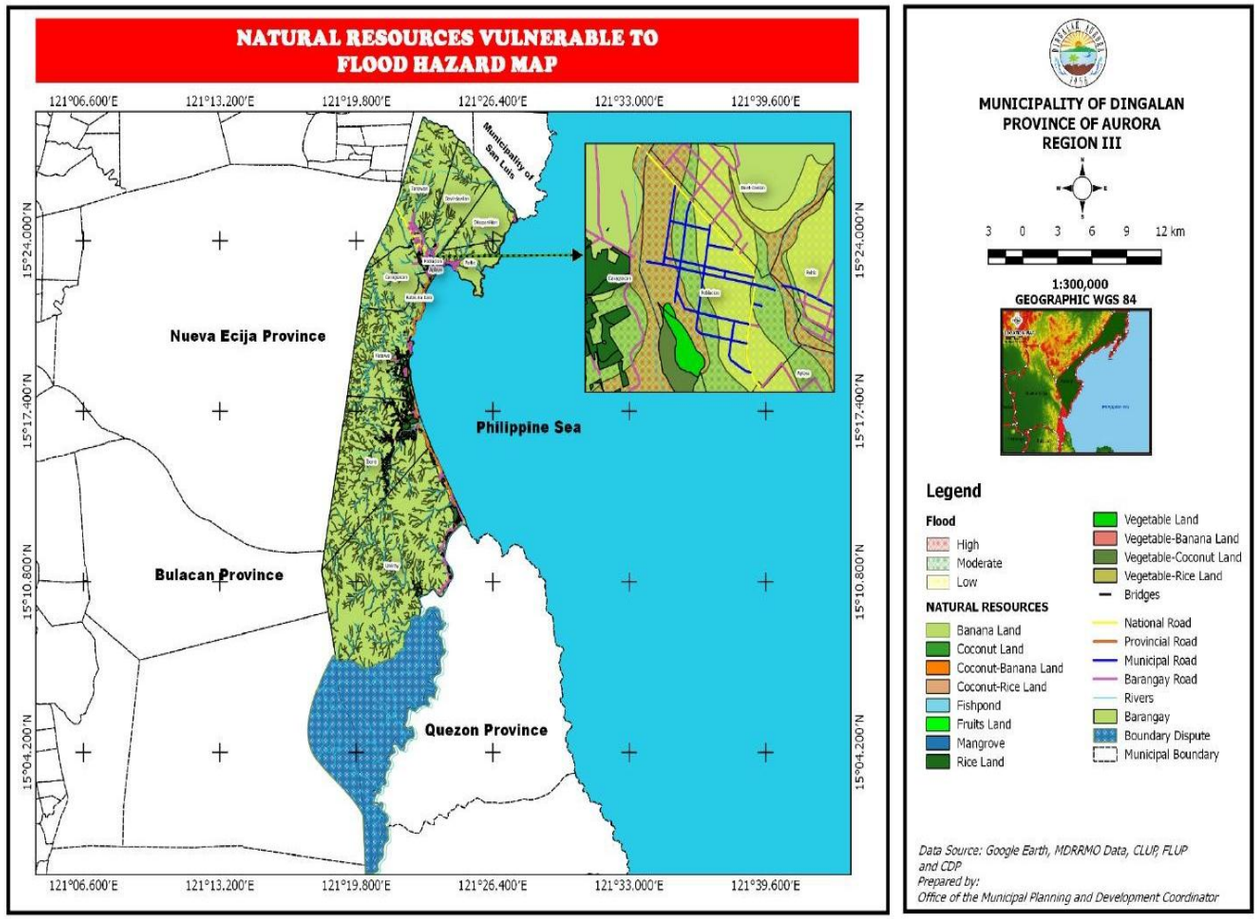


Figure 41. Natural Resources Vulnerable to Flood Hazard Map

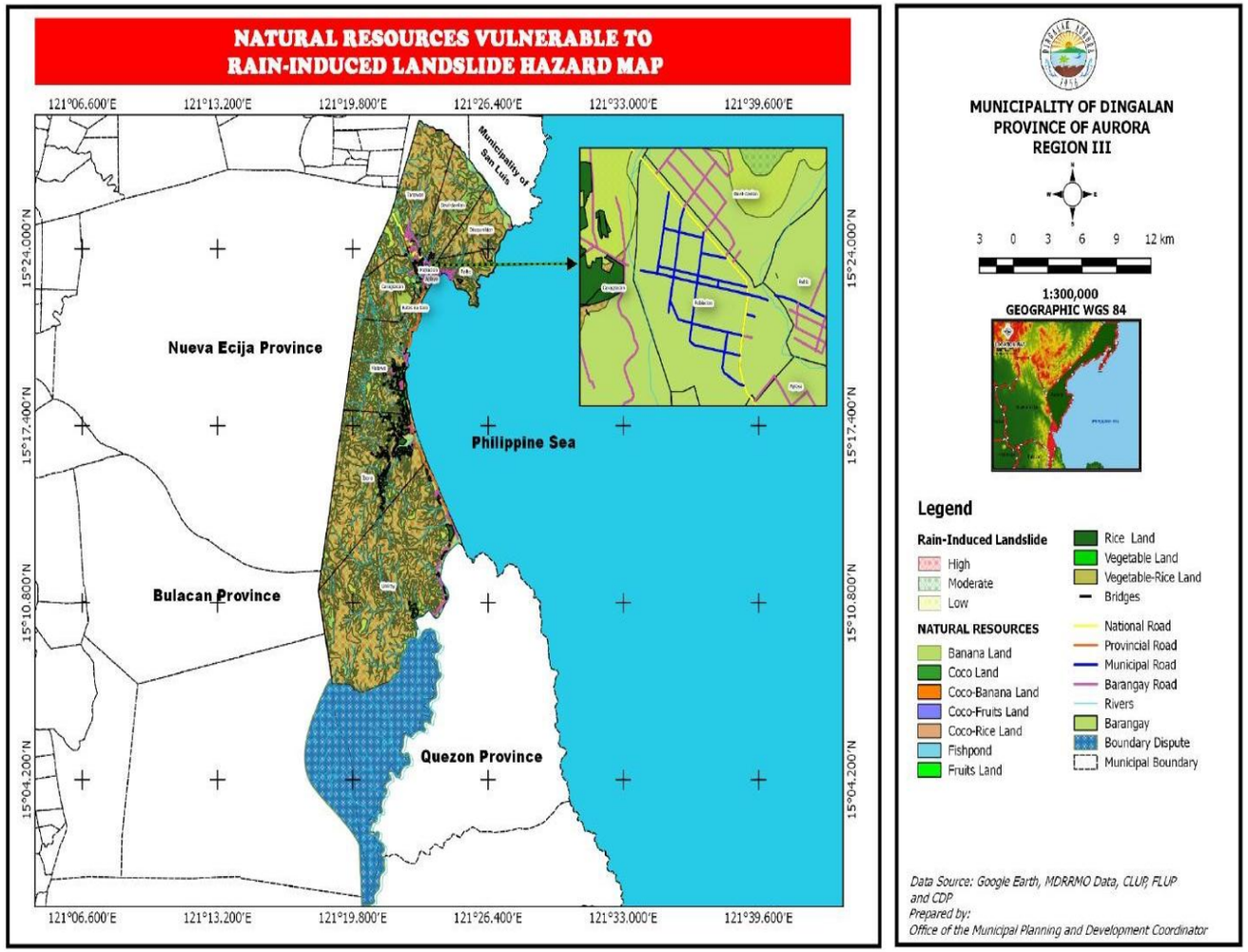


Figure 42. Natural Resources Vulnerable to Rain-Induced Landslide Hazard Map

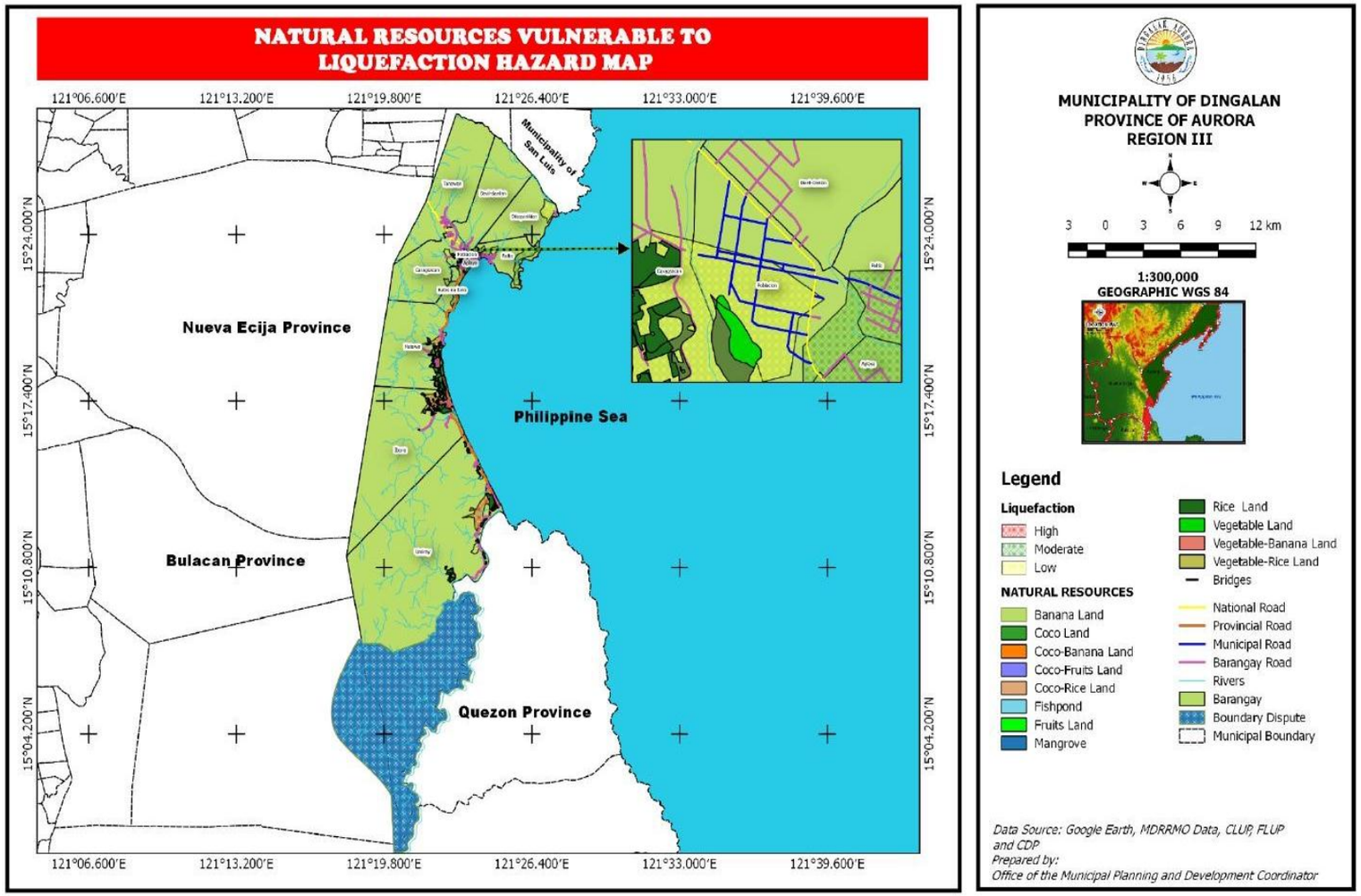


Figure 43. Natural Resources Vulnerable to Liquefaction Hazard Map

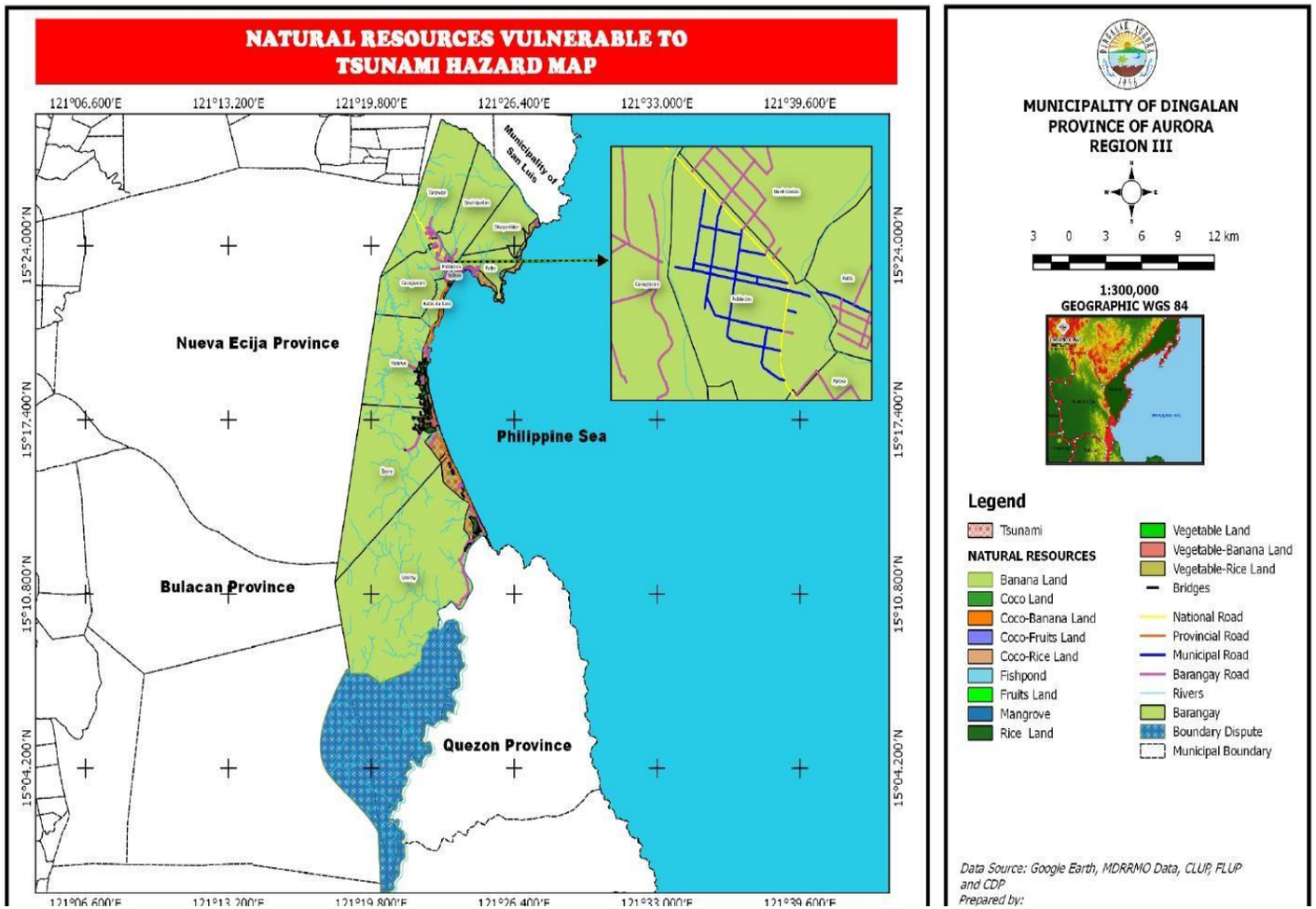


Figure 44. Natural Resources Vulnerable to Tsunami Hazard Map

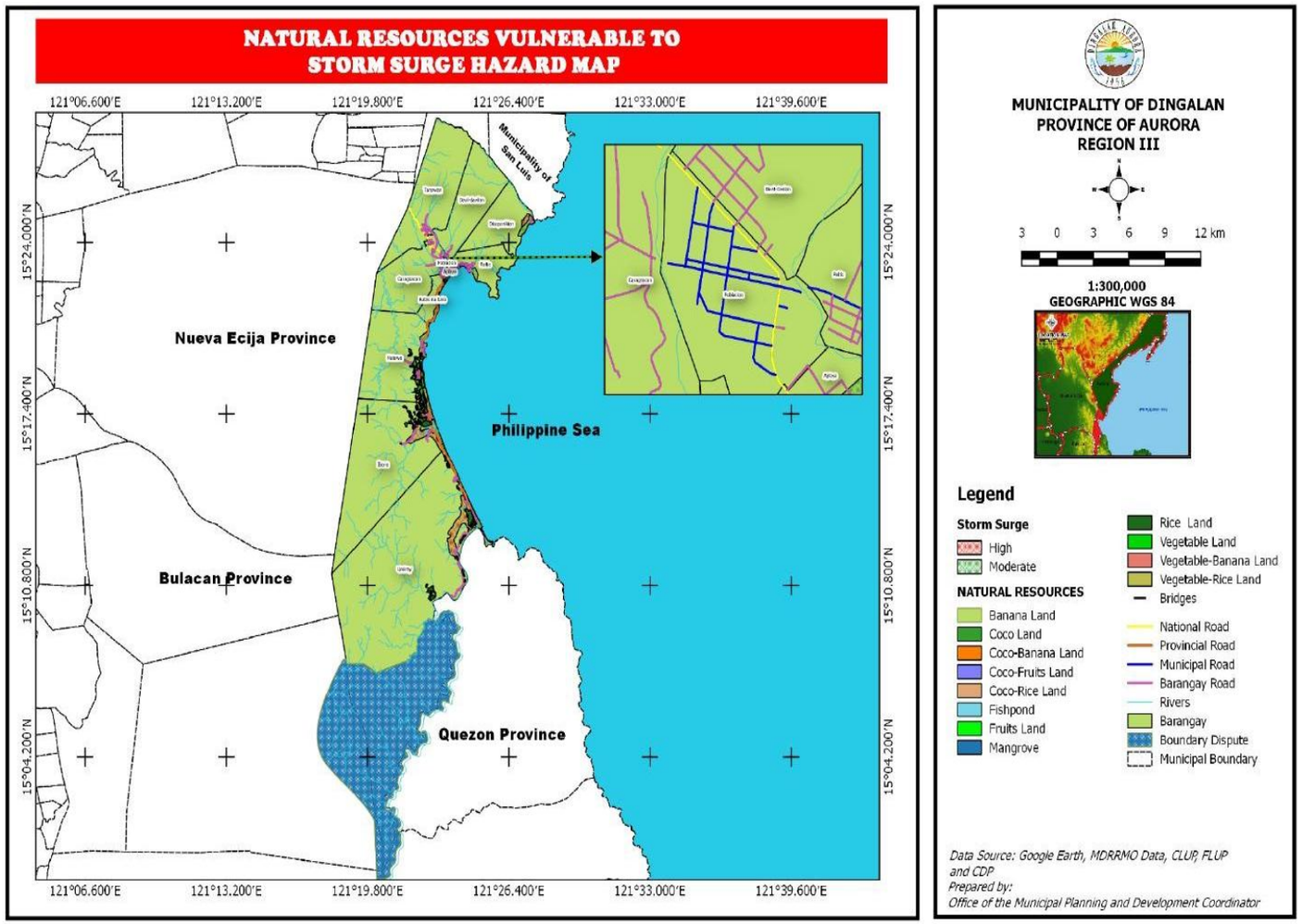


Figure 45. Natural Resources Vulnerable to Storm Surge Hazard Map

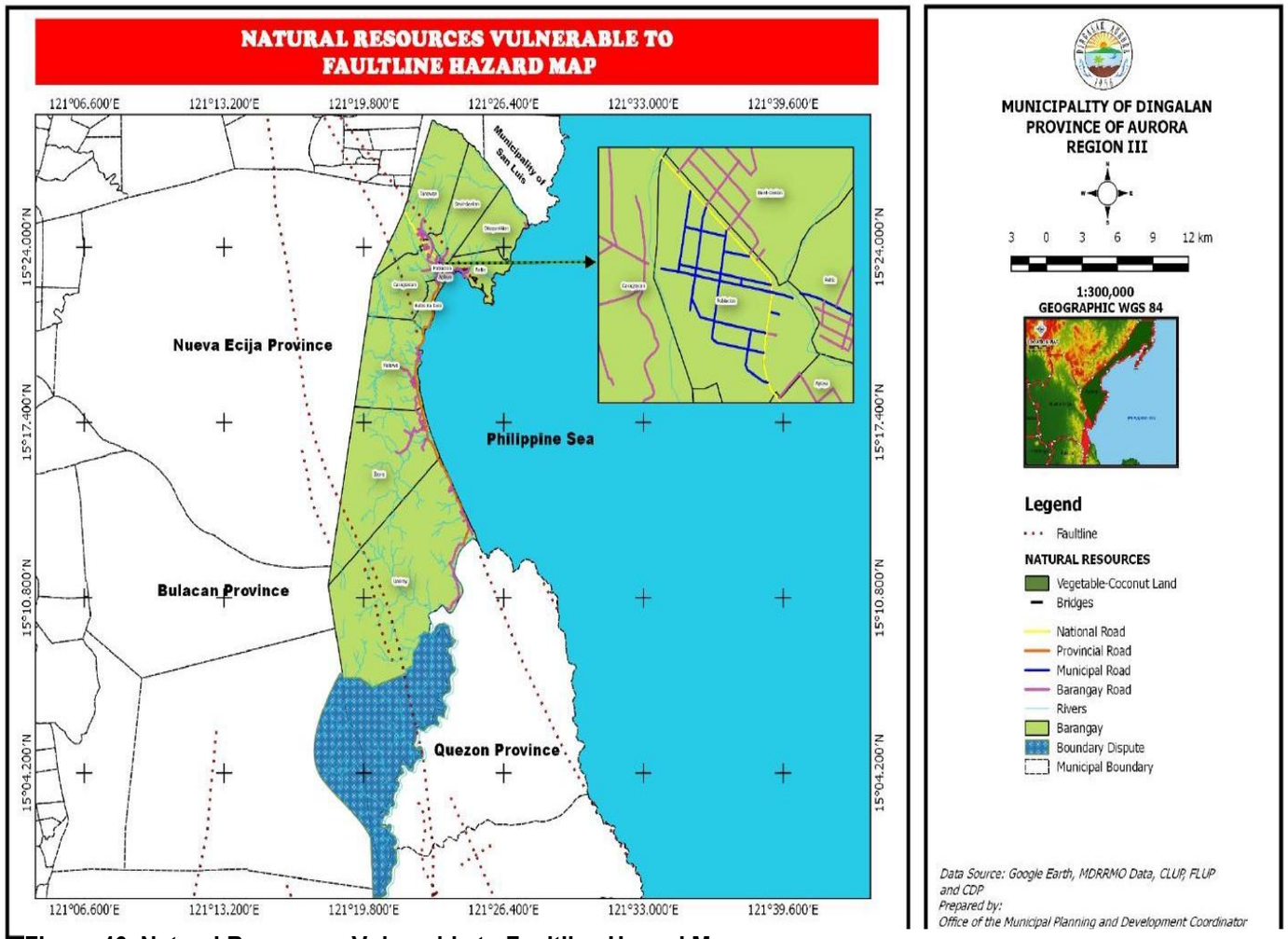


Figure 46. Natural Resources Vulnerable to Faultline Hazard Map

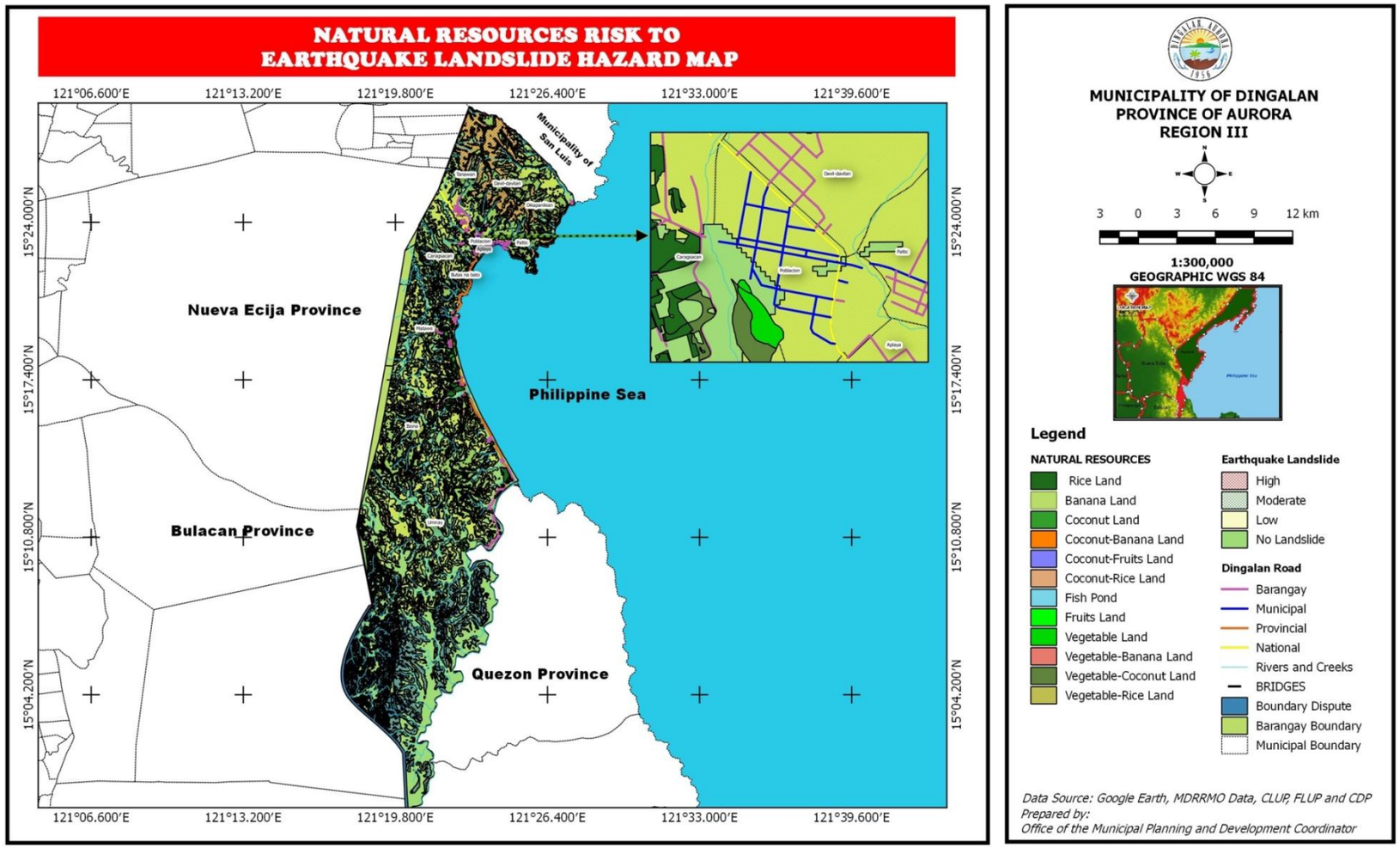


Figure . Natural Resources Vulnerable to Earthquake Landslide Hazard Map

CCVA for Critical Point Facilities

1. Climate Change Vulnerability Assessment Tables

Table 62. Climate Change Vulnerability Assessment of Critical Point Facilities in Dingalan

BARANGAY	FUTURE NUMBER OF EXTREME RAINFALL EVENTS										FUTURE SEA LEVEL CHANGES									
	Degree of Impact					Adaptive Capacity					Degree of Impact					Adaptive Capacity				
	To school infra	To hospitals and health centers	To barangay halls	To gymna-siums	To other gov't infra	Of school infra	Of hospitals and health centers	Of barangay halls	Of gymna-siums	Of other gov't infra	To school infra	To hospitals and health centers	To barangay halls	To gymna-siums	To other gov't infra	Of school infra	Of hospitals and health centers	Of barangay halls	Of gymna-siums	Of other gov't infra
Aplaya	High	High	Low	Low	Moderate	Moderate	Moderate	High	Moderate	Moderate	Low	Low	Low	Low	Low	Moderate	Moderate	Moderate	Moderate	Moderate
Butas Na Bato	Moderate	Low	High	Low	Low	Moderate	Moderate	High	Moderate	Moderate	Low	Low	Low	Low	Low	Moderate	Moderate	Moderate	Moderate	Moderate
Cabog (Matawe)	Low	Low	Low	Low	Low	Moderate	Moderate	Low	Moderate	Moderate	Low	Low	Low	Low	Low	Moderate	Moderate	Moderate	Moderate	Moderate
Caragsacan	Low	Low	Moderate	Low	Low	Moderate	Low	Low	Moderate	Moderate	Low	Low	Low	Low	Low	High	High	Moderate	Moderate	Moderate
Davildavilan	Low	Low	Low	Low	Low	Moderate	Low	Moderate	Moderate	Moderate	Low	Low	Low	Low	Low	High	High	Moderate	High	High
Dikapanikian	Low	Moderate	Moderate	Low	Low	Moderate	Moderate	Moderate	Moderate	Moderate	Low	Low	Low	Low	Low	Moderate	Moderate	Moderate	Moderate	Moderate
Ibona	Low	Low	Low	Low	Low	Moderate	Moderate	Low	Moderate	Moderate	Low	Low	Low	Low	Low	Moderate	Moderate	Moderate	Moderate	Moderate
Paltic	High	High	High	High	Moderate	Moderate	Low	Low	Moderate	Moderate	Low	Low	Low	Low	Low	High	High	Moderate	High	High
Poblacion	Low	Low	Low	Low	Low	Moderate	High	High	Moderate	Moderate	Low	Low	Low	Low	Low	Moderate	Moderate	Moderate	Moderate	Moderate
Tanawan	Low	Low	Low	Low	Low	Moderate	High	High	Moderate	Moderate	Low	Low	Low	Low	Low	High	High	Moderate	High	High
Umiray (Malamig)	Low	Low	Low	Moderate	Low	Moderate	Moderate	Moderate	Moderate	Moderate	Low	Low	Low	Low	Low	Moderate	Moderate	Moderate	Moderate	Moderate

Table 63. Climate Change Vulnerability Assessment of Critical Point Facilities in Dingalan (cont.)

BARANGAY	FUTURE TYPHOONS/ SUPERTYPHOONS										OVERALL VULNERABILITY OF CRITICAL POINT FACILITIES					
	Degree of Impact					Adaptive Capacity										
	To school infra	To hospitals and health centers	To barangay halls	To gymna-siums	To other gov't infra	To school infra	To hospitals and health centers	To barangay halls	To gymna-siums	To other gov't infra	Average Degree of Impacts	Count = 35	Average Adaptive Capacities	Count = 35	CC Vulnerability Index	CC Vulnerability Category
Aplaya	High	High	High	High	High	Low	Low	Low	Low	Low	1.51	35	2.40	35	3.63	Moderate
Butas Na Bato	High	High	High	Low	Low	Low	Low	Low	Low	Low	1.26	35	2.51	35	3.16	Moderate
Cabog (Matawe)	High	High	High	High	High	Low	Low	Low	Low	Low	1.29	35	2.49	35	3.20	Moderate
Caragsacan	High	High	High	High	High	Low	Low	Low	Low	Low	1.31	35	2.49	35	3.27	Moderate
Davildavilan	High	High	High	Low	High	Low	Low	Low	Low	Low	1.23	35	2.49	35	3.05	Low
Dikapanikian	High	High	High	Low	Low	Low	Low	Low	Low	Low	1.23	35	2.51	35	3.09	Low
Ibona	High	High	High	High	High	Low	Low	Low	Low	Low	1.29	35	2.46	35	3.16	Moderate
Paltic	High	High	High	High	High	Low	Low	Low	Low	Low	1.69	35	2.40	35	4.05	Moderate
Poblacion	High	High	High	High	High	Low	Low	Low	Low	Low	1.29	35	2.29	35	2.94	Low
Tanawan	High	High	High	Low	High	Low	Low	Low	Low	Low	1.23	35	2.29	35	2.81	Low
Umiray (Malamig)	High	High	High	High	High	Low	Low	Low	Low	Low	1.31	35	2.49	35	3.27	Moderate

Paltic has the highest average degree of impact to critical point facilities (1.69), while the Barangays Davildavilan, Dikapanikian, and Tanawan have been ranked as the lowest (1.23). As for the average adaptive capacity, Butas na Bato and Dikapanikian both take the first place (2.51), while Poblacion and Tanawan both get the lowest scores (2.29). Given thus, Paltci has the highest score for the climate change vulnerability index (4.05); on the other hand, Tanawan has the lowest score for the same index (2.81).

Overall, the climate change vulnerability of Dingalan with regards to its critical point facilities has been identified to be in the moderate category.

CCVA for Urban Use

1. Climate Change Vulnerability Assessment Tables

Table 64. Climate Change Vulnerability Assessment of Urban Use Areas in Dingalan

BARANGAY	FUTURE TEMPERATURE TRENDS										FUTURE RAINFALL TRENDS									
	Degree of Impact					Adaptive Capacity					Degree of Impact					Adaptive Capacity				
	To residential land use	To commercial land use	To tourist sites	To upland and sloping areas	To shoreline/ water bodies	Of residential land use	Of commercial land use	Of tourist sites	Of upland and sloping areas	Of shoreline/ water bodies	To residential land use	To commercial land use	To tourist sites	To upland and sloping areas	To shoreline/ water bodies	Of residential land use	Of commercial land use	Of tourist sites	Of upland and sloping areas	Of shoreline/ water bodies
Aplaya	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Moderate	Moderate	Low	Moderate
Butas Na Bato	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Cabog (Matawe)	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Caragsacan	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Moderate	Moderate	Low
Davildavilan	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Moderate	Moderate	Low
Dikapanikian	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Ibona	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Paltic	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Poblacion	Moderate	Moderate	Moderate	Low	Low	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Low	Low	Moderate	Moderate	Moderate	Low	Low
Tanawan	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Moderate	Moderate	Low
Umiray (Malamig)	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate

Table 65. Climate Change Vulnerability Assessment of Urban Use Areas in Dingalan (cont. 2)

BARANGAY	FUTURE NUMBER OF HOT DAYS										FUTURE NUMBER OF DRY DAYS									
	Degree of Impact					Adaptive Capacity					Degree of Impact					Adaptive Capacity				
	To residential land use	To commercial land use	To tourist sites	To upland and sloping areas	To shoreline/ water bodies	Of residential land use	Of commercial land use	Of tourist sites	Of upland and sloping areas	Of shoreline/ water bodies	To residential land use	To commercial land use	To tourist sites	To upland and sloping areas	To shoreline/ water bodies	Of residential land use	Of commercial land use	Of tourist sites	Of upland and sloping areas	Of shoreline/ water bodies
Aplaya	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Moderate	Moderate	Low	Moderate
Butas Na Bato	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Cabog (Matawe)	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Caragsacan	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Moderate	Moderate	Low
Davildavilan	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Moderate	Moderate	Low
Dikapanikian	Moderate	Low	Low	Moderate	Moderate	Moderate	Low	Low	Moderate	Moderate	Moderate	Low	Low	Moderate	Moderate	Moderate	Low	Low	Moderate	Moderate
Ibona	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Paltic	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Poblacion	Moderate	Moderate	Moderate	Low	Low	Moderate	Moderate	Moderate	Low	Low	Moderate	Moderate	Moderate	Low	Low	Moderate	Moderate	Moderate	Low	Low
Tanawan	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Moderate	Moderate	Low
Umiray (Malamig)	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate

Table 66. Climate Change Vulnerability Assessment of Urban Use Areas in Dingalan (cont. 3)

BARANGAY	FUTURE NUMBER OF EXTREME RAINFALL EVENTS										FUTURE SEA LEVEL CHANGES									
	Degree of Impact					Adaptive Capacity					Degree of Impact					Adaptive Capacity				
	To residential land use	To commercial land use	To tourist sites	To upland and sloping areas	To shoreline/ water bodies	Of residential land use	Of commercial land use	Of tourist sites	Of upland and sloping areas	Of shoreline/ water bodies	To residential land use	To commercial land use	To tourist sites	To upland and sloping areas	To shoreline/ water bodies	Of residential land use	Of commercial land use	Of tourist sites	Of upland and sloping areas	Of shoreline/ water bodies
Aplaya	Moderate	Moderate	Low	Low	Moderate	Moderate	Moderate	Moderate	Low	Low	Moderate	Moderate	Low	Low	Moderate	Low	Low	Low	Low	Low
Butas Na Bato	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Low	Low	Low	Low	Low
Cabog (Matawe)	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Low	Low	Low	Low	Low
Caragsacan	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Moderate	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
Davildavilan	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Moderate	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
Dikapanikian	Moderate	Low	Low	Moderate	Moderate	Low	Low	Low	Low	Moderate	Moderate	Low	Low	Low	Moderate	Low	Low	Low	Low	Low
Ibona	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Low	Low	Low	Low	Low
Paltic	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Moderate	High	Low	Moderate	Low	Low	Low	Low	Low
Poblacion	Moderate	Moderate	Low	Low	Low	Moderate	Moderate	Moderate	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
Tanawan	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Moderate	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
Umiray (Malamig)	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Low	Low	Low	Low	Low

Table 67. Climate Change Vulnerability Assessment of Urban Use Areas in Dingalan (cont. 4)

BARANGAY	FUTURE TYPHOONS/ SUPERTYPHOONS										OVERALL VULNERABILITY OF CRITICAL POINT FACILITIES					
	Degree of Impact					Adaptive Capacity										
	To residential land use	To commercial land use	To tourist sites	To upland and sloping areas	To shoreline/ water bodies	Of residential land use	Of commercial land use	Of tourist sites	Of upland and sloping areas	Of shoreline/ water bodies	Average Degree of Impacts	Count = 35	Average Adaptive Capacities	Count = 35	CC Vulnerability Index	CC Vulnerability Category
Aplaya	High	High	High	High	High	Low	Moderate	Low	Low	Low	1.91	35	2.40	35	4.59	Moderate
Butas Na Bato	High	High	High	High	High	Low	Moderate	Low	Low	Low	2.09	35	2.29	35	4.77	Moderate
Cabog (Matawe)	High	High	High	High	High	Low	Moderate	Low	Low	Low	2.11	35	2.29	35	4.83	Moderate
Caragsacan	High	High	High	High	High	Low	Moderate	Low	Low	Low	1.86	35	2.43	35	4.51	Moderate
Davildavilan	High	High	High	High	High	Low	Moderate	Low	Low	Low	1.86	35	2.43	35	4.51	Moderate
Dikapanikian	High	High	High	High	High	Low	Moderate	Low	Low	Low	1.89	35	2.49	35	4.69	Moderate
Ibona	High	High	High	High	High	Low	Moderate	Low	Low	Low	2.11	35	2.29	35	4.83	Moderate
Paltic	High	High	High	High	High	Low	Moderate	Low	Low	Low	2.14	35	2.29	35	4.90	Moderate
Poblacion	High	High	High	High	High	Low	Moderate	Low	Low	Low	1.69	35	2.51	35	4.24	Moderate
Tanawan	High	High	High	High	High	Low	Moderate	Low	Low	Low	1.86	35	2.43	35	4.51	Moderate
Umiray (Malamig)	High	High	High	High	High	Low	Moderate	Low	Low	Low	2.11	35	2.29	35	4.83	Moderate

The barangay with the highest average degree of impact score is Paltic (2.14), while Poblacion has the lowest score for the same criteria (1.69) since most of the houses in Poblacion are bungalow-type, and are built at least 650 meters from the seashore. With regards to the average adaptive capacity, Paltic has garnered the highest score (4.90), while Poblacion obtained the lowest (4.24).

Given thus, the climate change vulnerability of Dingalan with regards to its urban use is deemed to be moderate.

2. Hazard Maps for Urban Use Areas

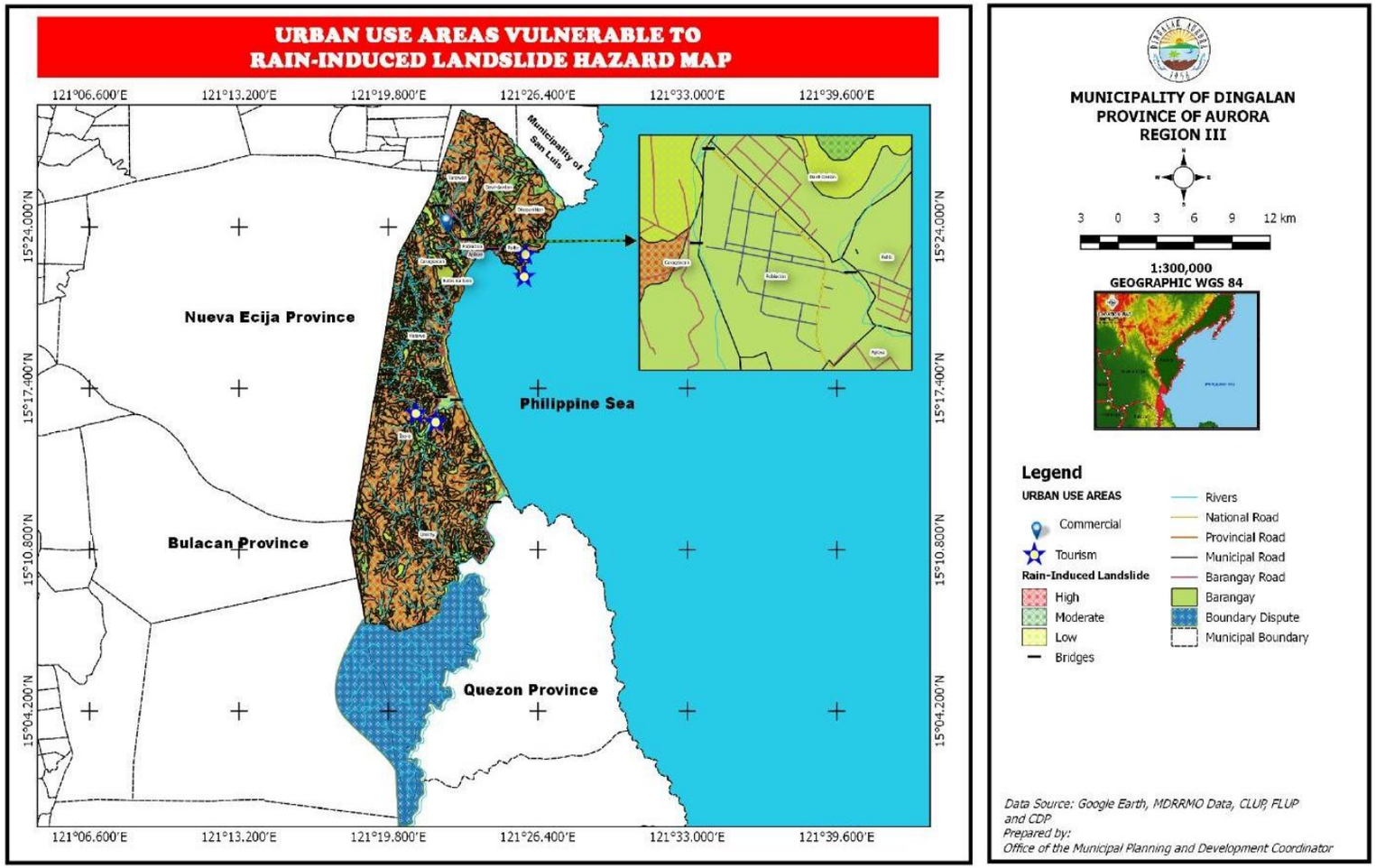


Figure 49. Urban Use Areas Vulnerable to Rain-Induced Landslide Hazard Map

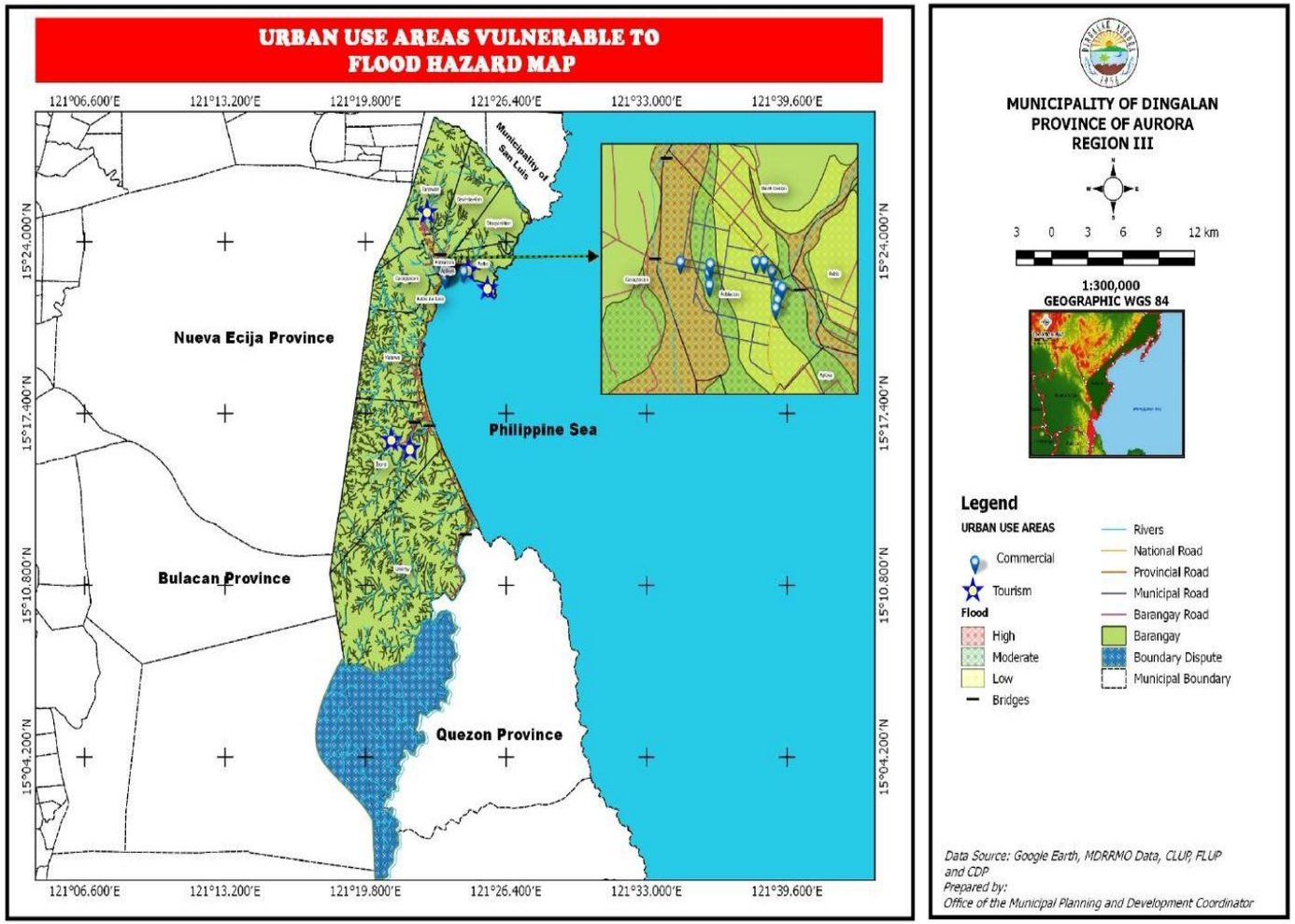


Figure 50. Urban Use Areas Vulnerable to Flood Hazard Map

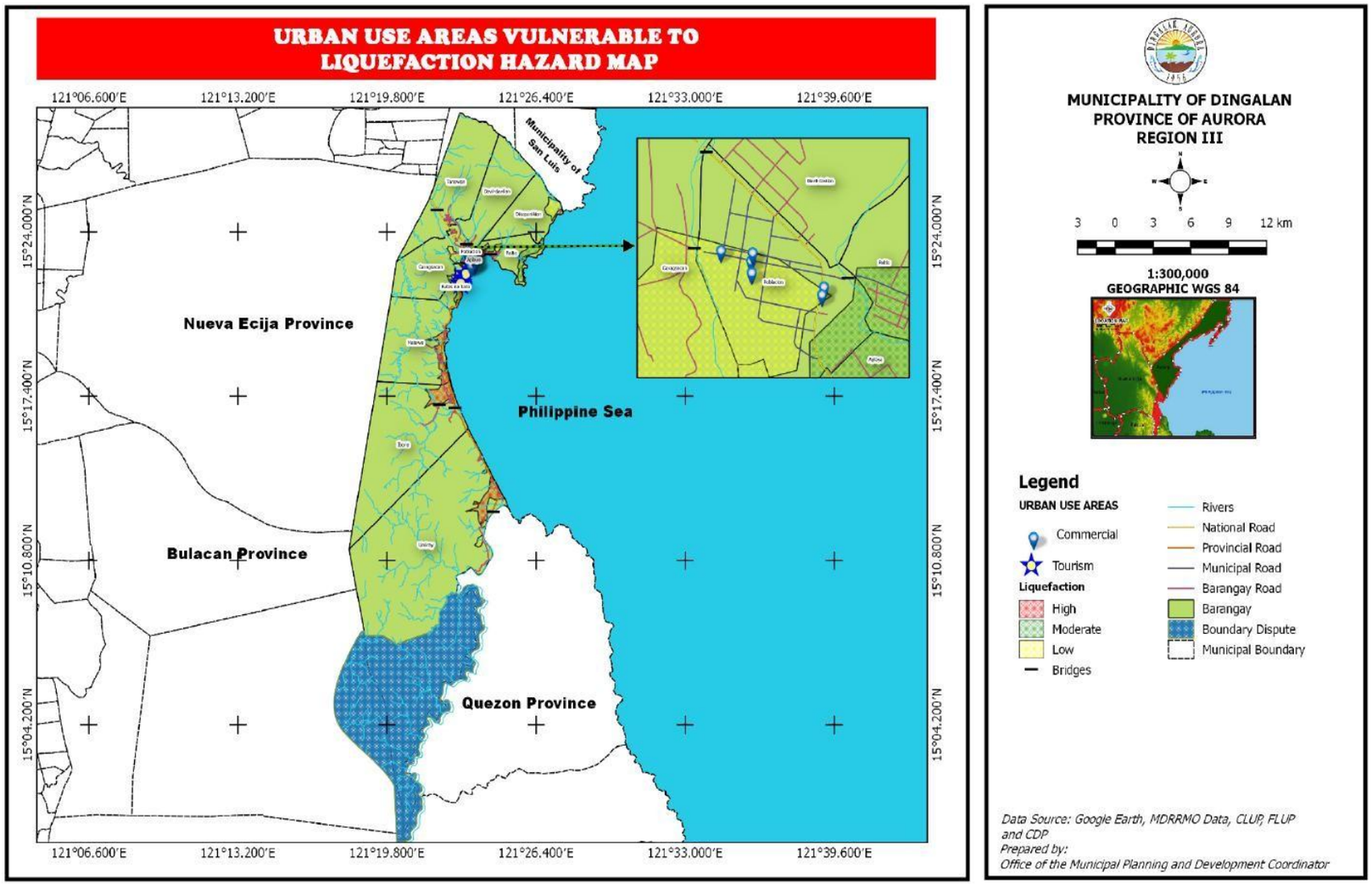


Figure 51. Urban Use Areas Vulnerable to Liquefaction Hazard Map

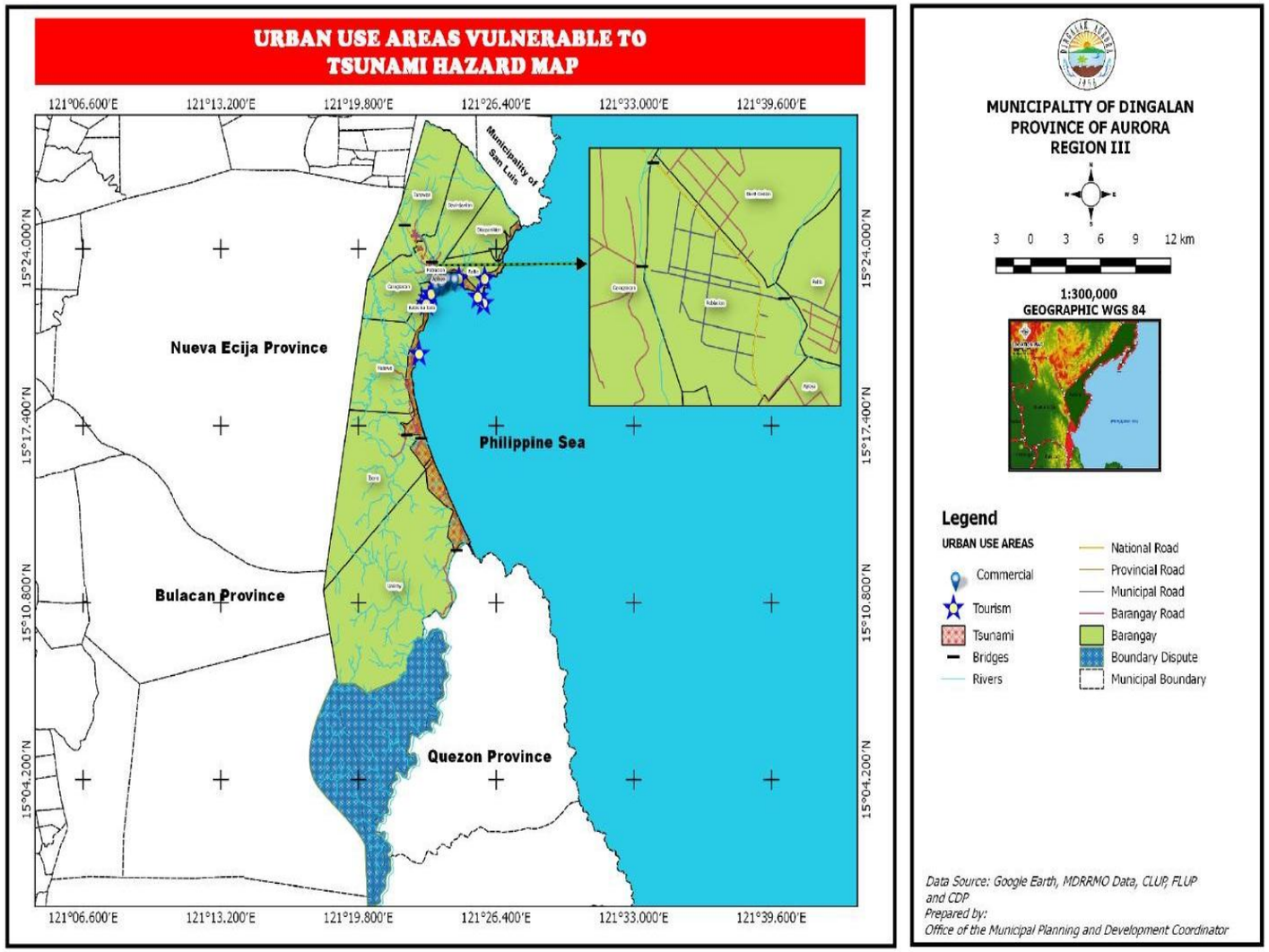


Figure 52. Urban Use Areas Vulnerable to Tsunami Hazard Map

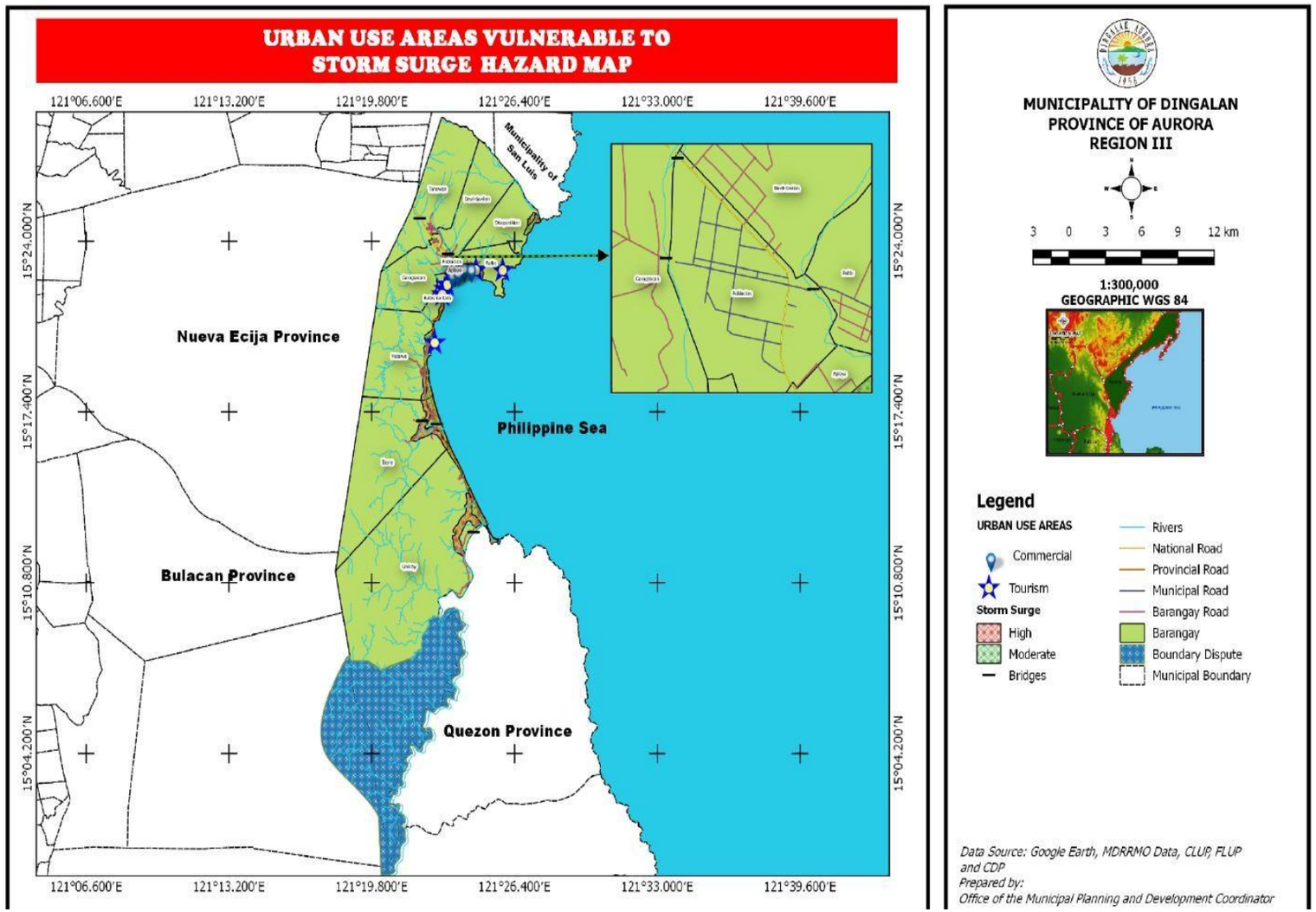


Figure 53. Urban Use Areas Vulnerable to Storm Surge Hazard Map

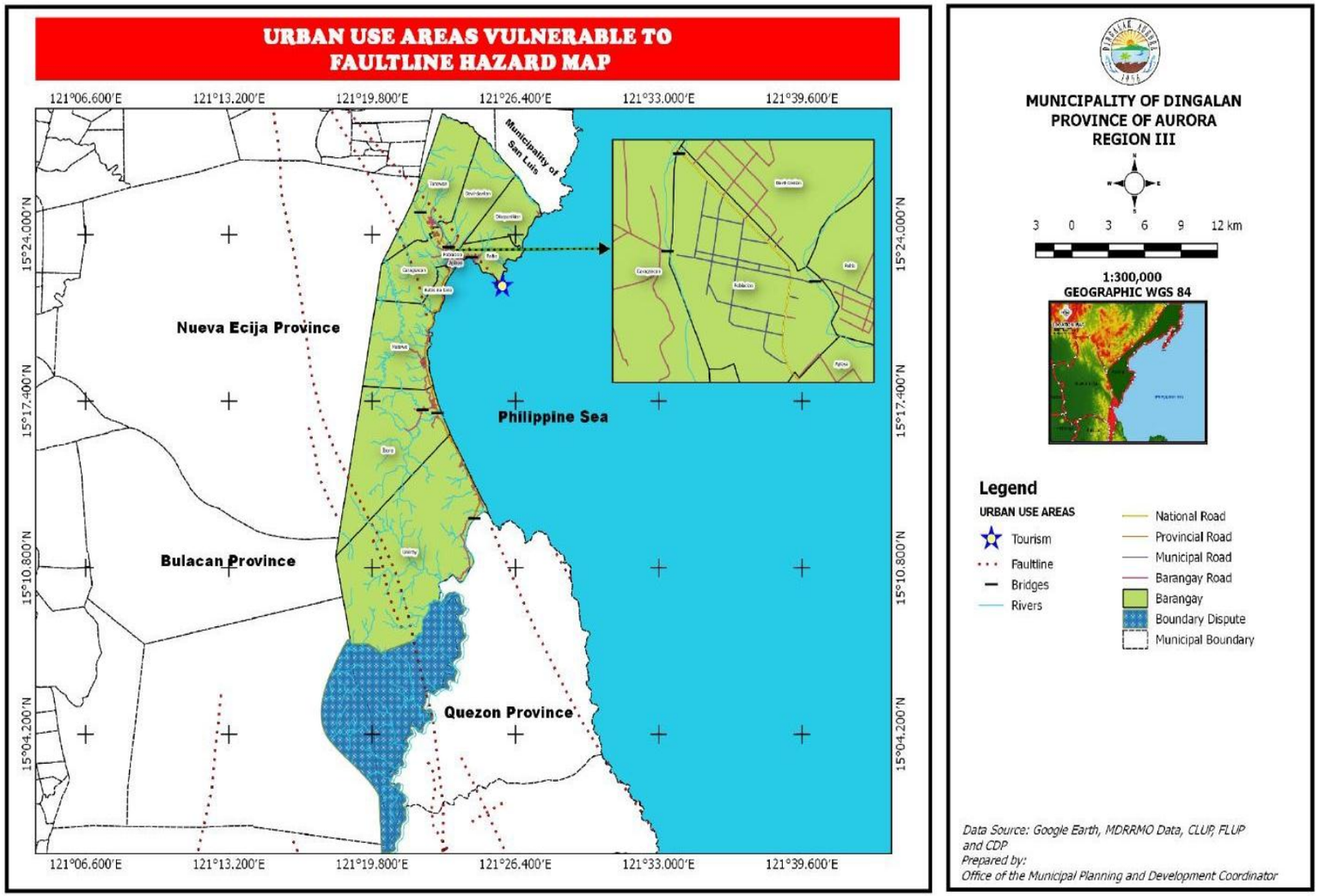


Figure 54. Urban Use Areas Vulnerable to Faultline Hazard Map

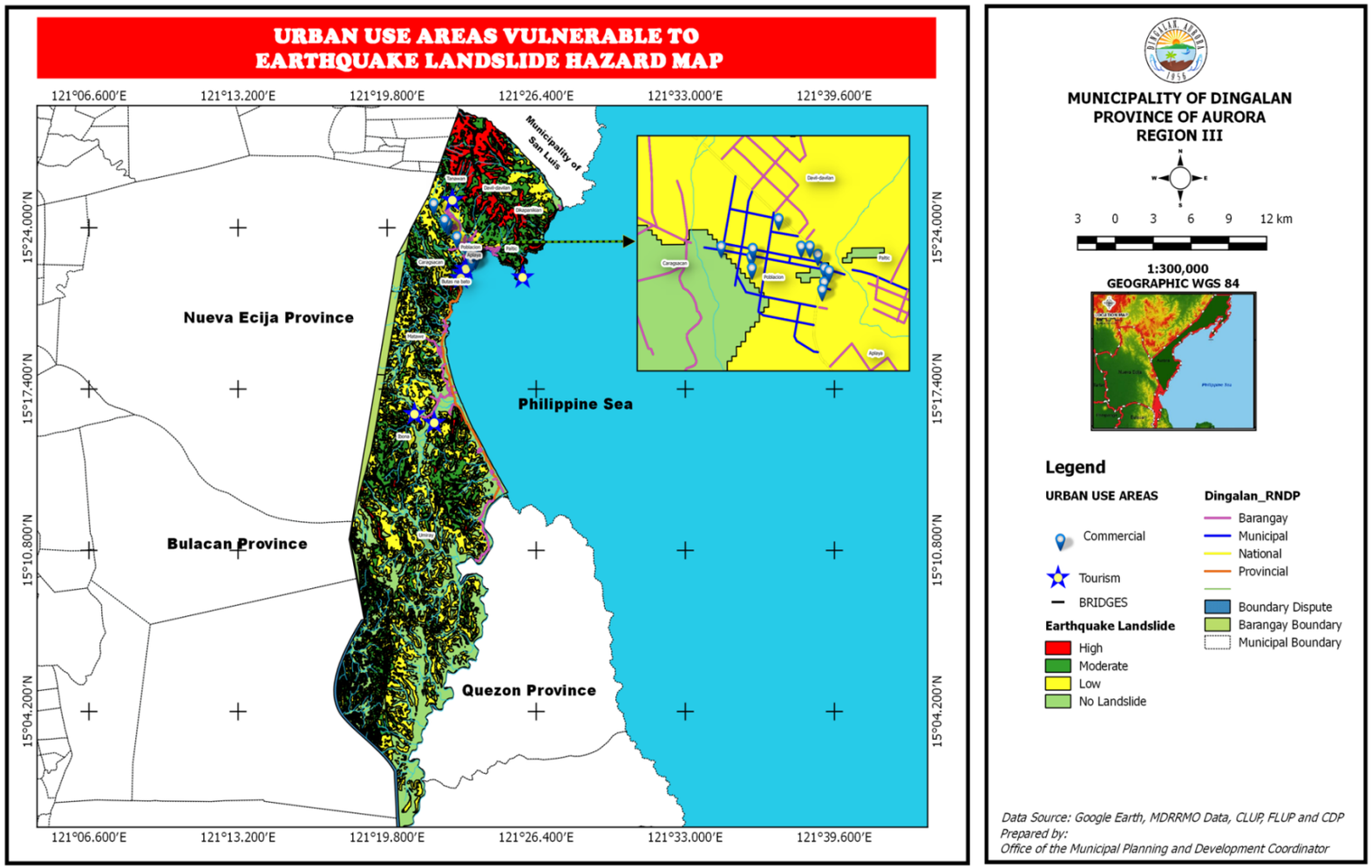


Figure 55. Urban Use Areas Vulnerable to Faultline Hazard Map

CCVA for Lifeline Utilities

1. Climate Change Vulnerability Assessment Tables

Table 68. Climate Change Vulnerability Assessment of Lifeline Utilities in Dingalan

BARANGAY	FUTURE TEMPERATURE TRENDS										FUTURE RAINFALL TRENDS									
	Degree of Impact					Adaptive Capacity					Degree of Impact					Adaptive Capacity				
	To roads	To bridges	To telecom systems	To water utilities	To power distribution systems	Of roads	Of bridges	Of telecom systems	Of water utilities	Of power distribution systems	To roads	To bridges	To telecom systems	To water utilities	To power distribution systems	Of roads	Of bridges	Of telecom systems	Of water utilities	Of power distribution systems
Aplaya	Low	Low	Low	Low	Low	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Low	High	Moderate	Moderate	Moderate	Low	Moderate
Butas Na Bato	Low	Low	Low	Low	Low	Moderate	Low	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Low	High	Moderate	Low	Moderate	Low	Moderate
Cabog (Matawe)	Low	Low	Low	Low	Low	Moderate	Low	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Low	High	Moderate	Low	Moderate	Low	Moderate
Caragsacan	Low	Low	Low	Low	Low	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Low	High	Moderate	Moderate	Moderate	Low	Moderate
Davildavilan	Low	Low	Low	Low	Low	Moderate	Low	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Moderate	High	Moderate	Low	Moderate	Moderate	Moderate
Dikapanikian	Low	Low	Low	Low	Low	Moderate	Low	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Low	High	Moderate	Low	Moderate	Low	Moderate
Ibona	Low	Low	Low	Low	Low	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	High	Moderate	Moderate	Moderate	Moderate	Moderate
Paltic	Low	Low	Low	Low	Low	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Low	High	Moderate	Moderate	Moderate	Low	Moderate
Poblacion	Low	Low	Low	Low	Low	Moderate	Low	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Low	High	Moderate	Low	Moderate	Low	Moderate
Tanawan	Low	Low	Low	Low	Low	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Low	High	Moderate	Moderate	Moderate	Low	Moderate
Umiray (Malamig)	Low	Low	Low	Low	Low	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Low	High	Moderate	Moderate	Moderate	Low	Moderate

Table 69. Climate Change Vulnerability Assessment of Lifeline Utilities in Dingalan (cont.)

BARANGAY	FUTURE TYPHOONS/ SUPERTYPHOONS										OVERALL VULNERABILITY OF NATURAL RESOURCES					
	Degree of Impact					Adaptive Capacity										
	To roads	To bridges	To telecom systems	To water utilities	To power distribution systems	Of roads	Of bridges	Of telecom systems	Of water utilities	Of power distribution systems	Average Degree of Impacts	Count = 35	Average Adaptive Capacities	Count = 35	CC Vulnerability Index	CC Vulnerability Category
Aplaya	High	High	Moderate	Low	High	Moderate	Moderate	Moderate	Low	Moderate	1.57	35	2.26	35	3.55	Moderate
Butas Na Bato	High	Low	Moderate	Low	High	Moderate	Low	Moderate	Low	Moderate	1.43	35	2.46	35	3.51	Moderate
Cabog (Matawe)	High	Low	Moderate	Low	High	Moderate	Low	Moderate	Low	Moderate	1.43	35	2.46	35	3.51	Moderate
Caragsacan	High	High	Moderate	Low	High	Moderate	Moderate	Moderate	Low	Moderate	1.49	35	2.29	35	3.40	Moderate
Davildavilan	High	Low	Moderate	High	High	Moderate	Low	Moderate	Moderate	Moderate	1.63	35	2.31	35	3.77	Moderate
Dikapanikian	High	Low	Moderate	Low	High	Moderate	Low	Moderate	Low	Moderate	1.43	35	2.46	35	3.51	Moderate
Ibona	High	High	Moderate	High	High	Moderate	Moderate	Moderate	Moderate	Moderate	1.83	35	2.11	35	3.87	Moderate
Paltic	High	High	Moderate	Low	High	Moderate	Moderate	Moderate	Low	Moderate	1.57	35	2.26	35	3.55	Moderate
Poblacion	High	Low	Moderate	Low	High	Moderate	Low	Moderate	Low	Moderate	1.37	35	2.46	35	3.37	Moderate
Tanawan	High	High	Moderate	Low	High	Moderate	Moderate	Moderate	Low	Moderate	1.49	35	2.29	35	3.40	Moderate
Umiray (Malamig)	High	High	Moderate	Low	High	Moderate	Moderate	Moderate	Low	Moderate	1.57	35	2.26	35	3.55	Moderate

Ibona has the highest average degree of impact, with 1.83; while the barangay with the lowest average degree of impact is Poblacion, with 1.37. There are several barangays ranked as top one with regards to average adaptive capacities – Butas na Bato, Cabog, Dikapanikian, and Poblacion all have the score of 2.46; on the other hand, Ibona, with 2.11, has the lowest rank. Despite this, Ibona has garnered the highest score in the climate change vulnerability index (3.87).

Overall, the climate change vulnerability of Dingalan with regards to its lifeline utilities has been determined to be within the moderate category.

2. Hazard Maps for Lifeline Facilities

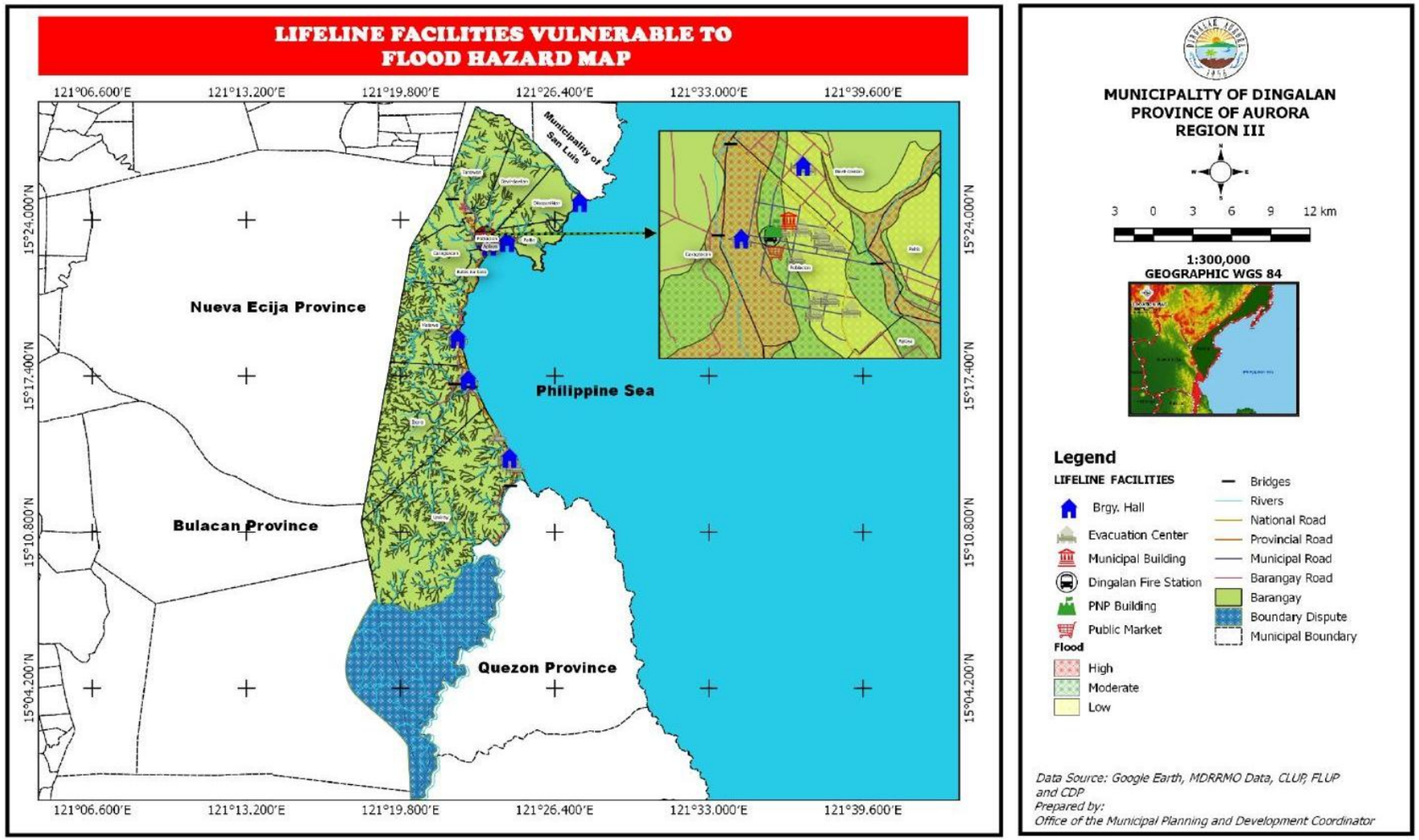


Figure 56. Lifeline Facilities Vulnerable to Flood Hazard Map

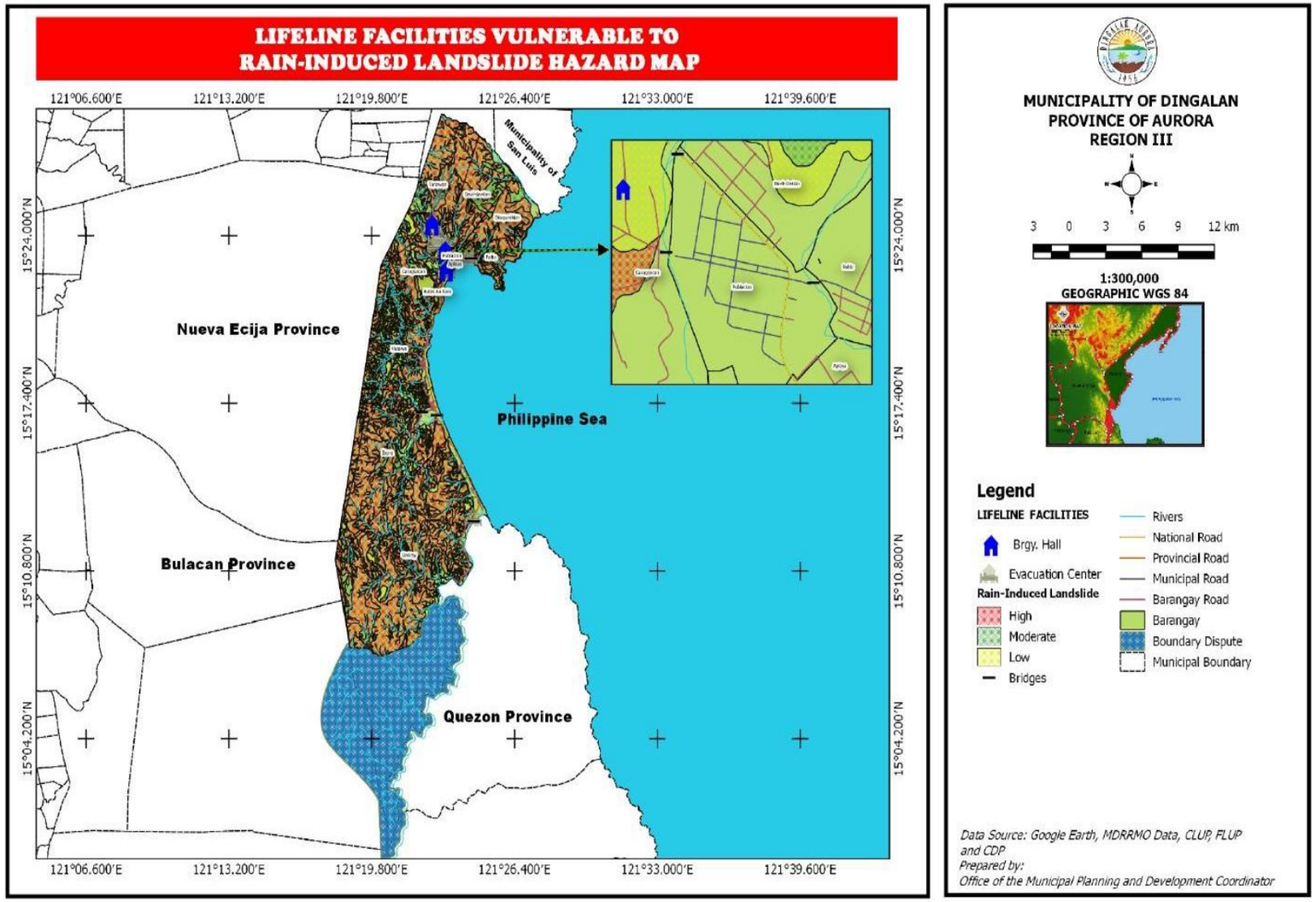


Figure 57. Lifeline Facilities Vulnerable to Rain-Induced Landslide Hazard Map

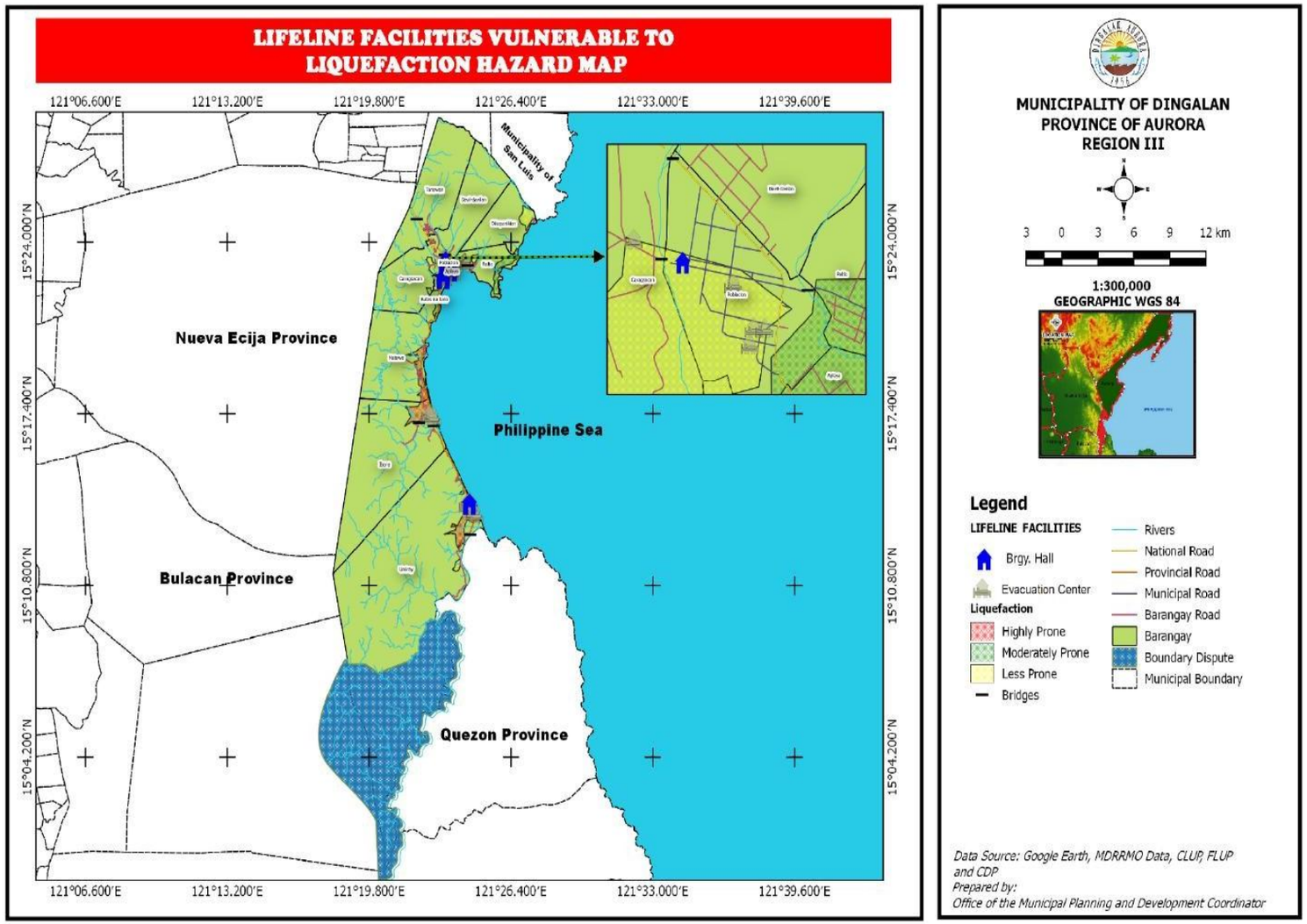


Figure 58. Lifeline Facilities Vulnerable to Liquefaction Hazard Map

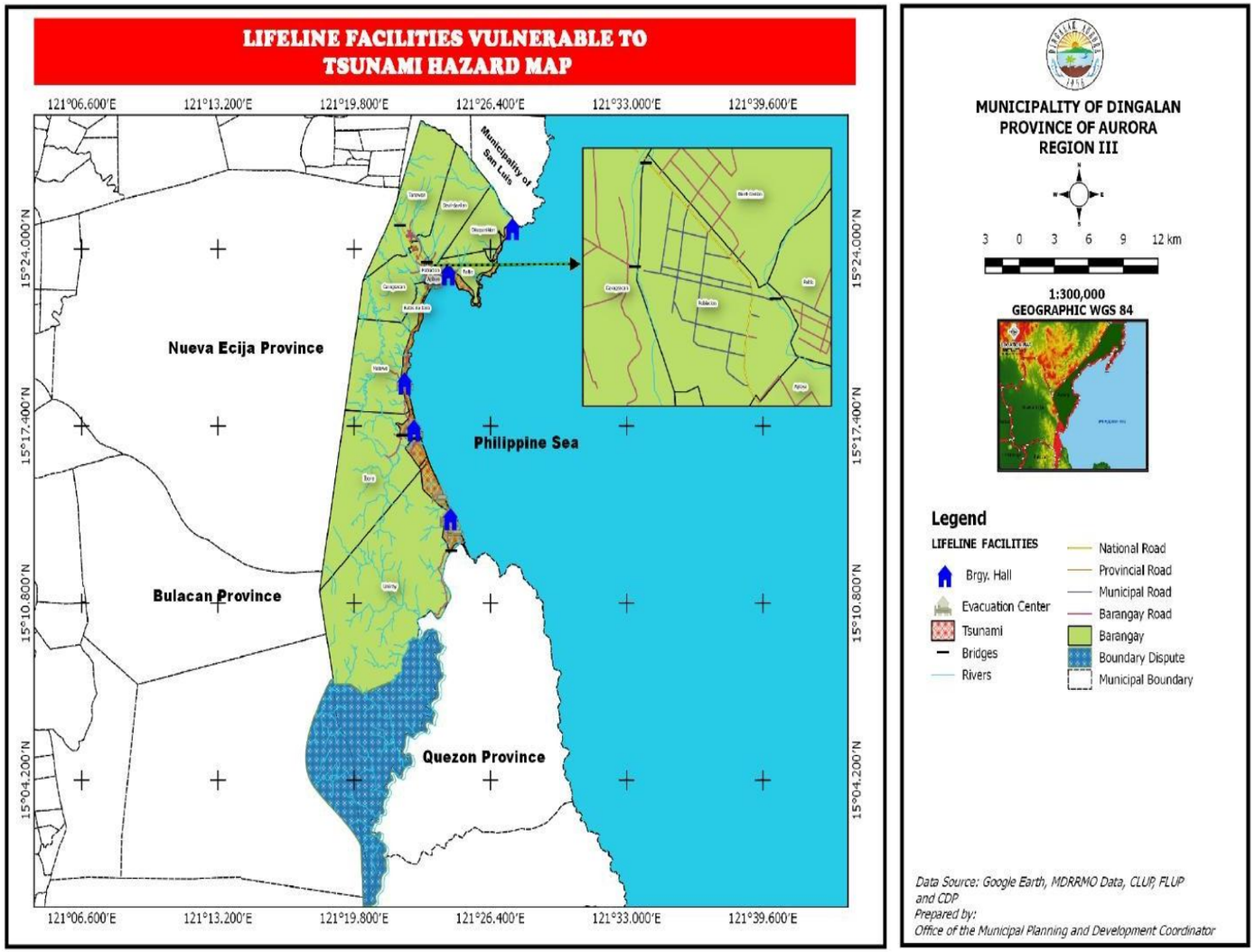

LIFELINE FACILITIES VULNERABLE TO
TSUNAMI HAZARD MAP
121°06.600'E
121°13.200'E
121°19.800'E
121°26.400'E
121°33.000'E
121°39.600'E
15°24.000'N
15°17.400'N
15°10.800'N
15°04.200'N
Municipality of San Luis
Nueva Ecija Province
Philippine Sea
Bulacan Province
Quezon Province
MUNICIPALITY OF DINGALAN
PROVINCE OF AURORA
REGION III
3 0 3 6 9 12 km
1:300,000
GEOGRAPHIC WGS 84
Legend
LIFELINE FACILITIES
Brgy. Hall
Evacuation Center
Tsunami
Bridges
Rivers
National Road
Provincial Road
Municipal Road
Barangay Road
Barangay
Boundary Dispute
Municipal Boundary
Data Source: Google Earth, MDRRMO Data, CLUP, FLUP and CDP
Prepared by:
Office of the Municipal Planning and Development Coordinator

Figure 59. Lifeline Facilities Vulnerable to Tsunami Hazard Map

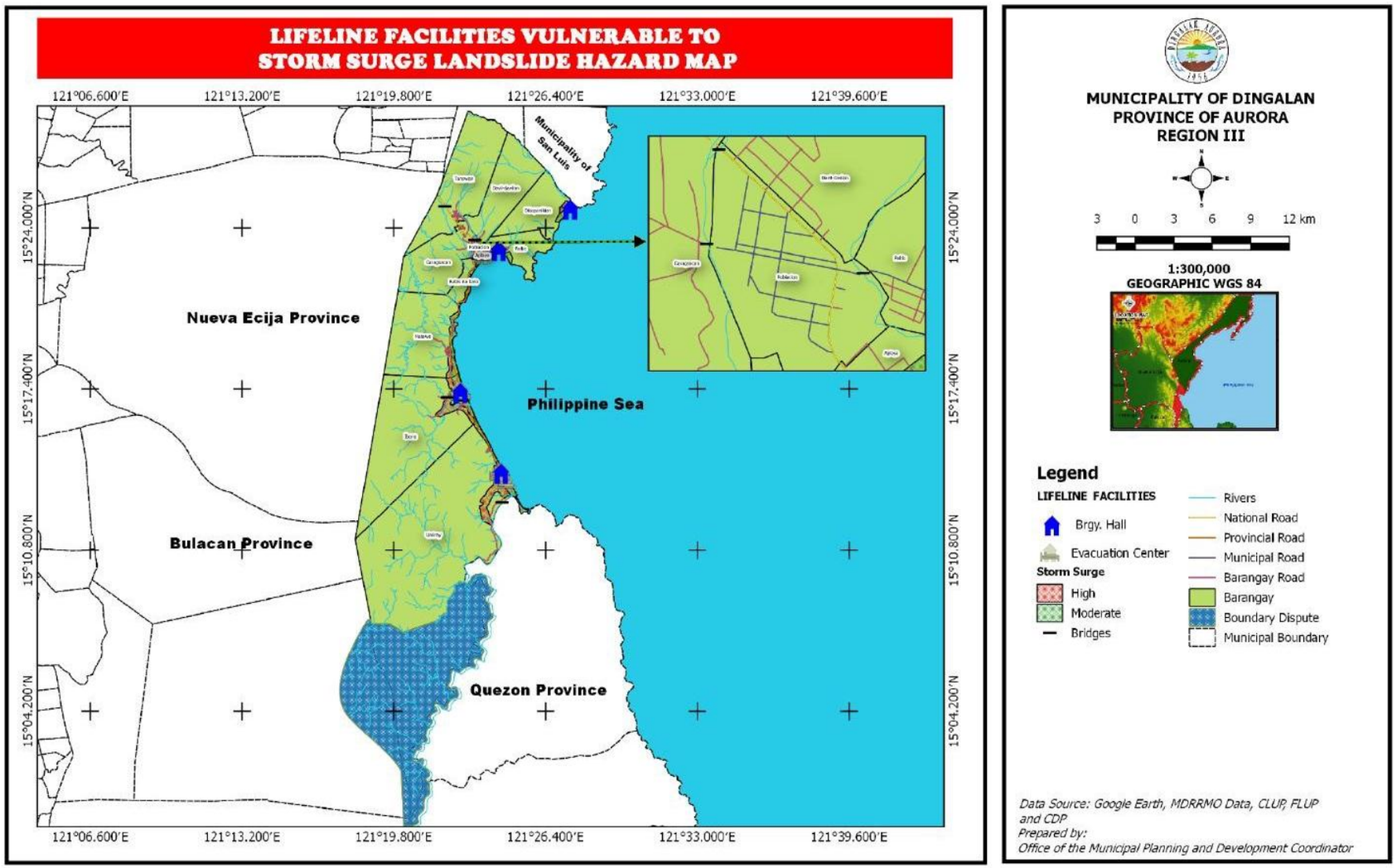


Figure 60. Lifeline Facilities Vulnerable to Storm Surge Landslide Hazard Map

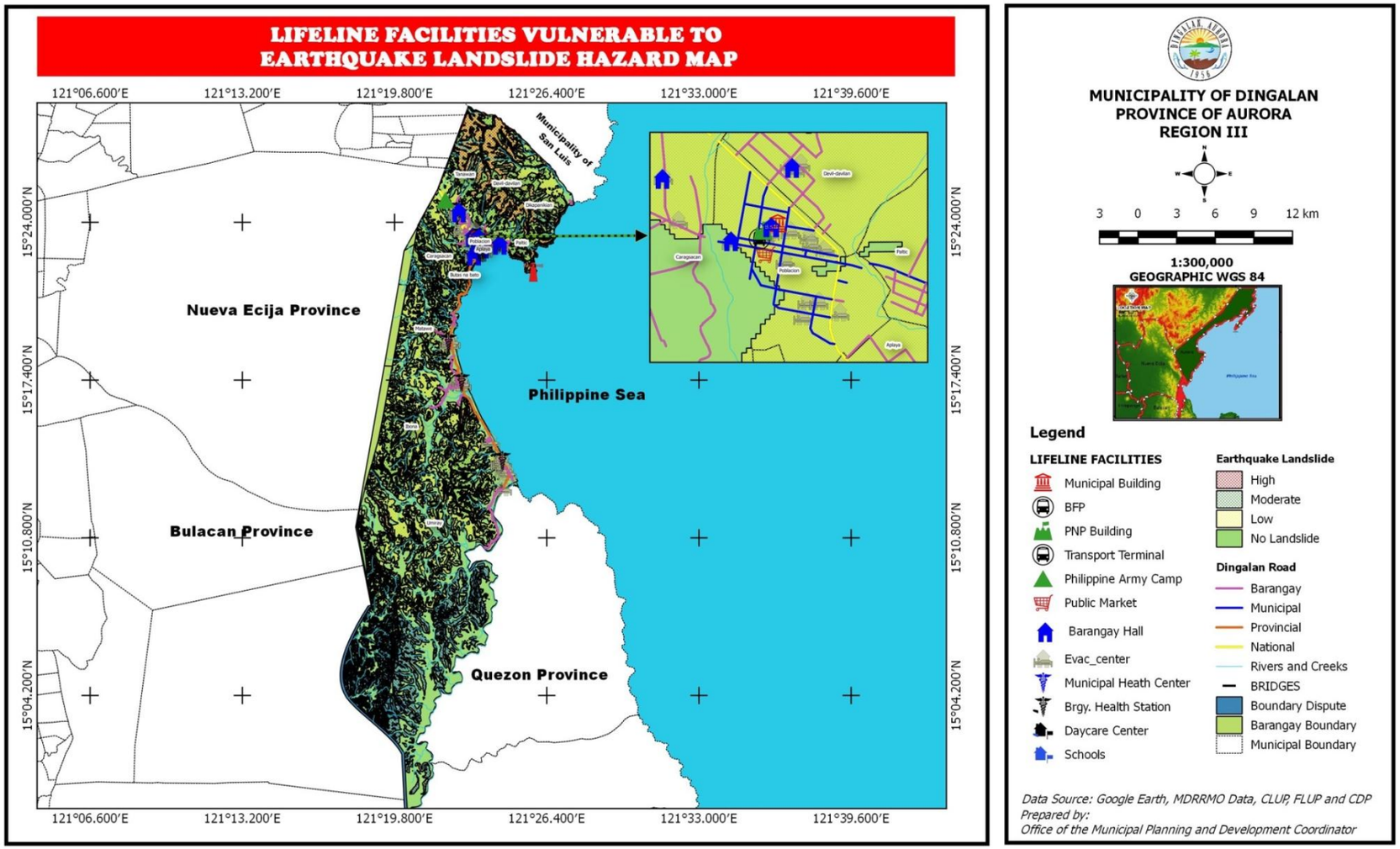


Figure 61. Lifeline Facilities Vulnerable to Tsunami Hazard Map

CCVA Summary

Table 70. Climate Change Vulnerability Assessment Summary for Dingalan

Barangays	Overall CCV Index	Overall CCV Category	Count of CC Vulnerabilities	Descriptive Summary of CC Vulnerabilities				
				Population	Natural Resources	Critical Point Facilities	Urban Use	Lifeline Utilities
Aplaya	4.06	Moderate	5	Around 7.07% of the total population of Dingalan lives in Aplaya, where they are moderately vulnerable to given hazards. It has 6% of total senior citizens and 3% of total PWD municipal-wide.	Aplaya is a lowland barangay. It has no mountains or hills. Two major rivers are present in this barangay, causing floods during heavy rainfall.	Infrastructure were constructed at an average elevation of 30 feet ASL. Some structures were constructed within the past ten years; hence, their structural stability might be in need of reinforcement.	Most of the houses are bungalow-type, and are usually constructed at least 50 meters away from the seashore.	Some parts of the roads were asphalted recently. Roads and bridges have been found to be structurally sound.
Butas na Bato	3.84	Moderate	5	Around 3.57% of the total population of Dingalan lives in Butas na Bato, where they are moderately vulnerable to given hazards. It has 3% of total senior citizens and 5% of total PWD municipal-wide.	Butas na Bato is a mix of lowland and upland. There are mountains and hills within the area.	Infrastructure were constructed at an average elevation of 14 meters ASL. Some structures were constructed within the past ten years; hence, their structural stability might be in need of reinforcement.	Most of the houses are bungalow-type, often made from wood and concrete. They are usually constructed at least 200 meters away from the seashore.	Most roads are still not made of concrete. Electricity powerlines are erected in sloppy areas.
Cabog (Matawe)	3.88	Moderate	5	Around 13.17% of the total population of Dingalan lives in Cabog, where they are moderately vulnerable to given hazards. It has 12% of total senior citizens and 10% of total PWD municipal-wide.	Cabog is a mix of lowland and upland. There are mountains and hills within the area.	Infrastructure were constructed at an average elevation of 10 meters ASL. Some structures were constructed within the past twenty years; hence, their structural stability might be in need of reinforcement.	Most of the houses are bungalow-type, often made from wood and concrete. They are usually constructed at least 450 meters away from the seashore.	Most of the roads are a mix of concrete and earth. Concrete roads are structurally sound. Construction of bridges are necessary for the area.
Caragsacan	3.83	Moderate	5	Around 11.74% of the total population of Dingalan lives in Caragsacan, where they are moderately vulnerable to given hazards. It has 13% of total senior citizens and 20% of total PWD municipal-wide.	Caragsacan is a mix of lowland and upland. There are mountains and hills within the area.	Infrastructure were constructed at an average elevation of 50 meters ASL. Some structures were constructed within the past twenty years; hence, their structural stability might be in need of reinforcement.	Most of the houses are bungalow-type, often made from wood and concrete. They are usually constructed at least 1.2 kilometers away from the seashore.	All the main thoroughfares are made of concrete, and have been found to be structurally sound. Completion of Langawan Bridge is extremely necessary.

Davildavilan	3.88	Moderate	5	Around 4.07% of the total population of Dingalan lives in Davildavilan, where they are moderately vulnerable to given hazards. It has 5% of total senior citizens and 5% of total PWD municipal-wide.	Davildavilan is a mix of lowland and upland. A vast majority of Dingalan Watershed lies within the boundaries of this barangay.	Infrastructure were constructed at an average elevation of 40 meters ASL. Some structures were constructed within the past twenty years; hence, their structural stability might be in need of reinforcement.	Most of the houses are bungalow-type, often made from concrete. They are usually constructed at least 1.2 kilometers away from the seashore.	Most roads are farm-to-market roads, some of which are made of concrete.
Dikapanikian	3.78	Moderate	5	Around 1.59% of the total population of Dingalan lives in Dikapanikian, where they are moderately vulnerable to given hazards. It has 1% of total senior citizens and 2% of total PWD municipal-wide.	Dikapanikian is a mix of lowland and upland. A vast majority of Dingalan Watershed lies within the boundaries of this barangay.	Infrastructure were constructed at an average elevation of 10 meters ASL. Some structures were constructed within the past twenty years; hence, their structural stability might be in need of reinforcement.	Most of the houses are bungalow-type, often made from concrete. They are usually constructed at least 170 meters away from the seashore.	Paltic to Dikapanikian Road is the only access to the barangay; it is currently under construction.
Ibona	3.96	Moderate	5	Around 14.22% of the total population of Dingalan lives in Ibona, where they are moderately vulnerable to given hazards. It has 16% of total senior citizens and 16% of total PWD municipal-wide.	Ibona is a mix of lowland and upland. There are mountains and hills within the area. Coral reefs are also present in the barangay's waters.	Infrastructure were constructed at an average elevation of 30 feet ASL. Some structures were constructed within the past twenty years; hence, their structural stability might be in need of reinforcement.	Most of the houses are bungalow-type, often made from wood and concrete. They are usually constructed at least 330 meters away from the seashore.	Most of the roads are a mix of concrete and earth. Concrete roads are structurally sound. Replacement of the bridge is necessary for the area.
Paltic	4.20	Moderate	5	Around 19.92% of the total population of Dingalan lives in Paltic, where they are moderately vulnerable to given hazards. It has 19% of total senior citizens and 15% of total PWD municipal-wide.	Paltic is a mix of lowland and upland. There are mountains and hills within the area. Coral reefs are also present in the barangay's waters.	Infrastructure were constructed at an average elevation of 40 feet ASL. Some structures were constructed within the past ten years; hence, their structural stability might be in need of reinforcement.	Most of the houses are bungalow-type, often made from wood and concrete. They are usually constructed at least 120 meters away from the seashore.	Most of the roads are already made of concrete. The reconstruction of Subsub Bridge and Aves Bridge is extremely necessary.
Poblacion	3.66	Moderate	5	Around 4.25% of the total population of Dingalan lives in Poblacion, where they are moderately vulnerable to given hazards. It has 6% of total senior citizens and 3% of total PWD municipal-wide.	Poblacion is a lowland barangay. It has no mountains or hills. Two major rivers are present in this barangay, causing floods during heavy rainfall.	Infrastructure were constructed at an average elevation of 90 feet ASL. Some structures were constructed within the past ten years; hence, their structural stability might be in need of reinforcement.	Most of the houses are bungalow-type, and are usually constructed at least 650 meters away from the seashore.	Some parts of the roads were asphalted recently. Roads have been found to be structurally sound. Construction of bridges are ongoing.

Tanawan	3.72	Moderate	5	Around 3.22% of the total population of Dingalan lives in Tanawan, where they are moderately vulnerable to given hazards. It has 3% of total senior citizens and 3% of total PWD municipal-wide.	Tanawan is an upland barangay. There are mountains and hills within the area.	Infrastructure were constructed at an average elevation of 200 meters ASL. Some structures were constructed within the past ten years; hence, their structural stability might be in need of reinforcement.	Most of the houses are bungalow-type, often made from wood and concrete. They are usually constructed at least 3.5 kilometers away from the seashore.	All the main thoroughfares are made of concrete and asphalt, and have been found to be structurally sound. Asphalt laying for the main roads is necessary.
Umiray (Malamig)	3.88	Moderate	5	Around 17.19% of the total population of Dingalan lives in Umiray, where they are moderately vulnerable to given hazards. It has 16% of total senior citizens and 18% of total PWD municipal-wide.	Umiray is a mix of lowland and upland. There are mountains and hills within the area. Coral reefs are also present in the barangay's waters.	Infrastructure were constructed at an average elevation of 30 feet ASL. Some structures were constructed within the past twenty years; hence, their structural stability might be in need of reinforcement.	Most of the houses are bungalow-type, often made from wood and concrete. They are usually constructed at least 300 meters away from the seashore.	Most of the roads are a mix of concrete and earth. Concrete roads and the bridge are structurally sound.

Table 71. Climate Change Vulnerability Assessment Summary for Dingalan (cont.)

Barangays	Overall CCV Index	Overall CCV Category	Count of CC Vulnerabilities	Needed Interventions to Address CC Vulnerabilities				
				Population	Natural Resources	Critical Point Facilities	Urban Use	Lifeline Utilities
Aplaya	4.06	Moderate	5	Promulgation of IEC campaings; construction of more durable houses, and climate-adaptive establishments	To encourage the use of organic fertilizers and feeds to lessen the production of carbon; to encourage the shift to more climate-adaptive crops and seedlings	Proper maintence of the facilities and regular structural inspections	To adopt the use of renewable energy; to construct more climate-adaptive facilities for the tourism industry	Consider engineering mitigations for roads and bridges; consider the use of solar energy
Butas na Bato	3.84	Moderate	5	Promulgation of IEC campaings; construction of more durable houses, and climate-adaptive establishments	To encourage the use of organic fertilizers and feeds to lessen the production of carbon; to encourage the shift to more climate-adaptive crops and seedlings	Proper maintence of the facilities and regular structural inspections	To adopt the use of renewable energy; to construct more climate-adaptive facilities for the tourism industry	Consider engineering mitigations for roads and bridges; consider the use of solar energy
Cabog (Matawe)	3.88	Moderate	5	Promulgation of IEC campaings; construction of more durable houses, and climate-adaptive establishments	To encourage the use of organic fertilizers and feeds to lessen the production of carbon; to encourage the shift to more climate-adaptive crops and seedlings; to conserve coral reefs and other marine plants	Proper maintence of the facilities and regular structural inspections	To adopt the use of renewable energy; to construct more climate-adaptive facilities for the tourism industry	Consider engineering mitigations for roads and bridges; consider the use of solar energy
Caragsacan	3.83	Moderate	5	Promulgation of IEC campaings; construction of more durable houses, and climate-adaptive establishments	To reinforce the use of organic fertilizers and feeds to lessen the production of carbon; to reinforce the shift to more climate-adaptive crops and seedlings; to conserve coral reefs and other marine plants; to eliminate *kaingin*	Proper maintence of the facilities and regular structural inspections	To adopt the use of renewable energy; to construct more climate-adaptive facilities for the tourism industry	Consider engineering mitigations for roads and bridges; consider the use of solar energy

Davildavilan	3.88	Moderate	5	Promulgation of IEC campaings; construction of more durable houses, and climate-adaptive establishments	To reinforce the use of organic fertilizers and feeds to lessen the production of carbon; to reinforce the shift to more climate-adaptive crops and seedlings; to conserve coral reefs and other marine plants; to eliminate *kaingin*	Proper maintence of the facilities and regular structural inspections	To adopt the use of renewable energy; to construct more climate-adaptive facilities for the tourism industry	Consider engineering mitigations for roads and bridges; consider the use of solar energy
Dikapanikian	3.78	Moderate	5	Promulgation of IEC campaings; construction of more durable houses, and climate-adaptive establishments	To encourage the use of organic fertilizers and feeds to lessen the production of carbon; to encourage the shift to more climate-adaptive crops and seedlings; to conserve coral reefs and other marine plants	Proper maintence of the facilities and regular structural inspections	To adopt the use of renewable energy; to construct more climate-adaptive facilities for the tourism industry	Consider engineering mitigations for roads and bridges; consider the use of solar energy
Ibona	3.96	Moderate	5	Promulgation of IEC campaings; construction of more durable houses, and climate-adaptive establishments	To encourage the use of organic fertilizers and feeds to lessen the production of carbon; to encourage the shift to more climate-adaptive crops and seedlings; to conserve coral reefs and other marine plants	Proper maintence of the facilities and regular structural inspections	To adopt the use of renewable energy; to construct more climate-adaptive facilities for the tourism industry	Consider engineering mitigations for roads and bridges; consider the use of solar energy
Paltic	4.20	Moderate	5	Promulgation of IEC campaings; construction of more durable houses, and climate-adaptive establishments	To encourage the use of organic fertilizers and feeds to lessen the production of carbon; to encourage the shift to more climate-adaptive crops and seedlings; to conserve coral reefs and other marine plants	Proper maintence of the facilities and regular structural inspections	To adopt the use of renewable energy; to construct more climate-adaptive facilities for the tourism industry	Consider engineering mitigations for roads and bridges; consider the use of solar energy
Poblacion	3.66	Moderate	5	Promulgation of IEC campaings; construction of more durable houses, and	To encourage the use of organic fertilizers and feeds to lessen the	Proper maintence of the facilities and regular structural inspections	To adopt the use of renewable energy; to construct more climate-	Consider engineering mitigations for roads and

				climate-adaptive establishments	production of carbon; to encourage the shift to more climate-adaptive crops and seedlings		adaptive facilities for the tourism industry	bridges; consider the use of solar energy
Tanawan	3.72	Moderate	5	Promulgation of IEC campaings; construction of more durable houses, and climate-adaptive establishments	To encourage the use of organic fertilizers and feeds to lessen the production of carbon; to encourage the shift to more climate-adaptive crops and seedlings	Proper maintence of the facilities and regular structural inspections	To adopt the use of renewable energy; to construct more climate-adaptive facilities for the tourism industry	Consider engineering mitigations for roads and bridges; consider the use of solar energy
Umiray (Malamig)	3.88	Moderate	5	Promulgation of IEC campaings; construction of more durable houses, and climate-adaptive establishments	To encourage the use of organic fertilizers and feeds to lessen the production of carbon; to encourage the shift to more climate-adaptive crops and seedlings; to conserve coral reefs and other marine plants	Proper maintence of the facilities and regular structural inspections	To adopt the use of renewable energy; to construct more climate-adaptive facilities for the tourism industry	Consider engineering mitigations for roads and bridges; consider the use of solar energy

DISASTER RISK ASSESSMENT

The Disaster Risk Assessment (DRA) involves the determination of the likelihood of occurrence of a particular hazard, namely (a) flood, (b) rain-induced landslide, (c) storm surge, (d) drought, (e) sea level rise, (f) earthquake-induced landslide, (g) liquefaction/sinkhole, (h) ground shaking, (i) ground rupture, (j) tsunami, and (k) volcanic eruption.

The likelihood of occurrence will be quantitatively determined using six scores: (1) Very Rare (>200 years), (2) Rare (101-200 years), (3) Improbable (31-100 years), (4) Occasional Slight Chance (11-30 years), (5) Moderate (4-10 years), and (6) Frequent (1-3 years). To determine the disaster risk for each system of interest in each barangay, the likelihood of occurrence of a risk is multiplied to the severity of its consequence, as further described in detail below:

Table 72. Description of Severity of Risk per System of Interest

Severity of Consequence Score	Population Risk Description	Natural Resources Risk Description	Critical Point Facilities Risk Description	Urban Use RiskDescription	Lifeline Utilities Risk Description
1	<5% of affected population needing immediate assistance	<5% of exposed natural resources likely to be affected	<5% of critical point facilities likely to be affected	<5% of urban use likely to be affected	<5% of lifeline utilities likely to be affected
2	5-10% of affected population needing immediate assistance	5-10% of exposed natural resources likely to be affected	5-10% of critical point facilities likely to be affected	5-10% of urban use likely to be affected	5-10% of lifeline utilities likely to be affected
3	10-20% of affected population needing immediate assistance	10.6-20% of exposed natural resources likely to be affected	10.6-20% of critical point facilities likely to be affected	10.6-20% of urban use likely to be affected	10.6-20% of lifeline utilities likely to be affected
4	>20% of affected population needing immediate assistance	>20% of exposed natural resources likely to be affected	>20% of critical point facilities likely to be affected	>20% of urban use likely to be affected	>20% of lifeline utilities likely to be affected

Given that the least possible risk score is “1” and highest is “24”, the following rubric is used to categorize risk scores: scores ranging 1-8 are categorized as “low” disaster risk, scores ranging 9-16 are categorized as “medium” disaster risk, and 17-24 scores are “high” disaster risk. Additionally, each system of interest has a particular set of exposure indicators to determine the overall severity of consequence of disaster risk.

Table 73. Variables for Determining Overall Severity of Consequence per System of Interest

System of Interest	Variables for determining overall severity of consequence				
Population	Severity of Consequence to barangay residents	Severity of Consequence to informal settlers	Severity of Consequence to houses made with light materials	Severity of Consequence to elderly and young people	Severity of Consequence to PWDs
Natural Resources	Severity of Consequence to crop-based farming areas	Severity of Consequence to aquaculturebased farming areas	Severity of Consequence to livestock/poultry areas	Severity of Consequence to production of major crop(s)	Severity of Consequence to irrigation systems
Critical Point Facilities	Severity of Consequence to school infrastructures	Severity of Consequence to hospitals & health centers	Severity of Consequence to barangay hall	Severity of Consequence to gymnasium(s)	Severity of Consequence to other government infrastructures
Urban Use	Severity of Consequence to residential land use	Severity of Consequence to commercial land use	Severity of Consequence to tourist sites	Severity of Consequence to upland and sloping area(s)	Severity of Consequence to shoreline/water bodies
Lifeline Utilities	Severity of Consequence to roads	Severity of Consequence to bridges	Severity of Consequence to telecommunication systems	Severity of Consequence to water supply utilities	Severity of Consequence to power distribution systems

The DRA of each system of interest (Population, Natural Resources, Critical Facilities, Urban Use, and Lifeline Utilities) will then be averaged to determine the overall DRA of a particular barangay.

DRA for Population

1. Disaster Risk Assessment Tables

Table 74. Disaster Risk Assessment of Population in Dingalan

BARANGAY	1. Flood						2. Rain-Induced Landslide						3. Storm Surge						4. Drought						5. Sea Level Rise						6. Earthquake-Induced Landslide					
	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs
Aplaya	6	3	3	3	2	1	1	1	1	1	1	1	1	4	3	3	2	2	4	1	1	1	1	1	3	3	2	2	2	1	1	1	1	1	1	2
Butas Na Bato	6	2	2	2	2	1	6	2	1	1	1	1	1	3	2	2	2	2	4	1	1	1	1	1	3	2	2	2	2	1	1	3	3	1	2	1
Cabog (Matawe)	6	3	3	2	2	1	4	2	1	1	1	1	1	3	2	2	2	2	4	2	2	1	1	1	3	2	2	2	2	1	1	3	2	1	1	1
Caragsacan	6	2	2	2	2	1	4	2	1	1	1	1	1	1	1	1	1	1	4	2	2	1	1	1	1	1	1	1	1	1	1	3	3	2	2	1
Davildavilan	6	1	1	1	2	1	4	2	1	1	1	1	1	1	1	1	1	1	4	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1
Dikapanikian	6	4	4	4	2	1	4	2	1	1	1	1	1	4	4	4	4	4	4	1	1	1	1	1	3	3	2	2	3	1	1	1	2	1	1	1
Ibona	6	4	4	4	2	1	6	1	1	1	1	1	1	3	2	2	2	2	4	3	3	2	1	1	3	2	2	2	2	1	1	2	3	2	1	1
Paltic	6	4	4	4	2	1	6	3	3	3	3	3	1	3	3	3	3		4	1	1	1	1	1	3	3	2	3	2	1	1	3	3	2	1	1
Poblacion	6	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	2	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Tanawan	1	1	1	1	2	1	3	3	3	3	3	3	1	1	1	1	1	1	4	1	1	1	1	1	1	1	1	1	1	1	1	2	4	3	2	1
Umiray (Malamig)	6	4	4	4	2	1	4	2	2	2	2	2	1	3	1	1	3	3	4	1	1	1	1	1	3	3	2	1	3	1	1	1	3	1	1	1

Table 75. Disaster Risk Assessment of Population in Dingalan (cont.)

BARANGAY	7. Liquefaction/ Sinkhole						8. Ground Shaking						9. Ground Rupture						10. Tsunami						11. Volcanic Eruption						Average Risk Score of Population			
	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs	Count of Disaster Risks = 11	Count of Severity of Consequences = 55	Average Score	Category
Aplaya	1	2	2	2	2	2	4	3	3	3	3	3	1	2	2	2	2	2	1	4	4	4	4	4	1						11	50	4.94	Moderate

Butas Na Bato	1	3	3	3	3	3	4	3	3	3	3	3	1	2	2	2	2	2	1	3	3	3	3	3	1						11	50	5.16	Moderate
Cabog (Matawe)	1	3	3	3	3	3	4	2	2	2	2	2	1	1	1	1	1	1	1	3	3	3	3	3	1						11	50	4.78	Moderate
Caragsacan	1	3	3	3	3	3	4	3	3	3	3	3	1	3	3	3	3	2	1	1	1	1	1	1	1						11	50	4.42	Low
Davildavilan	1	2	2	2	2	2	4	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1						11	50	3.12	Low
Dikapanikian	1	2	2	2	2	2	4	2	2	2	2	2	1	1	1	1	1	1	1	4	4	4	4	4	1						11	50	5.36	Moderate
Ibona	1	3	3	3	3	3	4	2	2	2	2	2	1	1	1	1	1	1	1	3	3	3	3	3	1						11	50	5.64	Moderate
Paltic	1	3	3	3	3	3	4	3	3	3	3	3	1	1	1	1	1	1	1	4	4	4	4	4	1						11	49	7.24	Moderate
Poblacion	1	2	3	3	3	3	4	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1						11	50	2.82	Low
Tanawan	1	3	3	3	3	3	4	3	3	3	3	3	1	2	2	2	2	2	1	1	1	1	1	1	1						11	50	3.66	Low
Umiray (Malamig)	1	3	3	3	3	3	4	2	2	2	2	2	1	1	1	1	1	1	1	3	3	3	3	3	1						11	50	5.94	Moderate

2. Hazard Maps for Households

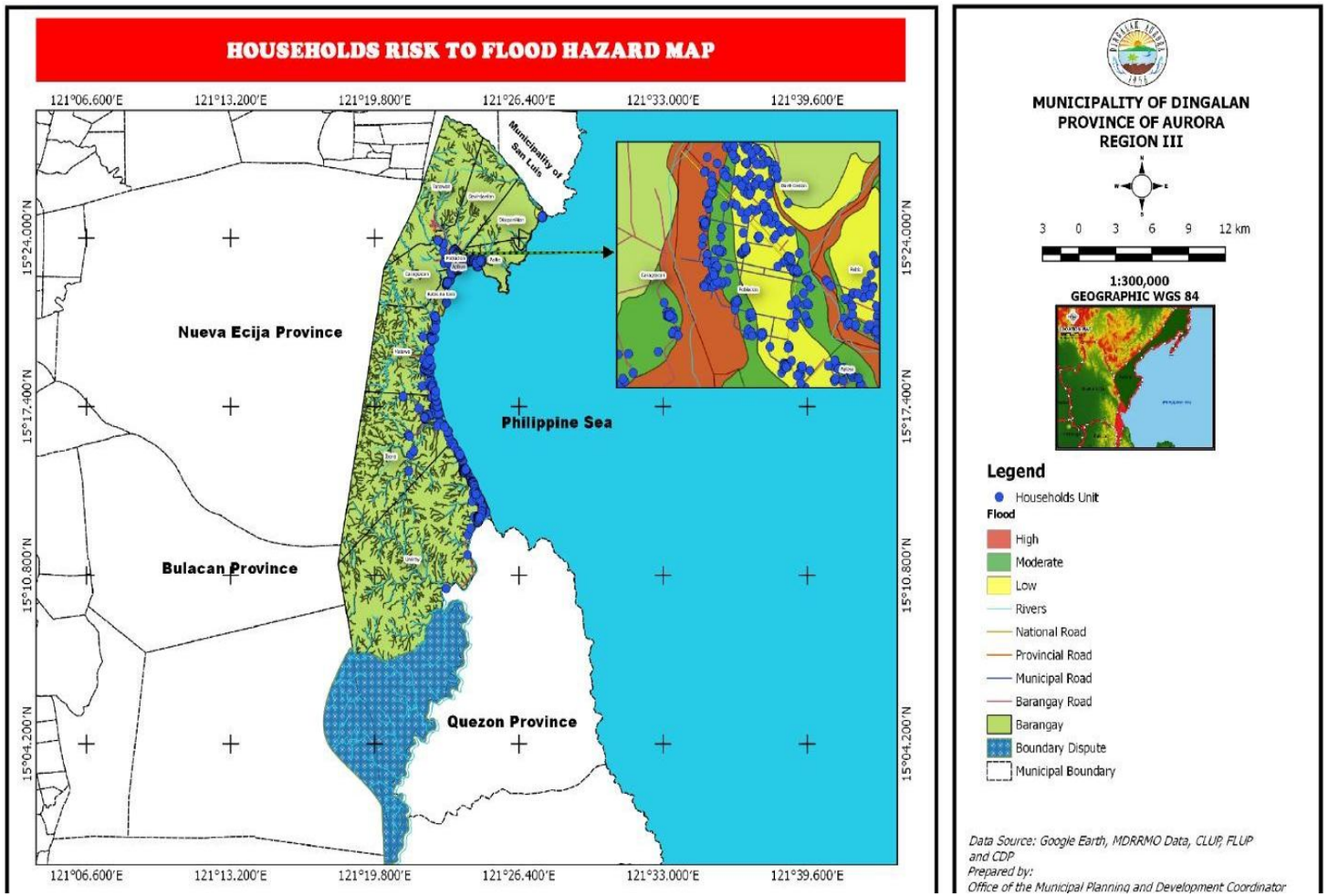


Figure 62. Households Risk to Rain-Induced Landslide Hazard Map

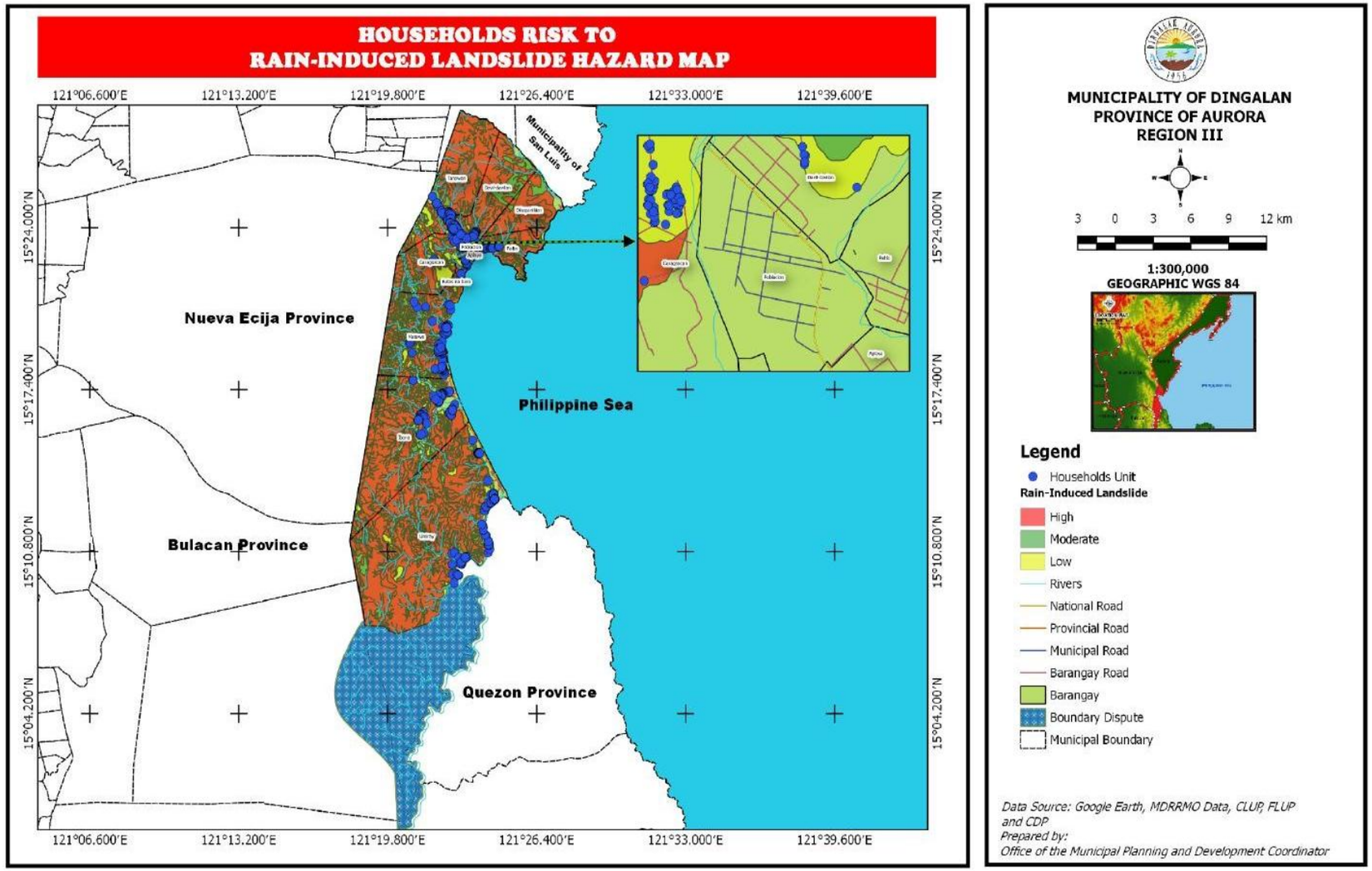


Figure 63. Households Risk to Flood Hazard Map

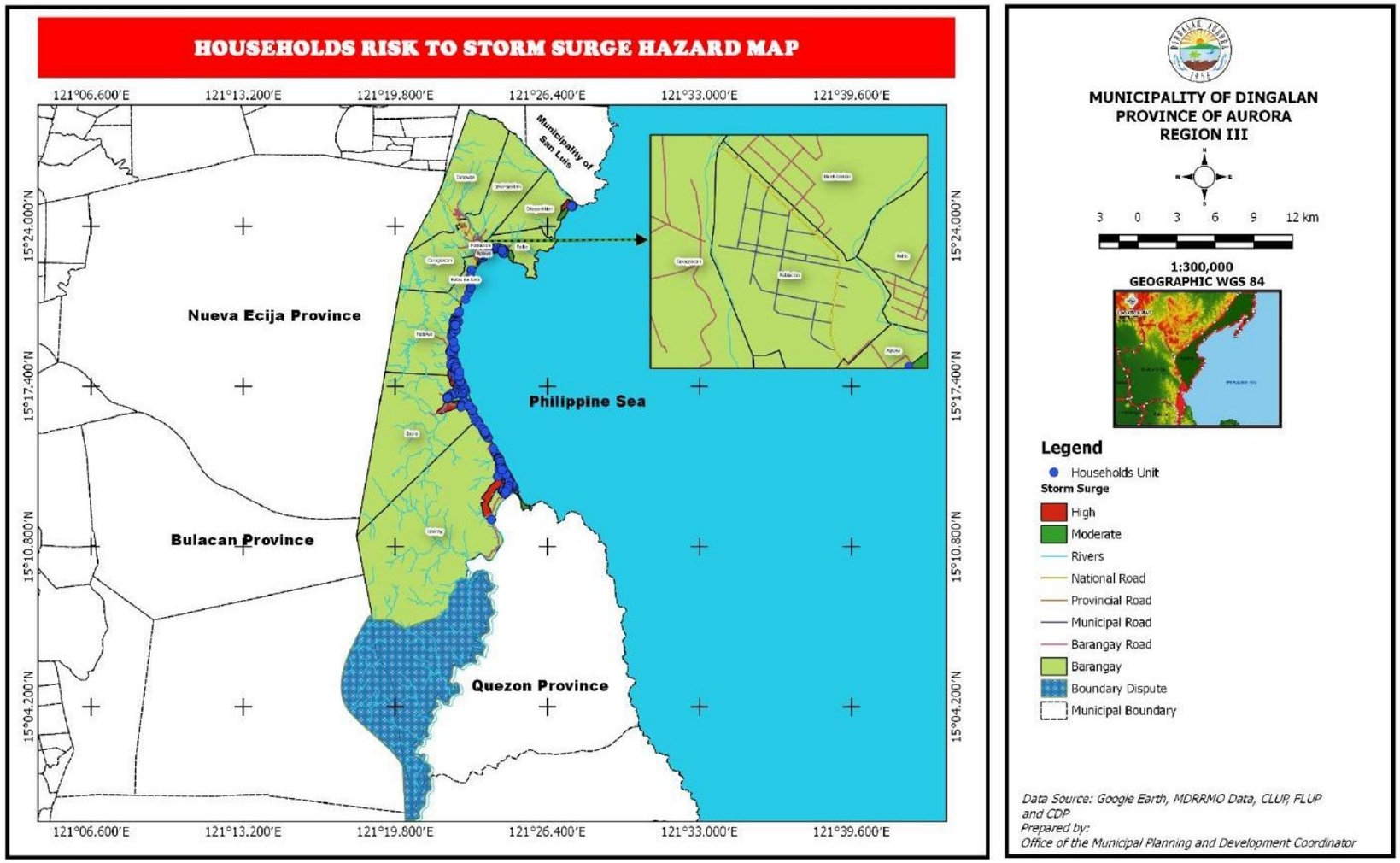


Figure 64. Households Risk to Storm Surge Hazard Map

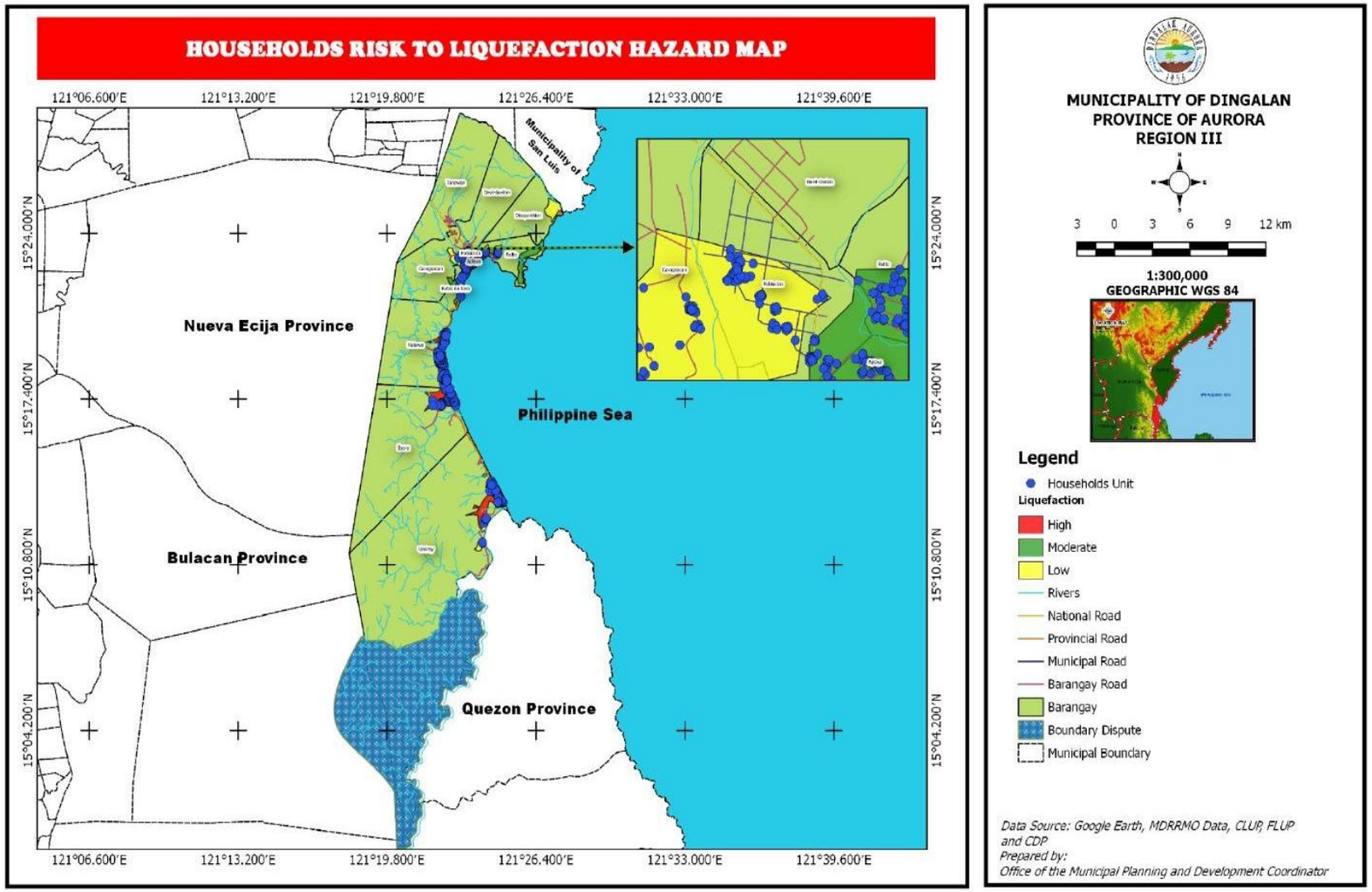


Figure 66. Households Risk to Liquefaction Hazard Map

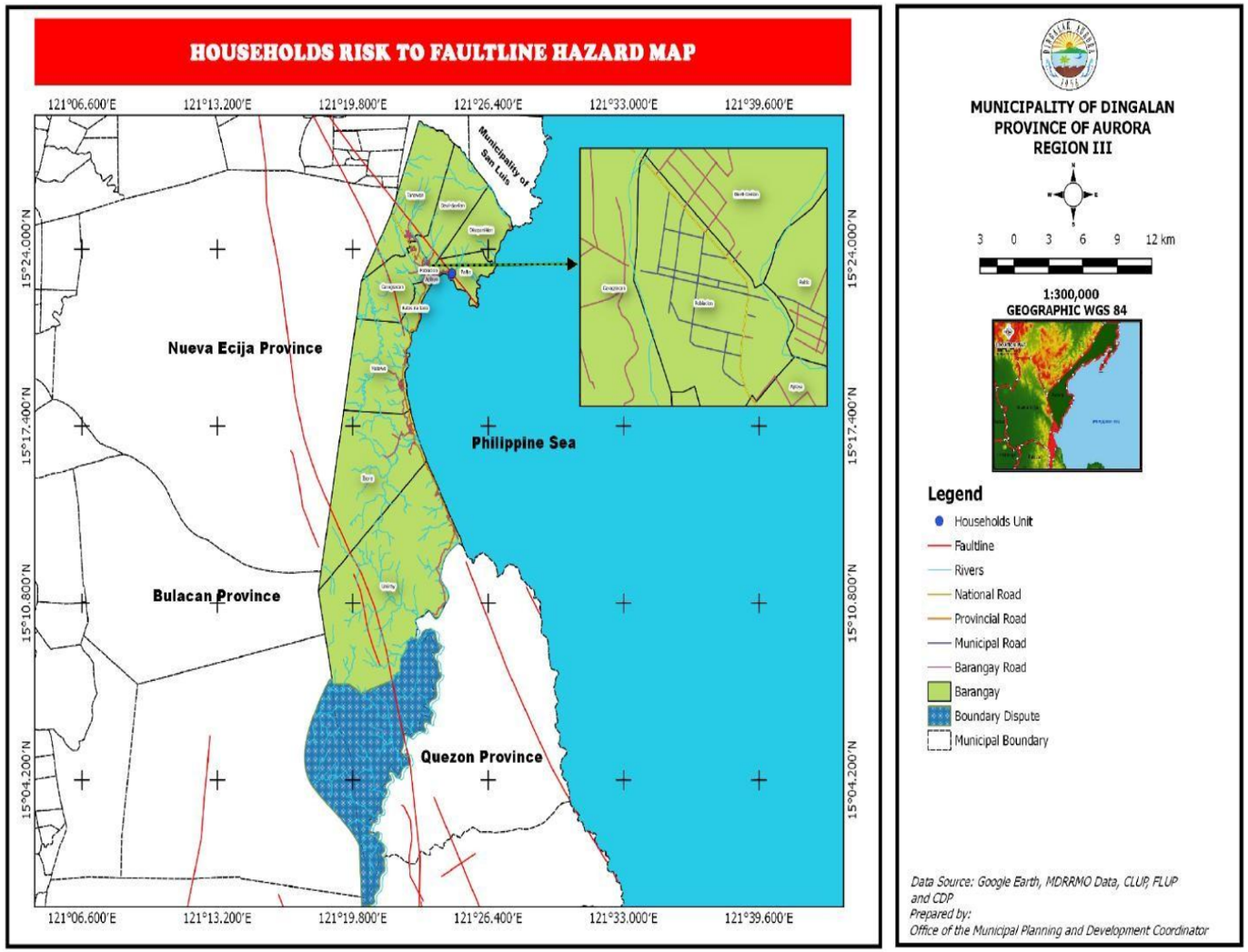


Figure 65. Households Risk to Faultline Hazard Map

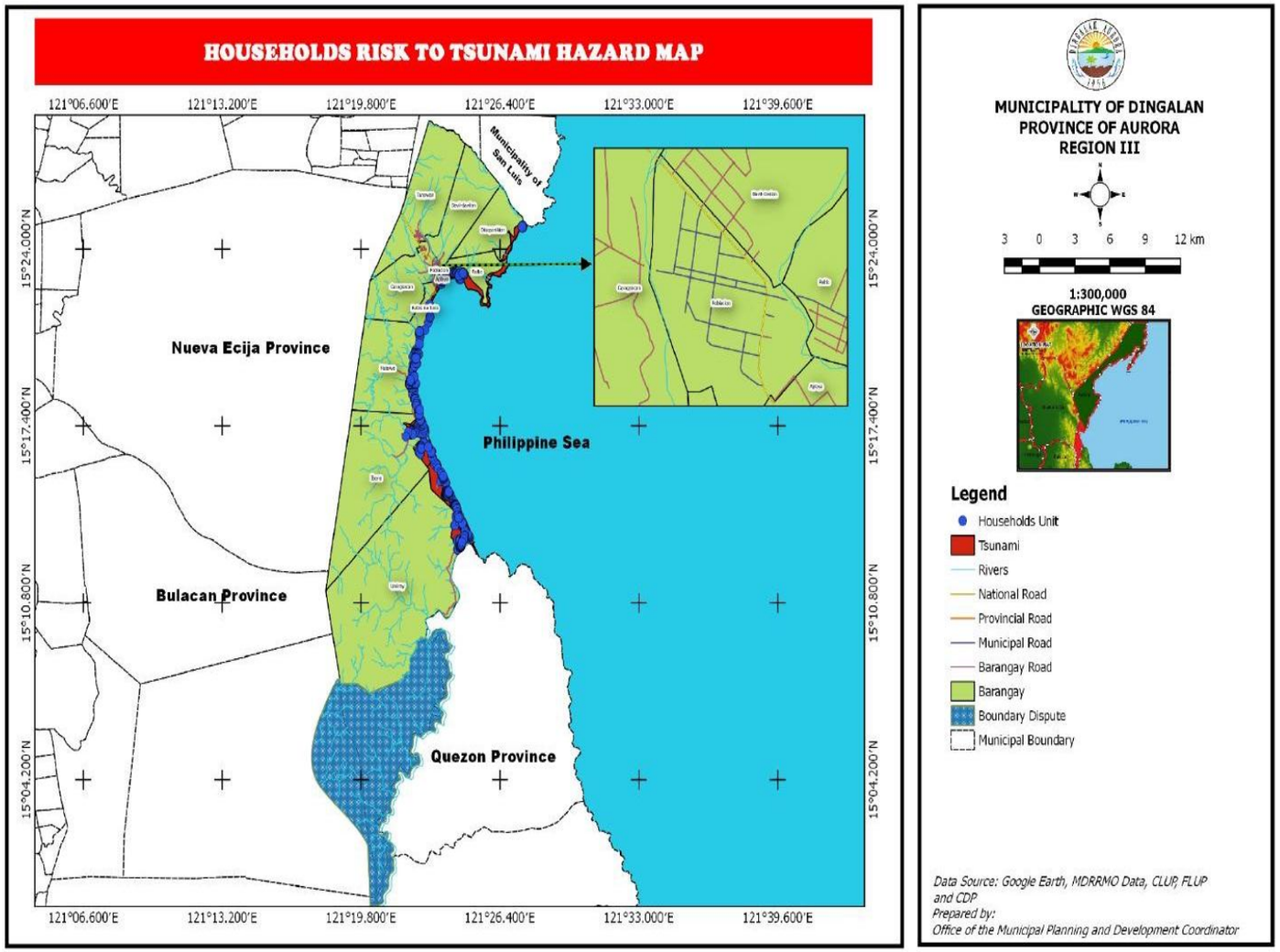


Figure 67. Households Risk to Tsunami Hazard Map

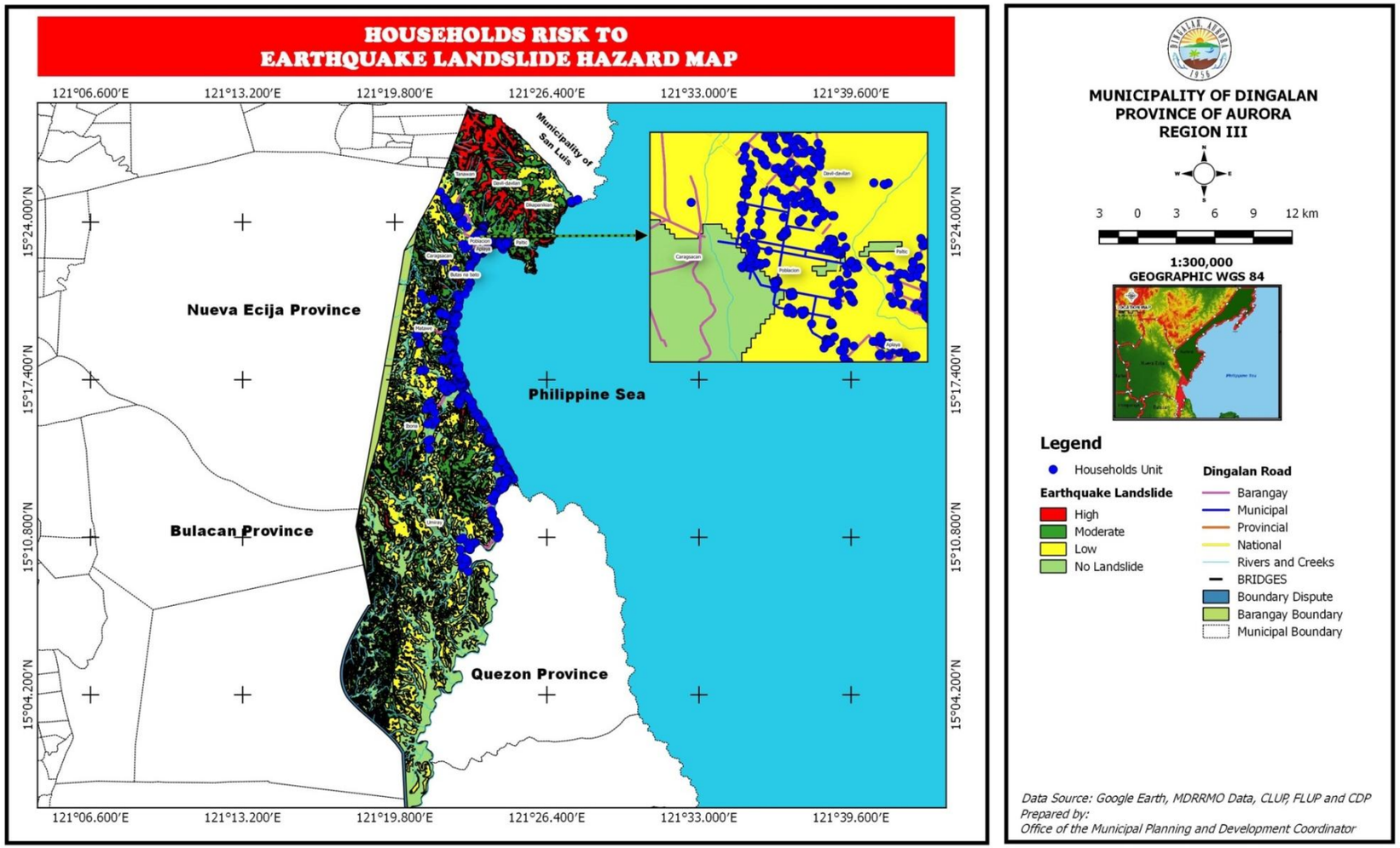


Figure 68. Households Risk to Tsunami Hazard Map

DRA for Natural Resources

1. Disaster Risk Assessment Tables

Table 76. Disaster Risk Assessment of Natural Resources in Dingalan

BARANGAY	1. Flood						2. Rain-Induced Landslide						3. Storm Surge						4. Drought						5. Sea Level Rise						6. Earthquake-Induced Landslide					
	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs
Aplaya	6	4	1	3	1	1	1	1	1	1	1	1	1	2	1	2	2	1	4	2	1	1	1	1	1	2	1	1	1	1	2	1	1	1	1	1

Butas Na Bato	6	2	1	2	3	1	6	2	1	1	2	1	1	2	1	2	2	1	4	2	1	1	2	1	1	2	1	1	1	1	2	3	1	2	3	1
Cabog (Matawe)	6	3	1	2	3	3	5	2	1	2	3	1	1	2	1	2	2	1	4	3	1	2	3	3	1	2	1	1	1	1	2	3	1	2	3	1
Caragsacan	6	3	1	2	3	1	5	2	1	2	3	1	1	1	1	1	2	1	5	3	1	2	3	3	1	1	1	1	1	1	2	3	1	2	3	1
Davildavilan	6	1	1	1	1	1	5	1	1	2	3	1	1	1	1	1	1	1	5	2	1	1	1	1	1	1	1	1	1	1	2	2	1	1	2	1
Dikapanikian	6	2	1	1	2	1	5	1	1	2	2	1	1	2	1	1	2	1	5	1	1	1	1	1	1	2	1	1	1	1	2	2	1	1	2	1
Ibona	6	3	1	2	3	3	6	3	1	2	3	1	1	2	1	2	2	1	5	4	1	2	3	3	1	2	1	1	1	1	2	3	1	2	3	1
Paltic	6	3	1	3	3	1	6	3	1	2	2	1	1	2	1	2	2	1	5	2	1	2	2	1	1	2	1	1	1	1	2	2	1	2	3	1
Poblacion	6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	5	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1
Tanawan	1	1	1	1	1	1	5	3	1	2	3	1	1	1	1	1	1	1	5	1	1	1	3	1	1	1	1	1	1	1	2	3	1	1	3	1
Umiray (Malamig)	6	3	3	3	3	3	5	3	1	2	3	1	1	2	4	2	2	1	5	4	4	2	3	3	1	2	2	1	1	1	2	3	1	2	3	1

Table 77. Disaster Risk Assessment of Natural Resources in Dingalan (cont.)

BARANGAY	7. Liquefaction/ Sinkhole						8. Ground Shaking						9. Ground Rupture						10. Tsunami						11. Volcanic Eruption						Average Risk Score of Population			
	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs	Count of Disaster Risks = 11	Count of Severity of Consequences = 55	Average Score	Category
Aplaya	2	1	1	1	1	1	6	2	1	2	1	1	1	2	1	1	1	1	1	4	4	4	4	4	1						11	50	3.82	Low
Butas Na Bato	2	2	1	2	2	1	6	3	1	2	3	1	1	3	1	2	3	1	1	4	3	3	3	3	1						11	50	5.20	Moderate
Cabog (Matawe)	2	3	1	3	3	2	6	3	1	2	2	1	1	1	1	1	1	1	1	4	4	4	4	4	1						11	50	6.04	Moderate
Caragsacan	2	3	1	3	3	2	6	3	1	2	3	3	1	3	1	2	3	1	1	2	1	2	2	2	1						11	50	6.22	Moderate
Davildavilan	2	1	1	1	1	1	6	2	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1						11	50	3.84	Low
Dikapanikian	2	1	1	1	1	1	6	2	1	2	1	1	1	1	1	1	1	1	1	4	4	4	4	4	1						11	50	4.12	Low
Ibona	2	3	1	3	3	2	6	3	1	2	1	2	1	1	1	1	1	1	1	4	4	4	4	4	1						11	50	6.68	Moderate
Paltic	2	1	1	2	2	1	6	3	1	2	1	1	1	1	1	1	1	1	1	4	4	4	4	4	1						11	50	5.58	Moderate
Poblacion	2	1	1	1	1	1	6	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1						11	50	2.72	Low
Tanawan	2	2	1	3	1	1	6	2	1	2	3	1	1	3	1	1	2	1	1	1	1	1	1	1	1						11	50	4.02	Low
Umiray (Malamig)	2	3	1	3	3	1	6	3	1	2	2	2	1	1	1	1	1	1	1	4	4	4	4	4	1						11	50	7.30	Moderate

DRA for Critical Point Facilities

1. Disaster Risk Assessment Tables

Table 78. Disaster Risk Assessment of Critical Point Facilities in Dingalan

BARANGAY	1. Flood						2. Rain-Induced Landslide						3. Storm Surge						4. Drought						5. Sea Level Rise						6. Earthquake-Induced Landslide					
	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs
Aplaya	6	3	3	1	1	1	1	1	1	1	1	1	1	3	3	2	2	3	5	1	1	4	4	4	3	1	1	1	1	1	1	1	1	1	1	1

Butas Na Bato	6	2	1	2	1	1	6	3	1	3	3	1	1	2	2	2	2	1	5	1	1	1	1	1	3	1	1	1	1	1	1	4	4	4	4	1
Cabog (Matawe)	6	1	1	1	1	1	4	1	2	2	2	1	1	3	2	3	1	1	5	1	1	1	1	1	3	1	1		1	1	1	3	3	3	3	2
Caragsacan	6	1	1	2	1	1	4	3	1	1	1	1	1	2	1	1	1	1	5	1	1	1	1	1	1	1	1	1	1	1	1	4	3	3	2	3
Davildavilan	6	1	1	1	1	1	4	1	1	1	1	1	1	1	1	1	1	1	5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3
Dikapanikian	6	1	2	1	1	1	4	2	1	1	1	1	1	3	3	3	3	1	5	1	1	1	1	1	3	1	1	1	1	1	1	2	1	1	1	1
Ibona	6	2	2	2	1	1	6	1	1	1	1	1	1	3	3	3	3	3	5	1	1	1	1	1	3	1	1	1	1	1	1	2	3	3	2	2
Paltic	6	4	4	4	1	1	6	3	3	3	3	1	1	3	3	3	3	3	5	1	1	1	1	1	3	1	1	1	1	1	1	4	3	3	3	3
Poblacion	6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Tanawan	1	1	1	1	1	1	3	3	3	3	3	1	1	1	1	1	1	1	5	1	1	1	1	1	1	1	1	1	1	1	1	3	2	2	1	3
Umiray (Malamig)	6	2	1	2	1	1	4	3	1	1	1	1	1	3	3	3	3	1	5	1	1	1	1	1	3	1	1	1	1	1	1	2	3	3	2	3

Table 79. Disaster Risk Assessment of Critical Point Facilities in Dingalan (cont.)

BARANGAY	7. Liquefaction/ Sinkhole						8. Ground Shaking						9. Ground Rupture						10. Tsunami						11. Volcanic Eruption						Average Risk Score of Population			
	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs	Count of Disaster Risks = 11	Count of Severity of Consequences = 55	Average Score	Category
Aplaya	1	4	4	4	4	4	4	4	4	4	4	4	1	2	2	2	2	2	1	4	4	4	4	4	1						11	50	5.84	Moderate

Butas Na Bato	1	4	4	4	1	4	4	4	4	4	1	4	1	3	3	3	3	3	1	4	4	4	4	4	1						11	50	5.88	Moderate
Cabog (Matawe)	1	4	4	4	4	4	4	4	4	4	4	4	1	1	1	1	1	1	1	4	2	3	3	2	1						11	50	4.94	Moderate
Caragsacan	1	4	4	4	4	4	4	4	4	4	4	4	1	3	1	1	1	1	1	1	1	1	1	1	1						11	50	4.54	Low
Davildavilan	1	4	4	4	1	4	4	4	4	4	1	4	1	1	1	1	1	1	1	1	1	1	1	1	1						11	50	3.74	Low
Dikapanikian	1	4	4	4	4	1	4	4	4	4	1	1	1	1	1	1	1	1	1	1	4	4	4	4	1						11	50	4.28	Low
Ibona	1	4	4	4	4	4	4	4	4	4	4	4	1	1	1	1	1	1	1	4	4	4	4	4	1						11	50	5.40	Moderate
Paltic	1	4	4	4	4	4	4	4	4	4	4	4	1	1	1	1	1	1	1	4	4	4	4	4	1						11	50	7.16	Moderate
Poblacion	1	4	4	4	1	4	4	4	4	4	4	4	1	1	1	1	1	1	1	1	1	1	1	1	1						11	50	3.64	Low
Tanawan	1	4	4	4	1	4	4	4	4	4	4	4	1	3	3	3	3	3	1	1	1	1	1	1	1						11	50	4.14	Low
Umiray (Malamig)	1	4	4	4	4	4	4	4	4	4	4	4	1	1	1	1	1	1	1	3	4	4	4	3	1						11	50	5.18	Moderate

2. Hazard Maps for Critical Point Facilities

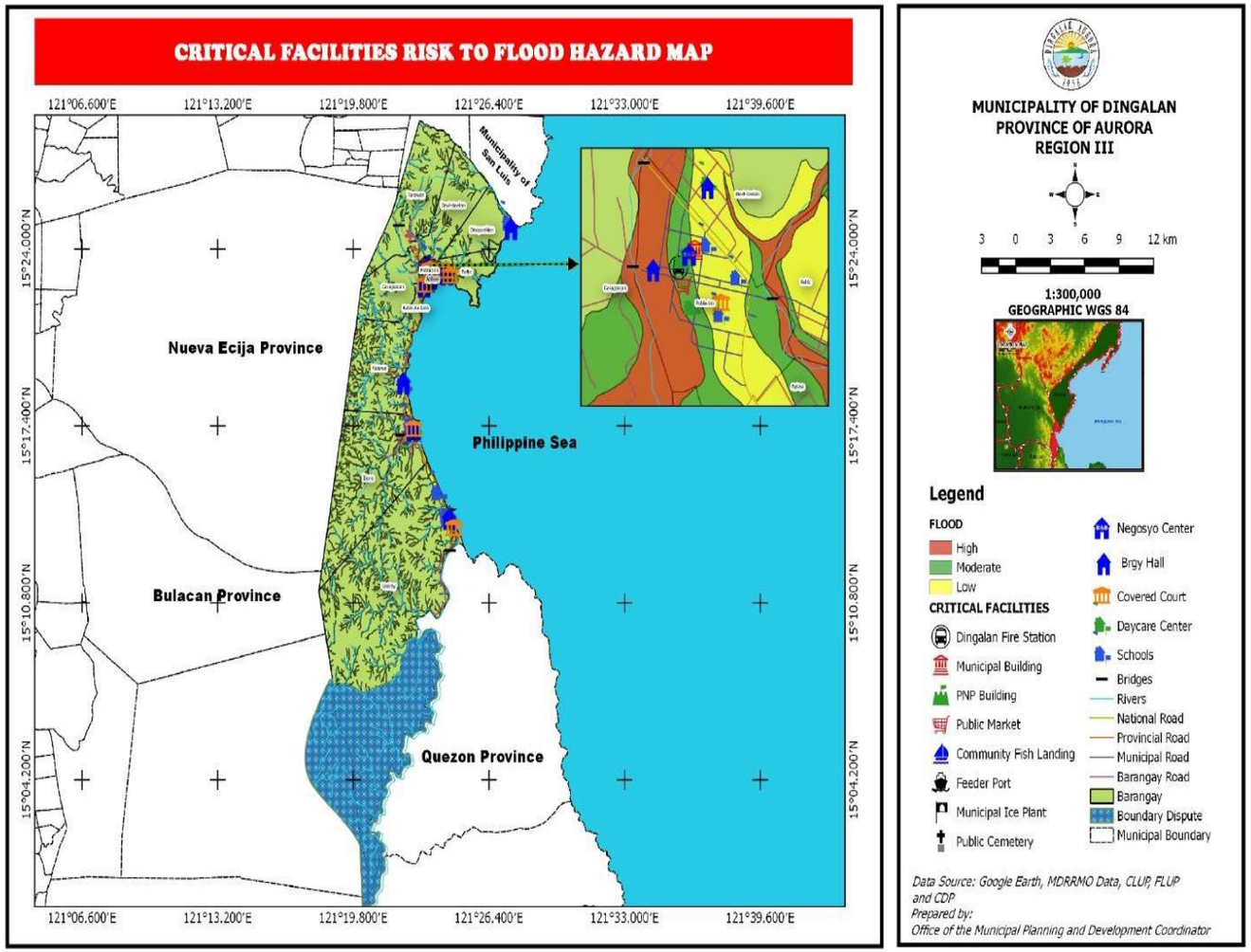


Figure 69. Critical Facilities Risk to Flood Hazard Map

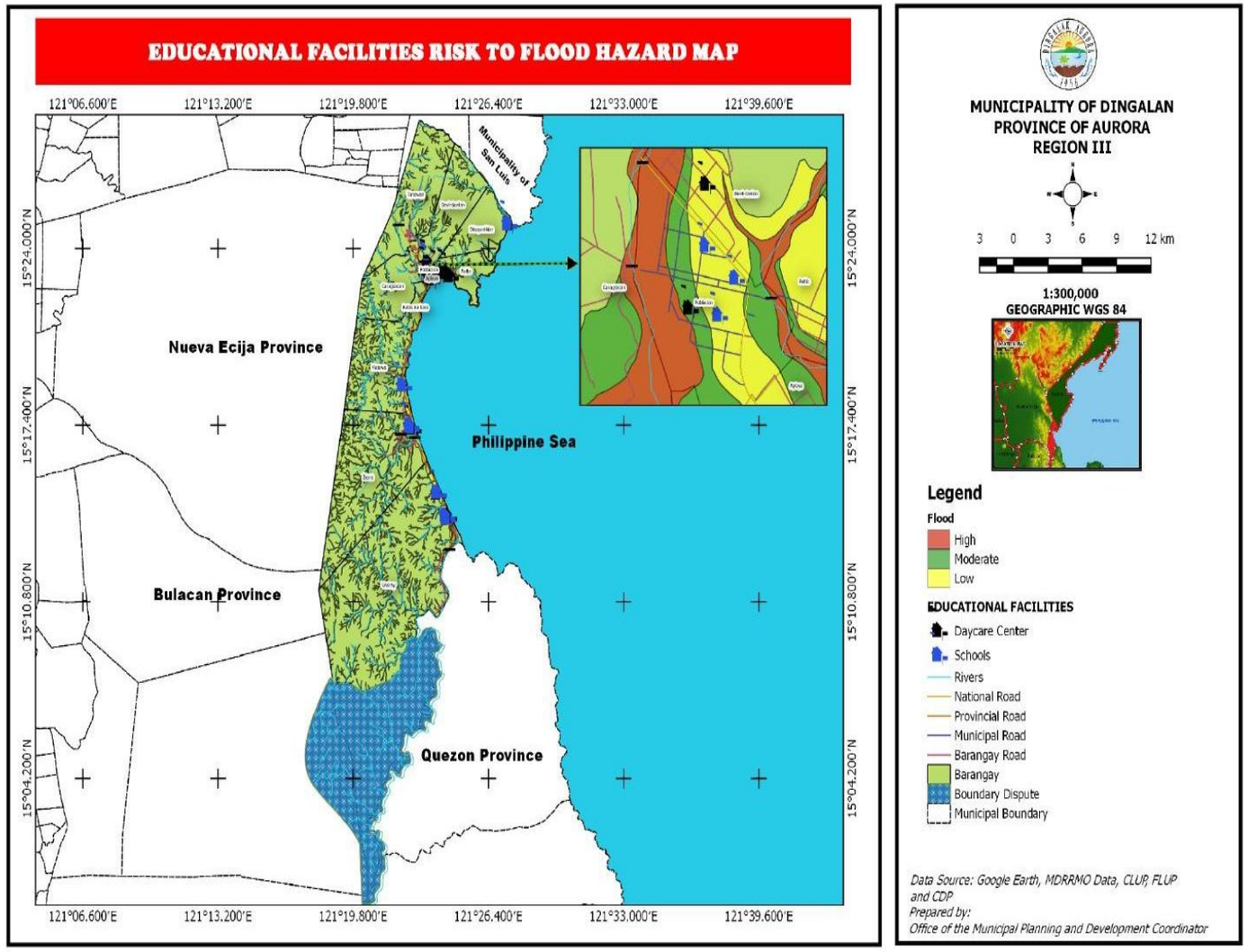


Figure 70. Educational Facilities Risk to Flood Hazard Map

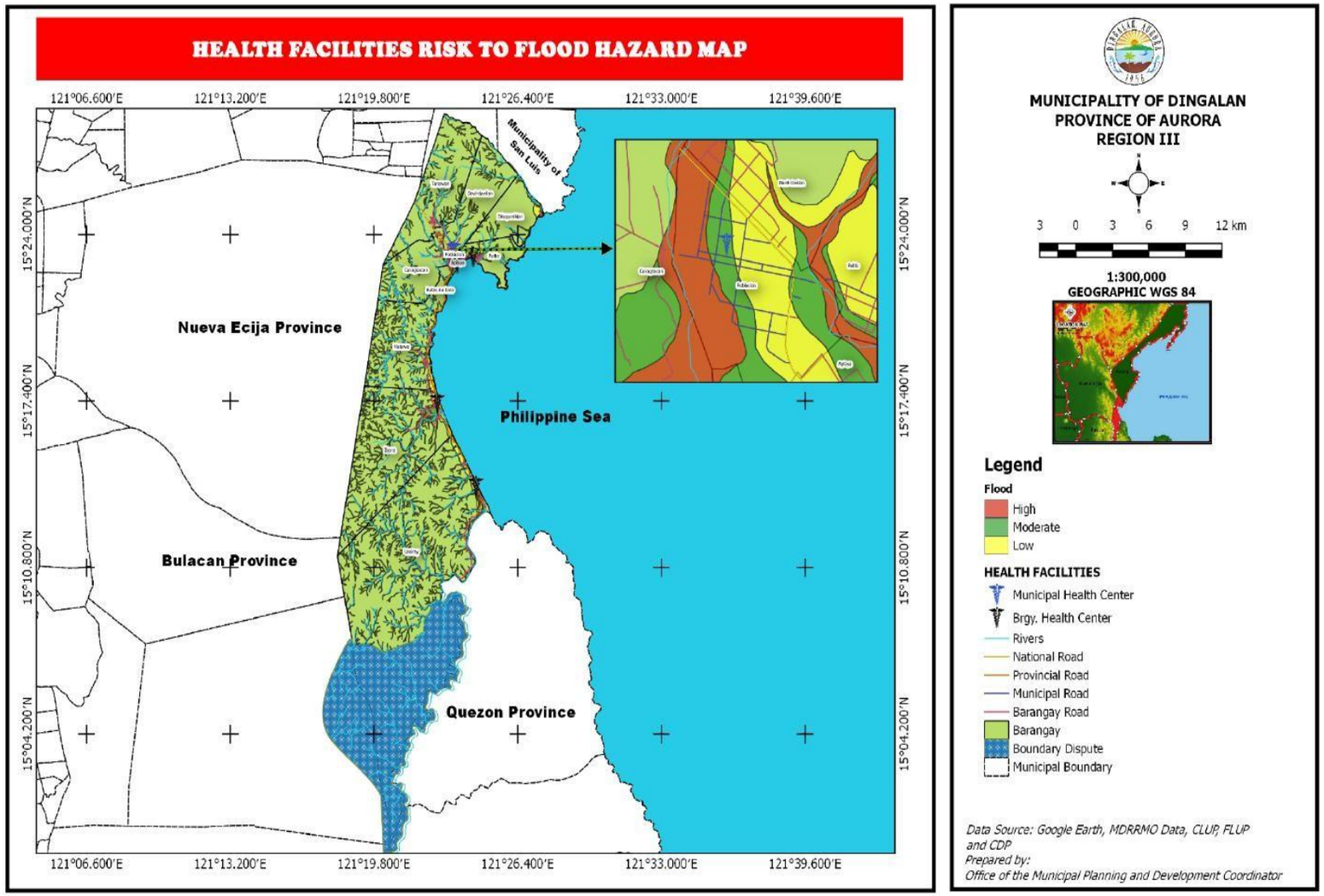


Figure 71. Health Facilities to Flood Hazard Map

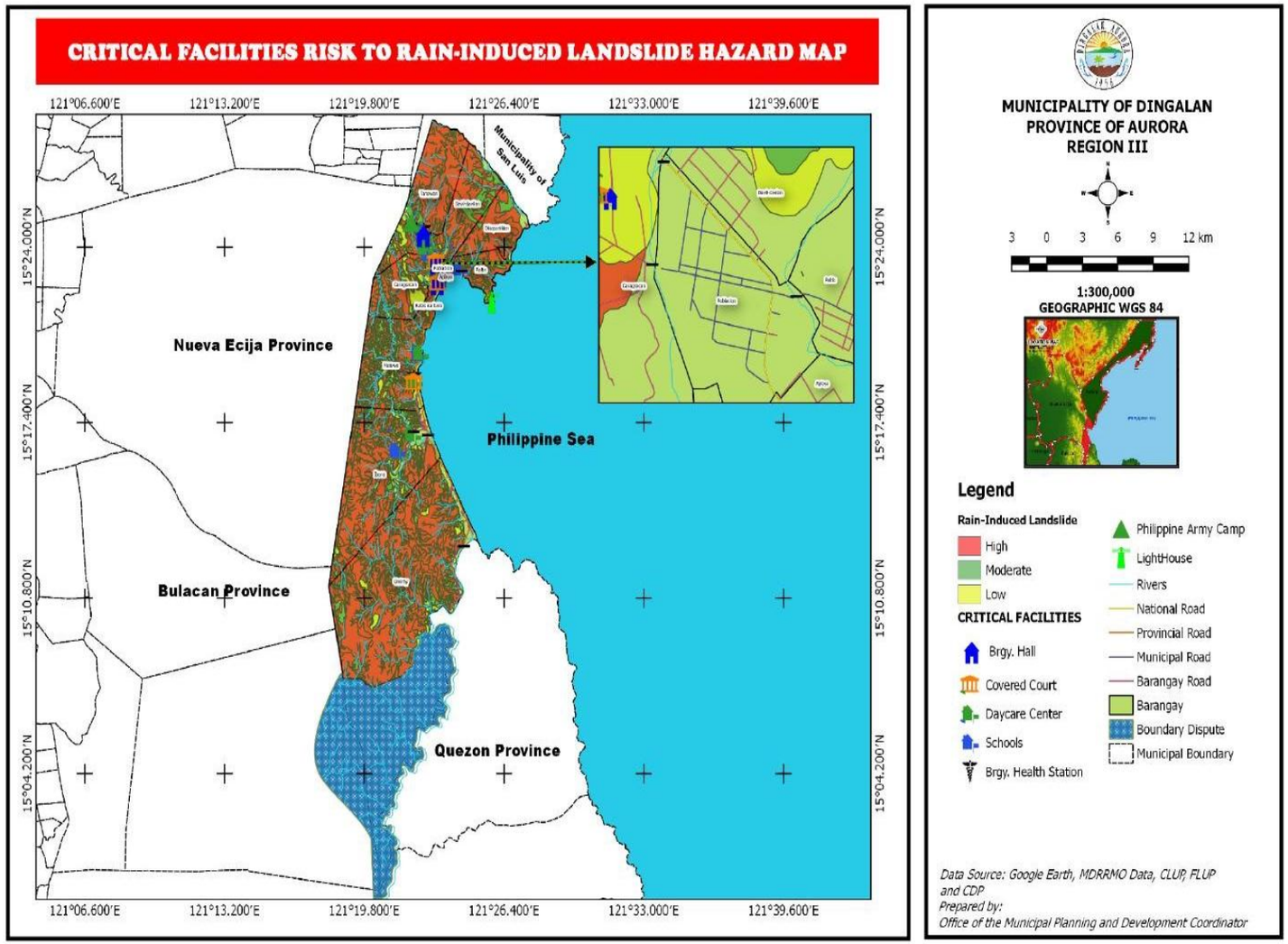


Figure 72. Critical Facilities Risk to Rain-Induced Landslide Hazard Map

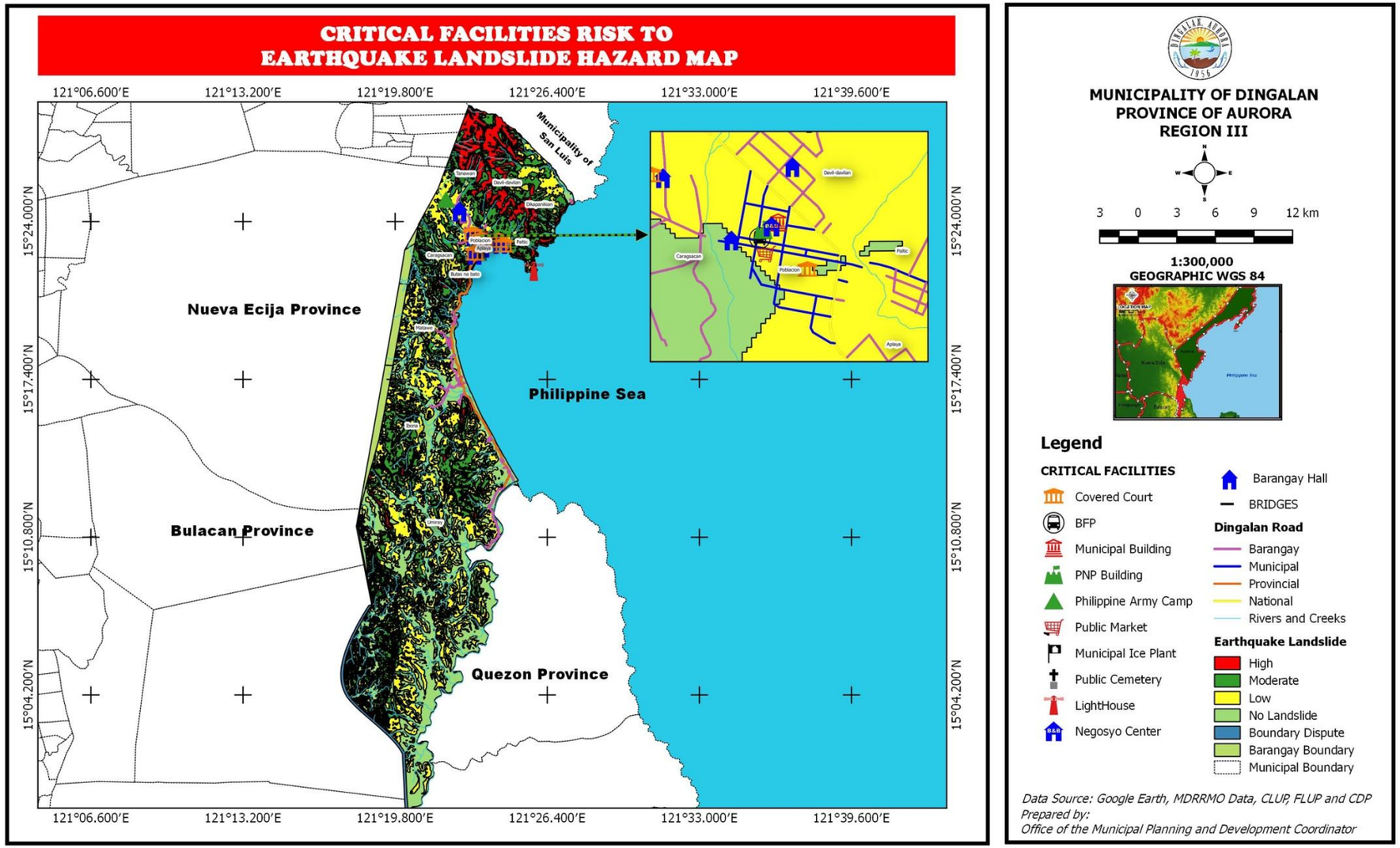


Figure 72. Critical Facilities Risk to Earthquake Landslide Hazard Map

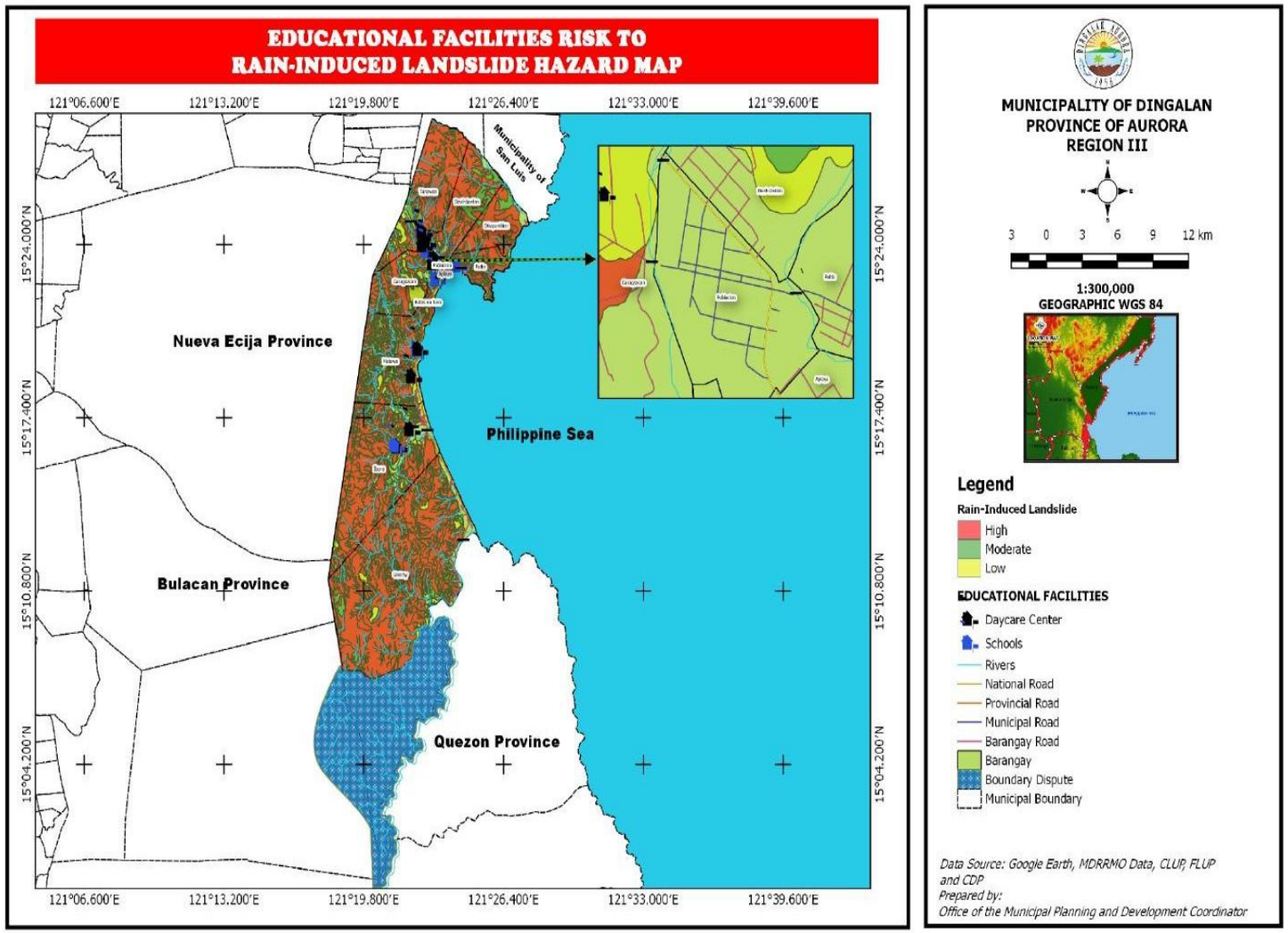


Figure 73. Critical Facilities Risk to Rain-Induced Landslide Hazard Map

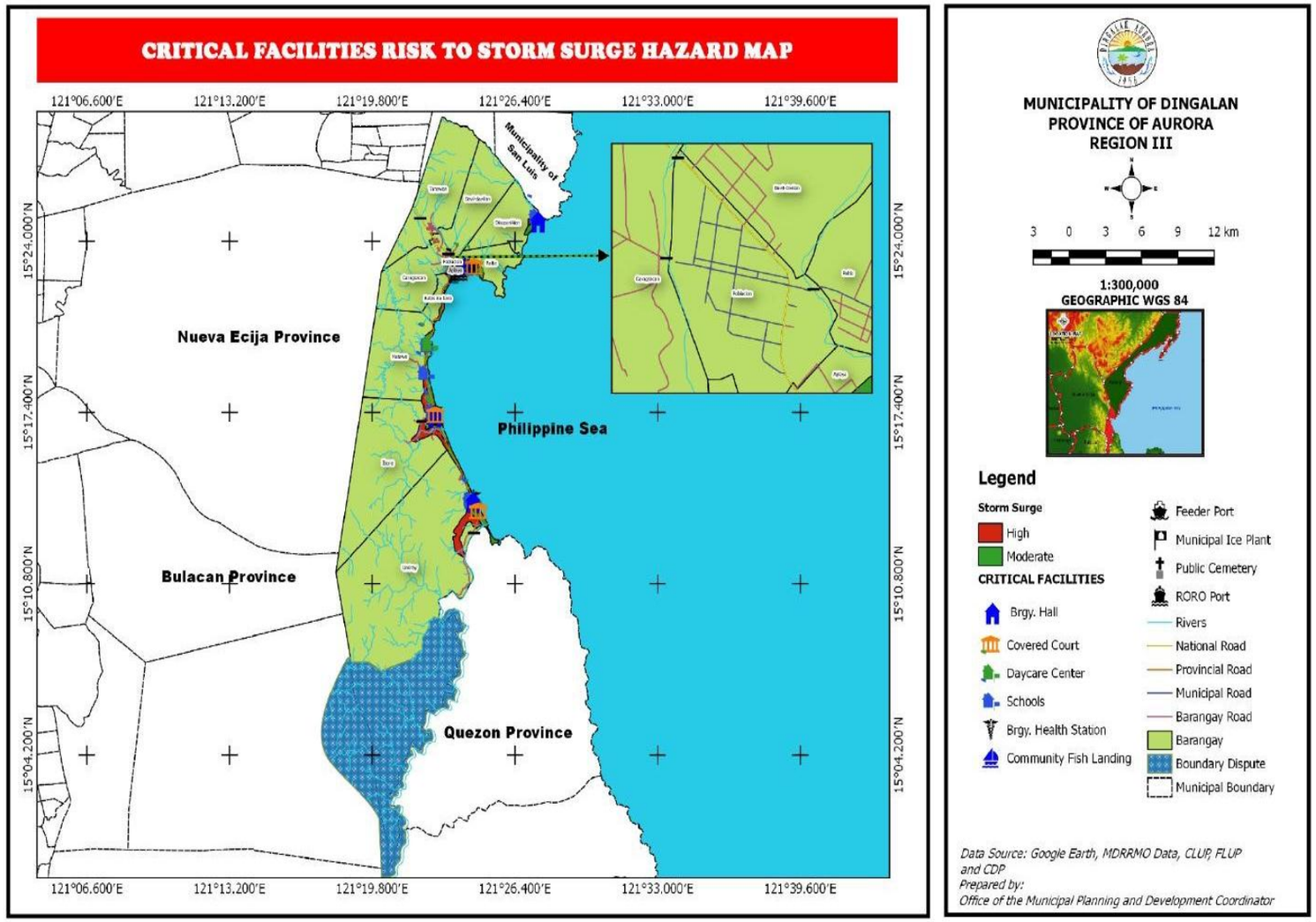


Figure 74. Critical Facilities Risk to Storm Surge Hazard Map

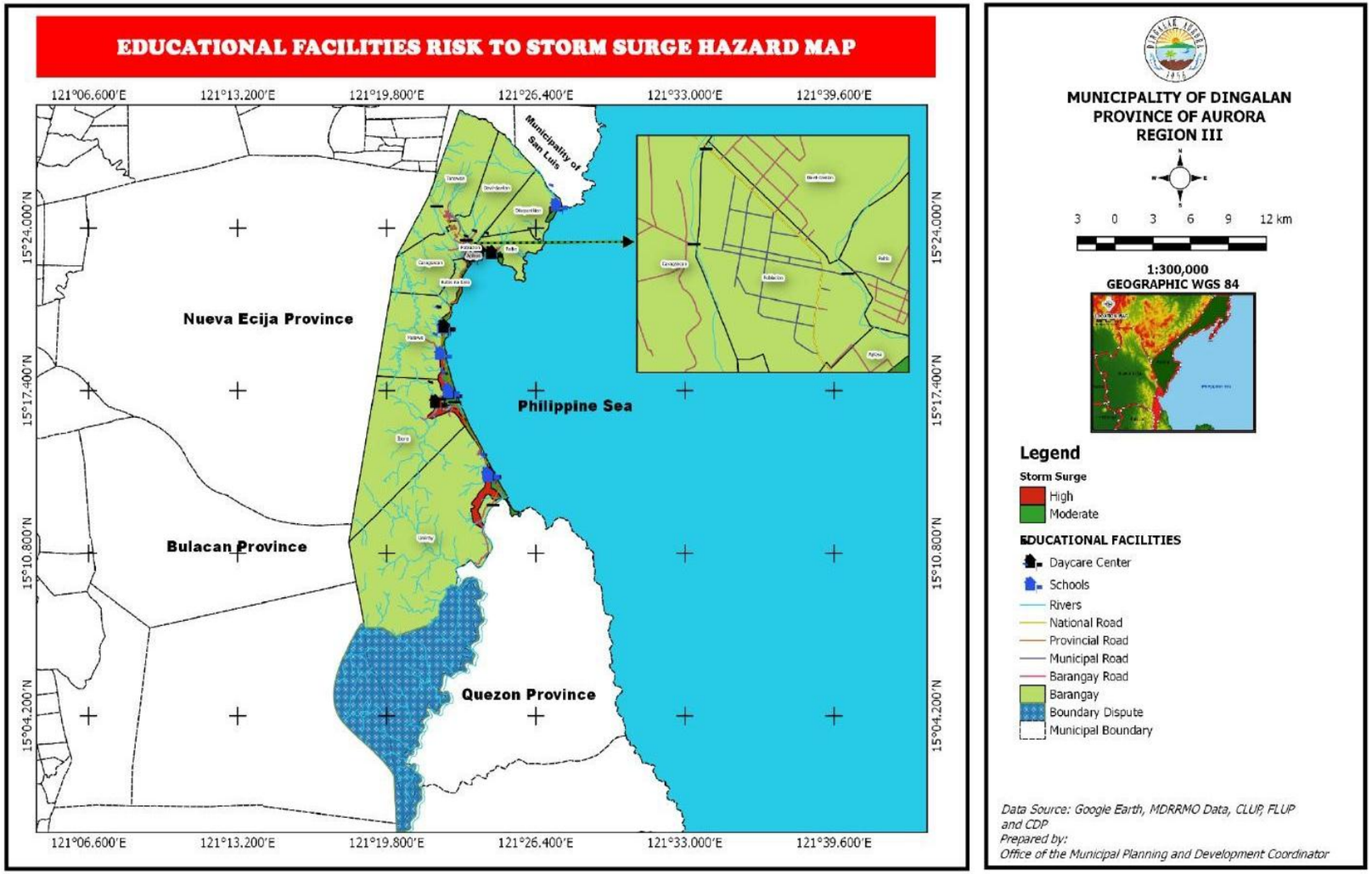


Figure 75. Educational Facilities Risk to Storm Surge Hazard Map

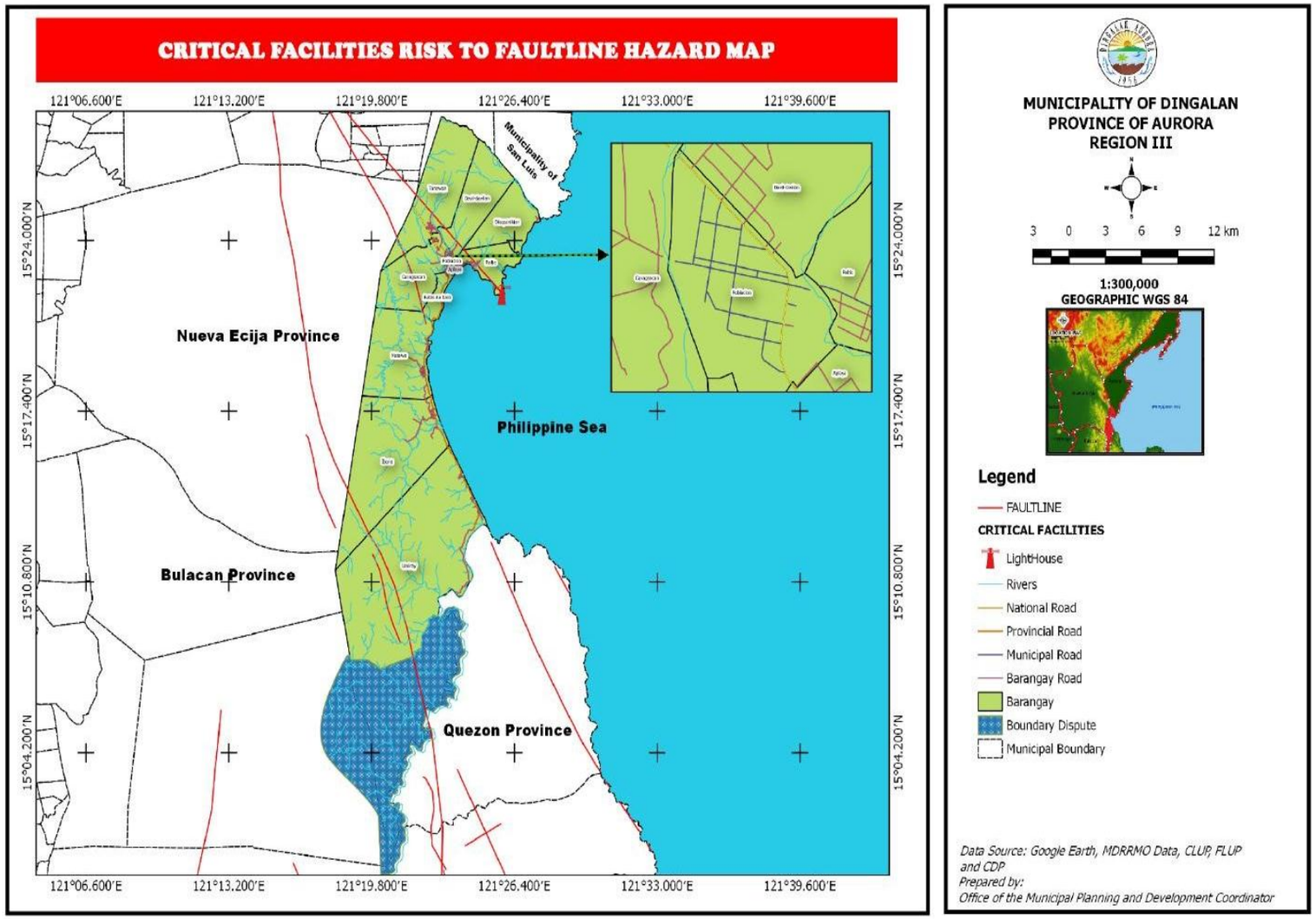


Figure 76. Critical Facilities Risk to Faultine Hazard Map

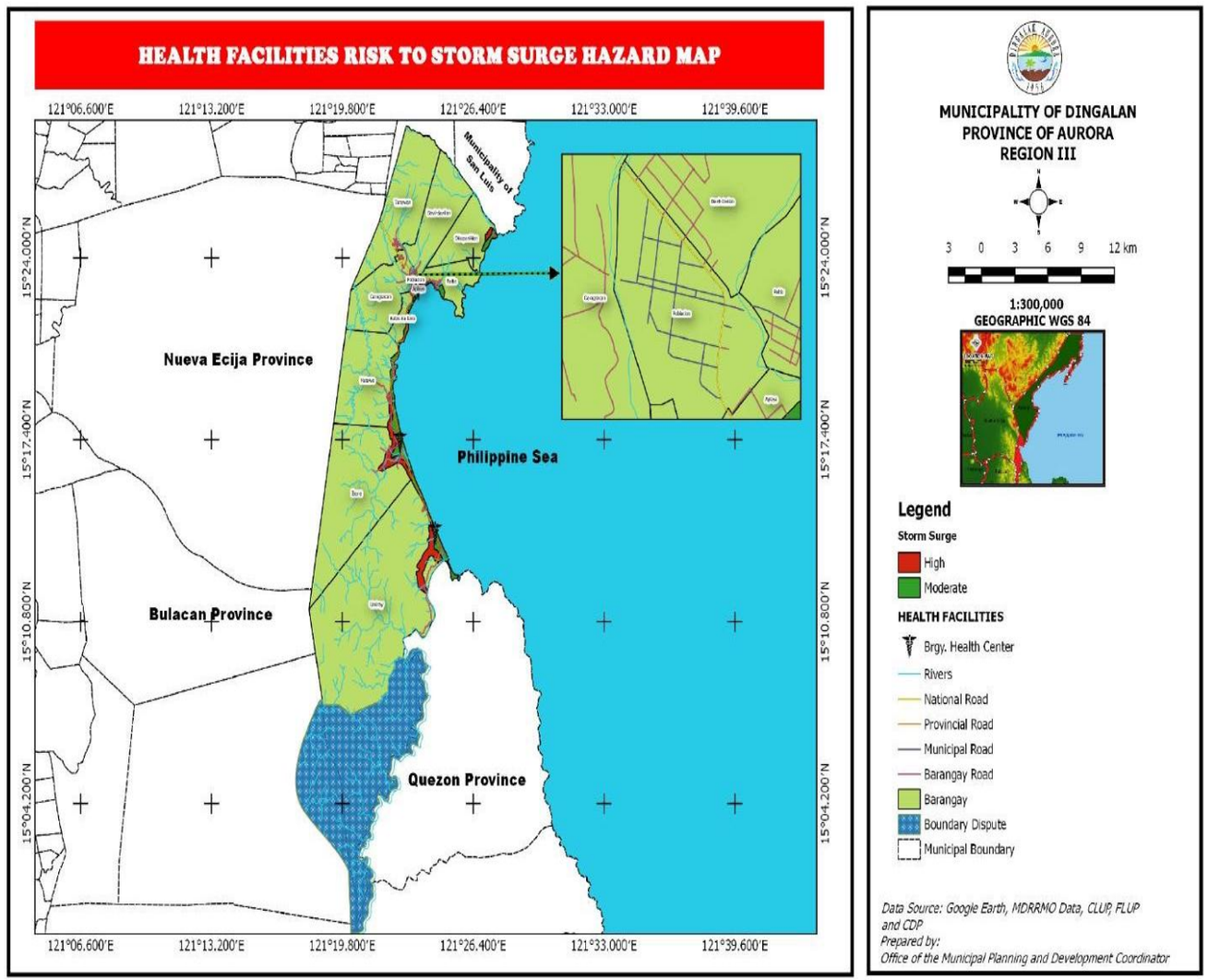


Figure 77. Health Facilities Risk to Storm Surge Hazard Map

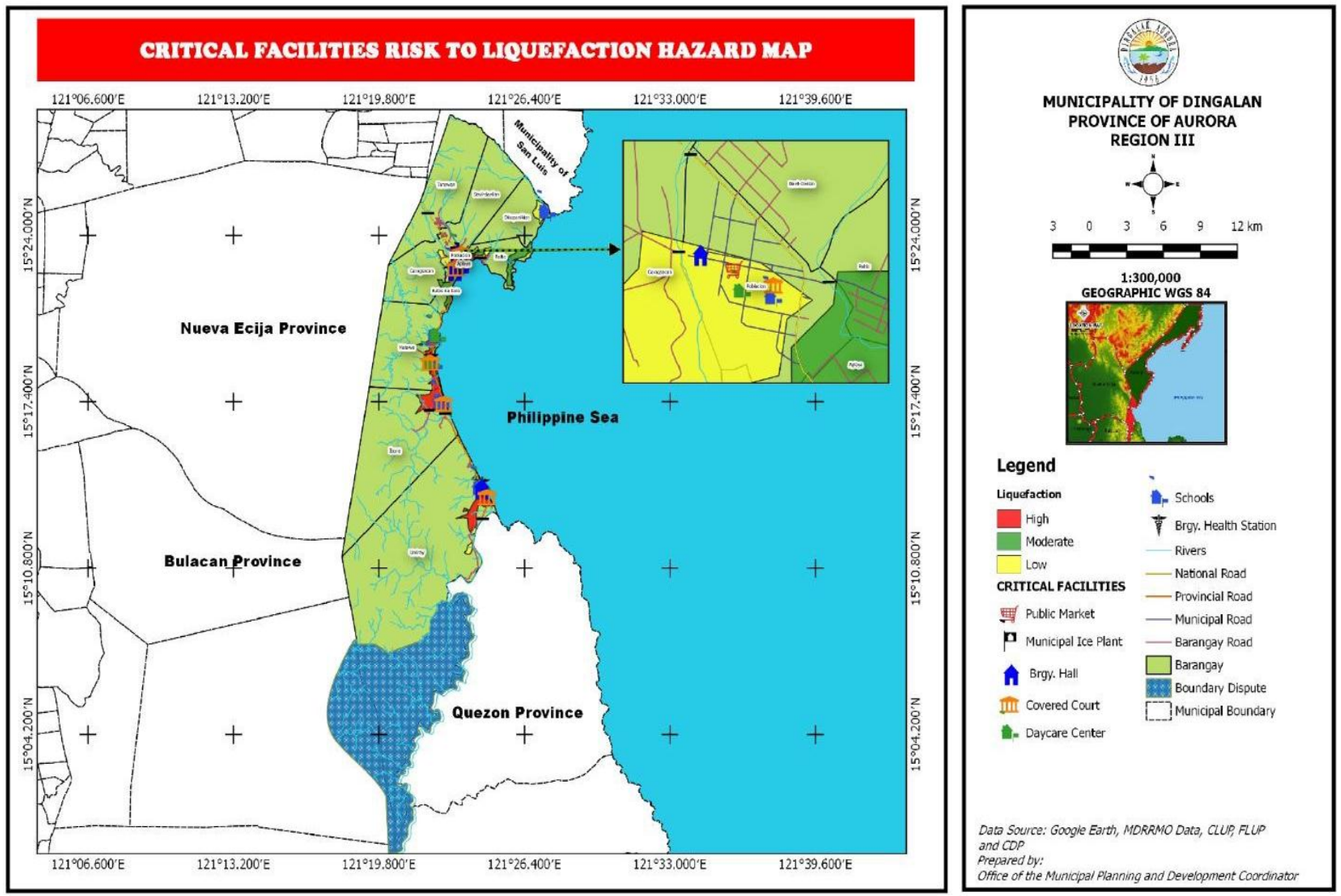


Figure 78. Critical Facilities Risk to Liquefaction Hazard Map

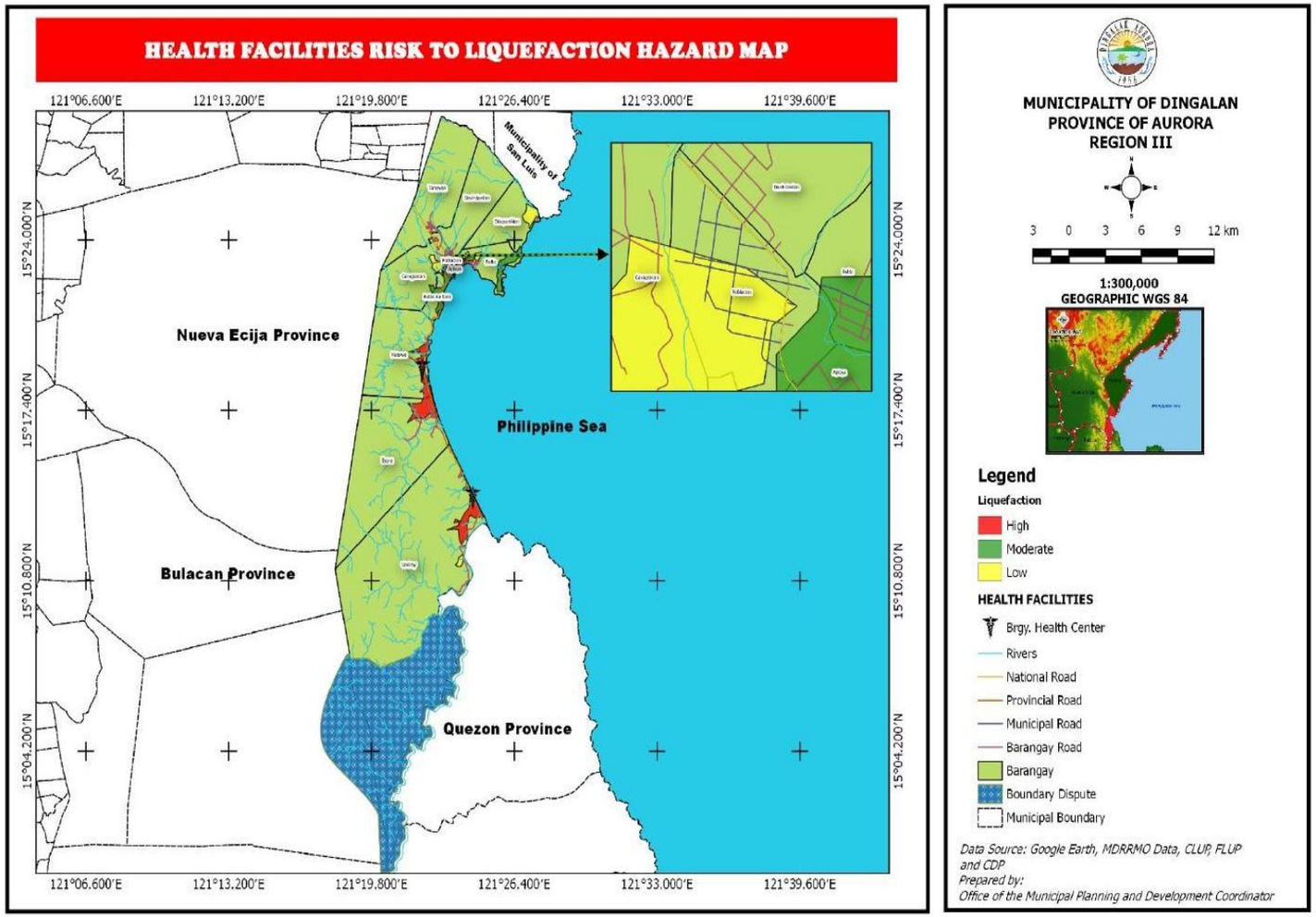


Figure 79. Health Facilities Risk to Liquefaction Hazard Map

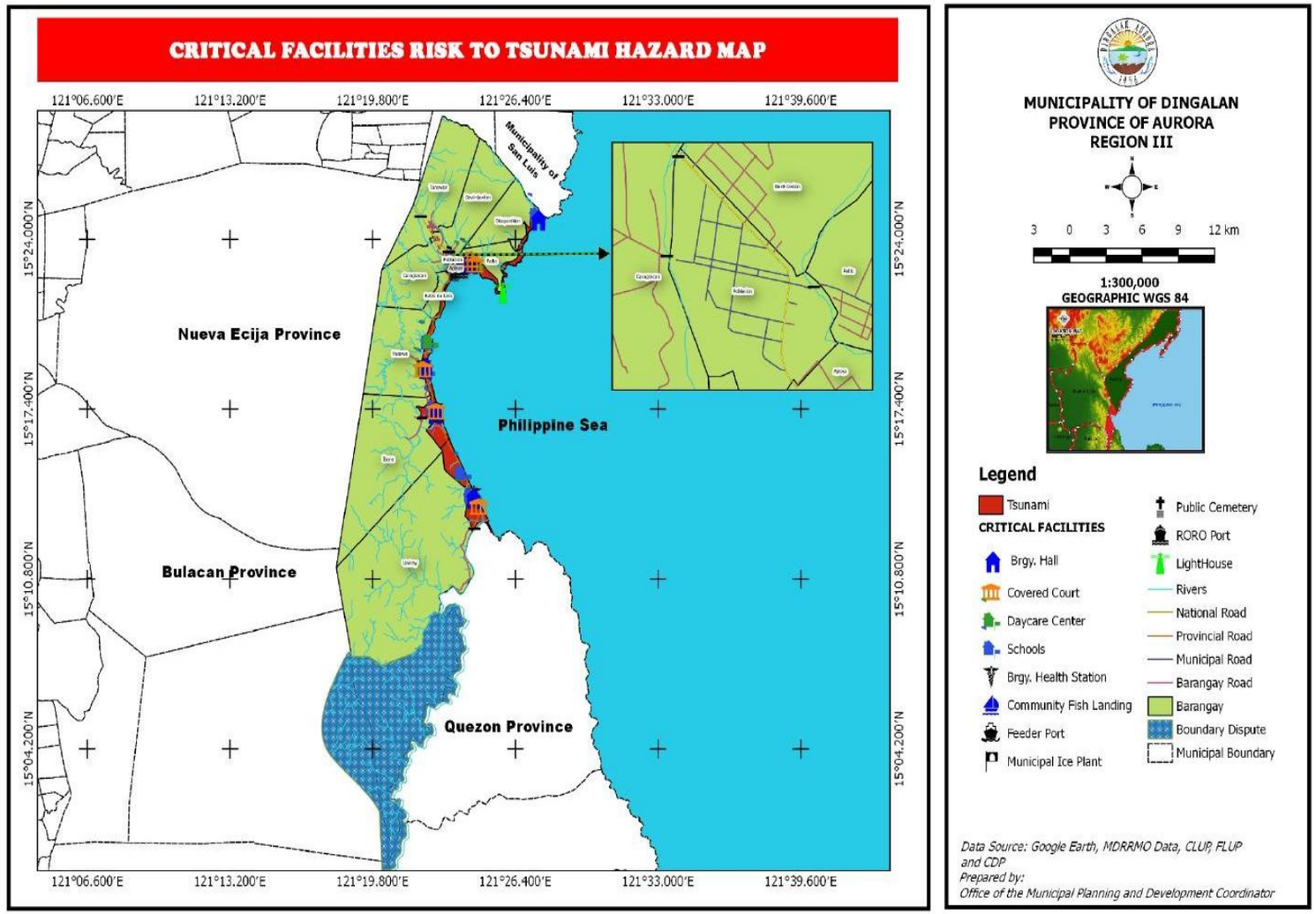


Figure 80. Critical Facilities Risk to Tsunami Hazard Map

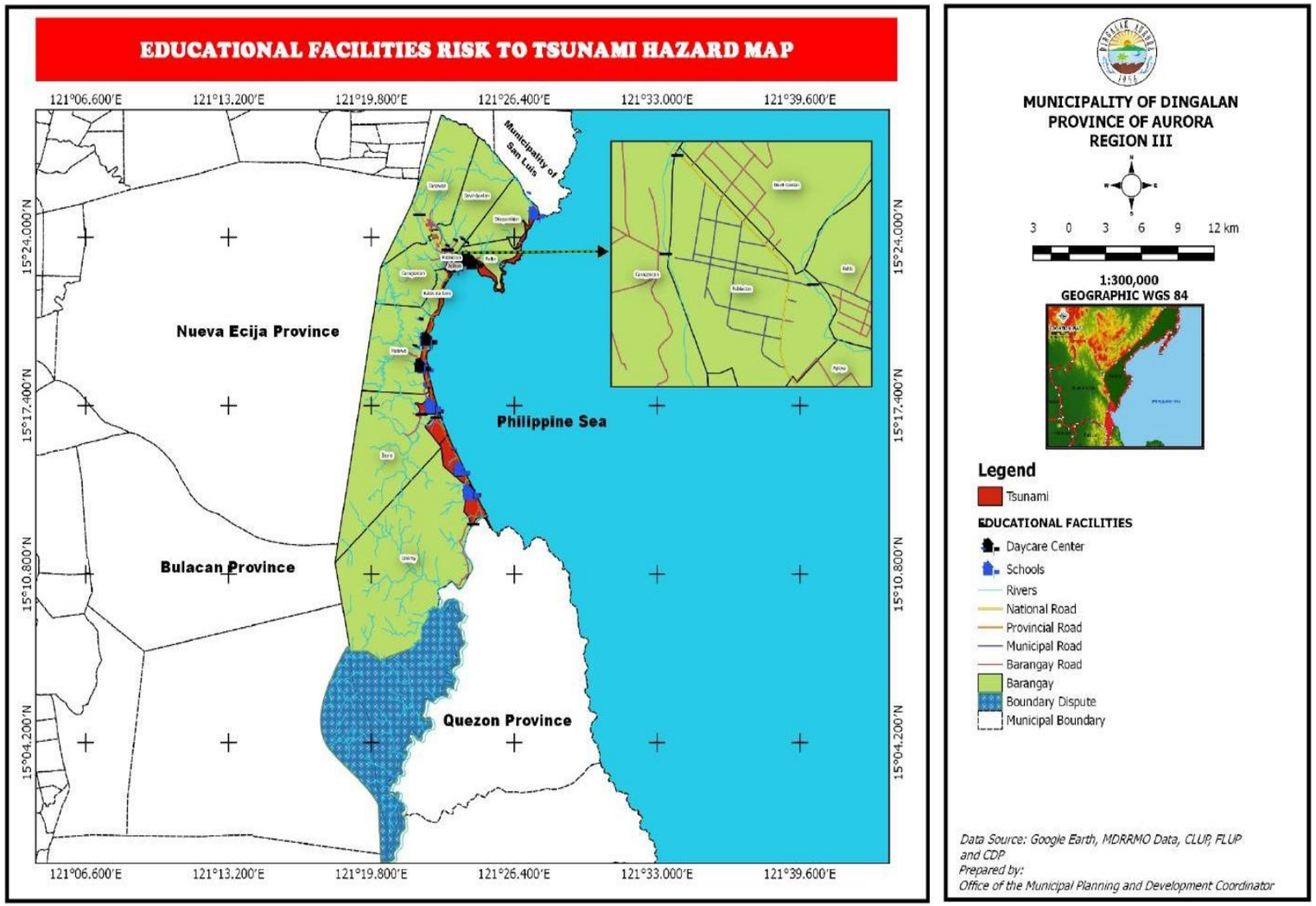


Figure 81. Educational Facilities Risk to Tsunami Hazard Map

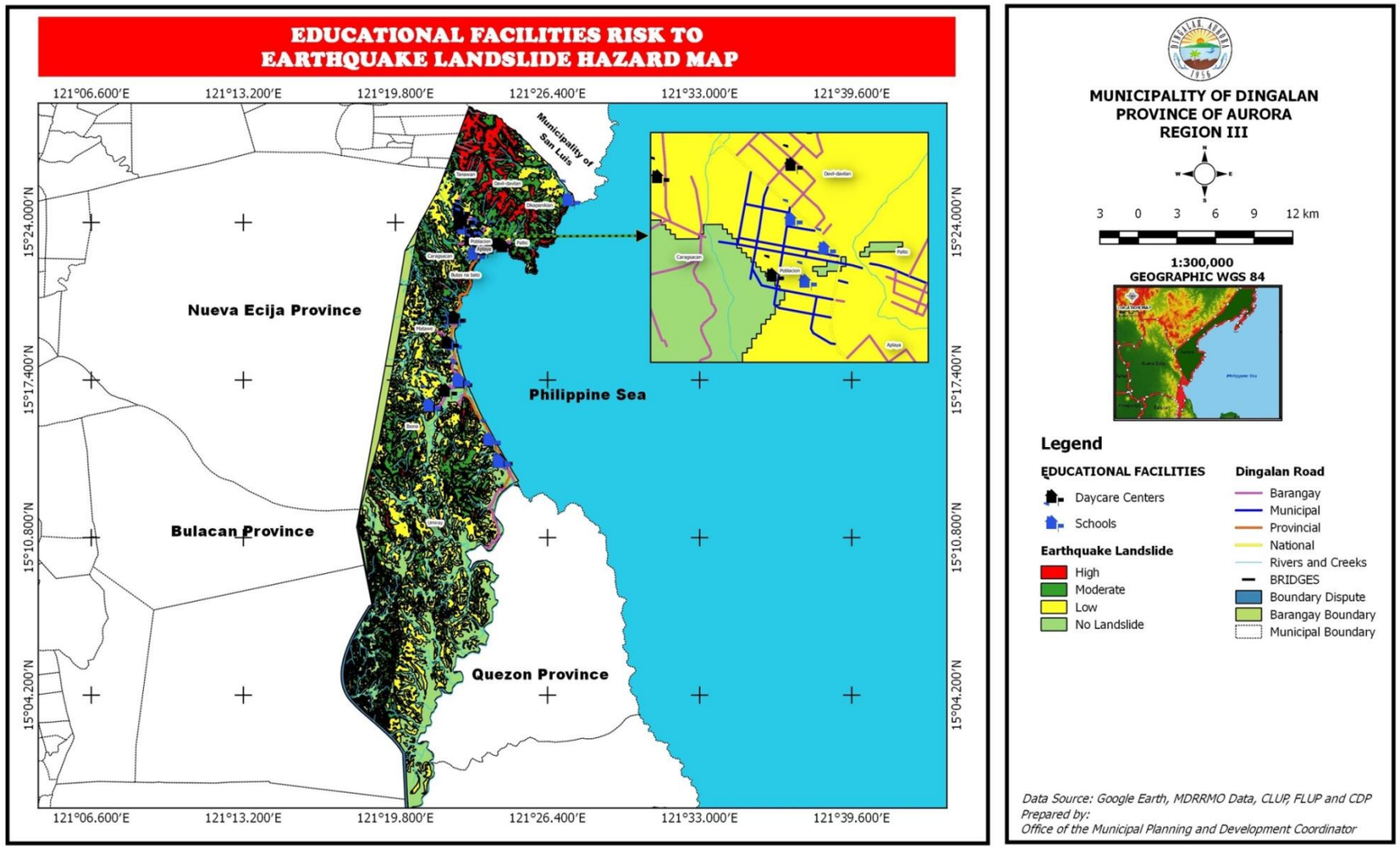


Figure 82. Educational Facilities Risk to Earthquake Hazard Map

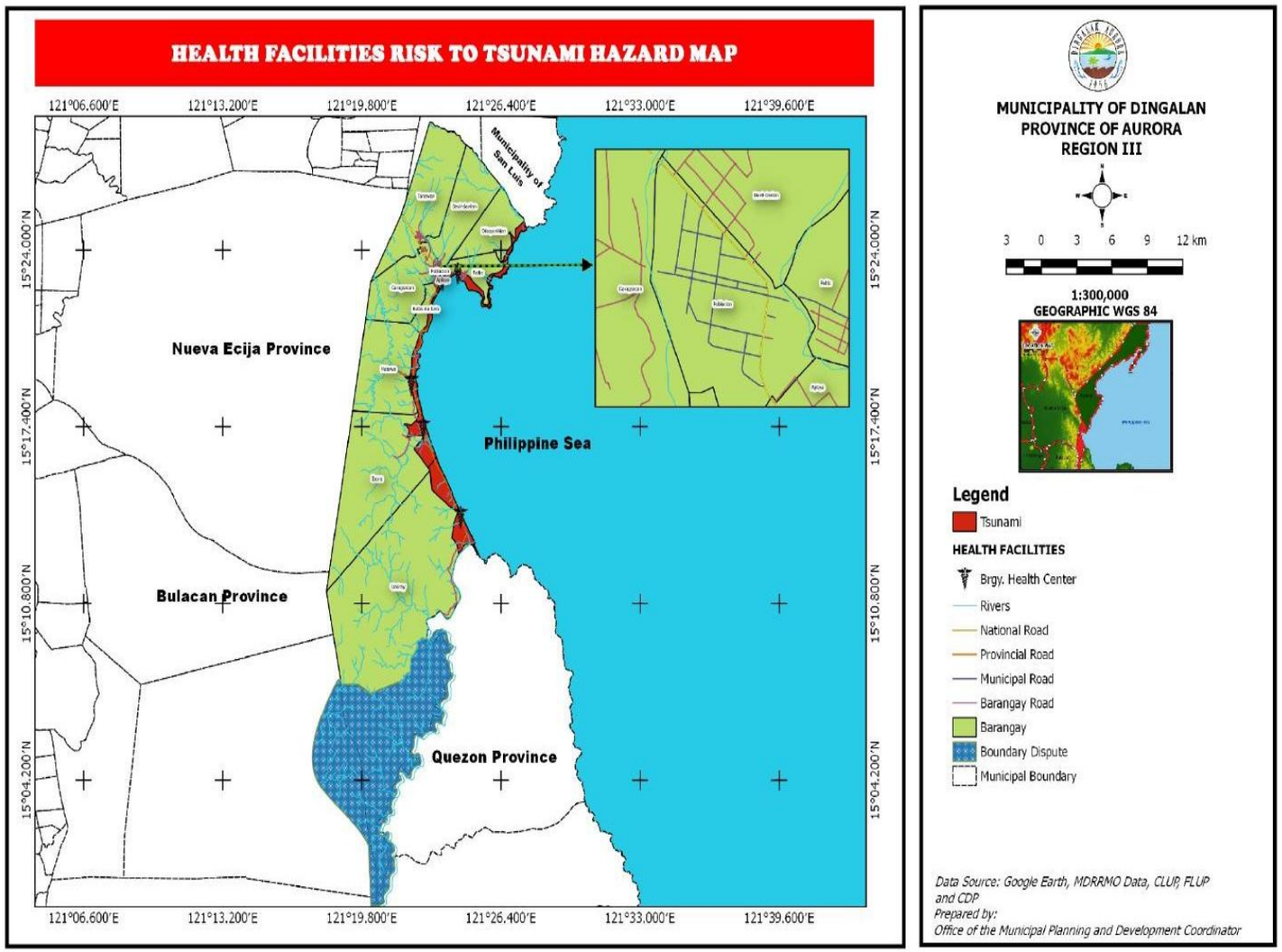


Figure 83. Health Facilities Risk to Tsunami Hazard Map

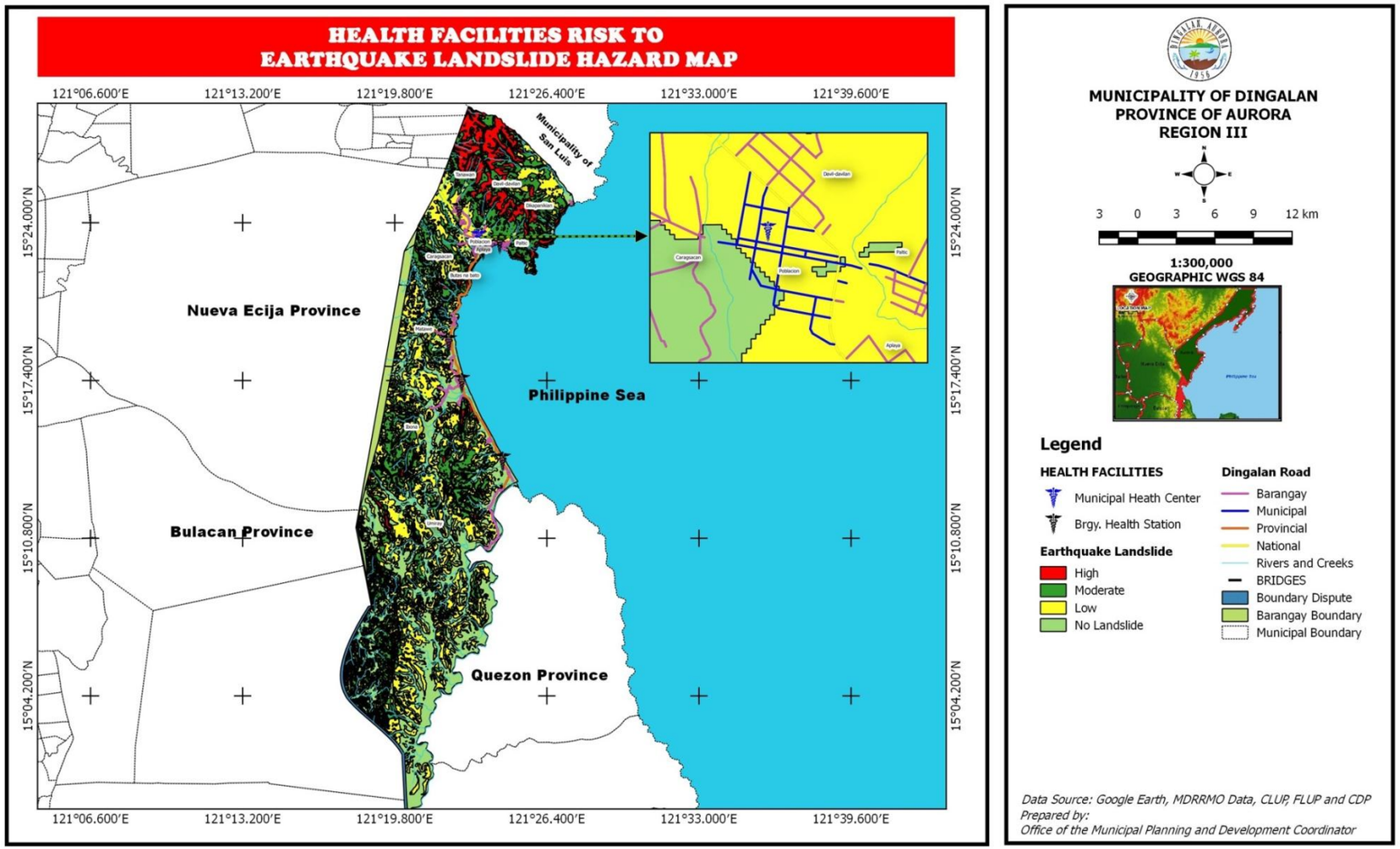


Figure 84. Health Facilities Risk to Earthquake Landslide Hazard Map

DRA for Urban Use Areas

1. Disaster Risk Assessment Tables

Table 80. Disaster Risk Assessment of Urban Use Areas in Dingalan

BARANGAY	1. Flood					
	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs
Aplaya	6	4	4	2	1	2

BARANGAY	2. Rain-Induced Landslide					
	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs
Aplaya	1	1	1	1	1	1

BARANGAY	3. Storm Surge					
	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs
Aplaya	1	4	4	1	1	4

BARANGAY	4. Drought					
	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs
Aplaya	4	2	3	1	1	3

BARANGAY	5. Sea Level Rise					
	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs
Aplaya	3	3	3	2	1	3

BARANGAY	6. Earthquake-Induced Landslide					
	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs
Aplaya	1	1	1	1	1	1

Butas Na Bato	6	3	2	2	2	2	6	3	2	2	2	2	1	3	3	4	2	4	4	2	2	3	2	3	3	2	3	3	2	3	1	3	3	3	3	2
Cabog (Matawe)	6	2	2	1	2	2	4	3	1	1	2	2	1	3	3	4	1	4	4	3	3	3	3	3	3	2	3	3	1	3	1	3	2	2	3	1
Caragsacan	6	2	2	1	2	1	4	3	3	1	3	1	1	1	1	1	1	1	4	3	3	2	3	1	1	1	1	1	1	1	1	4	2	2	3	1
Davildavilan	6	1	1	2	1	1	4	2	1	3	2	1	1	1	1	1	1	1	4	2	3	1	2	1	1	1	1	1	1	1	1	2	1	3	2	1
Dikapanikian	6	2	1	1	2	2	4	2	1	1	1	1	1	4	4	1	1	4	4	2	1	1	3	3	3	2	1	2	1	3	1	2	1	1	2	1
Ibona	6	3	2	3	2	2	6	2	2	2	3	2	1	3	3	3	1	4	4	3	2	3	3	3	3	2	3	2	1	3	1	3	2	3	2	1
Paltic	6	4	4	4	3	2	6	4	4	4	4	2	1	4	4	4	1	1	4	2	3	3	4	3	3	3	3	3	1	3	1	3	3	4	3	1
Poblacion	6	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4	1	4	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Tanawan	1	1	1	1	3	1	3	4	4	3	1	1	1	1	1	1	1	1	4	2	2	3	3	1	1	1	1	1	1	1	1	3	3	1	3	1
Umiray (Malamig)	6	3	3	3	2	2	4	3	2	2	3	2	1	3	3	4	1	4	4	3	2	3	3	3	3	2	2	2	1	3	1	3	3	2	3	1

Table 81. Disaster Risk Assessment of Urban Use Areas in Dingalan (cont.)

BARANGAY	7. Liquefaction/ Sinkhole						8. Ground Shaking						9. Ground Rupture						10. Tsunami						11. Volcanic Eruption						Average Risk Score of Population			
	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs	Likelihood of Occurrence	Severity of Consequence to Barangay Residents	Severity of Consequence to Informal Settlers	Severity of Consequence to Houses Made with Light Materials	Severity of Consequences to Elderly and Young People	Severity of Consequence to PWDs	Count of Disaster Risks = 11	Count of Severity of Consequences = 55	Average Score	Category
Aplaya	1	2	3	2	1	3	4	3	3	1	1	3	1	2	2	1	1	3	1	4	4	1	1	4	1						11	50	5.12	Moderate

Butas Na Bato	1	3	3	3	3	3	4	3	3	3	3	3	1	2	2	2	3	3	1	4	4	4	3	4	1						11	50	7.10	Moderate
Cabog (Matawe)	1	3	3	3	3	3	4	2	2	2	2	3	1	1	1	1	1	1	1	3	3	3	2	4	1						11	50	5.82	Moderate
Caragsacan	1	3	3	2	3	1	4	3	3	1	4	1	1	3	2	2	4	1	1	1	1	1	1	1	1						11	50	4.78	Moderate
Davildavilan	1	2	2	2	2	1	4	2	2	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1						11	50	3.56	Low
Dikapanikian	1	2	1	1	2	3	4	2	1	1	2	3	1	1	1	1	1	1	1	4	4	1	2	4	1						11	50	4.50	Low
Ibona	1	3	3	3	3	3	4	2	2	2	3	3	1	1	1	1	1	1	1	3	3	2	1	4	1						11	50	6.66	Moderate
Paltic	1	3	3	3	3	3	4	2	2	2	3	3	1	1	1	1	1	1	1	4	4	4	3	4	1						11	50	8.48	Moderate
Poblacion	1	2	2	1	1	1	4	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1						11	50	2.86	Low
Tanawan	1	3	3	2	3	1	4	4	4	4	4	1	1	3	2	1	4	1	1	1	1	1	1	1	1						11	50	4.14	Low
Umiray (Malamig)	1	3	3	2	3	3	4	2	2	2	3	3	1	1	1	1	1	1	1	3	3	1	2	4	1						11	50	6.42	Moderate

DRA Summary

Table 82. Disaster Risk Assessment Summary for Dingalan

Barangays	Overall DRA Index	Overall DR Category	Descriptive Summary of Attributes at Risk				
			Population	Natural Resources	Critical Point Facilities	Urban Use	Lifeline Utilities
Aplaya	4.87	Moderate	Flooding usually occurs in Aplaya due to its low elevation. The percentage of the affected population needing immediate assistance in the event of a disaster is 10%-20%.	Aplaya is located in the lowlands and within the coastal area of Dingalan. Flooding severely affects the 3 ha of agricultural lands in the area.	The gymnasium and barangay hall are newly constructed; the health station and daycare center are old structures still in good condition.	Most of the houses are bungalow-type, and are usually located at least 50 meters away from the seashore.	Roads and bridges are structurally sound; but the power distribution system is vulnerable to hazards.
Butas na Bato	5.62	Moderate	Flooding and rain-induced landslide usually occur in Butas na Bato due to its low elevation. The percentage of the affected population needing immediate assistance in the event of a disaster is 1%-10%.	Butas na Bato is located within the lowlands and highlands of Dingalan. Flooding and rain-induced landslides severely affect the 283 ha of agricultural lands in the area.	The school and barangay hall are old structures still in good condition.	Most of the commercial strcutures are located along the highway and in coastal areas. These are usually located at least 50 meters away from the seashore.	Some roads are structurally sound; but others are unpaved and are within sloping areas. The power distribution system is vulnerable to hazards.
Cabog (Matawe)	5.14	Moderate	Flooding usually occurs in Cabog due to its low elevation. The percentage of the affected population needing immediate assistance in the event of a disaster is 10%-20%.	Cabog is located within the lowlands and highlands of Dingalan. Flooding severely affects the 364 ha of agricultural lands in the area.	The schools, barangay hall, barangay health station, and gymnasium are old structures still in good condition.	Most of the commercial strcutures are located along the highway and in coastal areas. These are usually located at least 50 meters away from the seashore.	Some roads are structurally sound; but others are unpaved and are within sloping areas. The power distribution system is vulnerable to hazards.
Caragsacan	4.88	Moderate	Flooding usually occurs in Caragsacan due to its low elevation. The percentage of the affected population needing immediate assistance in the event of a disaster is 5%-10%.	Caragsacan is located within the lowlands and highlands of Dingalan. Flooding severely affects the 72 ha of agricultural lands in the area.	The school and gymnasium are newly constructed; the barangay hall is an old structure and is vulnerable to hazards.	Most of the houses are bungalow-type, and are usually located at least 1,200 meters away from the seashore.	Roads are structurally sound; Langawan Bridge is still under construction. The power distribution system is vulnerable to hazards.
Davildavilan	3.68	Low	Flooding usually occurs in Davildavilan due to its low elevation. The percentage of the affected	Davildavilan is located in the highlands of Dingalan. Two rivers are located close to the	The daycare cenand barangay hall are newly constructed.	Most of the houses are bungalow-type, and are usually	Roads are structurally sound; but the power

			population needing immediate assistance in the event of a disaster is 5%-10%.	municipality. Flooding severely affects the 42.25 ha of agricultural lands in the area.		located at least 1,000 meters away from the seashore.	distribution system is vulnerable to hazards.
Dikapanikian	4.36	Low	Flooding usually occurs in Dikapanikian due to its low elevation. The percentage of the affected population needing immediate assistance in the event of a disaster is more than 20%.	Dikapanikian is located within the lowlands and highlands of Dingalan. Flooding severely affects the 46 ha of agricultural lands in the area.	The health station and barangay hall are newly constructed; the school is newly constructed as wel, but of poor workmanship.	Most of the houses are bungalow-type, and are usually located at least 50 meters away from the seashore.	Roads going to the barangay are under construction; other roads are in good condition. The barangay is not yet 100% electrified.
Ibona	6.27	Moderate	Flooding and rain-induced landslide usually occur in Ibona due to its low elevation. The percentage of the affected population needing immediate assistance in the event of a disaster is more than 20%.	Ibona is located within the lowlands and highlands of Dingalan. Flooding severely affects the 988 ha of agricultural lands in the area.	The schools, barangay hall, and barangay health station are old structures still in good condition; the gymnasium and other government buildings are newly constructed.	Most of the houses are bungalow-type, and are usually located at least 50 meters away from the seashore.	Majority of the roads are unpaved; bridge should be replaced. The power distribution system is vulnerable to hazards.
Paltic	7.16	Moderate	Flooding and rain-induced landslide usually occur in Paltic due to its low elevation. The percentage of the affected population needing immediate assistance in the event of a disaster is more than 20%.	Paltic is located within the lowlands and highlands of Dingalan. Flooding and rain-induced landslides severely affect the 45.5 ha of agricultural lands in the area.	Majority of the structures are newly constructed; however, the barangay is vulnerable to flooding, tsunamis, and landslides.	Most of the houses are bungalow-type, and are usually located at least 50 meters away from the seashore.	Roads are due to be paved; bridges are to constructed; and water system facilities are to be installed. The power distribution system is vulnerable to hazards.
Poblacion	2.98	Low	Flooding usually occurs in Poblacion due to its low elevation. The percentage of the affected population needing immediate assistance in the event of a disaster is 1%-10%.	Poblacion is located in the highlands of Dingalan. Two rivers are located close to the municipality. Flooding severely affects the 0.75 ha of agricultural lands in the area.	Majority of the structures are newly constructed or newly repaired.	Most of the houses are bungalow-type, and are usually located at least 500 meters away from the seashore.	Almost all roads are paved and in good condition. Potable water system is under construction. The power distribution system is vulnerable to hazards.
Tanawan	3.85	Low	Drought usually occurs in Tanawan. The percentage of the affected population needing immediate assistance in the event of a disaster is 10%-20%.	Tanawan is located in the highlands of Dingalan. Rain-induced landslides severely affect the 15.5 ha of agricultural lands in the area.	Majority of the structures are newly constructed or newly repaired.	Most of the houses are bungalow-type, and are usually located at least 3,000 meters away from the seashore.	Roads and bridges are structurally sound; but the power distribution system is vulnerable to hazards.
Umiray (Malamig)	5.90	Moderate	Flooding usually occurs in Umiray due to its low elevation. The percentage of the affected population needing immediate assistance in the event of a disaster is more than 20%.	Umiray is located within the lowlands and highlands of Dingalan. Flooding severely affects the 1,047 ha of agricultural lands in the area.	The gymnasium is newly constructed; the schools, barangay hall, and health station are old structures still in good condition.	Most of the houses are bungalow-type, and are usually located at least 50 meters away from the seashore.	Roads and bridges are structurally sound; but most roads are unpaved. The power distribution system is vulnerable to hazards.

Table 83. Disaster Risk Assessment Summary for Dingalan (cont.)

Barangays	Overall DRA Index	Overall DR Category	Needed Interventions to Addess Disaster Risks				
			Population	Natural Resources	Critical Point Facilities	Urban Use	Lifeline Utilities
Aplaya	4.87	Moderate	Flood control facilities are needed.	Flood control facilities are needed.	All structures must conform with the NSCP.	Adopt the use of a renewable source of energy; construct more climate-adaptive facilities for the tourism industry.	Consider engineering mitigations for roads and bridges; consider the use of solar energy.
Butas na Bato	5.62	Moderate	Flood control facilities are needed.	Flood control facilities and tree planting projects are needed.	All structures must conform with the NSCP.	Adopt the use of a renewable source of energy; construct more climate-adaptive facilities for the tourism industry.	Provide slope protection, paved roads, and potable water system for the barangay.
Cabog (Matawe)	5.14	Moderate	Flood control facilities are needed.	Flood control facilities are needed.	All structures must conform with the NSCP.	Adopt the use of a renewable source of energy; construct more climate-adaptive facilities for the tourism industry.	Provide slope protection, paved roads, and potable water system for the barangay.
Caragsacan	4.88	Moderate	Flood control facilities are needed.	Flood control facilities are needed.	All structures must conform with the NSCP.	Adopt the use of a renewable source of energy; construct more climate-adaptive facilities for the tourism industry.	Consider engineering mitigations for roads and bridges; consider the use of solar energy.
Davildavilan	3.68	Low	Flood control facilities are needed.	Flood control facilities for Langawan and Subsub Rivers are needed.	All structures must conform with the NSCP.	Adopt the use of a renewable source of energy; construct more climate-adaptive facilities for the tourism industry.	Consider engineering mitigations for roads and bridges; consider the use of solar energy. Pursue the operation of the potable water system.
Dikapanikian	4.36	Low	Flood control facilities are needed.	Flood control facilities are needed.	All structures must conform with the NSCP.	Adopt the use of a renewable source of energy; construct more climate-adaptive facilities for the tourism industry.	Consider engineering mitigations for roads and bridges; consider the use of solar energy.
Ibona	6.27	Moderate	Flood control facilities are needed.	Flood control facilities are needed.	All structures must conform with the NSCP.	Adopt the use of a renewable source of energy; construct more climate-adaptive facilities for the tourism industry.	Consider engineering mitigations for roads and bridges; consider the use of solar energy. Pursue the operation of the potable water system.
Paltic	7.16	Moderate	Flood control facilities and tree planting projects are needed.	Flood control facilities and tree planting projects are needed.	All structures must conform with the NSCP.	Adopt the use of a renewable source of energy; construct more climate-adaptive facilities for the tourism industry.	Consider engineering mitigations for roads and bridges; consider the use of solar energy. Pursue the operation of the potable water system.

Poblacion	2.98	Low	Flood control facilities are needed.	Flood control facilities for Langawan and Subsub Rivers are needed.	All structures must conform with the NSCP.	Adopt the use of a renewable source of energy; construct more climate-adaptive facilities for the tourism industry.	Consider engineering mitigations for roads and bridges; consider the use of solar energy. Pursue the operation of the potable water system.
Tanawan	3.85	Low	Tree planting projects are needed.	Tree planting projects are needed.	All structures must conform with the NSCP.	Adopt the use of a renewable source of energy; construct more climate-adaptive facilities for the tourism industry.	Consider engineering mitigations for roads and bridges; consider the use of solar energy.
Umiray (Malamig)	5.90	Moderate	Flood control facilities and tree planting projects are needed.	Flood control facilities and tree planting projects are needed.	All structures must conform with the NSCP.	Adopt the use of a renewable source of energy; construct more climate-adaptive facilities for the tourism industry.	Consider engineering mitigations for roads and bridges; consider the use of solar energy.

MULTI HAZARD MAP

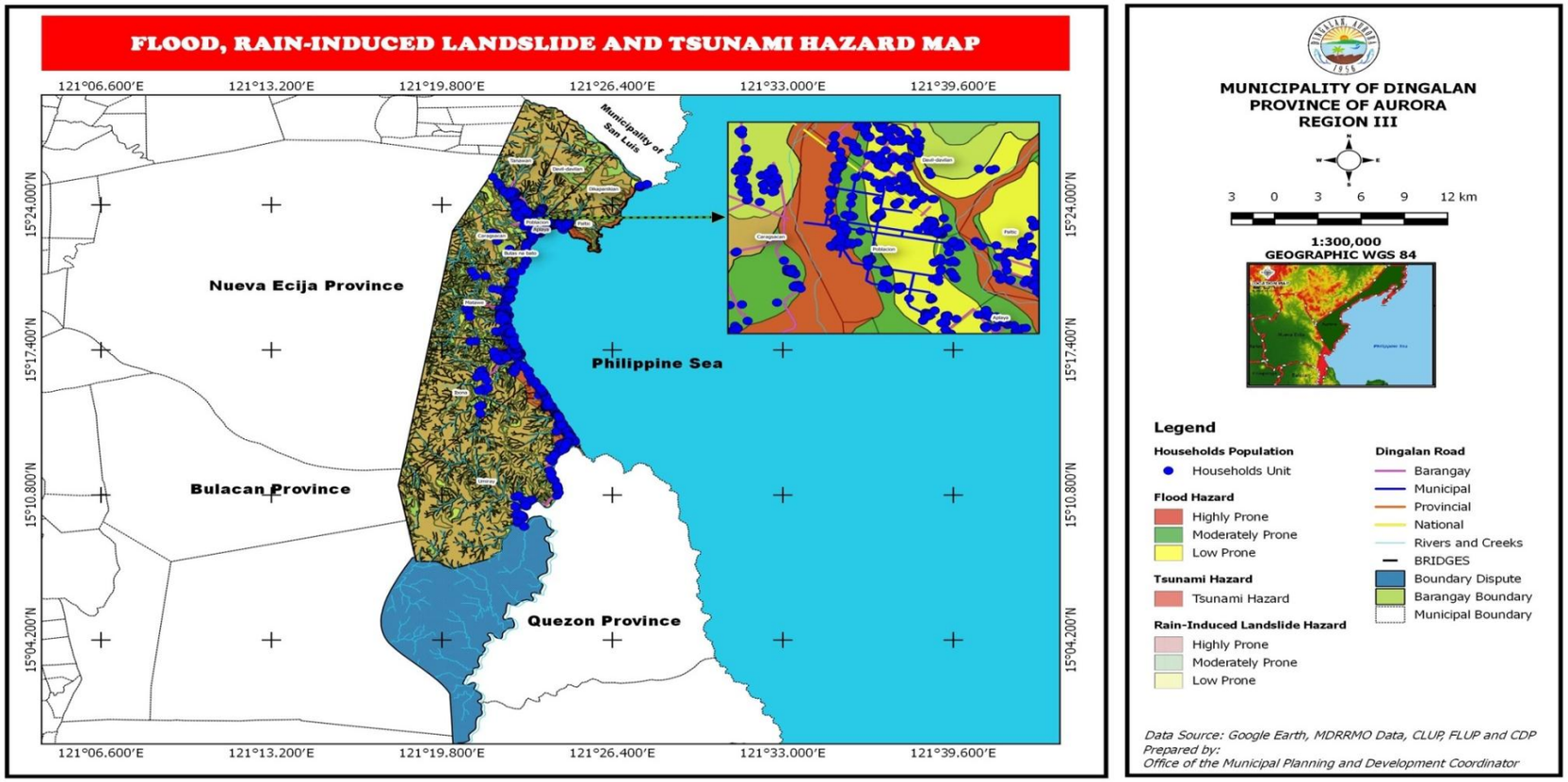


Figure 85. Multiple Hazard Map: Flood, Rain-induced Landslide and Tsunami Hazards

Greenhouse Gas Emissions and Existing Production Efforts

2.2.1 RATIONALE

Republic Act 9729, also known as the Climate Change Act of 2009, designates Local Government Units as the frontline agencies in the formulation, planning and implementation of climate change action plans in their respective areas. In line with these provisions of RA 9729, the Provincial Government of Aurora collaborated with the Climate Change and Clean Energy Project (CEnergy) of the United States Agency for International Development (USAID), in partnership with the Philippine League of Local Environmental and Natural Resources Officers (PLLENRO), to develop its GHG Inventory Report and formulate GHG Management Plan for the province.

The above-cited GHG Inventory Report is Aurora Province's first community-level GHG emissions report. Results of the inventory cover the reporting period from January 1, 2010 to December 31, 2010. The Province of Aurora, having the highest forest cover density (73.71%) in the Philippines, is deemed a carbon sink wherein there is more carbon sequestration (-2,790,820 tons CO2e) than emission (805,254 tons CO2e) resulting to net emission of - 1,985,565 tons CO2e in 2010. The report describes and estimates the GHG emissions produced within Aurora Province's geographic boundary, as well as certain additional emissions caused by consumption within the community but emitted elsewhere. Aside from providing GHG emission data, the report illustrates the methodological decisions and main assumptions underpinning the inventory, including details on inventory boundaries, quantification methods, data collection approaches and information sources considered and used in developing the GHG emissions inventory.

As part of the continuing effort to address climate change, the Provincial Government of Aurora, in collaboration with Municipal LCCAP TWG, spearheaded the updating of said community-level GHG Inventory Report. The inventory will become a critical tool in Aurora Province's effort to develop, implement and monitor measures to reduce its GHGs emissions. Their specific objective(s) for conducting the GHG Inventory include:

1. Establish a understandable and measurable GHG emissions baseline to quantify the province's current impact on climate change;
2. Understand the drivers for current GHG emissions in the province and gain insights to project future emissions;
3. Analyze the province's GHG emissions to identify opportunities to reduce emissions through various local policy initiatives and programs;

4. Create a system of measurement that will serve as basis for developing the province's climate goals and action;

5. Develop data sets and systems needed to monitor and assess local actions on climate change mitigation; and
6. Institutionalize GHG management capacity within the provincial and municipal government to facilitate the future inventories.

The primary purpose of this inventory report is to describe and account for GHG emissions caused by activities within the whole municipality of Dilasag, Aurora arising from the following major sectors:

- Stationary Energy (Fuel Combustion)
- Electricity Consumption
- Transportation
- Waste
- Agriculture
- Forestry & Other Land Use

Emission from industrial processes has been excluded since there is no big industry operating within the province of Aurora. There are very small industries but not considered as greenhouse gas emitters. Nonetheless, indirect emissions from electricity consumption also include consumption from these commercial establishments/businesses.

Results of the updated inventory cover the reporting period from January 1, 2017 to December 31, 2017. The report was completed primarily in accordance with the guidance from the World Resources Institute's (WRI) Greenhouse Gas Protocol, the current international standard for corporate greenhouse gas inventories, the 2006 IPCC Guidelines for National GHG inventories, and Tracking Greenhouse Gases: An Inventory Manual published by the Department of Environment and Natural Resources (DENR).Guidance from the following sources was also used: GHG Management in Local Governments: A Guide developed by the Greenhouse Gas Management Institute (GHGMI) with funding support from USAID, International Local Government Greenhouse Gas Emissions Analysis Protocol (IEAP)developed by ICLEI, and the newly published Global Protocol for Community-Scale Greenhouse Gas Emissions from WRI, ICLEI, and the C40 Climate Leadership Group were also used to supplement the GHG Protocol.

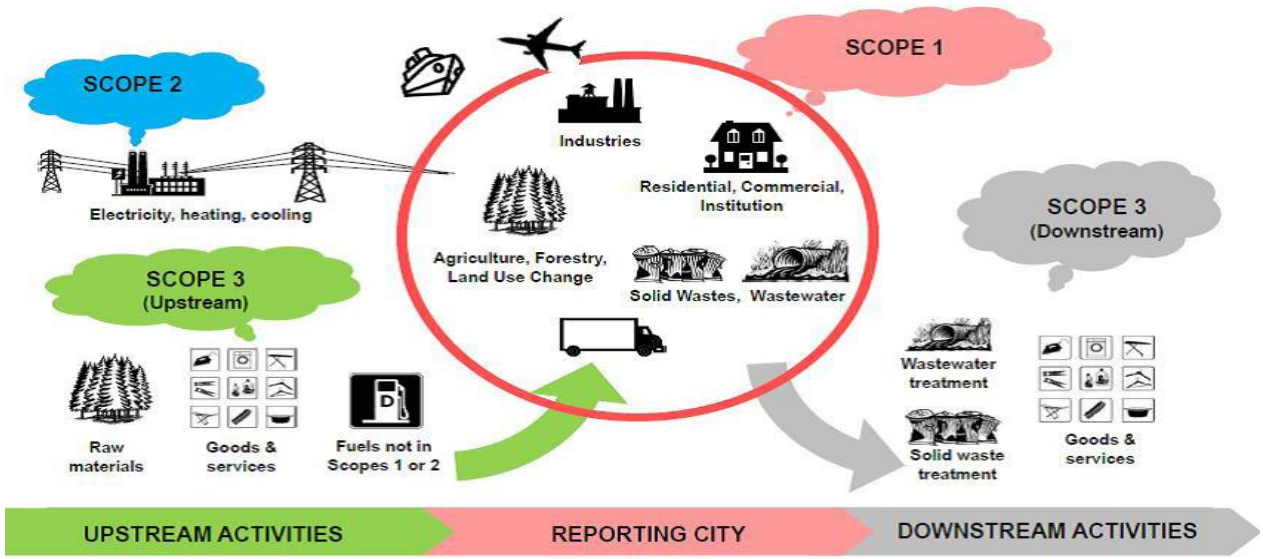
2.2.2 INVENTORY BOUNDARIES

Establishing inventory boundaries is necessary to help determine which GHG emissions are to be accounted for in the inventory. Boundaries define the scale and reach of emissions that will be included in a GHG inventory.

In defining the boundaries for this inventory, various protocols guided the decision-making of the LGU. The general guidance defined the city's/municipality's/province's emissions into either (i) direct emissions or those coming from within the city's boundary, and (ii) indirect emissions or those that are driven by activities within the city's boundary but occur at sources outside the city (World Resources Institute, ICLEI, Climate Leadership Group, 2012). This is further delineated by the scope framework (World Resources Institute, World Business Council for Sustainable Development, 2001), which gives the following definitions:

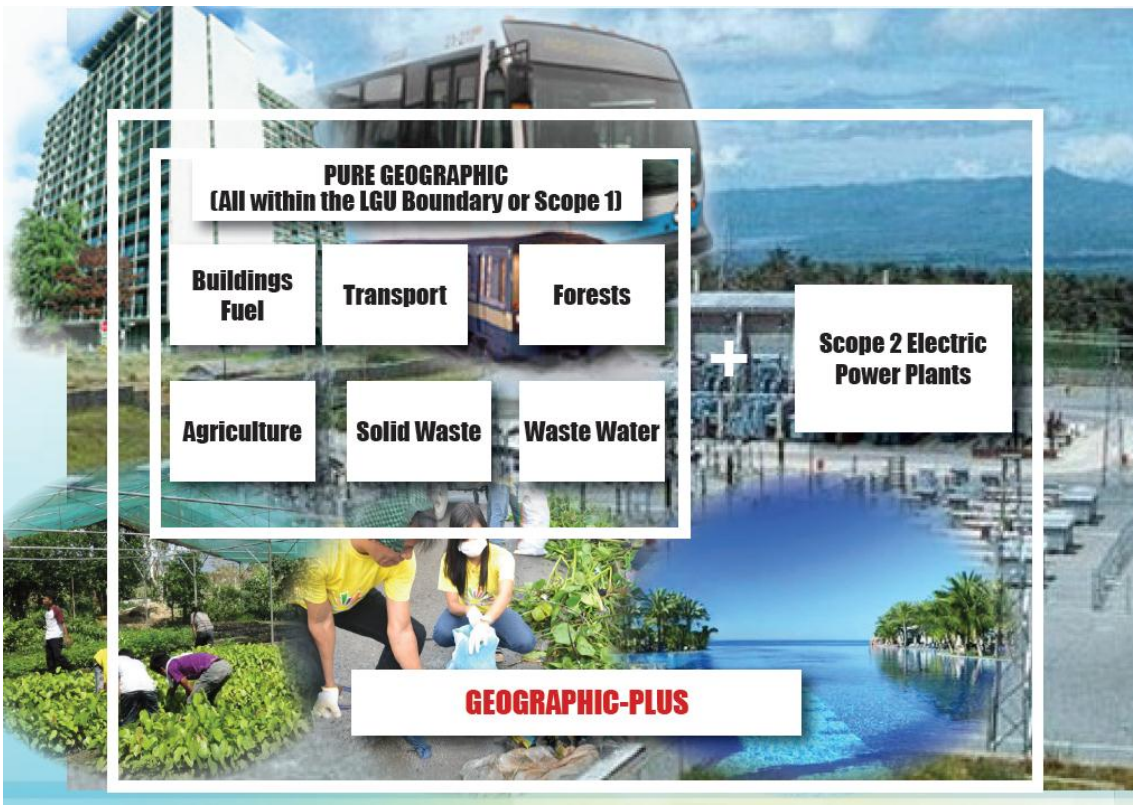
- Scope 1: All direct emissions from sources within the geopolitical boundary of the community.
- Scope 2: Energy-related indirect emissions that occur outside the community boundary as a consequence of consumption/use of grid-supplied electricity,
- Scope 3: All other indirect emissions that occur outside the boundary as a result of activities within the community's geopolitical boundary, including trans-boundary emissions due to exchange/use/consumption of goods and services

Figure ___. The Scope Framework



In addition to these guidelines, international experience on community level GHG accounting were also taken into consideration by the LGU especially in identifying sources that are most relevant for community level inventories. For this GHG inventory, the Aurora Province defined its boundaries using a 'Geographic Plus' approach, which included emissions coming from the sectors illustrated in Figure __.

Figure ___. Inventory Boundaries



GHGs Included and Excluded

Table ___ presents the different groups of greenhouse gases (GHGs) that have been identified and are being tracked internationally in GHG inventories. It also shows the relevance of the GHGs to overall global anthropogenic emissions, as well as the global warming potentials (GWP) of each (where it applies). The GWP is a measure of how much heat is trapped by a greenhouse gas in the atmosphere, relative to carbon dioxide (CO2), and is used to convert the various GHG values into comparable CO2 equivalents.

Table ___. GHGs listed under the Kyoto Protocol

Name	Symbol	Global Warming Potential (GWP)	Relevance in global GHG emissions
Carbon dioxide	CO_2	1	About 77% of the global anthropogenic emissions
Methane	CH_4	21	About 14% of global anthropogenic emissions
Nitrous Oxide	N_2O	310	About 8% of global anthropogenic emissions
Substances controlled by the Montreal Protocol	19 different compounds		Were widely used in the past but are currently phased out.
Hydrofluorocarbons (HFCs)	11 different compounds	140 – 11700	Small portion of the global emissions (less than 1%)
Perfluorocarbons (PFCs)	10 different compounds (e.g., CF_4)	6500 – 9200	Small portion of the global emissions (less than 1%)
Fluorinated ethers, hydrocarbons, perfluoropolyethers, and other compounds	19 different compounds		Small portion of the global emissions (less than 1%)
Short lived gasses	Water, NOx, CO, SO2, Aerosols		Water is the greenhouse gas that affects the Earth's climate the most.

For this inventory, Table ___ shows the GHGs that were included per sector/sub-sector.

Table ____. GHG per Subsector

Emission sources per sector	CO_2	CH_4	N_20	SF_6	PFCs	HFCs
1. Stationary Fuel Combustion						
Consumer Sectors						
Commercial/Institutional	√	√	√			
Residential	√	√	√			
Agriculture, Forestry, Fishing, & Fish Farms (Stationary Only)	√	√	√			
2. Electricity Consumption						
Commercial/Institutional	√	√	√			
Residential	√	√	√			
Public Buildings	√	√	√			
Street Lights	√	√	√			
3. Waste						
Solid Waste	√	√	√			
Waste Water		√	√			
4. Transportation						
Road transport (cars, trucks, buses, motorcycles, etc.)	√	√	√			
5. Agriculture						
Rice Paddy Cultivation		√				
Agricultural Soils		√	√			
Enteric Fermentation		√				
Manure Management		√	√			
6. Forestry and Land Use						
Biomass Removal	√					
Forest Growth Uptake	√					

2.2.3 GHG EMISSION RESULTS

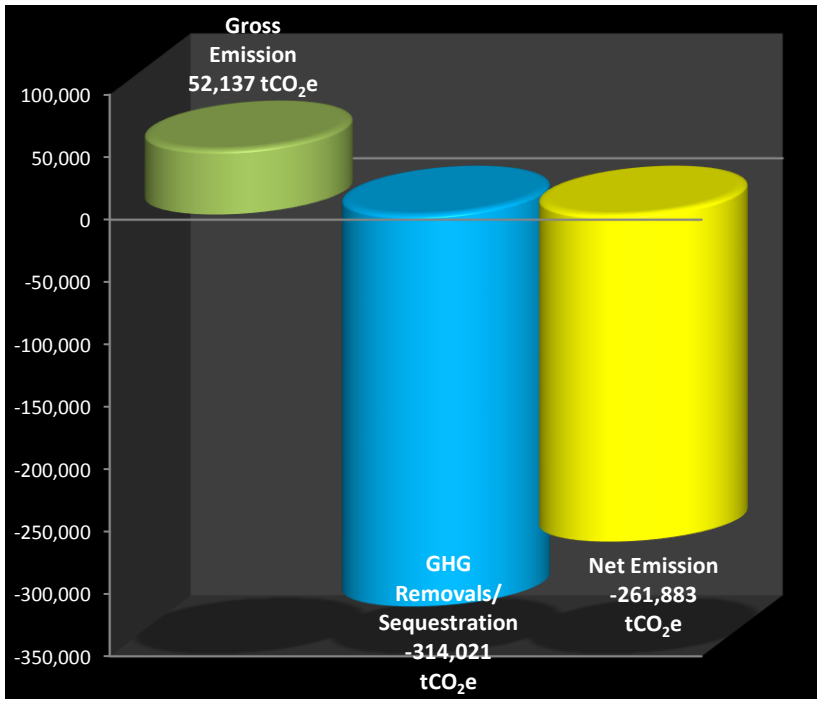


Figure ___. Annual GHG Flows of Dingalan, Aurora, 2017

As shown in Figure ___, the Municipality of Dipaculao, Aurora has a higher carbon sequestration of -314,021 tons CO_{2e} compared to low emission of 52,137 tons CO_{2e} resulting to net emission of -261,883 tons CO_{2e}. Total removals is almost twice higher than the gross emissions. The negative GHG emissions can be further attributed to absence of industry operating in the province of Aurora.

Excluding the Forestry uptake, the total gross emissions of the whole municipality for year 2017 amount to 225,029 tons CO_{2e} **(Table ____)**. From the concluded inventory, it was identified that the largest emission source for the municipality is forestry & land use sector amounting to about 75% (2170,990 tons CO_{2e}) of the total gross emissions. This was followed by agriculture and energy sector that constitute 18% (41,142 tons CO_{2e}) and 4% (8,895 tons CO_{2e}) of gross emissions, respectively.

As shown in Table ____, land use change comprises about 63% of the total gross emissions (141,158 tons CO_{2e}). The change in land use resulted to decrease in carbon stock that can be attributed to land conversion, logging operations and kaingin activities. Having an agriculture-based economy, agriculture sector is understandably the second biggest GHG contributor in Aurora. Looking closely at the GHG emissions of the sub-sectors, land use change and commercial harvest ranked first and second respectively. This was followed by rice cultivation (3rd) and livestock enteric fermentation (4th). The energy sector represented 4% of the total GHG emissions, with the electricity consumption in the 5th rank, and mobile and stationary sector in the 11th and 12th rank respectively. The waste sector accounted only for about 2% of the total gross emissions coming mostly from residential wastewater which is in the 7th rank.

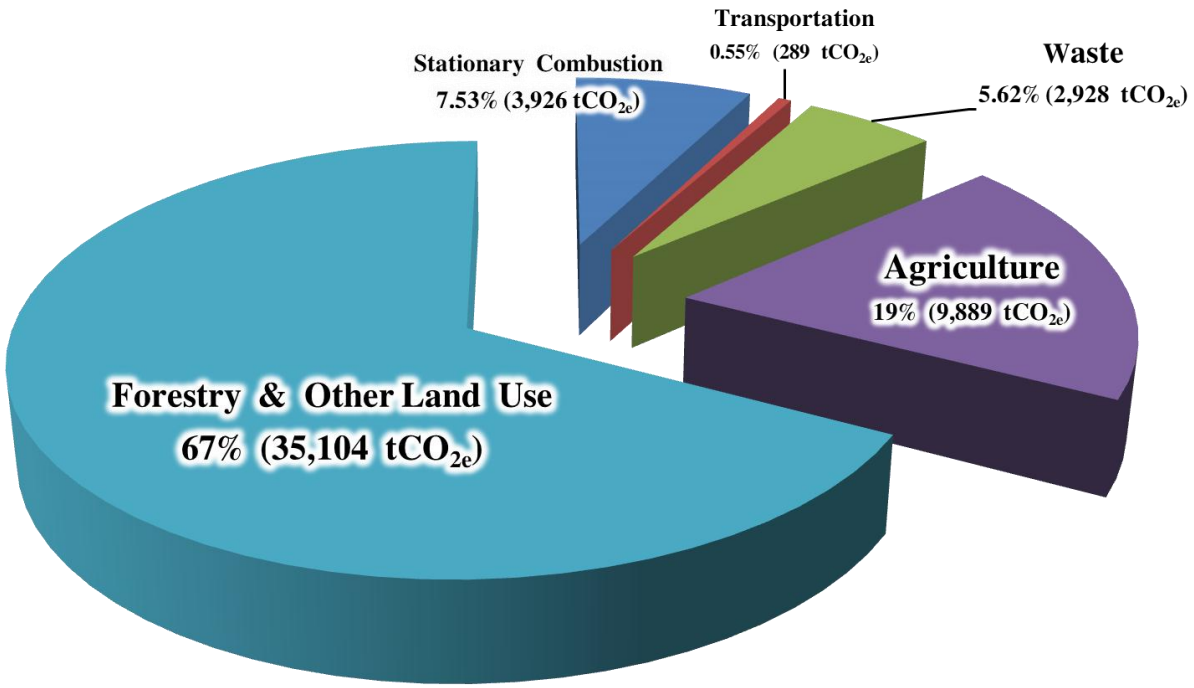
The given table and chart below is illustrative of the types of sectors present and the amount of contribution to GHG emissions/removals each sector has for the totality of the LGU.

Table ____. GHG Emissions/Removals per Sector from Dingalan, Aurora, 2017

Activity Sources/Sector	GHG Emissions/ Removals (tons CO2e)	% of Gross Emissions (805,254 tCO2e)	% of Removals	Ranking in terms of GHG Emissions
ENERGY	**8,895**	**3.95%**		
Stationary Combustion	**6,395**	**2.84%**		
Stationary Fuel Combustion (Residential)	1,145	0.51%		12
Electricity Consumption (Indirect Emission)	5,251	2.33%		5
Mobile Combustion (Road Transportation)	**2,499**	**1.11%**		11
WASTE	**4,003**	**1.78%**		
Solid Waste	**546**	**0.24%**		
Solid Waste Disposal	349	0.16%		13
Composting of Waste	196	0.09%		14
Open Burning of Waste	1	0.001%		15
Wastewater Treatment and Discharge	**3,457**	**1.54%**		7
AGRICULTURE, FORESTRY & OTHER LAND-USE (AFOLU)	**-200,504**	**94.27%**		
Agriculture	**41,142**	**18.28%**		
Rice Cultivation	**25,071**	**11.14%**		**3**
Livestock	**8,193**	**3.64%**		
Enteric Fermentation	5,401	2.400%		4
Manure Management	2,792	1.24%		10
Agricultural Soils	**7,878**	**3.50%**		
Animal-related Emissions	2,794	1.24%		9
Crop Residues	5,084	2.26%		6
Forestry and Other Land Use	**-241,645**	**75.99%**		
Biomass Removal	**170,990**	75.99%		

Commercial Harvest	26,561	11.80%		2
Fuelwood Consumption	3,270	1.45%		8
Land Use change	141,158	62.729%		1
Forest Growth Uptake	**-412,635**		**100.00%**	
Gross Emissions (w/o Forest Growth Removal)	**225,029**	**100.00%**		
Removals (Forest Growth)	**-412,635**		**100.00%**	
Net Emissions (w/ Forestry & Land Use)	**-187,606**			

Figure 12. Annual GHG Gross Emissions of Dingalan, Aurora



A. Stationary Energy

Stationary sources are energy systems that are fixed in place and generate GHG emissions with the combustion of fossil fuels or biomass. They can be deployed in power plants (e.g. gas powered turbines), manufacturing industries (e.g. gas powered boilers), residential households (e.g. gas stoves) and commercial establishments (e.g. small scale diesel generators).

The methodology adopted to estimate emissions from stationary combustion is based on the approach recommended in the 2006 IPCC guidelines. Due to current limitations in data availability, the methodology is modeled after IPCC's 'tier 1' approach, which provides guidance on how to estimate GHG emissions using relatively aggregated input data on fuel usage, combined with default emission factors by fuel. Thus the estimate is based on:

- Estimated total amount of fuel combusted by stationary energy sources, considering separately the following fuels: coal, LPG etc.
- A default emission factor for each fuel.

Specifically, the following equation is used:

Fuel Sold X Emissions Factor = GHG Emissions

Where:

- Fuel sold is the amount of fuel sold within the LGU in the source category, typically measured in liters, kg or m3
- Emission factor is a default emission factor typically obtained by IPCC or other international sources and generally provided in terms of kg of GHG emitted per unit of energy contained by the fuel (e.g kgCO2/TJ)

In cases where the data collected are not in the same units as the emissions factors, conversion is necessary typically performed by using the energy densities of the various energy types. An example of basic formula for conversion is provided below:

Emission Factor (kg CO2/TJ of energy) X Energy Density (MJ/L)/1,000,000 = Converted Emission Factor (kgCO2/L)

The table below illustrates the emission factors used in the computation of the GHG emissions from the stationary combustions in the commercial, institutional, residential and agricultural categories:

Table 8. Emission Factor by Fuel Type - Stationary Combustion

Fuel	Emission Factor (kg CO_2/TJ of energy)<1>	Emission Factor (kg CH_4/TJ of energy)<	Emission Factor (kg N_2O/TJ of energy)
Commercial and residential			
Fossil Fuels			
LPG	63,100	5	0.1
Diesel	74,100	10	0.6
Kerosene	71,900	10	0.6
Fuel Oil	77,400	10	0.6
Biofuels			
Charcoal	0 (biogenic)	200	1
Fuel Wood	0 (biogenic)	300	4

Source: 2006 IPCC Guidelines for National GHG Inventories, Volume 2, Chapter 2, default values from Tables 2.2, 2.3, 2.4, and 2.5

The total estimated direct GHG emission from stationary energy sources for the municipality of Dingalan, Aurora is 577 tons CO_{2e} (0.51% of gross emissions) coming from residential fuel. Table ____ presents the detailed emissions results for stationary fuel combustion of four (4) fuel types being use by households for cooking and lighting, namely: LPG, charcoal, diesel, fuelwood and kerosene. From a total emission of stationary fuel combustion, the largest emission source is the LPG being used for cooking with emission of 572 tons CO_{2e} (99% of the total stationary energy emission).

Table ___. Total Estimated GHG Emission - Stationary Energy

Sources	Annual Volume	Unit	CO2	CH4	N2O	Total GHG		
			GHG Emissions (kg CO_{2e})	GHG Emissions (kg CO_{2e})	GHG Emissions (kg CO_{2e})	GHG Emissions (kg CO_{2e})	GHG Emissions (tons CO_{2e})	% of Total
Residential Fuel								
Cooking (LPG)	183,563	Kilos	570,626	950	280	571,856	571.86	99.14%
Cooking (charcoal)	1,916	Kilos	0	237	18	255	0.25	0.04%
Lighting and Cooking (kerosene)	1,759	Liters	4,458	13	12	4,483	4.48	0.78%
Cooking (fuelwood)	1,916	Kilos	0	188	37	225	0.23	0.04%
TOTAL			**575,084**	**1,388**	**346**	**576,819**	**577**	**100%**

A. Electricity consumption

Greenhouse gas emissions from electricity consumption are classified as indirect or Scope 2 emissions, if the power plants producing the electricity are physically located outside the geographic boundaries of an LGU. The GHG inventory protocols, which the Aurora Team used for guidance, highly recommend that emissions from electricity consumption are included in the GHG inventory since they often represents a significant part of the total GHG emissions of a community. Scope 2 GHG emissions from electricity consumption where therefore includes in this inventory.

There is no electric power plant operating within the province of Aurora. The Aurora Electric Cooperative Inc. (AURELCO) is the sole distributor of electricity in the province. The AURELCO power sub-station in San Isidro, San Luis, Aurora supplies a 24-hour power to Central Aurora and the AURELCO sub-station in Casiguran, a maximum of 20 hours supply for the northern municipalities of Dinalungan, Casiguran, and Dilasag.

The Philippines has 2 major electricity grids, namely, (1) Luzon-Visayas, and (2) Mindanao. A number of smaller scale systems are also used in smaller island and communities. Aurora Province is connected to the Luzon-Visayas electricity-grid. The Luzon-Visayas electricity grid emission factor for year 2010 as computed is 0.5192 tCO_2/MWh. The emission factor is based on the weighted average of all the power sources in Luzon-Visayas including low-cost must run power plants. The calculation was based

on data provided by the Department of Energy (DOE) Electric Power Industry Management Bureau. Please refer to Appendix 5 for the detailed calculation.

AURELCO has an existing Transition Supply Contract with the Masinloc Power Plant from which it sources its major electricity requirements[1]. Masinloc Power Plant is a 600MW coal-fired power plant, located in Masinloc, province of Zambales (Island of Luzon).

Scope 2 emissions from electricity consumption are calculated according to the following equation:

(Electricity consumed + Systems losses) * Average electricity-grid Emission Factor = GHG emissions

Where:

Electricity consumed:	Total amount of electricity consumed in the community by residential, commercial, industrial and government users, typically expressed in kWh or MWh
Systems losses:	The amount of energy lost or wasted during transmission and distribution of electricity, including unaccounted use and theft, expressed in MWh
Electricity grid emission factor:	Average volume of GHG emissions associated with the generation of one unit of energy, typically expressed in kgCO2e/kWh or tCO2e/MWh

Nonetheless, the emission factor for AURELCO was estimated assuming that Masinloc Coal-Fired Power Plant is supplying 100% of its electricity needs. To be conservative on reporting Scope 2 emissions from electricity consumption, the Inventory Team used the "guaranteed heat rate" values provided by the Energy Regulatory Commission (ERC) . But for transparency sake, the team also computed for the emission factor by using "default heat rate" values as provided by the Department of

Energy (DOE). Average grid emission factor capture emissions of CO_2, CH_4 and N_2O. Refer to Appendix 6 for the detailed computation of emission factor for AURELCO.

As expected, AURELCO has a higher emission factor 0.9804 tCO_2/MWh as compared to the Luzon-Vizayas emission factor of 0.5192 tCO_2/MWh considering that Masinloc Power Plant uses bituminous coal as the dirtiest and most carbon intensive of all fossil fuels

As shown in Table _____, electricity consumption accounts for a total emission of 3,350 tons CO_{2e} (6.42% of gross emissions). From a total emission from electricity consumption, the residential sector contributes the highest emission amounting to 2,744 tons CO_{2e} (82% of total electricity emissions).

Table _____. Total Estimated GHG Emission – Electricity Consumption

Type of consumer	Annual consumption in MWh	Systems Loses in % <1>	Annual Consumption + systems losses in MWh	Electricity-grid Emission Factor (tCO_{2e}/MWh)	Total (tCO_2e) from consumption and system losses	% of Total
Residential	2,475.91	11.54%	2,798.90	0.9804	**2,744**	81.92%
Commercial	223.00	11.54%	252.09	0.9804	**247**	7.38%
Public Buildings	297.01	11.54%	335.75	0.9804	**329**	9.83%
Street lights	26.46	11.54%	29.91	0.9804	**29**	0.88%
Total	**3,022.38**		**3,416.66**	**0.9804**	**3,350**	**100.00%**

<1> provided by the Energy Regulatory Commission

A. Transportation

For local transportation (within the province), tricycle is the most common mean of transportation. In the case of travelling outside the province or to other far flung municipalities, public buses, utility vans and private cars are used utilizing either gasoline or diesel. There is no railway in the province. The common destination is terminal-to-terminal.

For water transportation, occasional motorized bancas are being used to transport people, goods, and agricultural products between coastal municipalities of Aurora Province, as well as nearby provinces such as Isabela and Infanta, Quezon. There is no regular boat schedule due to lack of commercial passengers and because of the unpredictable weather conditions.

For this GHG inventory, GHG emissions from transportation activities are based on the fuel consumption, and consequent GHG emissions, associated to road transportation. Only road transportation emissions are included in the GHG inventory since there is no available data on fuel usage for air or water transportation, and because both transportation modes are believed to only affect minimally the total inventory. It is also recognize that some fuel is being used for fishing boats and other non-road engines (chainsaw, agricultural equipment) but these are excluded due to non-availability of data.

The methodology adopted to estimate emissions from transportation is based on the approach recommended in the 2006 IPCC guidelines. As for stationary energy emissions, also for transportation related emissions the methodology is modeled after IPCC's 'tier 1' approach due to current limitations in data availability. GHG emissions are therefore estimated using relatively aggregated input data on fuel use, combined with default emission factors by fuel.

The GHG estimated are based on the following equation:

Fuel sold X Fuel Emission Factor = GHG Emissions

Where:

- Fuel sold is the total volume of fuel sold within the geographic boundaries of the LGU and used for road transportation.
- Emission factor is a default emission factor typically obtained by IPCC or other international sources and generally provided in terms of kg of GHG emitted per unit of energy contained by the fuel (e.g. kgCO2e/TJ)

The approach above was used for the quantification of CO_2, CH_4 and N_2O emissions. CO_2 emissions are typically a function of the volume of fuel combusted and therefore the formula above mirrors well the physical processes involved.

CH_4 and N_2O emissions for road transport, on the other hand, typically depend on a number of additional variables such as vehicle (exhaust) technology, fuel type, vehicle operating characteristics, and kilometers travelled. While 'tier 2' methodologies that take into consideration such variables are

available, this inventory is based on the simpler 'tier 1' approach, which estimates emissions from fuel consumption data also for CH_4 and N_2O emissions, due to the data availability constraints.

The GHG emissions calculations are based on heat content parameters obtained from the International Energy Agency[2]and on emission factors from the 2006 IPCC Guidelines for National GHG Inventories. As mandated by the Republic Act No. 9637, otherwise known as the *Philippine Biofuels Act of 2006*, all diesel fuels sold throughout the Philippines are currently blended with 2 per cent biodiesel by volume and a minimum of 5 per cent bio-ethanol by volume for gasoline. To compute the emission factor for blended fuels, the following steps are suggested:

Step 1: Split the fuel data i.e. gasoline and ethanol or diesel and biodiesel

Step 2: Adjust the emission factor using those for gasoline or diesel and 0 KgCO2/TJ for the biofuel component

Table ____ below summarizes the emission factors for CO_2, CH_4 and N_2O.

Table ____. Summary of the Emission Factors for CO_2, CH_4 and N_2O - Transport

Category of Fuel	Emission Factor (kg CO_2/TJ)<1>	Emission Factor (kg CH_4/TJ)<2>	Emission Factor (kg N_2O/TJ)<3>
Unleaded (95RON):			
Blue	69,300	20.24	6.35
Bio-ethanol blend	64,689	20.09	8.66
Unleaded (93RON and above):			
With AVSR-red	69,300	20.24	6.35

[2]International Energy Agency, Energy Statistics Manu

Without AVSR-green	69,300	20.24	6.35
Bio-ethanol blend	64.681	20.09	8.66
Unleaded (81RON and above):			
Orange	69,300	20.24	6.35
Diesel			
CME blended: 0.05% Sulfur	73,230	3.9	4.34
Kerosene	71,900	10	0.6
LPG			
Non-Automotive	63,100	62	0.2
Automotive	63,100	62	0.2

Sources: (Please refer to appendix 3 for the estimation of <3>and <4>)

<1>	**Based on 2006 IPCC Guidelines for National GHG Inventories, Volume 2, Chapter 3, default values from Table 3.2.1**
<2>	Based on 2006 IPCC Guidelines for National GHG Inventories, Volume 2, Chapter 3, default values from Table 3.2.2
<3>	

The total emissions from road transport in Dingalan, Aurora using data from 2017 is 289 tons CO_{2e} (0.55% of gross emissions). A summary of the GHG emissions per fuel type is presented in Table ___. From a total transportation emission, the largest emissions come from CME blended diesel amounting to 123 tons $CO2_e$ (43% of total transportation emission). Per capita emission in Dipaculao, Aurora is 0.0125 tons $CO2_e$ per person, that is lower than Philippine National GHG emission of 0.34 tons $CO2_e$ per person.

Table _____. Total Estimated GHG Emission – Road Transport

Fuel Type	Annual Volume	Unit	CO2 Emissions	CH4 Emissions	N2O Emissions	Total GHG Emissions	% of Total

				tCO_{2e}	tCO_{2e}	tCO_{2e}	tCO_{2e}	
Unleaded (93RON and above):								
Bio-ethanol blend	Gasoline	48,488	Liters	105.81	0.67	3.66	110.14	38.15%
Unleaded (81RON and above):								
Orange	Gasoline	23,588	Liters	53.62	0.33	1.52	55.47	19.22%
Diesel								
CME blended: 0.05% Sulfur	Diesel	45,404	Liters	120.70	0.14	2.22	123.06	42.63%
TOTAL		**117,480**		**280.13**	**1.14**	**7.40**	**288.67**	**100.00%**

A. Waste

Two (2) major subsectors are measured when tracking GHG emissions from waste: the solid waste and waste water (domestic and commercial). At the national level, latest data on the Philippines waste GHG emissions show the following figures:

Table ____. Philippines Waste GHG Emissions

	Solid Waste		Waste Water – Domestic		Waste Water – Industrial	
Years	**CH4 (k tons)**	**CO2e (k tons)**	**CH4 (k tons)**	**CO2e (k tons)**	**CH4 (k tons)**	**CO2e (k tons)**
1994	307	6,447	46.0	966.5	43.8	920.5
2000	287	6,207	307.4	6,465.0	64.2	1,348.2

In year 2000, Philippines had a total population of 76,506,928. The national GHG emissions for year 2000 indicated in Table ___ yielded an average per capita GHG emission of 0.081 tons CO2e for solid waste sector and 0.0845 tons CO2e for domestic wastewater.

At the local level, the waste sector is one of the more important areas of focus guided not just by national laws but with local policies as well. As this sector directly affects every day life of the community's population, local governments implement policies and programs to improve waste disposal and management.

D.1 Solid Waste

The methodology adopted to estimate GHG emission from solid waste was based on the approach recommended by the 2006 IPCC guidelines, specifically:

- For incineration, the methodology was based on Volume 5, chapter 5, *Incineration and open burning*
- For composting of biological solid waste, the methodology was based on Volume 5, Chapter 4, *Biological treatment of solid waste*
- For solid waste disposed in solid waste disposal sites the methodology was based on Volume 5, Chapter 3, *Solid Waste Disposal*. The IPCC approach is based on the First Order Decay (FOD) method. Such method recognizes the process by which CH4 and CO2 are formed in solid waste disposal sites, which is through slow decay throughout a few decades of degradable organic components in waste. Factors affecting the emissions calculation include the climatic zone where the community is located, the types of waste materials generated, and waste management and disposal systems. In particular these GHG emissions were estimated with the calculation tool included with the IPCC guidelines

Sources of data for waste sector came from Waste Analysis and Characterization Survey (WACS) and 10-Year Municipal SWM Plan of Dilasag, Aurora. Since WACS was conducted on 2015, the baseline data were projected to obtain the 2017 waste generation. The population data is based on Census of Population and Housing (CPH) of National Statistics Office (NSO).

Table _____2017 Waste Analysis and Characterization (WACS) Data for Aurora Province

Municipality	Baler	Casiguran	Dilasag	Dinalungan	Dingalan	Dipaculao	Ma. Aurora	San Luis	TOTAL/ AVERAGE
Waste per capita									
Waste per capita (kg waste/capita/day)	0.40	0.60	0.27	0.45	0.36	0.26	0.21	0.33	**0.36**
Waste per capita (kg waste/capita/year)	146.00	219.00	98.55	164.25	131.40	94.90	76.65	120.45	**131.40**
Waste per capita (ton waste/capita/year)	0.15	0.22	0.10	0.16	0.13	0.09	0.08	0.12	**0.1314**
Total solid waste generated	**7,542.14**	**5,830.59**	**1,736.63**	**2,042.28**	**4,451.94**	**2,881.82**	**3,944.98**	**3,419.57**	**31,849.96**
Waste Collected and Disposed in managed disposal facility (ton/year), 2017	2,948.22	2,279.18	678.85	798.33	1,740.26	1,126.50	1,542.09	1,336.71	**12,450.15**
Waste Uncollected and Disposed in unmanaged disposal facility (ton/year), 2017	4,593.92	3,551.41	1,057.78	1,243.96	2,711.67	1,755.31	2,402.89	2,082.86	**19,399.81**
% of total solid waste generated	23.68%	18.31%	5.45%	6.41%	13.98%	9.05%	12.39%	10.74%	**100.00%**
Solid Waste Composition (total solid waste generat	including composted and incinerated								
Food waste, beverages(%)	34.39	34.85	34.69	43.20	48.32	32.72	37.54	45.36	**38.419**
Garden, yard and park waste (%)	21.21	21.49	21.39	26.64	29.80	20.18	23.15	27.97	**23.693**
Wood and straw (%)	1.72	1.74	1.73	2.16	2.42	1.63	1.88	2.27	**1.921**
Paper, pulp, cardboard (%)	9.46	3.13	3.33	0.71	3.90	6.10	5.89	4.32	**5.330**
Textiles (%)	1.01	0.28	1.45	-	0.35	0.55	0.63	0.57	**0.607**
Rubber, leather (%)	2.34	0.65	3.38	-	0.81	1.27	1.46	1.34	**1.410**
Disposable nappies (%)	3.08	0.59	0.16	0.22	0.37	2.50	0.99	0.92	**1.360**
Plastics, other inerts (%)	26.79	37.28	33.87	27.07	14.03	35.05	28.46	17.25	**27.260**
Solid Waste Composition (solid waste collected)	including composted and sold to junkshops								
Food waste, beverages(%)	36.58	35.95	34.71	43.17	48.78	33.12	37.65	45.36	**39.253**
Garden, yard and park waste (%)	22.56	22.17	21.40	26.62	30.09	20.43	23.22	27.97	**24.207**
Wood and straw (%)	1.83	1.79	1.73	2.16	2.44	1.65	1.89	2.27	**1.963**
Paper, pulp, cardboard (%)	8.41	4.29	5.24	0.44	0.55	6.93	3.62	2.35	**4.494**
Textiles (%)	0.90	0.38	1.87	-	0.04	0.62	0.39	0.31	**0.528**
Rubber, leather (%)	2.08	0.89	4.76	-	0.40	1.44	0.90	0.73	**1.291**
Disposable nappies (%)	3.06	0.65	0.13	0.24	0.34	2.32	1.04	0.95	**1.354**
Plastics, other inerts (%)	24.59	33.87	30.15	27.38	17.36	33.48	31.31	20.06	**26.911**
Distribution of waste by waste management type	**Collected (39.09%)**			**Uncollected (60.91%)**					
	64.73 % composted 16.33% sold to junkshops 18.94% disposed at SWDS (100% semi-aerobic)			19.59% open burning 15.98% composted 15.19% fed to animals 8.67% sold to junkshops 40.57% disposed in unmanaged SWDS (60.85% shallow, 35.53% deep, 3.62% uncategorised)					

Solid waste disposal sites

The 2006 IPCC Guidelines for National Greenhouse Gas Inventories include a tool for calculating GHG emissions from solid waste disposal sites, which is based on the FOD method and reflects a Tier 1 calculation approach. The IPCC tool estimates emissions of methane from solid waste disposal sites, and utilizes readily available national or international statistics in combination with default emissions factors, while providing the flexibility to include LGU specific data, if available. The tool was used to calculate the LGU emissions from solid waste management sites. Some of the default factors included in the tool are reproduced below.

Table _____. Emission Factor for Solid Waste Disposal

Parameters		Default Value
DOC (Degradable Organic Carbon)	Paper/Cardboard	0.4
	Textile	0.24
	Food Waste	0.15
	Wood	0.43
	Garden/Park	0.2
	Nappies/Diaper	0.24
	Sewage/Sludge	0.05
	Rubber/Leather	0
	All other inerts	0
DOC_f(Fraction of Degradable Organic Carbon that decomposes)		0.5
MCF (Methane Correction Factor)	Unmanaged shallow	0.4
	Unmanaged deep	0.8
	Managed	1
	Managed semi-aerobic	0.5
	Categorized	0.6
k	Paper/Cardboard	0.06
	Textile	0.06
	Food Waste	0.185
	Wood	0.03
	Garden/Park	0.1
	Nappies/Diaper	0.1
	Sewage/Sludge	0.185

Parameters		Default Value
	Rubber/Leather	0
	All other inerts	0

Source: 2006 IPCC Guidelines for National GHG Inventory, Volume 5, Chapter 3

Where:

- **DOC** is the organic carbon waste that is accessible to biochemical decomposition.
- **DOC_f** is the estimate of the fraction of carbon that is ultimately degraded and released from SWDS and reflects the fact that some degradable organic carbon does not degrade, or degrades very slowly, under anaerobic conditions in the SWDS.
- **MCF** reflects the way waste is managed and the effect of site structure and management practices on CH4 generation.
- **K** is the time it takes the wastes to decay to half its initial mass.

Composting

Out of the total waste collected, 64.73 % biodegradable wastes are being composted at MRF. In the case of uncollected biodegradable waste, around 16% is composted and 15% fed to animals. Those households with enough space have their own backyard or small-scale composting such as bottomless composters, tire tower composters, container composters and clay pot composters. For schools, other institutions and establishments with substantial space, medium-sized compost bins are being used, such as those using bamboo slats, concrete blocks or chicken wire. Solid wastes from the households are mostly (40.57%) buried in pit, burned (19.59%) or sold to junkshops (8.67%)

Biodegradables collected and composted centrally: Several technologies are being used in the composting areas of 8 municipalities of Aurora Province located in their respective Central Materials Recovery Facility (MRF). Structures include heap type (mound forming) and windrow composting (long piles)using 3-layer CHB. For composting process, the MRF carry out natural composting and composting using activators and other effective microorganisms (EM), such as Trichodermaharzianum and other nitrogen-fixing bacteria. Other LGUs use vermi-composting utilizing African Nightcrawler worm.

The province has no appropriate emission factors for each of the composting techniques described above. As approximation, the province relied on the default parameters provided by IPCC. The emission factors used for this calculation are reported below.

Table 26. Emission Factor for Composting of Waste

Category	Greenhouse Gas	Emission Factor
Composting (wet weight basis)	CH_4	4 gCH_4/kgwaste
Composting (wet weight basis)	N_2O	0.3 gN_2O/kgwaste

Open Burning/Incineration

With incineration GHG emissions are driven by the:

1. Amount of fossil carbon present in the waste, which is a function of the type of materials in the waste
2. Type of incineration technology adopted
    a. CO_2 emissions depend on the degree by which the waste is combusted, which is higher in modern incinerator facilities and in open burning operations.
    b. CH_4 and N_2O emissions depend on incineration steps (continuous incineration, semi continuous incineration, batch incineration) and combustion technology (stocker vs. fluidized bed)

Some of the default factors provided by IPCC and used in the calculation are summarized below. The complete description of the open burningcalculation is provided in Appendix 12: Solid Waste Emission Calculation Spreadsheet

Table 27.Default Factor for Incineration and Open Burning of Waste

Waste type	Dry Matter as % of Wet Weight	% Carbon in Dry Weight	% Fossil Carbon in Carbon	% Oxidation Factor Incinerator	% Oxidation Factor Open Burning
Paper/cardboard	90.00%	46.00%	1.00%	100%	58%
Textiles	80.00%	50.00%	20.00%	100%	58%
Food waste	40.00%	38.00%	0.00%	100%	58%
Wood	85.40%	50.00%	0.00%	100%	58%
Garden and Park waste	40.00%	49.00%	0.00%	100%	58%
Nappies	40.00%	70.00%	10.00%	100%	58%
Rubber and Leather	84.00%	67.00%	20.00%	100%	58%
Other, inert waste	90.00%	3.00%	100.00%	100%	58%

The total estimated GHG emission from solid waste is 532 tons CO_{2e} (1% of gross emissions) mostly coming from solid waste disposal with 342 tons CO_{2e} (64% of total solid waste emissions). For solid waste disposed at solid waste disposal sites, wood wastes accounts for the highest contribution with 114 tons CO_{2e} (21.35% of total solid waste emissions). This was followed by nappies and paper waste disposal that constitutes 14% (72 tons CO_{2e}) and 11% (59 tons CO_{2e}) of total solid waste emissions, respectively.

Table _____. Total Estimated GHG Emission –Solid Waste

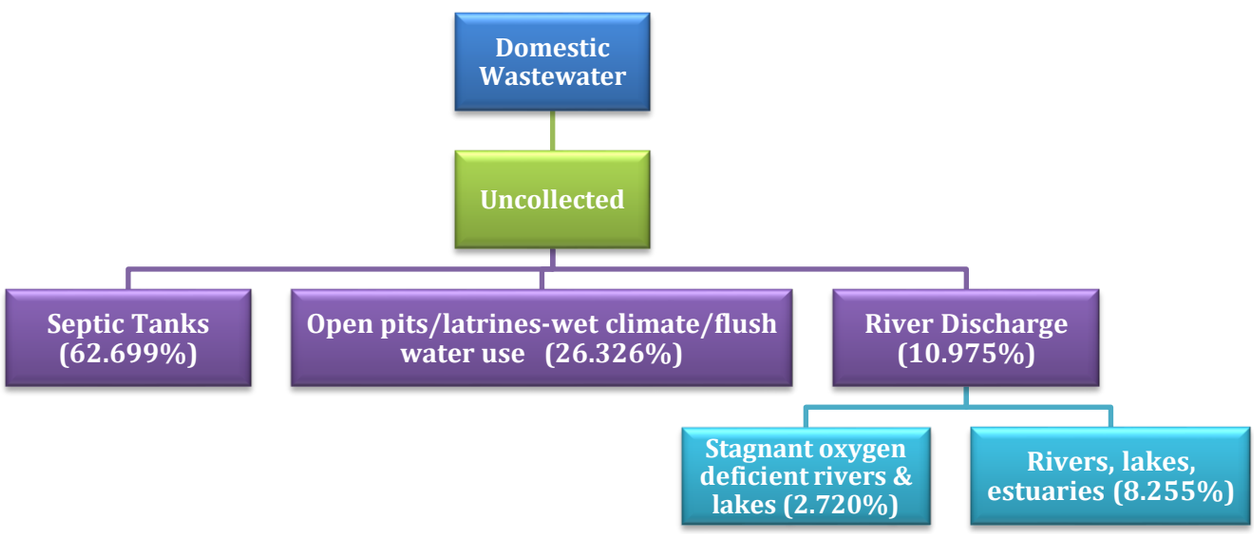
Sources	GHG Emissions (tons CO2e)			% of Total
	Managed SWDS (anaerobic)	Unmanaged SWDS	Total	
Solid Waste Disposal	**155**	**188**	**342**	**64.37%**

Food	-	52	52	9.78%
Garden	-	40	40	7.54%
Paper	-	59	59	11.14%
Wood	95	19	114	21.35%
Textile	-	5	5	0.93%
Nappies	60	13	72	13.61%
Composting of Solid Waste			**188.48**	**35.42%**
Open Burning of Solid Waste			**1.12**	**0.21%**
TOTAL			**532.06**	**100.00%**

D.2 Wastewater

Residential waste water is also significant sources of emissions in LGUs. In quantifying these emissions, the pathways by which waste water is produced need to be determined first. Nonetheless, for residential sector the wastewater is uncollected. Based on the survey conducted by Provincial Health Office, most households (63%) discharge wastewater through septic tanks. Some (26%) are using open pits/flush water while others (11%) are through river discharge. Figure 9, shows the waste water pathways currently used in Aurora Province.

Figure 9.Domestic Wastewater Pathways in Aurora Province



The methodo logy adopted to estimate GHG emission from waste water is based on the approach recommended by the 2006 IPCC guidelines, specifically, volume 5, chapter 6 waste water treatment and discharge.

The general equation to estimate CH_4 emissions from domestic wastewater is as follows:

Total emissions =

Population using septic tanks * Per capita BOD generated * $EF_{septic\ tanks}$ +

Population using open pits* Per capita BOD generated * $EF_{open\ pits}$ +

Population discharging in rivers * Per capita BOD generated * $EF_{river\ discharge}$ +

The general equation to estimate N_2O emissions from domestic wastewater is as follows:

Total emissions =

Population discharging untreated waste water in rivers or lakes * Protein consumption per person per year * Fraction of N in protein * Fraction of non-consumed protein added to water * conversion factor * EF

The 2006 IPCC Guidelines for National Greenhouse Gas Inventories provides a tool for calculating GHG emissions from waste water. It uses the Tier 1 method for estimating emissions of methane from wastewater, which utilizes readily available national or international statistics in combination with default emissions factors.

Methane emissions from waste water

This inventory uses the IPCC default value for per capita BOD generation of *40 gBOD/person/day*. The table below illustrates the emission factors used in the computation of the GHG emissions from the waste water sector, based on maximum CH_4 production capacity of *0.6 kgCH4/kgBOD*.

Activity	Methane Correction Factor, IPCC Default *Index*	Methane Correction Factor, used by LGU *Index*	Emission Factor BOD related (residential) *$kgCH_4/kgBOD$*
Uncollected			
Septic tanks	0.5	0.5	0.30
Open pits/latrines			
wet climate/flush water use, ground water table higher than latrine	0.7	0.7	0.42

River discharge Stagnant oxygen deficient rivers and lakes Rivers, lakes and estuaries	0.1	0.1	0.06

Table 30.Methane Emission Factor for Waste Water

N_2O emissions from waste water

Some of the key parameters and emission factor used to estimate GHG emissions from waste water are reported below.

Table 31.N_2O Emission Factor for Waste Water

Variable	Unit	Value	Source
Annual per capita protein consumption	*g/person/DAY*	59	2005-2007 Data, source FAO
Fraction of nitrogen in protein	*kg N / kg protein*	0.16	IPCC default. Source IPCC 2006 guidelines vol. 5, chapter 6, page 6.25
Factor for non-consumed protein added to waste water	*index*	1.1	IPCC default. Source IPCC 2006 guidelines vol. 5, chapter 6, page 6.25
Factor for industrial and commercial co-discharged protein into the sewer system	*index*	1.25	IPCC default. Source IPCC 2006 guidelines vol. 5, chapter 6, page 6.25
Nitrogen removed with sludge	*kg N /year*	0	IPCC default. Source IPCC 2006 guidelines vol. 5, chapter 6, page 6.25
EF effluent	*kgN2O-N/kgN*	0.005	IPCC default. Source IPCC 2006 guidelines vol. 5, chapter 6, page 6.25
Conversion factor kgN2O-N to kg N2O	*kgN2O/kgN2O-N*	1.571428571	Source IPCC 2006 guidelines vol. 5, chapter 6, page 6.25

For Dipaculao, Aurora, the total estimated GHG emissions from residential waste water in 2017 are 2,396 tons CO_{2e} (4.6% of gross emissions). CH4 contributes 89% of waste water emissions (2,129 tons CO_{2e}) and N2O emissions from wastewater treatment effluent that is discharged in aquatic environments represents the remaining 11% (267 tons CO_{2e}). A summary of GHG emissions for wastewater is presented in Table 32.

Considering that in 2017 the municipality had a total population of 23,128, Dingalan, Aurora had an average per capita GHG emission of 0.104 tons CO2e for domestic wastewater. This is relatively higher than the per capita GHG emission at national level, which is 0.0845 tons CO2e. Given that the domestic wastewater is uncollected and untreated, the per capita GHG emission in the province is understandably higher than the national level.

Table 32. Total Estimated GHG Emission – Waste Water

Gas	Sources/Wastewater System	Population using the System	GHG Emission (tons CO2e)	% of Total
CH4	Residential-Uncollected			
	Septic Tanks	14,501	1,334	55.66%
	Open pits/latrines (wet climate/flush water use, ground water table than latrine)	6,089	784	32.72%
	River Discharge			
	Stagnant oxygen deficient rivers and lakes	629	12	0.48%
	Rivers, lakes and estuaries	1,909	-	0.00%
	Subtotal		**2,129**	**88.86%**
N2O	Wastewater treatment effluent that is discharged in aquatic environments	23,128	267	11.14%
TOTAL			**2,396**	**100.00%**

A. Agriculture

The emissions accounted for from the agricultural sector is from the interaction of plants and animals with the soil and the atmosphere, and not the energy consumed by agricultural equipment such as mobile and stationary farm machineries.

At the national level, agricultural GHG emissions are one half as large as that from the energy sector making it an important contributor to the carbon footprint of the Philippines. The emissions included from the agricultural sector are from the interaction of plants and animals with the soil and the atmosphere and not the energy consumed by agricultural equipment such as mobile and stationary farm machines.

Aurora's economy is largely agricultural, with rice, corn and coconut as principal products. For 2010, Aurora has a total rice and corn production of 84,994 tons and 18,395 tons, respectively. Other agricultural crops include, banana, camote or sweet potato, calamansi or Philippine citrus, cassava, peanuts, pineapple, coffee, eggplant and abaca. About 61,933 hectares, or 19% of the province's total land area, consist of cultivated land. Aurora is also into poultry and livestock such as chicken, swine, duck, carabao, goat and cattle.

The overall strategy adopted for estimating GHG emissions for the agriculture sector is to capture the vast majority of emissions by focusing on activities causing the majority of agriculture emissions nationwide. Activities comprising 93% of the total nationwide agriculture sector emissions of the Philippines are targeted in this community-level inventory. The activity data used are hectares of rice cultivation, livestock population, and volume of crop production. These activities were chosen because data was either readily available or could be collected by the LGU in the timeframe provided for the inventory. Emission factors are based on IPCC inventory guidelines and/or derived from the publication, *Tracking Greenhouse Gases: An Inventory Manual.*

The following equation is used:

GHG Emissions (CO_2e) = Activity Data X Emission Factor X GWP

Where:

Activity data	are typically expressed in hectares (ha) of land cultivated with a GHG emitting crop (e.g. ha of rice) or headcount of GHG emitting animals (e.g. number of swine)
Emission Factor	are the average GHG emissions associated with the cultivation of a ha or GHG emitting crop (e.g. kgCH_4/ha rice) or with a headcount of anima (e.g. kgN_2O/swine)
GWP	is the Global Warming Potential of the emitted greenhouse gas (21 for CH_4 and 310 for N_2O)

CH_4 and N_2O are the important GHGs, comprising 98% of agricultural GHG emissions. Emissions of these two gases predominantly occur from the following major agricultural activities:

- Rice paddy cultivation because rice paddies release CH_4 from anaerobic decomposition when flooded
- Enteric fermentation releases CH_4, mainly from cattle and buffalo digestion
- Manure management releases CH_4 and N_2O from collected manure
- Agricultural Soils release N_2O from manure and crops added to the soil

The disposition of animal wastes affect where the GHGs are emitted and accounted. Animal wastes are either collected or uncollected. Collected animal wastes are either subject to manure management or used as manure fertilizer. Uncollected animal wastes are left where they are excreted. In this inventory, accounting for GHG emissions from animal related activities is driven by type and head count of animals.

Table 33.Animal-Related Emissions from Agriculture Sector

Animal	Digestion	Waste			
		Collected			Uncollected
	Enteric Fermentation	Manure Management		Manure Fertilizer	Grazing Animals
GHG Type	CH_4	CH_4	N_2O	N_2O	N_2O
Cattle	✓✓	✓	✓	✓	✓✓
Buffalo	✓✓	✓	NA	✓	✓✓
Swine	✓	✓✓	✓✓	✓✓	NA

Poultry	NA	✓	✓✓	✓✓	NA
% Capture Nationwide*	98%	99%	95%	98%	89%

Legend: ✓✓ **Important** ✓ **Minor but headcount collected for other purposes**

Emission factors were also derived based upon national averages. This approach makes the simplifying assumption that national average conditions apply at the local level, which might introduce some uncertainty into the results. It was judged that relying on data that was either readily available or reasonable to collect at the local level, along with the simpler set of calculations, was appropriate for this initial community GHG inventory.

The emission factors used in the computation are based on the 2006 IPCC inventory guidelines and/or derived from Tracking Greenhouse Gases: An Inventory Manual for the Philippines. Please refer to Appendix 8 for the derivation of the emission factors.

6.6.3.1 Rice cultivation emission factors

Methane emission factors per hectare of rice land in the Philippines:

Table 37. Methane Emission Factor for Rice Cultivation

Data Needed	Emission Factors (CH_4/hectare)
Wet season – irrigated	338 kg
Wet season – rainfed	139 kg
Dry season – irrigated	120 kg
Dry season – rainfed	52 kg

Source: These are country-specific to the Philippines derived from Philippines 2000 inventory

6.6.3.2 Animal-related emission factors

Table 38.Animal-Related Emission Factor

Animal	Digestion	Waste			
		Collected			Uncollected
	Enteric Fermentation	Manure Management		Manure Fertilizer	Grazing Animals
GHG Type	**kg CH_4/ head<1>**	**kg CH_4/ head<2>**	**kg N_2O/ head<3>**	**kg N_2O/ head<4>**	**kg N_2O/ head<5>**
Non-dairy Cattle	47	1.00	0.25	0.21	1.01
Non-dairy Buffalo	55	2.00	N/I	0.01	1.24
Swine	1	7.00	0.43	0.33	N/I
Poultry/Ducks	N/I	0.02	0.02	0.01	N/I

Horses	18	2.19	N/I	N/I	N/I
Goats	5	0.22	0.19	0.16	N/I

N/I – not included

<1>	**IPCC, volume 4, Table 10.10 and Table 10.11**
<2>	Table 39. Comparison of the IPCC default Emissions Factors on Methane Emissions from Manure Management, Tracking Greenhouse Gas, An Inventory Manual, page 86
<3>	Derived from Philippines 2000 inventory (Please refer to Appendix 3)
<4>	- Computed national averages for each animal type
<5>	- Based on IPCC defaults and Philippine-specific assumptions

6.6.3.3 Emission Factor for nitrous oxide emissions due to crop residues:

Table 39. N_2O Emission Factor for Crop Residues

Activity data	kg N_2O/metric ton of dry weight
Crop production (in metric tons of dry weight)	0.20

Source: Derived from Philippines 2000 inventory, as described in Tracking Greenhouse Gases: An Inventory Manual for the Philippines. Computed from the national average N2O emission per metric ton of dry weight for all crops.Based on IPCC defaults and Philippine-specific assumptions. (Please refer to Appendix 9.)

The total emission from the agriculture sector of Dingalan, Aurora is 9,889 tons CO2e which accounts for the second highest emission source (19% of total gross emission). For agriculture sector, the highest emission comes from rice cultivation with emission of 5,098 tonsCO2e (51% of total agriculture emissions.). The table below presents a more detailed breakdown of the emissions. Having an agriculture-based economy, agriculture sector is understandably the second biggest GHG contributor in Dipaculao, Aurora with agriculture land area of 2,168 hectares which represents about 7% of the total LGU's area. Rice is the major crop being grown in Aurora Province, thus, this contributes the highest emission source for agriculture sector.

Table ____. Total GHG Emission for Dingalan, Aurora-Agriculture Sector

Activity	Gas	Data Input	Activity Metric	GHG Emissions (tons CO2e)	% of Total
Rice Cultivation	CH4			**5,098**	**51.54%**
Dry Season - Irrigated		530	hectares of cropland	1,336	13.51%
Dry Season - Rainfed		-	hectares of cropland	-	0.00%
Wet Season - Irrigated		530	hectares of cropland	3,762	38.04%
Wet Season - Rainfed		-	hectares of cropland	-	0.00%
Livestock				**2,970**	**30.03%**
Enteric Fermentation	CH4				
Buffalo		1,886	head count of animals	2,178	22.03%

Cattle		558	head count of animals	551	5.57%
Swine		265	head count of animals	6	0.06%
Subtotal				**2,735**	**27.65%**
Manure Management CH4	CH4				
Swine		265	head count of animals	39	0.39%
Buffalo		1,886	head count of animals	79	0.80%
Cattle		558	head count of animals	12	0.12%
Poultry		4,010	head count of animals	2	0.02%
Subtotal				**132**	**1.33%**
Manure Management N2O	N2O				
Swine		265	head count of animals	35	0.36%
Poultry		4,010	head count of animals	25	0.25%
Cattle		558	head count of animals	43	0.44%
Subtotal				**103**	**1.05%**
Agricultural Soils	N2O			**1,822.32**	**18.43%**
Animal Manure Fertilizer	N2O				
Swine		265	head count of animals	27.11	0.27%
Poultry		4,010	head count of animals	12.43	0.13%
Cattle		558	head count of animals	36.33	0.37%
Buffalo		1,886	head count of animals	5.85	0.06%
Subtotal				**81.71**	**0.83%**
Grazing Animals	N2O				
Buffalo		1,886	head count of animals	724.98	7.33%
Cattle		558	head count of animals	174.71	1.77%
Subtotal				**899.69**	**9.10%**
Crop Residues	N2O	13,563	tons of dry weight of crops	840.92	8.50%
TOTAL				**9,889.50**	**100%**

A. Forestry & Other land Use

The province of Aurora covers the eastern portion of the Sierra Madre Mountains, hence it is generally mountainous. There are flat lands unevenly distributed throughout the province. Its coastline spans 332 kilometers in length. The municipality of Dingalan, in the south, has the most irregular topography.

Rainfall in Aurora is evenly distributed throughout the year. The average monthly rainfall is 273.9 millimeters. Rainfall is heaviest during the months of January, February, April, October, and November, while August is the driest month. Tropical cyclones are a seasonal occurrence. Since Aurora faces the Pacific Ocean, there are no barriers that can shield the province from typhoons coming from the east.

Table____ Land-Use Classification of Dipaculao, Aurora, 2007-2013

Land Use Classification	Area in hectares	
	2007	2013
Old growth	1,788	1,788
Secondary forest	22,718	22,918
Brushland	1,405	1,454
Grassland	876	907
Inland Water/Wetlands	162	162
Cropland	2,981	2,168
Other Land Uses	525	1,058
Total	**30,455**	**30,455**

The following key parameters were used in the computation of GHG emissions from forestry and other land-use sector:

Table____. Emission Factor for Forestry and Other Land Use

Forest land use	Region	C content in biomass *%*	Total above ground biomass *t biomass/ha*	Rate of above ground biomass change *t biomasss/ha/year*
Old growth forest	Visayas	44.7%	446	2.1
Second growth forest	Luzon	43.45%	279	7.81
Brushland	Visayas	45.3%	65	9.4
Grassland	Visayas	44.5%	29	0
Cropland (agrosilvicultural)	Humid Tropical-SE Asia	47.0%	120.0	2.6
Other Land Uses		0.0%	0	0

Source:

IPCC Guidelines-Volume 4: Agriculture, Forestry and Other Land Use (AFOLU), Chapter 5: Tables 5.1

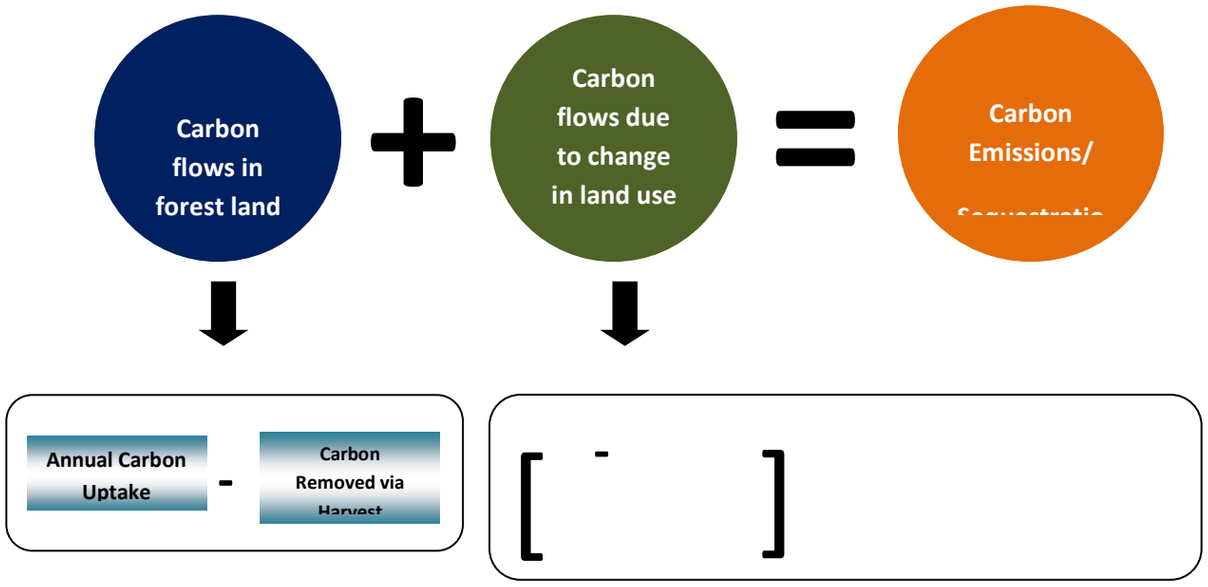
& 5.2, page 5.9;

Philippines Tracking Greenhouse Gases: An Inventory Manual, page129

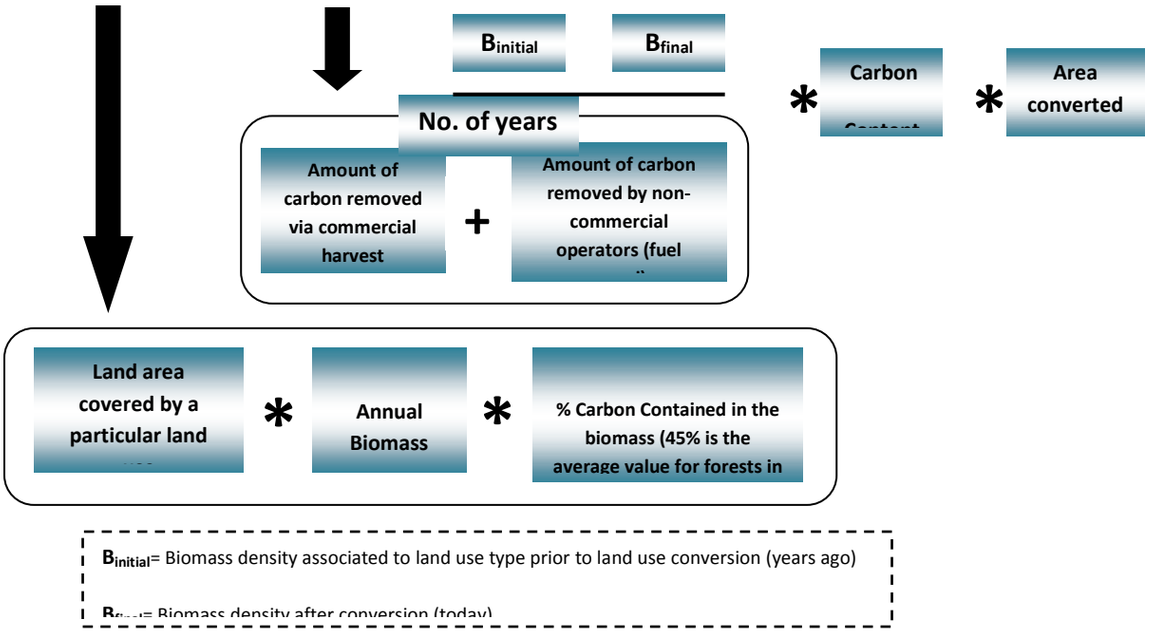
Note: Default Carbon Fraction=0.47

This research adopted a simplified approach to the estimate forestry emissions based on the guidance provided by DENR's publication, *"Tracking Greenhouse Gases: An Inventory Manual"*. This methodology is based on (1996) IPCC guidelines for national GHG inventories and focuses on the GHG emissions or removals resulting from changes in the above ground stock of biomass/carbon. The manual also includes information about factors used for the national GHG inventory that were used as default factors for the LGU calculations[3].

The key determinants for GHG emissions and removals from the forestry sector, according to the Climate Change Commission's manual, are illustrated by the picture below:



[3]An advantage of using the approach and data provided by the DENR's publication, *"Tracking Greenhouse Gases: An Inventory Manual"* is that the emissions estimates for the LGU are consistent with the national GHG inventory. A limitation is that the methodology focuses on above ground biomass and does not include emissions or removals resulting from changes in carbon stocks in below ground biomass, soil carbon, dead organic matter or biomass burning or decay.



With a forest cover of 24,706 hectares (81% of the municipality's land area), Dingalan, Aurora has a higher carbon sequestration of -314,020.56 tons CO2e as compared to biomass removal of 35,104.24 tons CO_{2e} resulting to net emission of -278,916.32 CO_{2e} from forestry and other land use sector. Eventhough there is biomass removal attributed to timber harvesting and land use change, this is relatively small compared to high forest growth uptake. The Local Government is in the forefront of ensuring the protection, conservation and sustainable management of the natural resources of Aurora Province. In this light, various programs are being implemented by the Local Government to protect the environment from wanton destruction arising from illegal use and degradation of the natural resources and preserve the ecological balance of the province towards sustainable development. As such, forest growth uptake is relatively high compare to low biomass removal attributed to logging operations and kaingina ctivities.

Nonetheless, the commercial harvest from forestry and land use contributes the highest GHG emissions amounting to about 40% (20,802 tons $CO2_e$) of the total gross emissions. In this light, the local government should implement policies and programs to regulate land use conversion and protect the forest from wanton destruction arising from illegal use and degradation of the natural resources and preserve a carbon-sink province towards sustainable development.

Table ___. Total GHG Emission for Forestry and Land Use Sector

Sources/Activity	Data Input	Activity Metric	GHG Emissions (tons CO2e)
a) Forest Growth/CO2 uptake			**(314,020.56)**
Old Growth Forest	1,788.00	hectares	(6,154.12)
Secondary Growth Forest	22,918.00	hectares	(285,160.23)

Brushland	1,454.28	hectares	(22,706.21)
b) Biomass Removal/CO2 Emissions			**35,104.24**
Commercial Harvest	13,057.21	ton biomass/year	20,802.31
Fuelwood use by households	1,398.59	ton biomass/year	2,228.18
Annual Land Use Change		land use change	12,073.75
Total CO2 Uptake			**(278,916.32)**

2.2.4 EXISTING GHG REDUCTION EFFORTS

Economic progress and population growth in Aurora brought about a significant increase in greenhouse gas (GHG) emissions especially in urban areas. If not addressed now, the climate change problem will continue to grow and have detrimental impacts on human health and the environment. The ongoing call for climate action at the international level requires governments at the local level to mitigate GHG emissions. A GHG inventory and a GHG management plan are important actions that all local government units (LGU) should undertake in order to contribute to the national emissions reduction agenda.

The province of Aurora is implementing various GHG emissions reduction programs as part of climate change mitigation initiatives. The GHG inventory report revealed that forestry and land use sector contributed the highest GHG emission, followed by agriculture and waste sector. In this light, interventions are taken to reduce emissions from these sectors. Summarized below are the various LGU programs and activities that have helped meet the objectives of the climate action initiative:

FORESTRY

With the highest forest cover density of 73.71% in the Philippines, the results of the inventory shows that province of Aurora is deemed a carbon sink sequestering a net removal of -2,261,034 tons CO_{2e} of greenhouse gases. Nonetheless, the biomass removal as a result of logging operations and kaingin activities contributes the highest GHG emission amounting to about 66.42% (529,785.47 tons CO_{2e}) of the total gross emissions. In this light, the local government should implement policies and programs to protect the forest from wanton destruction arising from illegal use and degradation of the natural resources and preserve a carbon-sink province towards sustainable development.

In a move to ensure the effective management of the forest and forestlands and the protection of watersheds in the province, the Provincial Government, through the Environment and Natural Resources Office (ENRO), has been working with DENR in helping municipalities prepare the Forest Land Use Plan (FLUP). The FLUP will serve as the framework for the municipalities in allocating and putting in place effective e management system in the forest and forestlands in their respective jurisdiction.

To assist the DENR in the implementation of forest laws, the Governor created the Provincial Task Force Sagip Kalikasan as a merger of the efforts of all concerned government agencies, LGUs, NGOs, civilian volunteer groups, religious and other sectors of the society towards a single intent and purpose, that is, environmental protection and preservation. With the program, monitoring checkpoints were established at all entry and exit points of Aurora to monitor the transport of forest products.
The greening program initiatives are also included in the incentives criteria for Gawad Punong Lalawigan para sa Kapaligiran. Likewise, various tree planting activities are conducted by LGUs, NGOs, Youth Organization and other groups in relation to National Greening Program.

Solid Waste Management (SWM)

All the eight component municipalities of Aurora have completed and legitimized their Ten-Year Municipal SWM Plans. All have taken steps to implement their respective SWM program and they are currently at various stages of implementation. The Provincial Government of Aurora (PGA) believes that LGU implementation needs to be pushed and supported so that neither the environment nor the socio-economic development of the province is compromised. In this light, all the Municipal SWM Plans were integrated to formulate the Provincial Integrated Solid Waste Management (ISWM) Plan for Aurora.

- **SWM Activities of Municipal LGUs**

  Summarized below are activities of the eight municipal LGUs on three aspects of solid waste management: waste diversion, disposal management, and enforcement, education and management.

  Waste Diversion

  Waste diversion essentially covers segregation at source, segregated collection, recycling and composting. Of the eight LGUs, four (Baler, Maria Aurora, Dinalungan and Dipaculao) are deemed to have achieved significant waste diversion through their efforts to implement waste segregation in households, schools, public markets and offices; segregated collection (except Dipaculao) in urban barangays and public markets; and the recovery and composting of waste materials, at source or in the Materials Recovery Facility (MRF).

  Waste Disposal

  Waste disposal and residual waste management includes efforts to improve the management of residual waste, the closure and rehabilitation of open dumps and the development of sanitary landfills (SLF). Four of the municipalities have established their own temporary Residual Containment Areas (RCA). Two LGUs are currently operating Category 1 SLF while others are managing wastes at household level. The capital town of Baler is operating a Residual Waste Processing Center which reduces the volume of residual waste. The residual wastes are being pulverized and mixed with cement to manufacture bricks, paving blocks and other non-load bearing cement products with a maximum production of 120 bricks/day.

  Enforcement, Education and Management

  Enforcement, education and SWM management refers to activities to enact and enforce SWM ordinance, promote desirable SWM behavior and practices and put in place a SWM organization. Baler and Maria Aurora are the only LGUs that have so far enacted a comprehensive SWM Ordinance and have prepared an enforcement plan to support the implementation of their respective SWM plan. The other LGUs are In the process of drafting or finalizing their ordinances. All towns have ongoing IEC campaigns focusing on the urban barangays, schools, public market and selected establishments.
  At present, there are only three LGUs which have created Municipal Environment and Natural Resources Offices (MENRO). These are Baler, Maria Aurora and Dinalungan. The MENROs are tasked to supervise their SWM programs and activities. In the other LGUs, there is a staff

designated to coordinate and supervise SWM implementation. All LGUs have ESWM Boards but some are not fully functional.

The different LGus have allocated budgets for SWM sourced from either their General Fund or the 20% Development Fund. These exclude the services of LGU regular staff who are managing the program and the various facilities that have been set up.

- **SWM Support Program of the Provincial Government**

The Provincial Government is currently supporting SWM in several ways. One is through its technical assistance and some funding/material support to component LGUs in SWM planning and implementation. Another is the recognition of the efforts of deserving local government units through the "Gawad Punong Lalawigan para sa Kapaligiran." Still another area of support is the implementation of its own SWM program within the Provincial Capitol.

PGA assistance in SWM implementation focuses on IEC, the establishment of SWM facilities and SLF development. It continues to monitor the performance of the component LGUs to ensure that activities are being sustained.

To help sustain LGU environmental management programs, Governor Castillo initiated the implementation of the "Gawad Punong Lalawigan para sa Kapaligiran." This is Aurora's version of the "Gawad Pangulo sa Kapaligiran" program of the Office of the President, which was temporarily suspended in 2005. Governor Castillo's program was expanded to include a "Search for Cleanest and Greenest" municipality, barangay, school, institution, church and establishment. The criteria of the program are detailed in the appendix.

Under the Enhanced Solid Waste Management (ESWM) Program in the Provincial Capitol, waste segregation is done at source (per office) using properly labeled waste receptacles. A "no segregation, no collection policy" is being enforced in the provincial capitol. Biodegradable and recyclable wastes are transported to MRF while residual and special wastes are brought to the disposal facility of Baler.

ENERGY

The General Services Office is currently implementing austerity measures for energy efficiency and conservation program which include regulating electricity usage (turning off lights, regulating aircon), regulating fuel consumption and coordinated trips of employees.

With regards to renewable energy, the Mini-Hydro Electric Project is an on-going project of the municipality of San Luis, Aurora with an initial generating capacity of 800 kilowatts and maximum generating capacity of 1.2 megawatts which is more than enough for the power requirements of the municipality. LGU San Luis, with the approval of the Municipal Council, decided to develop and implement the project as sole owner by providing its IRA as its collateral. The project is currently completed and become operationalized in year 2011. As such, the project is not yet included in 2010 GHG inventory.

The power plant is located two (2) kilometers from the National Highway in Barangay Ditumabo, San Luis, Aurora or just upstream of the existing National Irrigation Administration (NIA) Dam. The project would have no effect on the irrigation project since the location of the powerhouse will be in such a manner that the water will flow back to the river, hence the NIA Dam will have the same volume and quality of water. Rather than build a Dam on top of the Fall to generate more energy, only the downstream part at the foot of the Falls was developed to preserve the beauty of the Falls. A natural pool was created with the construction of a three (3) meter high, run-of-the-river Rubble Masonry Dam.

AGRICULTURE

The first biomass gasification plant for rural electrification was inaugurated on March 17, 2012 at Dinalungan, Aurora producing 250 kW of power. Biomass gasification is a renewable source of energy because it uses recurring agricultural and forest wastes as fuel which does not burn or combust biomass but rather uses heat in an oxygen-starved environment to release combustible gases. The current power plant uses about 8 tons of biomass a day at full load thereby reducing the GHG emission from agriculture sector.

Vermiculture and Vermi-composting Project was established at ENRO Compound under the DBP Project producing high quality organic fertilizer primarily to support the requirement of Aurora DBP Forest Project as well as ENRO Nursery. Upon expansion, the project become income-generating through selling of cultured earthworms and vermicompost products to farmers and other plant growers. The average production level is 400 to 500 bags (50 kg/bag) per year using about 11 tons of substrate (farm waste and animal dung).

Considering the booming economic activity and population explosion, much more remains to be done in order to achieve the necessary GHG reduction goals. Meeting these goals will likely require the LGU to undertake ambitious and far reaching initiatives.

2.2.5 GHG Programs, Projects, Activities

The city's/municipality's/province's low carbon path rests on reducing the GHG emissions of the broader community. For Aurora Province, the potentials are in the sectors of stationary energy, transportation, waste, agriculture, forestry and land use. Existing initiatives that work for the community will be continued and may be improved or expanded, while a more comprehensive list of initiatives and policies will be extensively studied and developed for long-term implementation. In this Framework Plan, initiatives to bring down community GHG emissions are divided into:

- Strategic Long-Term Initiatives - Initiatives for further assessment in preparation for the Long-Term GHG Management Plan
- Rapid Launch Initiatives - New initiatives for rapid launch that will be implemented in parallel with the preparation of the Long-Term GHG Management Plan.

i. ***Strategic Long-Term Initiatives***

- **Climate Smart Transportation.** The transportation sector of Aurora Province accounts for the least contribution of GHG emission that is only 2% of total gross emission. Nonetheless, with the booming economic activity and increasing influx of tourist, the GHG emission is expected to increase. To make an impact and significantly improve this sector's carbon footprint, coordinated urban planning policies, provision of enabling means for low-carbon transportation, and initiatives to directly reduce fuel consumption are necessary. The LGU has identified the following priorities to reduce transportation related emissions and achieve low GHG transportation systems.

Five priorities

1. Reducing GHG emissions and improving livability through planning

2. Promoting non-motorized transportation and moving information
3. Utilizing public transportation and high occupancy vehicles
4. Improving transportation system efficiency
5. Supporting the adoption of renewable fuels and clean energy

Priority 1: Reducing GHG emissions and improving livability in planning processes

- Prioritizing GHG emissions reductions in transportation planning
- Integrating transportation planning with urban planning and other forms of municipal planning
- Integrating planning at the local, and regional levels
- Applying principles of Smart Growth and Transit-Oriented Development (e.g. mixed use communities and car-free areas)
- Managing parking to reduce GHG emissions by employing parking pricing techniques and parking supply management
- Promoting the expansion of the green canopy by encouraging street trees

Priority 2: Promoting non-motorized transportation and moving information

- Creating pedestrian, car-free areas in commercial districts
- Expanding the number and quality of bicycle lanes
- Implementing bicycle parking spaces, bike racks and public bicycle programs throughout the city, and especially adjacent to transit stations
- Giving priority access to public space and transit stations to pedestrians and bicycle riders
- Expanding the number and quality of sidewalks along principal pedestrian routes and in regional centers
- Rationalizing parking on public streets
- Promoting telecommuting for municipal and private sector workers
- Promoting the use of the internet to move information instead of people and materials
- Supporting investments in telecommunications and teleworking technologies
- Utilizing bicycles for police officers in urban centers

Priority 3: Utilizing public transportation and high occupancy vehicles

- Investing in medium and high capacity systems (subways, trains, and exclusive bus corridors)
- Increasing the efficiency and connectedness of low capacity systems (bus, jeepney, and tricycle)
- Promoting education and incentive-based trip reduction programs
- Promoting car-pooling, van-pooling, and car share programs for private vehicles
- Introducing market-based instruments to reduce congestion and pollution

Priority 4: Improving transportation system efficiency

- **Improving the circulation of traffic**
  - Improving the capacity and design efficiency of the road system
  - Improving traffic signal synchronization
  - Utilizing intelligent traffic management systems
  - Using communications technology to provide information about transportation and traffic
  - Promoting GHG inventories and mitigation planning for private sector

- **Improving the efficiency of the transportation fleet**
  - Promoting the use of hybrid and other efficient private vehicles
  - Promoting community purchases of compact and hybrid vehicles
  - Promoting the retirement of old and under-used vehicles
  - Purchasing fuel efficient (e.g. hybrid) and/or smaller fleet vehicles for the municipal fleet
  - Utilizing fuel-efficient vehicles (e.g. scooters) for parking enforcement
  - Restricting idling of municipal vehicles
  - Improving vehicle inspection program and technical inspections of vehicles in the streets

- **Improving the movement of freight**
  - Promoting the use of freight movement planning by the private sector
  - Providing electric plug-in stations for freight vehicles at truck stops or ports
  - Restricting idling at public facilities

- **Improving the integration of modes of transportation**

- Supporting intercity rail

Priority 5: Supporting the adoption of renewable fuels and clean energy

- Utilizing alternative fuel vehicles (biodiesel, ethanol, electric, compressed natural gas) for city fleet
- Promoting the use of low carbon alternative fuels
- Opening local government alternative fueling stations to the public

- **Low Carbon Neighborhoods, and Buildings.** Energy use in residential and commercial establishments can significantly be improved and made efficient to reduce GHG emissions. By providing initiatives for existing buildings and new constructions to invest in energy efficient technologies, complemented by implementing energy conservation measures, stationary energy use would contribute less to the carbon footprint of the province.

The following strategies and initiatives have been identified to reduce emissions from building energy use:

Five priorities:

1. Designing low carbon neighborhoods
2. Building community capacity to understand and address GHG emissions
3. Improving building and equipment energy efficiency
4. Promoting low carbon energy sources for buildings

Priority 1: Designing low carbon neighborhoods

- Prioritizing GHG emissions reductions/minimization goals when conducting urban planning Developing green, sustainable, efficient, and thriving neighborhoods
- Locating commonly used facilities within walking distance of each neighborhood

Priority 2: Building community capacity to understand and address GHG emissions

- Increasing community awareness of GHG and their role in climate change
- Increasing community awareness of GHG mitigation opportunities
- Increasing community support for GHG mitigation initiatives
- Increasing community capacity to implement GHG mitigation initiatives (supply of products and expertise)

Priority 3: Improving building and equipment energy efficiency

- **Improving building energy efficiency**
  - Promoting “green building codes/standards” for new and rehabilitated buildings
  - Promoting energy efficiency retrofits for existing buildings
  - Promoting the use of shade trees and eco-roofs

- **Improving the efficiency of energy-using equipment in buildings**
  - Promoting the use of energy efficient air conditioning

- Promoting the use of energy efficient lighting
- Promoting the use of energy efficient appliances
- Promoting the use of energy efficient electronic equipment
- Promoting the use of energy efficient motors in commercial building
- Promoting the use of intelligent building management systems in commercial buildings

Priority 4: Promoting low carbon energy sources for buildings

- Promoting the use renewable energy and distributed generation
- Promoting the use of lower carbon electricity from the power grid
- Promoting the use of biogas as a replacement for LPG
- **Low Carbon Consumption and Intelligent Waste Management.** As a primary local concern, waste management is a reflection of the activities in a community, the goods it consumes, and the quality of services that the local government provides to dispose of waste. Waste sector is the third biggest GHG contributor in Aurora amounting to about 4% of total gross emission Positive outcomes of reducing carbon emissions from the waste sector are magnified by the co-benefits on the physical surrounding of a community, health and sanitation, and overall livability.

All the eight component municipalities of Aurora have completed and legitimized their Ten-Year Municipal SWM Plans. All have taken steps to implement their respective SWM program and they are currently at various stages of implementation, the pace of which depends on their capacity and budget resources, and the readiness of their constituents to comply with LGU regulations and ordinances. . The Provincial Government of Aurora (PGA) believes that LGU implementation needs to be pushed and supported so that neither the environment nor the socio-economic development of the province is compromised. In this light, all the Municipal SWM Plans were integrated to formulate the Provincial Integrated Solid Waste Management (ISWM) Plan for Aurora.

As waste management is not just merely focused on disposal but is also influenced by the consumption of goods, initiatives to address the GHG emissions from this sector include promoting the consumption of goods with low carbon intensity and implementing more efficient management of waste produced.

Three priorities

1. Low carbon consumption
2. Waste minimization
3. Intelligent waste management

Priority 1: Low carbon consumption

- Increase awareness and knowledge of the GHG impacts of different products
- Promote the consumption of products and services that genuinely increase well-being and have a low-carbon-footprint
- Discourage the consumption of high-carbon-footprint products and services
- Promote collaborative consumptions (behaviors, technologies, institutions)

Priority 2: Waste minimization

- Minimize packaging
- Promote reuse and recycling behaviors
- Penalize wasteful consumption
- Invest in recycling facilities and improved collection systems
- Promote local ventures that can transform waste into marketable products

Priority 3: Intelligent waste management

- Increase the share of organic waste composted and reused
- Improve solid waste management practices to eliminate methane emissions
- Invest in improved waste water collection and treatment systems
- Improve waste collection processes (optimized routes, less frequent waste collection days, fuel efficient and low carbon trucks)
- **Sustainable Agriculture, Forestry, and Natural Systems.** The development of province, with population growing and more economic activity taking place, without safeguards, sacrifices its natural systems such as vegetation and natural habitats. With this kind of unsustainable development and degradation of natural systems such as forests (tropical or urban), is also the loss of protection against rising levels of GHG emissions. Planting trees or greening initiatives do not just play a role in addressing climate change, but it also offers various benefits such as air quality improvement, flood protection, and revitalization of neighborhoods, to name a few.

With the highest forest cover density of 73.71% in the Philippines, the results of the inventory shows that province of Aurora is deemed a carbon sink sequestering a net removal of -2,261,034 tons CO_{2e} of greenhouse gases. Nonetheless, the biomass removal as a result of logging operations and kaingin activities contributes the highest GHG emission amounting to about 66.42% of the total gross emissions. In this light, the local government is implementing policies and programs to protect the forest from wanton destruction arising from illegal use and degradation of the natural resources and preserve a carbon-sink province towards sustainable development.

Having an agriculture-based economy, agriculture sector is understandably the second biggest GHG contributor in Aurora amounting to about 25% of the total gross emissions. To reduce the community's GHG emissions from land use, the LGU has identified the following priorities.

Nine priorities

Agriculture

1. Promote low-carbon crops and cropland management practices
2. Improve the management livestock and pastures

Forestry

3. Reduce deforestation
4. Improve forest management
5. Establish forests on un-forested land

Common to Both Agriculture and Forestry

6. Promote the sustainable production and processing bio-energy from crops and forests
7. Establish land use planning processes that prioritize the preservation high quality agricultural and forestry lands
8. Develop agriculture and forestry sector capacity to engage in carbon management
9. Create high value and sustainable uses for agricultural and forestry land

AGRICULTURE

Priority 1: Promote low-carbon crops and cropland management practices

- Manage rice cropland to reduce CH4 emissions by:
  - Draining of irrigated rice paddies once or several times per season
  - Using of low methane varieties of rice
  - Applying crop residues during the dry rather than wet season

- Improve farming practices to increase soil carbon by using:
  - Higher yielding crops and organic agriculture to build soil carbon
  - Cover and catch crops for nutrient and soil retention
  - Non-nitrogen fertilizers to correct soil deficiencies
  - Reduced-tillage and no-till farming

- Improve nitrogen fertilizer efficiency to reduce N2O emissions by using:
  - Slow-release nitrogen fertilizers
  - Legumes in crop rotations
  - Precision farming to optimize amount and timing of nitrogen fertilization

Priority 2: Improve the management livestock and pastures

- Improve grazing land by promoting:
  - Optimal grazing intensity by avoiding over-grazing and under-grazing
  - The introduction of deep-rooted grasses and legumes into pasture land

- Improve feeding practices for ruminants (especially cattle and carabao)
  - Upgrading of pasture quality to reduce CH4 emissions
  - Use of feed concentrates and additives to reduce CH4 emissions
  - Optimization of protein intake to reduce N2O emissions

- Improve the management of manure to reduce CH4 and N2O emissions
  - Improved manure handling and storage facilities
  - Promote the use of anaerobic digesters

FORESTRY

Priority 3: Reduce deforestation

- Promote enforcement of current logging regulations
- Increase or promote the increase of penalties for illegal logging
- Review and revise agricultural policies that encourage land clearing
- Promote the establishment of legal protection for designated forest areas
- Seek opportunities for REDD+ or other funding

Priority 4: Establish forests on un-forested land

- Promote incentives for reforestation and afforestation
  - Afforestation and reforestation grants
  - Tax exemptions for forestry investments

- Promote the reversion and restoration of marginal and degraded land to natural systems

Priority 5: Improve forest management in native forests, plantations, and urban areas

- Articulate a long term management plan designed to increase the health of local forests and their ability to store additional carbon
- Promote regulation of forestry practices in plantations and native forests
- Promote improved monitoring of forests and forestry practices to ensure compliance with regulations
- Further expand urban forests and curb-tree planting and maintenance
- Promote forestry practices that increase carbon storage, such as reducing impact logging, , reducing harvest rates, accelerating replanting rates, lengthening rotations, and changing the species mix
- Build capacity and systems to increase forest protection against damage from insects, disease, and fire
- Promote voluntary certification of forest products to sustainable forest management standards
- Develop specific incentives for sustainable forestry practices, with policy tools such as: tax credits, subsidies, cost sharing, contracts, technical assistance, and environmental service payments
- Support the creation of joint management agreements between local communities and the LGU private sector operators, national and international agencies to share the costs and benefits of sustainable forestry

COMMON TO BOTH AGRICULTURE AND FORESTRY

Priority 6: Give priority to producing and processing bio-energy from crops and forests

- Promote the use of bio-energy
  - Promote the use bio-gas generators to generate electricity
  - Promote the use of biogas as a replacement for LPG
  - Promote the use of bio-energy crops as transportation fuels through such mechanisms as subsidies for alternative fuels and alternative fuel content requirements
- Promote the production of bio-energy crops
- Promote the development of bio-energy processing facilities

Priority 7: Establish land use planning processes that prioritize the preservation of high quality agricultural and forestry lands

- Specific consider, and assign a high weight to, the biodiversity value and other ecological values of land parcels, when deciding their use (e.g. a floodplain with a rich and diverse ecosystem should not be allocated to urban development even if it would potentially attract rapid urbanization.
  Degraded lands with low ecological value are better suited for urban development)
- Seek the preservation of agricultural land prioritizing according to carbon storage capacity
- Seek the preservation and expansion of forest land prioritizing according to carbon storage capacity and ability to deliver other ecosystem, services

Priority 8: Develop agriculture and forestry sector capacity to engage in carbon management

- Promote the inclusion of carbon management in the training and practices for:
  - Rice and other crop cultivation; livestock range, and pasture land management; and soil management.
  - Forestry, forest monitoring, and forest regulation
  - Land use planning
  - The economics, finance, and business administration fields

- Promote the development of knowledge base on biofuel production and processing.

Priority 9: Create high value and sustainable uses for agricultural and forestry land

- Promote the development and use of financial mechanisms that provide payment for ecosystem services such as maintaining and/or increasing carbon storage in the agriculture and forestry sectors
- Support the local production of higher value crops to relieve pressure on forests and natural systems
- Promote the production and consumption of locally grown, low carbon crops
- Promote the production of tree-based agro-forestry crops
- Support the development and established of markets and value chains for new non-timber forest products, harvested, manufactured and processed locally
- Support the development of a strong local offer for sustainable eco-tourism services

ii. *New Initiatives for Rapid Launch*. As initial action to jumpstart the community's journey towards its low carbon vision, the Province of Aurora shall implement the following:

- **Gawad Punong Lalawigan para sa Kapaligiran Program**

To help sustain LGU environmental management programs, Governor Castillo initiated the implementation of the "Gawad Punong Lalawigan para sa Kapaligiran" as part of the incentives and rewards program. This is Aurora's version of the "Gawad Pangulo sa Kapaligiran" program of the Office of the President, which was temporarily suspended in 2005. Governor Castillo's program was expanded to include a "Search for Cleanest and Greenest" municipality, barangay, school, institution, church and establishment. Currently, the program helps reduce GHG emission from waste and forestry sector.
The criteria of the program will be revised to include energy efficiency and conservation initiatives as well as low-carbon emission farming practices. The program is designed to encourage wider participation of key stakeholders in reducing GHG emission in the province.

The Provincial Search Committee for the Gawad Punong Lalawigan para sa Kapaligiran (PSC-GPK), created through Executive Order 01-2005, is headed by the DILG Provincial Director. The members are: PGA-ENRO (Vice-Chair), PENRO-DENR (Co-Vice-Chair), Sangguniang Kabataan Federation, Provincial Tourism Officer, District Superintendent of DepEd, Provincial Health Officer, Provincial Information Officer, NGO and a private sector representative.

- **Provincial Task Force Sagip Kalikasan Program**

Being one of the most precious natural resource of Aurora, the forest must be protected and preserved to sustain a carbon-sink model province. Many laws had been enacted and amended to preserve the surviving forests and other natural riches, and protect them from unscrupulous persons and groups. But it seemed that there was no strong effort to stop such unlawful activities despite these existing tenets. Nonetheless, the DENR needs the assistance of other agencies/institution to handle such responsibility due to lack of resources to protect our natural resources.

To address such issues, Provincial Governor BELLAFLOR J. ANGARA-CASTILLO signed Executive Order No. 024 on July 23, 2008 CREATING THE PROVINCIAL TASK FORCE SAGIP KALIKASAN as a merger of the efforts of all concerned government agencies, LGUs, NGOs, civilian volunteer groups, religious and other sectors of the society towards a single intent and purpose, that is, environmental protection and preservation.

As part of the program, monitoring checkpoints were established at all entry and exit points of Aurora to monitor transport of forest products so as to protect the environment from wanton destruction arising from illegal use and degradation of the natural resources and to preserve the ecological balance of the province towards sustainable development.

As part of GHG management initiative, dialogue with charcoal makers will be facilitated to reagaarding the adoption of the new technology of charcoal briquetting which is indeed environment-friendly. This will serve as alternative livelihood project which will reduce occurrence of kaingin operations (forest burning) and minimize deforestation rate. In addition, reforestation activities will be intensively promoted which is in line with the national greening program.

In addition to the Provincial Task Force, Municipal and Barangay Task Forces shall be organized and activated to effectively implement its mandated tasks and functions.

1. At the Provincial Level

Chairman	……..	Provincial Governor
Vice Chairman	……..	PENRO
Members:		
Law Enforcement	……..	SP Chairman on Environment
	……..	AFP (Army)
	……..	PNP (APPO)
	……..	ENRO/CENRO/Tourism Officer
	……..	DOJ (RTC)
	……..	BFAR/PFARO/PVO/OPAg/PDCC/PCA
	……..	NGOs/CVOs
	……..	Media (Radyo Natin)
Public Awareness	……..	PENRO/ENRO/CENRO
	……..	LGUs
	……..	DILG
	……..	DepEd
	……..	Media (Radyo Natin)
	……..	NGOs/CVOs
Advisory/Consultation	……..	SP Chairman on Environment
	……..	SP Chairman on Tourism

…….. Other concerned agencies

2. At the Municipal Level

Chairman …….. Mayor

Vice Chairman …….. CENRO

Members:

Law Enforcement …….. AFP Unit Cmdr (Army)

…….. PNP (Chief of Police)

…….. SB Chairman on Environment

…….. ABC President

…….. NGOs/CVOs

…….. Media

3. At the Barangay Level

Chairman …….. Barangay Captain

Vice Chairman …….. SB Chairman on Peace & Order

Members:

Law Enforcement …….. AFP Unit Cmdr (Army)

…….. PNP

…….. Barangay Tanod

…….. NGOs/CVOs

…….. Media

SECTION 3. CLIMATE INFORMATION AND SITUATIONAL ANALYSIS

OBJECTIVES OF DINGALAN'S LOCAL CLIMATE CHANGE ACTION PLAN

Dingalan's LCCAP is prepared and to be submitted to the National Government in response to the Climate Change Act of 2009 (RA 9729) covering the year 2019 to 2029. The LCCAP's goal is to:

> *"Enhance transformative framework of resiliency in local communities through a capacity development program for empowerment to mitigate, prepare, respond, recover and adapt to climate change and related disasters."*

The LCCAP covers five core development areas: coastal, health, agriculture, water and water resources, and environment. Each area has a corresponding identification of its climate change vulnerability, key actions, adaptation measures and targets, implementing partners, indicative budgetary requirement, and a timeframe.

The plan is accompanied by a Climate Change Vulnerability Assessment (Anticipatory Adaptation Management) report that identifies the climate change vulnerability for the five areas and the associated socioeconomic impact. Actions outlined in the LCCAP identify new climate change-specific actions and the need for continued and/or improved implementation of existing policies and ordinances. Significant inter-departmental coordination will be necessary for the successful implementation of the plan given the numerous partners required for each action.

The submission of the LCCAP is a testament to the commitment of the municipality, as well as the current Mayor and Sangguniang Panlungsod, to climate change action in Dingalan. To reiterate, the purpose of this report is to submit LCCAP and to provide further research to build upon the existing climate change related policies and actions in the Dingalan for a longer term climate action strategy.

PLANNING AND POLICY ANALYSIS

LGUs must plan for multiple challenges, including traditional planning areas such as land use, transportation, and solid waste management. Taking action on climate change may initially appear as an additional burden for local governments. Coupled with inadequate resources and budget constraints, the enormity and complexity of climate change can make it seemingly impossible to address.

however, addressing climate change means recognizing how existing planning activities can lead, support, and/or complement climate change planning. There is considerable overlap with climate change adaptation and mitigation requirements within the traditional areas of government planning responsibility.

Effective climate change planning should be mainstreamed and integrated with all aspects of local government planning and decision-making. This helps to coordinate and improve the likelihood of project implementation, avoid policy conflict, ensure climate change planning is sustained within government activities, and leverage the necessary resources and tools to realize a climate-smart city.

Specifically, the Climate Change Act of 2009 (Republic Act 9729) defines mainstreaming as the ***"integration of policies and measures that address climate change into development planning and sectoral decision-making."***

In order to identify opportunities for mainstreaming, a planning and policy analysis is conducted using a climate change frame/lens on the Dingalan's Vision and Mission and the following planning documents as required by all LGUs to prepare:

- Comprehensive Land Use Plan (CLUP); and
- Comprehensive Development Plan (CDP);

This section is intended for municipal staff and elected officials to understand how specific issues, goals, objectives, policy, and programs outlined in these documents relate to climate change planning.

Specifically, an asset-based approach is used to highlight the strengths of the various planning documents as they relate to climate change and how these existing plans and policies can be integrated into climate change planning to strengthen inter-departmental coordination.

Additional analysis is conducted on other relevant plans prepared by the Municipal Government of Dingalan.

Social Development Plan

The Social Development Plan focuses on the capacity of the people of Dingalan through the improvement of social infrastructure and the provision of responsive public services to be able to meet their essential needs and achieve social justice. The Plan is based on Dingalan's vision for its people to be disciplined and empowered citizens.

1. Key Issues and Concerns

The Dingalan community stated the following issues and concerns:

a. Inaccessibility and insufficiency of social services.

Health, Nutrition and Family Planning. The lack of medical facilities, equipment and personnel is a prevalent issue throughout Dingalan. Insufficiency of medical supplies, facilities and professional medical personnel is most common in Barangays Butas na Bato, Davildavilan and Dipanikian where no barangay health stations are available. Though Barangay Caragsacan has no barangay health station present, the Dingalan Community Hospital provides the medical needs of the residents. Shortage of ambulance in some barangays is also noted especially in barangays with no health stations. Other health concerns include the high prevalence of malnutrition with 11.6% of the population *(CBMS 2016)*, the increasing cases of communicable diseases and the lack of facilities to diagnose upper and lower respiratory tract, as well as influenza and other related diseases.

Housing. Settlement concerns include the lack of permanent housing or the high percentage of those who do not own the residential unit that they are occupying, the insufficiency of housing projects and the absence of power supply in some of those that have been already established, the lack of sanitary toilet facilities which is experienced by 21.4% of the municipal population *(CBMS, 2016)*, and the 291 or 5.7% of Dingalan's households who are considered as informal settler families (ISF) *(CBMS, 2016)*.

Peace and Order/Protective Services. With regard to peace and order as well as public safety, there are cases of illegal drug use, index crimes (theft, robbery, etc.), street brawls, and alcohol-fueled violence in Dingalan. Another identified problem is the lack of streetlights (and CCTVs) which poses a public safety concern to the constituents of Dingalan.

Social Welfare Services. Issues related to social protection include the cases of "against the rights of the poor", vulnerable and disadvantage individuals which include violence against women and children (VAWC), children in conflict with law (CICL), abandoned/ neglected senior citizens (SCs), street children, lack of income for indigent families, and the presence of prostitution due to tourists influx.

b. Unemployment and lack of livelihood opportunities.

Unemployment rates are reportedly high in Barangay Paltic with 20.7% followed by Barangay Davildavilan with 17.9 and Barangay Aplaya with 16.3% *(CBMS, 2016)*. This is mainly due to either i) lack of livelihood opportunities, ii) the unemployability of the residents, or iii) the unwillingness of the people themselves to seek economically productive opportunities. The low income for employees is also identified as an employment issue.

2. Goals, Objectives, Targets, and Strategies

Table 84. Goals, Objectives, Targets, and Strategies for the Social Sector

GOALS	OBJECTIVES	TARGETS	STRATEGIES
Improved quality of life of the citizenry	To increase availability of health services	80% of the total population has equal access to health services by 2050	• Establishment of Barangay Health Units • Hiring of additional health personnel • Establishment of diagnostic facilities
	To provide decent and humane life condition among the residents of the municipality		• Provision of social protection and promotion of the rights and welfare of the poor, vulnerable and disadvantage individuals, families and communities • Provision of employment opportunities • Allocation of funds for resettlement/ housing
	To maintain peace and order	10% decrease in Crime Clearance Efficiency (CCE) and Crime Solution Efficiency (CSE) per year	• Strict implementation of laws and ordinances • Improve community awareness through community right-based policing

3. Programs, Projects, and Activities

Table 85. Programs, Projects, Activities, Policies, Location, and Urgency for the Social Sector

GOAL: Improved quality of life of the citizenry				
DECISION AREA	**TECHNICAL FINDING**	**IMPLICATIONS**	**OBJECTIVE**	**POTENTIAL OPTIONS**
11 Barangays (priority barangays are Butas na Bato, Davildavilan, and Dikapanikian)	Need to improve medical facilities and develop Barangay Health Units	When not addressed, may result in increased morbidity and/or mortality	Better healthcare and improved access to health facilities	- Construction and improvement of health units - Expansion and upgrading of hospital - Hiring of medical professionals for the vacant positions and establishing funds thereof - Provision of additional ambulance - Improvement of road access to health facilities - Purchase of quality medical equipment - Sustained supply of medicines
	Need to upgrade medical facilities and manpower requirements of health services			- Capacity building of health personnel - Increase employment opportunities in health institutions - Provision of benefits to employed staff - Increase income for health personnel

	Need to establish diagnostic facilities in rural barangays			- Dental Program - Food fortification program - Nutrition in essential maternal and child health services - Provision of various preventive, curative treatment and intervention - Micronutrient supplementation - Physical fitness and skills development program - Regular monitoring of private and public school canteens and eateries - IEC on nutrition
11 Barangays	Need for community social housing projects and financial facilities	When not addressed, may result in increased number of homeless individuals and informal settlers	Adequate housing and better access to social housing projects	- Construction of Level II water systems to cover households without water connection - Monitor construction of household sanitation facilities - Provision of low-cost sanitary latrines - Integrated approach for the prevention and control of illegal and informal settlement - Establish linkages with national agencies like HLURB, NHA, HUDCC to access funds for housing program - Relocation and resettlement of ISF to government housing projects - Formulation of Local Shelter Plan (LSP) - Establishment of Community Mortgage Program - Ordinance for the implementation of social housing projects and the funds thereof - Memorandum of understanding with Social Housing Finance Corporation (SHFC) for the CMP - Local Shelter Plan (LSP) - Updating of Comprehensive Land Use Plan (CLUP)
11 Barangays	Need for increased police visibility and IEC for DRRM-CCA	When not addressed, may result in higher incidences of crime and/or lower adaptive capacity to disasters	Increased public safety and resilience to disasters	- Acquisition of modern equipment under protective services (i.e. fire trucks, police vehicles, ambulances) - Hiring of additional police and fire personnel - Strengthening of Barangay Police Auxiliary Unit (BPAU) under the PNP and Barangay Peace Action Teams (BPATs) and Special Police Forces: Motorcycle Cops, and TOP (Tourist Oriented Police) Cops - Updating of LDRRMP and LCCAP - Capability building for protective personnel - Mandatory fire drills and earthquake drills at all public places - Additional CCTV cameras in strategic locations - Installation of streetlights in all barangays

				- Additional purchase of surveillance and response communication equipment for the PNP and DRRMO - Construction of evacuation centers in safe areas - Inclusion of DRRM-CCA to school curriculum - Ordinance establishing the guidelines for the establishment and installation of streetlights and CCTVs in public places
11 Barangays	Need for social development and family-oriented projects	When not addressed, may result in increased numbers of out-of-school youth and less sensitivity to issues regarding gender	Better social welfare programs	- Family development program - Mandatory training for all LGU personnel on GAD or gender sensitivity - Formulation of GAD code - Municipal Memorandum/ Ordinance on the formulation of the GAD Code
Barangays Aplaya, Davildavilan, and Paltic	Need to introduce capacity-building and livelihood development projects to households	When not addressed, may negatively impact the economy and not cultivate a good investment climate	More livelihood opportunities and increased number of businesses	- Establishment of linkages with TESDA and the private sector for technical skills trainings - Business enabling program - Cooperative development program - Implementation of sustainable livelihood program - Livelihood Program for OSY - Ordinance to enter MOA with TESDA and CDA - Memorandum of Agreement with TESDA and CDA for trainings and community development

Economic Development Plan

The Economic Development Sector of Dingalan will be focusing on Employment, Agriculture, Commerce and Trade, Industry, and Tourism.

Currently, the municipality's economic activities are dominated by the Primary sector such as Agriculture, particularly rice and banana production, livestock and poultry raising, and fishing.

The Secondary sector is composed of light industries involved in food processing such as "*tinapang isda"* smoked fish and banana chips.

For the Tertiary sector, there are ___ registered business establishments mostly in retail enterprises, and tourism-related establishments such as resorts and restaurants.

1. Key Issues and Concerns

a. Low Palay Production
The Municipal Agriculture Office (MAO) reported about 1,170 hectares of land being utilized for palay production in year 2016. From 2011 to 2016, palay production in Dingalan had an average of 2.92 MT/ha. from rainfed farms and 3.46 MT/ha. from irrigated rice fields. The national average for palay production in 2015 is 2.96 MT/ha. for rainfed and 4.31 MT/ha. for irrigated. Among the various factors that contributed to the low production are seasons of drought and typhoons.

b. Low Corn Production
Approximately 150.6 hectares were utilized for yellow corn and another 25 hectares for white corn with an average yield per hectare of 1.34 MT/ha. and 2.0 MT/ha., respectively. Dingalan's yellow corn production fell short of the 2015 national average of 4.15 MT/ha. but has a higher yield than the national average for white corn of 1.69 MT/ha.

c. Insufficient supply of local meat products
In 2015 and 2016, the MAO recorded a daily average of 1,027 heads of swine and 58 heads of cattle slaughtered. Still, a significant volume of Dingalan's meat supply comes from neighboring LGUs, such as Gabaldon and Cabanatuan City, Nueva Ecija.

d. Low Fish Production
Total fish production from 2012 to 2016 was recorded at an average of 537.84 MT. Still, with its long shoreline and vast marine waters, the town's current fish catch is low, considering its big potential in the fisheries industry. According to the fisheries statistics, the average catch in the municipal waters (marine) in year 2015 is 1,216.5 MT.

e. Lack of Business Establishments
Being a rural town with a relatively small population, Dingalan has very few private businesses which offer diverse services to the people.

f. Lack of Employment and Livelihood Opportunities
Results from the Community Based Monitoring System (CBMS) conducted in 2016 revealed an unemployment rate of 7.6%, which is higher than the national average of 5.4% in the same year (Labor Force Survey, PSA).

g. High poverty incidence
The CBMS likewise recorded a very high number of poverty incidence in Dingalan. Around 72.7% or 16,746 population have an income below the poverty threshold, which is way beyond the 21.6% poverty incidence among all Filipinos in 2015 (Family Income and Expenditure Survey, PSA). In addition, Dingalan's population with income below the food threshold was recorded at 57.1% compared to the national average of 8.1 percent.

2. Goals, Objectives, Targets, and Strategies

Overall Local Economic Goal:

Enhanced production and manufacturing of Agri-fishery, increased livelihoods and businesses, and stablished tourism industry in the Municipality.

Table 86. Goals, Objectives, Targets, and Strategies for the Economic Sector

OBJECTIVES	TARGETS	STRATEGIES
1. To increase and have a higher yield per hectare for palay and corn production 2. To increase supply of meat products from local source 3. To intensify marine fishing 4. To provide agriculture infrastructure support 5. To increase diversified private business establishments 6. To decrease unemployment rate 7. To reduce poverty incidence	1. Increase rice production by 10% with an average yield per hectare of 2.96 MT for rainfed and 4.31 MT for irrigated by year 2022 1.1 Increase corn production by 10% with an average yield per hectare of 4.15 MT for yellow corn by year 2022 2. Supply at least 60% of the town's meat requirements (beef, pork, chicken, etc.) from local source, by year 2022 3. Double (1,070 MT) the annual average of fish catch from the town's marine waters by year 2025 4. Construct additional agricultural infrastructure such irrigation system, farm-to-market roads, and pre- and post-harvest facilities 5. Double the number of private businesses in Dingalan by year 2025 6. Decrease unemployment rate from 7.6% to 5.6% by year 2025 7. To reduce poverty incidence from 57.1% to 30% by year 2025	Farm Modernization and Agro-Technology Application Promotion of Organic Farming Livestock and Poultry Quality Enhancement Commercial Fishery Revitalization Post-Harvest Facilities Modernization and Infrastructure Support Development Improvement of business/ investment climate Establishment of labor-intensive industries Skills development and direct assistance

Programs, Projects, and Activities

Table 87. Programs, Projects, Activities, Policies, Location, and Urgency for the Economic Sector

GOAL: Enhanced production and manufacturing of Agri-fishery, increased livelihoods and businesses, and stablished tourism industry in the Municipality				
DECISION AREA	**TECHNICAL FINDING**	**IMPLICATIONS**	**OBJECTIVE**	**POTENTIAL OPTIONS**
Barangays Ibona, Matawe, and Umiray	Need for production support services	When not addressed, may result in decreased income for farmers	Increased rice production and income for farmers	- Seeds distribution - Pesticide distribution - Fertilizer distribution - Soil fertility and soil mapping - SB approval of Agricutlural Management Plan - Memorandum of Agreement with farmer groups
	Need for market development services			- Conduct market events
	Need for education and training services			- Conduct of trainings and massive IEC
Barangays Ibona, Matawe, and Umiray	Need for production support services	When not addressed, may result in decreased income for farmers	Effective High Value Commercial Crops Program	- Seeds distribution - Planting materials distribution - Establishment and maintenance of nursery - Maintenance of greenhouses - SB approval of Agricutlural Management Plan - Memorandum of Agreement with farmer groups
	Need for market development services			- Conduct of local and international market-related events
	Need for education and training services			- Conduct of trainings and massive IEC
Barangays Ibona, Matawe, and Umiray	Need for production support services	When not addressed, may result in decreased income for livestock and poultry farm owners	Increased income for livestock and poultry farm owners	- Animals distribution - Vaccines and drugs distribution - Laboratory services rendering - Semen straw distribution - Production facilities maintenance - Incentives for investors on livestock and poultry
	Need for education and training services			- Conduct of trainings and massive IEC
	Need for research and development			- Conduct of production-related R & D activities
Barangays Ibona, Matawe, and Umiray	Need for production support services	When not addressed, may result in the increased costs for organic vegetable farms	Increased production of organic vegetables	- Seeds distribution - Biological control agents distribution - Memorandum of Agreement with farmer groups
	Need for market development services			- Conduct of local and international market-related events
	Need for education and training services			- Conduct of training and IEC
Barangays Ibona, Matawe, and Umiray	Need for training on modern farming techniques and entrepreneurship	When not addressed, may result in decreased income and less economic epportunities for farmers	Better access of farmers to education and training programs	- Hiring of Trainors - Preparation of training modules, equipment and venue - Conduct of regular trainings
Barangay Aplaya	Need to improve the Municipal Fish Port	When not addressed, may result in inefficiency in	Improve accessibility to and within Dingalan	- Site Development Plan Formulation - Facilities and Amenities Development - Construction of cold storage facility - Fencing of the market area

		transporting people and goods		- Installation of commercial stalls - Expansion of Fish Port - Price regulation - Public-Private Partnership; - Philippine Economic Zone Authority (PEZA)
Barangays Butas na Bato and Matawe	Need to construct more and improve existing farm-to-market roads	When not addressed, may result in loss of income for farmers and traders	Improve accessibility to and within Dingalan	- Detailed Engineering Design and Preparation of Program of Work - Mobilization and Site Preparation - Construction of FMR - Purchase of RROW
Barangays Ibona, Matawe, and Umiray	Need to upgrade irrigation and drainage networks, especially around agricultural areas	When not addressed, may result in loss of income for farmers	Increase support for farmers and reduce instances of flooding	- Develop gravity irrigation - Install communal pump irrigation - Increase water yield of aquifer - Secure Budgetary Allocation and requirements - Purchase of RROW
Barangays Ibona, Matawe, and Umiray	Need to modernize existing post-harvest facilities	When not addressed, may result in loss of income for farmers	Increase support for farmer	- Rehabilitation of Post-harvest facilities
11 Barangays	Need to improve the process of doing business	When not addressed, may result in fewer businesses and investors	Cultivate a good business climate	- Establish objectives and timeline within department concerns to BOSS - Review and Update of the Municipal Revenue Code - Review of the Revenue and Tax Incentive Codes - Streamlining of Administrative procedures - Cheaper cost of doing business - Investment Incentives
11 Barangays	Need to establish the Investment Promotion Office	When not addressed, may result in fewer businesses and investors	Cultivate a good business climate	- Creation and staffing of Local Investment Promotion Office
	Need to develop the Basic Investment Package and Investment Promotion Website			- Production of Investment Promotion Pamphlet - Website development
	Need for an Investment Summit			- Build network with key partners business-related sectors - Company visits to determine needs of target companies - Preparation of sector-specific information for investment areas to be promoted - Development of project briefs for specific investment projects - Organize business summit/investment summit - Memorandum of Agreement with investors
11 Barangays	Need for the development of pacakage offerings for microfinance	When not addressed, may result in fewer businesses and investors	Cultivate a good business climate	- Regular consultation - Facilitate organization of businesses and community-based organizations - Incentives for microfinancing businesses
11 Barangays (priority barangays are Aplaya,	Need for livelihood program for fisherfolks	When not addressed, may result in loss of income	Increase support for fisherfolks and	- Inventory of Skills and Resources - Skills Matching - Capitalization and Financing Development

Caragsacan, Davil-davilan, and Paltic)	Need for capacity building on agrobusiness	and livelihood opportunities for fisherfolks and agrobusiness owners	agrobusiness owners	- Inventory of Skills and Resources - Capitalization and Financing Development
	Need for business development for the fishing industry			- Demand and Supply Study - Business Model Building and Selection - Capitalization and Financing Development
	Need for the strengthening and promotion of local entrepreneurship			- Livelihood and Entrepreneurship Program, including Young Entrepreneurs - Incentives for business owners and investors - Incentives for investors - Incentives for Microfinancing businesses - Incentives for business owners and investors
Barangays Aplaya, Caragsacaan, Davil-davilan, and Paltic	Need to construct facilities for processing, marketing, and deistribution of basic food stuff and associated service and input activities	When not addressed, may result in loss of income for agrobusiness owners	Increase support for agrobusiness owners	- Construction of agro-processing facilities - Incentives for investors

Economic Development Sector: Tourism, Culture, and Heritage

Dingalan's tourism will capitalize primarily on its nature-based attractions to be supported by its cultural assets through local events and festivals. At present, there are 106 tourism-related businesses catering to the municipality's existing demand. There are 70 accommodation facilities (hotels, homestays, lodges, and resorts), which are yet to be accredited by the Department of Tourism (DOT).

1. Key Issues and Concerns

a. Underdeveloped tourism areas

Dingalan, being a municipality blessed with numerous natural resources and cultural assets, has a huge potential for tourism success through ecotourism, coastal tourism, and farm tourism, among others. However, the municipality's existing tourist attractions have not yet reached their full potential. The reason for this is the lack of amenities, activities, and access roads leading to these tourist spots.

b. Environmental degradation

Being heavily reliant on natural resources for its tourism assets, Dingalan is highly prone to environmental degradation caused by water pollution, oil spill, informal settlements especially along coastlines, and improper waste disposal.

c. Lack of infrastructural support

Another important concern raised is the lack of infrastructure support for tourism-related establishments. The impending influx of tourists in Dingalan will also depend on the availability and condition of roads and bridges since most of the municipality's attractions can be accessed by land travel.

b. Weak marketing and promotion program

Having an effective marketing and promotion program is crucial for any type of business. In the case of Dingalan, different marketing channels such as social media, events and expos can still be employed to boost its current marketing efforts.

2. Goals, Objectives, Targets, and Strategies

Table 88. Goals, Objectives, Targets, and Strategies for the Tourism, Culture, and Heritage Subsector

GOAL	OBJECTIVES	TARGETS	STRATEGIES
Sustainable tourism industry	1. To introduce new tourism activities to offer the target market	1. Double the number of activities being offered in tourist attractions.	Promotion of Dingalan to private investors. Recruitment of more locals to be tourism employees.
	2. To promote Dingalan as a nature-based tourism destination	2. Post at least one (1) tourism-related post in Dingalan Tourism's Facebook page per day.	Social media marketing

3. Programs, Projects, and Activities

Table 89. Programs, Projects, Activities, Policies, Location, and Urgency for the Tourism, Culture, and Heritage Subsector

GOAL: Sustainable tourism industry				
DECISION AREA	**TECHNICAL FINDING**	**IMPLICATIONS**	**OBJECTIVE**	**POTENTIAL OPTIONS**
11 Barangays (priority barangays are Ibona, Matawe, Paltic, Tanawan, and Umiray)	Need for product development	When not addressed, may result in decreased opportunities to benefit from tourism	Boost the tourism and export industry in Dingalan	- Identify all the municipality's local food and souvenir products and come up with new souvenir items that will be made available in pasalubong centers and regional centers. - Create a quality control (QC) procedure that will ensure that Dingalan's local products are export quality. - Impose that only products which passed the QC will be offered in pasalubong and regional centers, and during expos - Participate in food and travel expos outside Dingalan.
	Need for hotel, resort, and travel agency accreditation			- Ensure that all the accommodation facilities and travel agencies operating in the municipality are registered in the tourism office and have secured an accreditation with the Department of Tourism. - SB Resolution requiring accommodations and travel agencies operating in Dingalan to register in the tourism office
	Need for infrastructure support development			- Construct access roads for tourist spots that are not yet accessible to the tourists. - Prepare studies on possible additional sources of power that will be able to support the growing tourism demand in the municipality.
	Need for safety and security initiative			- Establish first aid kiosks at the entrance of every tourist attraction under adventure tourism category (hiking and trekking, scuba diving, surfing) - Ensure that tourists who will go trekking will register in the tourism office so they will be properly assisted by an accredited tour guide.

11 Barangays	Need for knowledge management system	When not addressed, may result in decreased opportunities to benefit from tourism	Boost the tourism industry in Dingalan	- Maintain an up-to-date inventory of all tourism establishments and amenities, and support facilities. - Automate all the available tourism data such as tourism assets, tourist arrivals, tourism maps, revenue generated, etc., through a centralized system. -. Identify the carrying capacity of each tourism site in terms of physical, economic, social, and biophysical parameters.
	Need for human capital development			- Conduct trainings for tourism employees (boatmen, tour guides, hotel and restaurant workers and owners, LGU) about the basic concepts of carrying capacity, basic life support and first aid, tourism marketing and promotion, and customer service. - Record all the tourism employees (tour guides and boatmen) and have them apply for DOT accreditation. - Promote courses on tourism and hotel and restaurant management - Memorandum of Agreement with TESDA or other technical-vocational schools - Regular seminars for capacity building
11 Barangays	Need for tourism branding development	When not addressed, may result in decreased opportunities to benefit from tourism	Boost the tourism industry in Dingalan	- Conduct a public consultation to determine what will be Dingalan's official tourism slogan. - Identify what will be Dingalan's primary target market and take it into consideration when making marketing materials. - Hire a tourism marketing officer who will be in-charge of updating Dingalan's existing tourism website and social media pages, and improving existing marketing materials. - Create tourism packages

	Need to promote events and festivals			- Involve the stakeholders in organizing local events and festivals. - Identify what will be the municipality's banner event or festival that will be heavily promoted to tourists. - Boost the marketing scheme of each event and festival by posting on social media and inviting bloggers and influencers - SB Resolution on the official events and festivals of Dingalan
11 Barangays	Need for public-private partnerships	When not addressed, may result in decreased opportunities to benefit from tourism	Boost the tourism industry in Dingalan	- Identify possible sites for private investments. - Invite prospective investors that will be willing to engage under a joint venture with the local government. - Create a one-stop shop that will make it easier for prospective investors to process permits
	Need for tourism-related NGOs			- Create partnerships with sustainable tourism NGOs that can assist the municipality in marketing and financial aspects - Memorandum of Agreement with NGOs
	Need for the support of the national government			- Ask assistance from National Government Agencies (DOT, TIEZA, TPB)

Infrastructure Development Plan

The Infrastructure Development Sector of Dingalan shall be focusing on roads and linkage, power, and support infrastructure for tourism. Based on the challenges identified during the Goals, Objectives, Targets, and Strategies (GOTS) workshop, the local government of Dingalan has identified potential ways by which to address the said challenges and induce further development in the area.

1. Key Issues and Concerns

a. Need to improve linkages

Road accessibility, especially for the remote sitios, need to be improved by means of constructing concrete roads and improving existing ones so as to enhance the flow of movement for both people and goods. Additionally, since Dingalan is a tourism destination, the future development of other network linkages – such as seaports and airports – should be taken into account.

b. Need for more tourist destination sites along the coastal area

Dingalan is known for both its coastal tourism and ecotourism assets, thus, the construction and rehabilitation of support infrastructure for tourism should be given consideration, especially if the municipality intends to capitalize on such assets and increase its revenue from tourism.

c. Need for renewable energy sources

Since Dingalan is located in a generally mountainous area which is situated by the coast, the municipality could invest in a facility which generates renewable sources of energy such as solar power, wind power, and hydropower.

2. Goals, Objectives, Targets, and Strategies

The overall local infrastructure goal of Dingalan is to provide infrastructure that would enable its residents to enjoy a decent quality of life as well as ecological balance. Given this, listed in the table below are the corresponding objectives, targets, and strategies.

Table 90. Goals, Objectives, Targets, and Strategies for the Infrastructure Sector

GOALS	OBJECTIVES	TARGETS	STRATEGIES
To provide infrastructure that would enable its residents to enjoy a decent quality of life as well as ecological balance	To better facilitate the movement of people from one place to another, as well as the flow of goods and services	To connect all the barangays and sitios by means of concrete roads by the year 2024	Creation of a Local Transport Route Plan for Dingalan Upgrading and rehabilitation of roads, bridges, and flood control projects
	To improve and create new support infrastructure for tourism, especially along the coastal areas	To increase revenue from tourism by 10% by the year 2024	Construction of bay walk and/or sea wall along the coastal stretch
	To have a facility which generates renewable source of energy	To supply at least 20% of local power requirement	Creation of a Local Energy Plan for Dingalan

3. Programs, Projects, and Activities

Given the three objectives identified during the GOTS workshop, the table below lists down the corresponding program, projects, actions, as well as the location and its urgency.

Table 91. Programs, Projects, Activities, Policies, Location, and Urgency for the Infrastructure Sector

GOAL: To provide infrastructure that would enable its residents to enjoy a decent quality of life as well as ecological balance				
DECISION AREA	**TECHNICAL FINDING**	**IMPLICATIONS**	**OBJECTIVE**	**POTENTIAL OPTIONS**
11 Barangays (priority barangays are Butas na Bato, Ibona, Matawe, Paltic, and Umiray)	Need to construct and rehabilitate roads and bridges	When not addressed, may result in inefficiency in transporting people and goods	Improve accessibility to and within Dingalan	- Evaluation of the current road and bridge infrastructure in Dingalan - Purchase of Road Right of Way (RROW)
	Need to construct a domestic airport			- Identify the best site for the airport - Coordination with concerned government agencies and funding agencies - Approval of National Government Agencies such as the Civil Aviation Authority of the Philippines (CAAP)
	Need to cosntruct a cable car or a similar mechanically-operated mode of transport			- Identify the best site for the cable car project, and which barangays are in need of its services - Coordination with concerned government agencies and funding agencies - Approval of National Government Agencies such as the Department of Transportation (DOTr)
11 Barangays (priority barangays are those along the coast)	Need to construct and rehabilitate tourism infrastructure	When not addressed, may result in decreased opportunities to benefit from tourism	Boost the tourism industry in Dingalan	- Evaluation of the current conditions of tourism infrastructure in Dingalan - Implementation of relevant guidelines from the Department of Tourism (DOT)
Barangays Butas na Bato, Caragsacan, Dikapanikian, Ibona, Matawe, Tanawan, and Umiray	Need to construct a solar power/ windmill/ hydropower plant	When not addresses, may lead to higher costs for electricity and potential damage to the environment	Need for sustainable energy	- Identify the best site for the sustainable energy program - Coordination with concerned government agencies and funding agencies - Implementation of relevant guidelines from the Department of Energy (DOE) and Department of Environment and Natural Resoruces (DENR)

Environmental Management Plan

Recognizing the value of the natural environment in planning for the future of Dingalan, the vision of the municipality of a healthy environment puts focus on natural systems and ecological processes as essential components in achieving sustainable development and inclusive growth.

1. Development Issues, Concerns, and Challenges

In the context of pursuing development and being the Growth Center of Southern Aurora, the Municipality of Dingalan will tend to exploit the natural environment to accommodate projected built up and population growth. Thus, there is a need to enhance environmental management interventions to preserve the livability and quality of the natural and built environments for a more balanced development.

Below are the identified issues and concerns arising in this sector.

Table 92. Environmental Management Issues and Concerns of Dingalan

Poblacion	Mountainous	Coastal
• Compost pit is not in conformity with the proper design of a sanitary landfill as prescribed by DENR • No suitable and available sites for the construction of sanitary landfill • Lack of functional sanitation management system since there are households without access to sanitary toilets	• Barangays located in landslide prone areas • Agricultural land encroaching in forestlands • Forest derogation due to presence of timber poaching, charcoal making, quarrying operation (barangays Matawe, Ibona, and Umiray)	• Presence of informal settlers in coastal barangays • Presence of illegal fishing within the municipal waters • Marine protected areas are not demarcated

a. Flooding

Like many places in the Philippines, Dingalan has vulnerabilities to flooding. Based from the flood hazard map of the municipality, it has, high and low flood susceptibility. There are four (4) barangays covering an area of 1,424.31 ha with high susceptibility to flooding (Poblacion, Aplaya, Ibona, and Umiray). On the other hand, Barangays Dikapanikian, Matawe, Ibona, and Umiray are streaked by moderate susceptibility of flooding covering an area of 602.05 hectares.

Slope and topography comes into account as to why this is a concern. Areas adjacent to the river and areas on lower ground tend to be more susceptible to flooding.

Though the issue on flooding being experienced by the municipality is only 5.07% of the total land area, this issue should be addressed because flooding could cause dire consequences, like damage to properties, destruction of crops, loss of livestock, public health hazard, like outbreaks of diseases such as dengue fever, malaria, leptospirosis, and others, and loss of human lives.

b. Waste Generation

Another issue faced by the Municipality of Dingalan is the increase in waste generation. One implication that could happen when this issues goes unresolved is the imparment of visual aesthetic quality of the

land. Waste are not pretty to look at and could place negative impact on the municipality. Another implication the need for additional space for the management of solid waste compliying with RA 9003. Environmentally the increase in waste generation could affect the quality of the Municpality's groundwater, surface water, and soil and could lead to contamination. Public health are also brought upon by waste generation.

c. Waste Disposal

Hand in hand with the issue in the increase in waste generation is the issue in improper waste disposal methods. Not all barangays in Dingalan are covered by waste collection service. Only Barangays Poblacion, Aplaya, Caragsacan, Davildavilan and Paltic are being serviced by the garbage truck with only one loading trip every other day.

d. Forestland Encroachment

Forestland encroachment and lack of protection for forests is another concern. Looking at their land cover map, 12,369.67 ha or 30.93% of the total land area of Dingalan is classified as closed forest while 18,201.81 ha or 45.51% is delineated as open forest. Activities that are detrimental to the quality of the terrestrial environment are timber poaching, charcoal making, quarrying operation, which are present in Dingalan. These are caused by the people using forest lands for sustenance. If these practices continue, there could be land degradation and biodiversity loss among others if no protection instruments are in place. There is also the possibility of low carbon sequestration.

e. Threats to the Coastal and Marine Ecosystems

Major threats to coastal and marine ecosystems are high population growth, overfishing and destructive and illegal fishing, pollution from residential and commercial developments, loss and conversion of coastal ecosystems (particularly mangroves), degradation of critical coral systems due to tourism and climate induced extreme weather events (heat waves, cyclones and typhoons).

In Dingalan, destructive and illegal fishing practices are a major problem. These practices have degraded marine life, reduced fisheries productivity and endangered the lives of fishers using them. In order to arrest the rapid degradation of the coastal and marine resources of the municipality, the LGU should enforce environmental laws most especially on the coastal community established marine protected areas (MPAs).

2. General Policies

It shall be the policy of the Municipal Government of Dingalan, Aurora to:

- Promote and encourage inclusive environmental management towards ecological conservation and preservation; and
- Adhere to the pertinent laws, rules, and ordinances on environmental concerns.

Being the new growth center of Southern Aurora, achieving its development aspirations without sacrificing the environment poses a major challenge. However, there is still the need to strengthen environmental management as the development of the environment sector is usually being compromised in order for other sectors to progress. Sustainable development reverses this misconception, upholding harmonization of various sectors to spur an inclusive, comprehensive development for the general welfare wherein the maintenance and restoration of the environment plays a key role in sustaining the collective future of the municipality.

3. Strategic Framework

The overall strategic framework for the Environmental Management Plan is shown below:

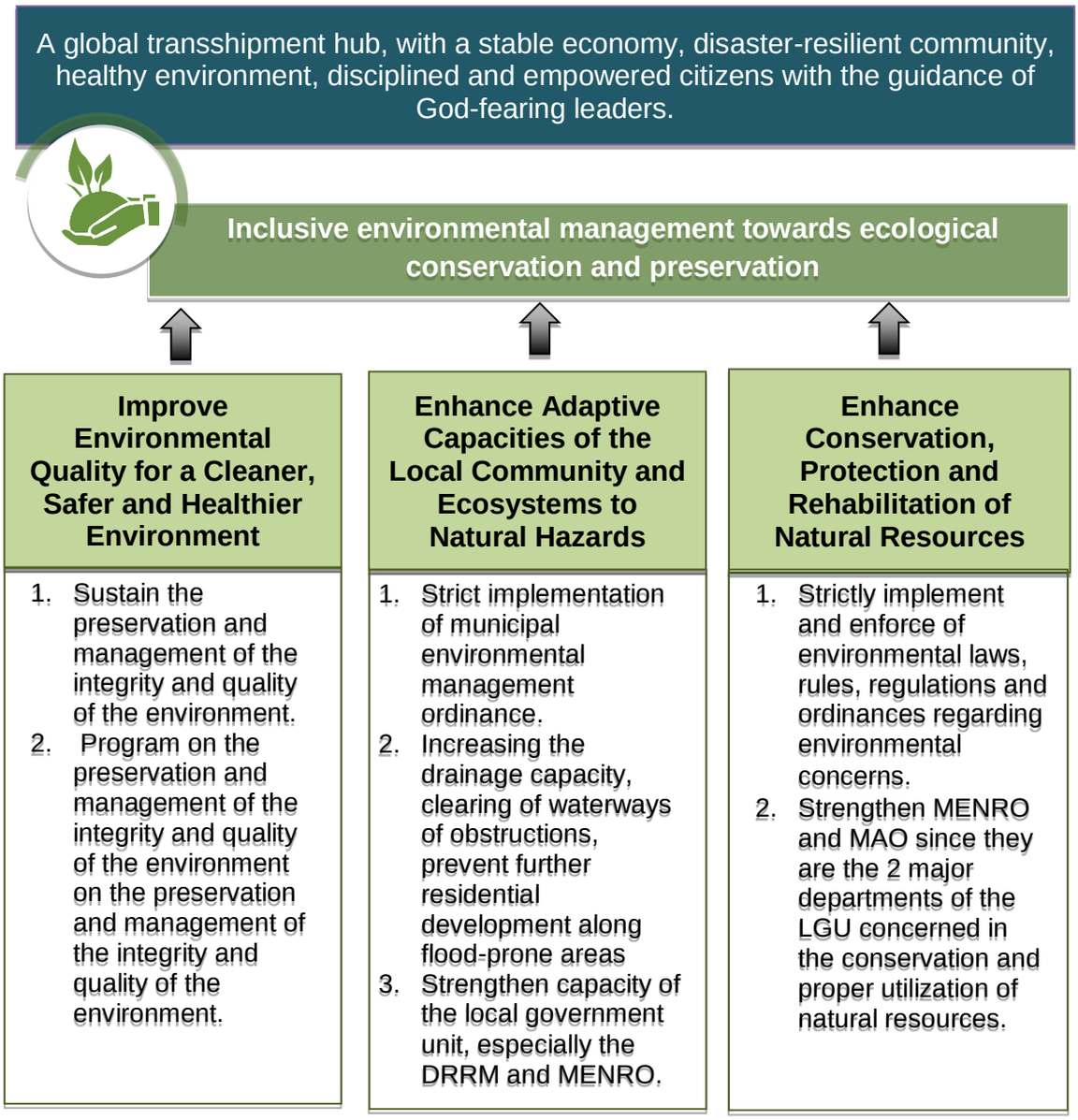


Figure 86. Strategic Development Framework to Ensure Inclusive Environmental Management

4. Development Goal

The overarching goal of the Municipality of Dingalan under the environmental management sector is to have an inclusive environmental management towards ecological conservation and preservation.

5. Objectives and Strategies

To achieve the stated goal, the following are the objectives of the environmental management sector:

Objective 1- Improve Environmental Quality for a Cleaner, Safer and Healthier Environment

The Municipality will ensure that a cleaner, safer and healthier environment is established through improvements in environmental quality. This will be achieved by formulating and effectively implementing its 10-year Ecological Solid Waste Management Plan in compliance with RA 9003, attaining Class AA freshwater quality standard based on the Guidelines for Water Quality Guidelines and General Effluent Standards (DENR DAO 2016-08) and meeting acceptable groundwater quality standard values based on Philippine National Standard for Drinking Water (DOH DAO 2007-0012).

Strategies for the attainment of this goal include intensifying and/or instigating local action plans/enabling ordinances in support to relevant regulations on clean water and solid waste management, establishment/ completion of solid waste management facilities, monitoring/review of the locality's compliance to applicable environmental regulations and enhancing capacity building, institutional strengthening and IEC campaign.

Programs and projects to improve the environmental quality of Dingalan include MRF construction, integrated waste management project, barangay solid waste management strengthening and support program, Waste-to-Win project, IEC campaign on relevant environmental issues especially on solid waste management and water quality management.

Siltation from the wastes could also occur. To prevent these from happening, it is recommended that the municipality minimizes the improper solid waste disposal methods (like burning of wastes). Instead, the municipality should increase the coverage area of the waste collection service, extending to the other barangays not currently in range of the service.

Objective 2 – Enhance Adaptive Capacities of the Local Community and Ecosystems to Natural Hazards

The Municipality will ensure that the local community and existing ecological systems have enhanced capacity to undertake adjustments, to cope with impacts or to take new opportunities in order to sustain and improve its performance in view of natural hazards. This will be achieved by reducing the risks/ hazards by addressing the sources of vulnerability and strengthening coordination on disaster risks reduction (DRR) and climate change and adopting and/or enhancing plans and technologies to mitigate the impacts of natural disasters.

Strategies for the attainment of this goal include increasing the drainage capacity, clearing of waterways of obstructions, prevent further residential development along flood-prone areas, enhancing DRR-CCA measures, strict implementation of national building, sanitation and/or water codes, conduct of a comprehensive risk/ vulnerability assessment and sustaining capacity building, institutional strengthening and IEC campaign.

Programs and projects to enhance the adaptive capacities of the local community and ecosystems in Dingalan to natural hazards include clean-up, maintenance, repair of existing canals/drainage network/ expansion of drainage system, relocation of residential community located in flood-prone areas, river clean-up, application of suitable buffer zones and landscaping scheme along river banks with indigenous and water-resistant plant types, and real-time water level monitoring.

Objective 3 - Enhance Conservation, Protection and Rehabilitation of Natural Resources

The Municipality will ensure that the forest, agricultural, watershed, coastal and marine and other natural resources of Dingalan are conserved, protected and rehabilitated. This will be achieved by managing, protecting/ developing natural forest, established plantation and economically important non-timber forest, encouraging communities to enhance protection and sustain productivity of upland areas, minimizing the use of pesticides, encouraging organic farming, preserving agricultural lands and conserving groundwater resources.

Strategies for the attainment of this goal include: the Municipality to issue and create/enhance the protection of forests through policy instruments that would preserve the remaining forest vegetation as

protection forests and instigate suitable buffer zones, strictly implement and enforce of environmental laws, rules, regulations and ordinances regarding environmental concerns, and strengthen MENRO and MAO since they are the two (2) major departments of the LGU concerned in the conservation and proper utilization of natural resources

Programs and projects to conserve, protect and/or rehabilitate the natural resources of Dingalan include community tree planting programs, multi-stakeholder participation and partnership in natural resources management and governance and sustained capacity building, institutional strengthening and IEC campaign.

For the conservation, protection and management of coastal and marine resources, the municipality should create an MPA management body that will be responsible in carrying the programs and projects of its MPAs.

6. Programs, Projects, and Activities

Table 93. Programs, Projects, Activities, Policies, Location, and Urgency for the Environmental Sector

GOAL: To have an inclusive environmental management towards ecological conservation and preservation.				
DECISION AREA	**TECHNICAL FINDING**	**IMPLICATIONS**	**OBJECTIVE**	**POTENTIAL OPTIONS**
11 Barangays	Need for an Ecological Solid Waste Management Program	When not addressed, may result in accumulation of waste, leading to increased cases of morbidity	Better management of waste disposal and waste collection	- Creation of Solid Waste Management Board - Formulate and Enforce ESWM Ordinances - Provide citizens with waste disposal capacity, waste collection services and waste reduction opportunities - Increase the efficiency and cost effectiveness of the solid waste management program of the municipality - Educate the public on recycling and maximize the number and types of materials that can be recycled - Minimize improper waste disposal and littering - Identify financing sources, including user fees for major waste generators to support Plan implementation activities - Ecological Solid Waste Management Ordinance - Appropriation Ordinance

11 Barangays	Need for a Disaster Risk Reduction and Management Program	When not addressed, may result in damage to properties, injuries, and loss of lives	Increase the adaptive capacity and reduce the vulnerability of the people	- Maintenance, repair of existing canals/drainage network/ expansion of drainage system - Disaster Emergency Drills, Exercises, and IEC Campaign - Capacity Enhancement on Disaster Preparedness and Response - Monitoring and Evaluation of Dingalan Disaster Risk Reduction and Management Program - Installation of early warning and communication system - Quick Response Fund (Relief Assistance, Cash Assistance, Medical Assistance, Rental of Transportation, Livelihood Assistance, Cash for Work, Rehabilitation, Emergency Shelter Assistance, and Assistance to other LGU) - Appropriation Ordinance
11 Barangays (priority barangays are Caragsacan, Davil-davilan, Dikapanikian, Ibona, Matawe, Paltic, and Umiray	Need for a Community-Based Forest Management Project	When not addressed, may result in poor management of resources and resource depletion	Better management of natural resources	- Community tree planting - Multi-stakeholder participation and partnership in natural resources management and governance - Institutional strengthening and IEC campaign - Appropriation Ordinance
	Need for an Integrated Coastal Resource Management Project			- Formulation of an integraged Coastal Resource Management Program - Conduct of resource assessment including identification of threats to determine the current status (baseline conditions) of covered marine key biodiversity areas and MPAs - Establishment of Marine Protected Area to include more marine key biodiversity areas under protection and conservation measures - Capacitating of people's organizations in MPA management planning, biophysical monitoring, business and financial planning, etc - Establishment and operation of biodiversity-friendly enterprise including improvement of existing ecotourism sites and development of those areas with potential - Increased Coastal Resource Management Ordinance

Institutional Development Plan

Dingalan envisions to be a government that is *Matino*, *Mahusay* and *Maytakot sa Dios*, which shall be demonstrated by having a **strong participative local governance**.

The municipal government has notable management practices in development administration such as needs-based resource allocation, consultative engagement with barangay local government units and its constituents, conduct of mechanisms for a more organized tax generation, and improved information systems for better transparency and accountability. There is, however, a need to acquire more technologies and electronic systems to maximize the productivity and efficiency of the government offices.

The main concern of the institutional sector is the improvement of structure and functions of local planning bodies, attainment of an efficient and effective fiscal management, promotion of public participation in local governance, and the assurance of transparency and accountability in government transactions, among others.

1. Key Issues and Concerns

a. Lower rank per Cities and Municipalities Competitiveness Index

In 2017, the National Competitive Council of the Philippines ranked Dingalan as the 281st most competitive municipality out of the 853 3rd to 6th class participating municipalities, while it ranked 519th out of the 1,342 participating municipalities in the country. Dingalan, however, exhibits excellence in Resiliency being the number one among all municipalities in terms of land use plan, disaster risk reduction plan, annual disaster drill, early warning system, and local risks assessments. The municipality also ranked first in availability of basic utilities under Infrastructure sub-indicator. But, the municipality requires significant improvement in economy, overall infrastructure, and government efficiency.

b. Poor revenue performance

The uncommitted cash balance to local LGU expenditures ratio is decreasing from 2013 (4.8%) to 2015 (2%). For the same period, BLGF consistently rated Dingalan with poor revenue and expenditure performances. Hence, it is also consistently considered a Type 4 in terms of Financial Performance.

Table 94. Revenue Performance of Dingalan from 2013-2015

Year	Net Operating Surplus to Total LGU Revenue Ratio	Uncommitted Cash Balance to Local LGU Expenditures Ratio	Financial Performance Type	Overall Revenue Performance	Overall Expenditure Performance
2015	34%	2%	Type 4	Poor Revenue Performance	Poor Expenditure Performance
2014	34%	4%	Type 4	Poor Revenue Performance	Poor Expenditure Performance
2013	23.20%	4.8%	Type 4	Poor Revenue Performance	Poor Expenditure Performance

Meanwhile, it is worth noting that Dingalan is debt free. However, its social services expenditure ratio has been decreasing from 23.1% in 2013 to 16% in 2014 and then further dipped to 14% in 2015. Likewise, the economic services expenditure ratio decreased from 7.10% in 2013 to 3% in 2015.

c. On Manpower Resources
d. On Municipal Revenue
e. On Municipal Expenditures
f. On Barangay Revenues
g. On Legislation
h. On Public-Private Linkages

2. Goals, Objectives, Targets, and Strategies

Overall Institutional Goal: **Strong participative local governance**

Table 95. Goals, Objectives, Targets, and Strategies for the Institutional Sector

Objectives	Targets	Strategies
To enhance participative mechanisms between government and the public	Accreditation of CSOs, NGOs, and POs embracing all sectors by 100%	Capacity building of the CSOs, NGOs, and POs
		Public Assembly
		Kapihan with sectors

3. Programs, Projects, and Activities

Table 96. Programs, Projects, Activities, Policies, Location, and Urgency for the Institutional Sector

GOAL: Strong participative local governance				
DECISION AREA	**TECHNICAL FINDING**	**IMPLICATIONS**	**OBJECTIVE**	**POTENTIAL OPTIONS**
11 Barangays	Need for more trainings, seminars, and workshops	When not addressed, may result in decreased capacity to carry out responsibilities	Enhance capacity building	- Conduct of training needs analysis and capacity assessment - Design training themes - Conduct trainings, seminars, or workshops based on approved design - Action Planning - Implementation of Action Plan - Monitoring and Supervision - Final Report, Presentation and Evaluation
	Need for public assemblies	When not addressed, may result in loss of the public trust	Increase transparency and accountability	- Conduct barangay assembly (BA) in accordance with Section 397 (b) of the RA 7160 - Deliver State of Barangay Address during BA highlighting physical and financial accomplishments of the current period, new programs and projects, and new enacted ordinances, policies or guidelines - Discuss compliance of the barangay on national laws and issuances - Report on the constitution and organization of barangay-based institutions - Discuss issues and concerns affecting the barangay such as peace and order, disaster preparedness, and solid waste management
	Need for public forum	When not addressed, may result in loss of the public trust	Increase transparency and accountability	- Development of a periodical (i.e. 6-months) forum agenda - Enter into Memorandum of Agreement with concerned stakeholders representing all sectors - Conduct of periodical Kapihan

Haramonizing and Prioritizing Options

SOCIAL SECTOR

Options	Stakeholder Acceptability	Technical Feasibility	Urgency of Implementation	Ease of Implementation	Relative of Effectiveness	Relative Cost		Mainstreaming Potential	Multi- sectoral Relevance	TOTAL	RANK	GOAL ACHIEVEMENT: Inclusive environmental management towards ecological conservation and preservation
Construction and improvement of health units	3	2	3	1	3	3		3	3	21	4	
Expansion and upgrading of hospital	3	2	3	1	3	3		3	3	21	4	
Hiring of medical professionals for the vacant positions and establishing funds thereof	3	3	3	2	3	3		3	3	23	2	
Provision of additional ambulance	3	3	2	2	3	3		3	3	22	3	
Improvement of road access to health facilities	3	1	1	1	3	3		3	3	18	6	
Purchase of quality medical equipment	3	3	3	2	2	2		3	3	21	4	
Sustained supply of medicines	3	2	2	3	2	2		3	3	20	5	
Capacity building of health personnel	3	3	3	3	3	3		3	3	24	1	
Dental Program	3	3	2	2	3	1		3	3	20	5	
Food fortification program	3	3	3	3	3	3		3	3	24	1	
- Nutrition in essential maternal and child health services	3	3	3	3	3	3		3	3	24	1	
Physical fitness and skills development program	3	2	1	1	2	1		2	2	14	9	
Regular monitoring of private and public school canteens and eateries	3	3	2	3	3	1		3	3	21	4	
IEC on nutrition	3	3	3	3	3	1		3	3	22	3	

Construction of Level II water systems to cover households without water connection	3	2	3	1	3	3		3	3	21	4	
Monitor construction of household sanitation facilities	3	3	3	3	3	3		3	3	24	1	
Provision of low-cost sanitary latrines	3	3	3	3	3	3		3	3	24	1	
Establish linkages with national agencies like HLURB, NHA, HUDCC to access funds for housing program	3	2	2	2	3	2		3	3	20	5	
Relocation and resettlement of ISF to government housing projects	3	3	3	3	3	3		3	3	24	1	
Formulation of Local Shelter Plan (LSP)	3	2	2	2	2	2		2	2	17	7	
Memorandum of understanding with Social Housing Finance Corporation (SHFC) for the CMP	3	2	2	2	2	1		2	2	16	8	
Updating of Comprehensive Land Use Plan (CLUP)	3	3	3	3	3	3		3	3	24	1	
- Acquisition of modern equipment under protective services (i.e. fire trucks, police vehicles, ambulances)	3	3	3	3	3	3		3	3	24	1	
Strengthening of Barangay Police Auxiliary Unit BPAU) under the PNP and Barangay Peace Action Teams (BPATs) and Special Police Forces: Motorcycle Cops, and TOP (Tourist Oriented Police) Cops	3	3	3	3	3	3		3	3	24	1	
Updating of LDRRMP and LCCAP	3	3	3	3	3	3		3	3	24	1	
Mandatory fire drills and earthquake drills at all public places	3	3	3	3	3	3		3	3	24	1	
Additional CCTV cameras in strategic locations	3	2	3	2	2	3		3	3	21	4	
Installation of streetlights in all barangays	3	2	3	2	2	3		3	3	21	4	
Additional purchase of surveillance and response communication equipment for the PNP and DRRMO	3	3	3	3	3	3		3	3	24	1	

Construction of evacuation centers in safe areas	3	3	3	3	3	3		3	3	24	1	
Inclusion of DRRM-CCA to school curriculum	3	3	3	3	3	1		3	3	22	3	
Ordinance establishing the guidelines for the establishment and installation of streetlights and CCTVs in public places	3	3	3	3	3	3		3	3	24	1	
Mandatory training for all LGU personnel on GAD or gender sensitivity	3	2	2	2	2	2		2	2	17	7	
Municipal Memorandum/ Ordinance on the formulation of the GAD Code	3	2	3	2	3	2		2	3	20	5	
Establishment of linkages with TESDA and the private sector for technical skills trainings	3	2	2	1	3	2		2	3	18	6	
- Implementation of sustainable livelihood program	3	3	3	3	3	3		3	3	24	1	
- Livelihood Program for OSY	3	3	3	3	3	3		3	3	24	1	

ECONOMIC SECTOR

Options	Stakeholder Acceptability	Technical Feasibility	Urgency of Implementation	Ease of Implementatio	Relative of Effectiveness	Relative Cost		Mainstreaming Potential	Multi- sectoral Relevance	TOTAL	RANK	GOAL ACHIEVEMENT: Inclusive environmental management towards ecological conservation and preservation
Seeds distribution	3	3	3	3	3	2		3	3	23	2	
Pesticide distribution	3	3	3	3	3	2		3	3	23	2	
Fertilizer distribution	3	3	3	3	3	2		3	3	23	2	
Soil fertility and soil mapping	3	2	2	2	3	3		3	3	21	4	
SB approval of Agricultural Management Plan	3	3	3	3	3	3		3	3	24	1	
Memorandum of Agreement with farmer groups	3	3	3	3	3	1		3	3	22	3	
Conduct market events	3	2	2	2	2	2		2	3	18	7	
Establishment and maintenance of nursery	3	3	3	3	3	2		3	3	23	2	
Animals distribution	3	3	2	3	2	2		3	3	21	4	
Facilities and Amenities Development	3	2	2	1	2	2		2	2	16	9	
Construction of cold storage facility	3	3	3	3	3	3		3	3	24	1	
Installation of commercial stalls	3	3	2	2	2	2		2	3	19	6	
Expansion of Fish Port	3	3	3	3	3	3		3	3	24	1	
Public-Private Partnership; - Philippine Economic Zone Authority (PEZA)	3	3	3	3	3	2		3	3	23	2	
Construction of Farm to Market Road	3	3	3	3	3	3		3	3	24	1	
Develop gravity irrigation	3	2	2	2	3	3		3	3	21	4	
Install communal pump irrigation	3	2	2	2	3	3		3	3	21	4	
Rehabilitation of Post-harvest facilities	3	3	3	3	3	3		3	3	24	1	
Production of Investment Promotion Pamphlet	3	2	2	3	2	1		3	2	18	7	
Website development	3	3	3	3	3	1		3	3	22	3	

- Organize business summit/investment summit	3	3	2	2	3	2		2	3	20	5	
Memorandum of Agreement with investors	3	3	2	1	2	2		3	3	19	6	
Livelihood and Entrepreneurship Program, including Young Entrepreneurs	3	2	2	2	2	1		2	2	16	9	
Construction of agro-processing facilities	3	2	2	2	2	2		2	2	17	8	
TOURISM												
- Identify all the municipality's local food and souvenir products and come up with new souvenir items that will be made available in pasalubong centers and regional centers.	3	3	3	3	3	3		3	3	24	1	
- Create a quality control (QC) procedure that will ensure that Dingalan's local products are export quality.	3	2	2	2	2	2		2	2	17	8	
Participate in food and travel expos outside Dingalan.	3	2	2	2	2	2		2	2	17	8	
Ensure that all the accommodation facilities and travel agencies operating in the municipality are registered in the tourism office and have secured an accreditation with the Department of Tourism.	3	3	3	3	3	1		3	3	22	3	
SB Resolution requiring accommodations and travel agencies operating in Dingalan to register in the tourism office	3	3	3	3	3	1		3	3	22	3	
Construct access roads for tourist spots that are not yet accessible to the tourists.	3	3	3	3	3	3		3	3	24	1	
Establish first aid kiosks at the entrance of every tourist attraction under adventure tourism category (hiking and trekking, scuba diving, surfing)	3	2	2	2	2	3		3	3	20	5	
Conduct trainings for tourism employees (boatmen, tour guides, hotel and restaurant workers and owners, LGU) about the basic concepts of carrying capacity, basic life support and first aid, tourism marketing and promotion, and customer service.	3	3	3	3	3	3		3	3	24	1	

Record all the tourism employees (tour guides and boatmen) and have them apply for DOT accreditation.	3	3	3	3	3	1		3	3	22	3	
Memorandum of Agreement with TESDA or other technical-vocational schools	3	3	3	3	3	1		3	3	22	3	
Regular seminars for capacity building	3	3	3	3	3	3		3	3	24	1	
Involve the stakeholders in organizing local events and festivals.	3	3	3	3	3	3		3	3	24	1	
SB Resolution on the official events and festivals of Dingalan	3	3	3	3	3	1		3	3	22	3	
Create a one-stop shop that will make it easier for prospective investors to process permits	3	3	2	2	2	2		2	2	18	7	
- Ask assistance from National Government Agencies (DOT, TIEZA, TPB)	3	3	3	3	3	3		3	3	24	1	

INFRASTRUCTURE SECTOR

Options	Stakeholder Acceptability	Technical Feasibility	Urgency of Implementation	Ease of Implementation	Relative of Effectiveness	Relative Cost		Mainstreaming Potential	Multi- sectoral Relevance	TOTAL	RANK	GOAL ACHIEVEMENT: Inclusive environmental management towards ecological conservation and preservation
Evaluation of the current road and bridge infrastructure in Dingalan	3	2	2	1	3	1		2	2	16	4	
Coordination with concerned government agencies and funding agencies	3	2	2	2	2	2		2	2	17	3	
Approval of National Government Agencies such as the Civil Aviation Authority of the Philippines (CAAP)	3	1	1	1	2	2		2	2	14	5	

- Approval of National Government Agencies such as the Department of Transportation (DOTr)	3	3	3	3	3	3		3	3	24	1	
Evaluation of the current conditions of tourism infrastructure in Dingalan	3	3	3	3	3	3		3	3	24	1	
Implementation of relevant guidelines from the Department of Tourism (DOT)	3	3	3	3	2	1		3	2	20	2	
Identify the best site for the sustainable energy program	3	3	3	3	3	3		3	3	24	1	

ENVIRONMENTAL SECTOR

Options	Stakeholder Acceptability	Technical Feasibility	Urgency of Implementation	Ease of Implementation	Relative of Effectiveness	Relative Cost		Mainstreaming Potential	Multi- sectoral Relevance	TOTAL	RANK	GOAL ACHIEVEMENT: Inclusive environmental management towards ecological conservation and preservation
Creation of Solid Waste Management Board	3	3	3	3	3	1		3	3	22	2	
Formulate and Enforce ESWM Ordinances	3	3	3	3	3	3		3	3	24	1	
Provide citizens with waste disposal capacity, waste collection services and waste reduction opportunities	3	3	3	3	3	3		3	3	24	1	
Increase the efficiency and cost effectiveness of the solid waste management program of the municipality	3	3	3	3	3	3		3	3	24	1	
Educate the public on recycling and maximize the number and types of materials that can be recycled	3	3	3	3	3	3		3	3	24	1	
Minimize improper waste disposal and littering	3	3	3	3	3	3		3	3	24	1	

Identify financing sources, including user fees for major waste generators to support Plan implementation activities	3	2	2	1	2	2		3	2	17	4	
Ecological Solid Waste Management Ordinance	3	3	3	3	3	3		3	3	24	1	
Maintenance, repair of existing canals/drainage network/ expansion of drainage system	3	2	2	1	2	3		3	2	18	3	
Disaster Emergency Drills, Exercises, and IEC Campaign	3	3	3	3	3	3		3	3	24	1	
Capacity Enhancement on Disaster Preparedness and Response	3	3	3	3	3	3		3	3	24	1	
Monitoring and Evaluation of Dingalan Disaster Risk Reduction and Management Program	3	3	3	3	3	3		3	3	24	1	
Installation of early warning and communication system	3	3	3	3	3	3		3	3	24	1	
Quick Response Fund (Relief Assistance, Cash Assistance, Medical Assistance, Rental of Transportation, Livelihood Assistance, Cash for Work, Rehabilitation, Emergency Shelter Assistance, and Assistance to other LGU)	3	3	3	3	3	3		3	3	24	1	
Community tree planting	3	3	3	3	3	3		3	3	24	1	
Multi-stakeholder participation and partnership in natural resources management and governance	3	2	2	2	2	2		2	3	18	3	
Institutional strengthening and IEC campaign	3	3	3	3	3	3		3	3	24	1	
Formulation of an integrated Coastal Resource Management Program	3	2	2	2	2	1		2	3	17		
Conduct of resource assessment including identification of threats to determine the current status (baseline conditions) of covered marine key biodiversity areas and MPAs	3	2	2	2	2	2		2	3	18	3	

Establishment of Marine Protected Area to include more marine key biodiversity areas under protection and conservation measures	3	2	2	2	2	2		2	3	18	3	
Capacitating of people's organizations in MPA management planning, biophysical monitoring, business and financial planning, etc	3	2	2	2	2	2		2	3	18	3	
Establishment and operation of biodiversity-friendly enterprise including improvement of existing ecotourism sites and development of those areas with potential	3	3	3	3	3	3		3	3	24	1	

INSTITUTIONAL SECTOR

Options	Stakeholder Acceptability	Technical Feasibility	Urgency of Implementatio	Ease of Implementatio n	Relative of Effectiveness	Relative Cost		Mainstreaming Potential	Multi- sectoral Relevance	TOTAL	RANK	GOAL ACHIEVEMENT: Inclusive environmental management towards ecological conservation and preservation
Conduct of training needs analysis and capacity assessment	3	3	3	3	3	3		3	3	24	1	
Conduct trainings, seminars, or workshops based on approved design	3	2	3	2	3	3		3	3	22	3	
Conduct barangay assembly (BA) in accordance with Section 397 (b) of the RA 7160	3	3	3	3	3	3		3	3	24	1	
Deliver State of Barangay Address during BA highlighting physical and financial accomplishments of the current period, new programs and projects, and new enacted ordinances, policies or guidelines	3	3	3	3	3	3		3	3	24	1	

Discuss compliance of the barangay on national laws and issuances	3	3	3	3	3	3		3	3	24	1	
Discuss issues and concerns affecting the barangay such as peace and order, disaster preparedness, and solid waste management	3	3	3	3	3	3		3	3	24	1	
Enter into Memorandum of Agreement with concerned stakeholders representing all sectors	3	3	3	3	3	2		3	3	23	2	
Conduct of periodical Kapihan	3	3	3	3	3	3		3	3	24	1	

SOCIAL SECTOR

PROJECTS (PPAS)	Stakeholder Acceptability	Technical Feasibility	Ease of Implementation	Urgency of Implementation	Relative of Effectiveness	Cost	Mainstreaming Potential	Multi- sectoral Relevance	OVERALL (SUM)	CONTRIBUTION GOAL
Health System Improvement Program	3	2	2	2	3	2	3	3	20	
Barangay Health Unit Development Project	3	2	1	1	2	3	2	3	17	
Provision of additional Rescue Ambulance	3	2	2	2	3	3	3	3	21	
Purchase quality medical equipment	3	3	3	1	2	1	2	2	17	
Upgrading of medical facilities and manpower requirements of health services	3	2	1	1	2	2	2	2	15	
Capacity Building of health Personnel	3	2	2	1	2	2	2	2	16	
Establishment of Diagnostic facilities in barangays	3	2	1	3	2	3	2	3	19	
Dental Program	3	2	2	1	2	2	2	2	17	

Nutrition in essential maternal and child health services	3	3	3	3	3	3	3	3	24	
IEC on nutrition	3	3	3	3	3	3	3	3	24	
Adequate Housing Program	3	1	1	2	3	3	2	3	18	
Community social housing projects and financial facilities	3	1	1	2	3	3	2	3	18	
Construction of Level II water system	3	2	1	3	2	3	3	3	20	
Construction of household sanitation facilities	3	2	2	2	2	1	2	2	16	
Integrated approach for the prevention and control of illegal and informal settlements	3	1	1	1	2	1	2	2	13	
Updating of Local Shelter Plan	3	2	2	1	2	2	2	2	16	
Installations of streetlights and CCTVs in public places	3	2	2	3	3	3	3	3	22	
Procurement of Disaster Rescue Equipment	3	3	3	3	3	3	3	3	24	
Updating of Local Disaster Risk Reduction and Management Plan	3	2	2	3	3	2	3	3	21	
Training and Capability Building	3	2	2	3	3	2	3	2	20	
Construction of Evacuation Center	3	2	2	3	3	3	3	3	22	
Formulation/ Updating of GAD Code	3	2	2	1	2	2	2	2	16	
Implementation of sustainable livelihood program	3	3	2	2	2	2	2	3	19	
Retrofitting/ Construction of typhoon resilient public-school building	3	2	1	1	2	2	2	3	16	

ECONOMIC SECTOR

PROJECTS (PPAS)	Stakeholder Acceptability	Technical Feasibility	Ease of Implementation	Urgency of Implementation	Relative of Effectiveness	Cost	Mainstreaming Potential	Multi- sectoral Relevance	OVERALL (SUM)	CONTRIBUTION GOAL
Conduct training and Massive IEC	3	3	2	2	3	2	2	3	20	
Rice Production Program	3	3	3	3	3	3	3	3	24	
High Value Commercial Crops Program	3	3	3	3	3	3	3	3	24	
Livestock and Poultry Program	3	3	3	3	3	3	3	3	24	
Organic Vegetable program	3	3	3	3	2	2	3	3	22	
Farmers Continuing Education Program	3	3	2	2	2	2	3	3	20	
Improvement of Municipal Fish Port	3	3	3	2	3	3	2	3	22	
Construction of cold storage facility	3	2	1	2	2	3	2	3	18	
Construction of Farm to Market Road	3	2	2	3	3	3	3	3	22	
Irrigation System and Facilities Improvement	3	2	1	2	2	3	2	2	17	
Investment Promotion and facilitation Program	3	2	1	2	2	2	2	2	16	
Livelihood Program for Fisherfolks	3	2	2	2	2	2	2	2	17	
Capacity Building on Agro- business	3	2	1	2	2	2	2	3	17	
Tourism enhancement Program	3	3	3	3	3	3	3	3	24	

INFRASTRUCTURE SECTOR

PROJECTS (PPAS)	Stakeholder Acceptability	Technical Feasibility	Ease of Implementation	Urgency of Implementation	Relative of Effectiveness	Cost	Mainstreaming Potential	Multi-sectoral Relevance	OVERALL (SUM)	CONTRIBUTION GOAL
Construction/ Rehabilitation of Roads and Bridges	3	3	3	3	3	3	3	3	24	
Construction of a Domestic airport in Dingalan	3	1	1	1	2	3	2	2	15	
Construction of a cable car or a similar mechanically operated mode of transport	3	1	1	1	2	3	2	2	15	
Construction and rehabilitation of tourism infrastructure	3	2	2	2	3	3	2	2	19	
Construction of a solar power plant/ wind wills/ hydropower plant	3	2	1	1	3	3	2	2	17	
Construction of Flood Control Project	3	3	3	3	3	3	3	3	24	
Construction of Sea Wall	3	3	2	2	3	3	3	3	22	

ENVIRONMENTAL SECTOR

PROJECTS (PPAS)	Stakeholder Acceptability	Technical Feasibility	Ease of Implementation	Urgency of Implementation	Relative of Effectiveness	Cost	Mainstreaming Potential	Multi- sectoral Relevance	OVERALL (SUM)	CONTRIBUTION GOAL
Integrated Solid Waste Management Project	3	3	2	2	3	2	2	3	20	
Construction of Material Recovery Facility	3	3	2	2	3	3	3	3	22	
IEC campaign on relevant environmental issues	3	2	3	2	2	1	2	2	17	

Greening Program (Coastal Clean Up and Tree Planting	3	3	3	3	3	1	3	3	22	
Formulation of an integrated Coastal resources Management Program	3	2	2	1	2	2	2	2	16	
Establishment of Marine Protected Area	3	2	2	2	2	2	2	2	17	
Construction of Sanitary Landfill	3	3	3	3	3	3	3	3	24	

INSTITUTIONAL SECTOR

PROJECTS (PPAS)	Stakeholder Acceptability	Technical Feasibility	Ease of Implementation	Urgency of Implementation	Relative of Effectiveness	Cost	Mainstreaming Potential	Multi- sectoral Relevance	OVERALL (SUM)	CONTRIBUTION GOAL
Capacity Building of the CSOs, NGOs and POs	3	3	2	3	3	2	2	2	20	
Conduct Training needs Analysis and Capacity assessment	3	3	2	2	3	2	2	2	19	
Participatory, Transparency and accountability Governance	3	2	2	2	3	2	2	2	18	
Kapihan	3	2	2	2	2	2	2	3	18	

Action Plan

SOCIAL SECTOR

PROGRAMS	PROJECT	ACTIVITIES	DESCRIPTION (Target Sector/ no. of beneficiaries, decision areas	Implementing Office	Schedule (Time Frame)	Expected Output)	Funding Source	Budget	Amount of Expenditure
Health System Improvement Program	Medical facilities improvement and Barangay Health Units Development Project	a) Provision of additional ambulance b) Construction of additional clinics and health centers c) Expansion and upgrading of hospital d) Improvement of road access to health facilities e) Purchase of quality medical equipment f) Sustained supply of medicines	11 barangays (priority for brgys. Butas na Bato, Davil davilan and Dikapanilian for the construction of barangay health units	MHO, MEO, MPDC, MDRRMO	2019-2028	-Purchased ambulance - hellth centers constructed - improved hospital - road access to health facilitries improved - medical equipment, supplies and medicine purchased	National, DOH, DBM, LGU, PSF	70,000,000.00	
	Upgrading of medical facilities and manpower requirements of health services	a) Capacity building of health personnel b) Increase employment opportunities in health institutions c) Provision of benefits to employed staff Increase income for health personnel	11 barangays, BHW, health personnel,	MHO, HRMO, MBO	2019-2028	-trained and capable health personnel - hired additional personnel - health benefits provided	LGU, DOH	10,000,000.00	

	Establishment of diagnostic facilities in rural barangays	a) Dental Program b) Food fortification program c) Nutrition in essential maternal and child health services d) Provision of various preventive, curative treatment and intervention e) Micronutrient supplementation f) Physical fitness and skills development program g) Regular monitoring of private and public school canteens and eateries h) IEC on nutrition	11 barangays, under nourished children, pregnant women,	MHO	2019-2028	-Establised diagnostic facilities - dental program conducted -essential nutrition for maternal and child provided - micronutrient supplementation implemented -physicl firness and development program conducted	DOH, NGOs, National, LGU	40,000,000.00	
Communicable and Infectious Disease Prevention and Control	Dengue Prevention Rabies control program TB control program Malarai Control and Elimination		11 barangays	MHO	2019-2028	Communicable and Infectious Disease Prevention and Control implemented	LGU, DOH,	10,000,000.00	
Adequate Housing Program	Community social housing projects and financial facilities	a) Construction of Level II water systems to cover households without water connection b) Monitor construction of	11 barangays, 4ps, household without sanitary latrine, informal settlers High risk areas	MEO, MPDC, Sanitary Inspector, MSWDO	2019-2028	-Water system constructed - household sanitation facilities construted - sanitart latrines provided	DILG, National, DSWD, DOH, NHA, PSF	100,000,000.00	

		household sanitation facilities c) Provision of low-cost sanitary latrines d) Integrated approach for the prevention and control of illegal and informal settlement e) Establish linkages with national agencies like HLURB, NHA, HUDCC to access funds for housing program f) Relocation and resettlement of ISF to government housing projects g) Formulation of Local Shelter Plan (LSP) Establishment of Community Mortgage Program				-prevent illgeal and informal settelement - likages wlth national agencies established - - Local Shelter plan Formulated			
Crime Prevention, Drrm and Public Safety	Installation of streetlights and CCTVs in public places Procurement of protective services and	a) Acquisition of modern equipment under protective services (i.e. fire trucks, police vehicles, ambulances)	11 barangays	MHO, PNP, MDRRMO, BFP, MPDC, MEO	2019-2028	-Installed streetlights and CCTV in public places - purchased modern equipment - additional police and fire personnel	National, LGU, DPWH, NDRRMC	500,000,000.00	

	security equipment Emergency Evacuation and Calamity-Related Trainings and Drills	b) Hiring of additional police and fire personnel c) Strengthening of Barangay Police Auxiliary Unit (BPAU) under the PNP and Barangay Peace Action Teams (BPATs) and Special Police Forces: Motorcycle Cops, and TOP (Tourist Oriented Police) Cops d) Updating of LDRRMP and LCCAP e) Capability building for protective personnel f) Mandatory fire drills and earthquake drills at all public places g) Additional CCTV cameras in strategic locations h) Installation of streetlights in all barangays i) Additional purchase of surveillance and response communication equipment for the PNP and DRRMO				- capacited and well trained BPATS, BPAU etc. -Updated LDRRM Plan - Fire drills, earthquake drills and other prepradeness drill conducted - installed CCTV cameras in strategic locations - communication equipment purchased - evacuation centers constructed in safe areas - DRR and CCA Subject included to Schools curriculum			

		j) Construction of evacuation centers in safe areas k) Inclusion of DRRM-CCA to school curriculum							
Social Welfare Program	Social Development and Family oriented Projects	a) Family development program b) Mandatory training for all LGU personnel on GAD or gender sensitivity c) Formulation of GAD code	BLGU, LGU employees	MSWDO, GAD focal person	2019-2028	-family development program conducted - GAD training conducted to LGU personnel -GAD code formulated	LGU	500,000.00	
Employment Facilitation and Manpower Development Program	Introduction of capacity-building and livelihood development projects to households	a) Establishment of linkages with TESDA and the private sector for technical skills trainings b) Business enabling program c) Cooperative development program d) Implementation of sustainable livelihood program e) Livelihood Program for OSY	OSY, Sectoral group (Business secto etc.)	PESO, BPLO, MAO,	2019-2028	-linkages with TESDA and private sector established -cooperative development program conducted - sutaniable livelihood program implemented -livelihood program for OSY implemented	National, LGU	1,000,000.00	
Capability enhancement	Construction of manpower			MEO, MPDC	2019-2028	-mapower development center constructed	LGU, National	55,000,000.00	

of individual with different	development center								
Provision of facilities thru construction of structure that will accommodate numbers of Clienteles and Beneficiaries esp in the Remotest Part of the Municipality	Construction of Municipal Extension		Barangay Ibona	MEO, MPDC	2019-2028	-municipal extension constructed	LGU, National	20,000,000.00	
	Construction of fence for government buildings and establishment			MEO	2019-2028	-fence constructed in government building and establishment	LGU, national	20,000,000.00	
	Construction of convention center			MEO, MODC	2019-2028	-convention center constructed	LGU, National, PSF	500,000,000.00	
Provision of second home to elderlies	Construction of home for the aged facility			MEO, MSWDO,	2019-2028	-home for the aged facility constructed	LGU, DSWD	5,000,000.00	
Climate adaptive Housing program for informal settlers and victims of	Purchase and development of land for the relocation of informal settlers and relocations of victims of calamities			MEO, MSWDO, MPDC, MASSO	2019-2028	-land for relocations of informal settlers and victims of disaster purchased	LGU, DSWD, PSF, National	22,000,000.00	

natural calamities									

ECONOMIC SECTOR:

Objective 1: To increase and have a higher yield per hectare for palay and corn production
Objective 2: To increase supply of meat products from local source

PROGRAMS	PROJECT	ACTIVITIES	DESCRIPTION (Target Sector/ no. of beneficiaries, decision areas	Implementing Office	Schedule (Time Frame)	Expected Output)	Funding Source	Budget	Amount of Expenditure
Rice Production Program	Production Support Services	a. Seeds distribution b. Fertilizer distribution c. Soil fertility and soil mapping	11 Barangays, Farmers	MAO,	2019-2028	-Seeds, pesticide and fertilizer distriuted to farmers association	National, LGU, DA,	1,000,000.00	
	Market Development Services	a.Conduct Market events	Market associations	MAO, Market Inspector	2019-2028	-market events conducted	MAO,	500,000.00	
	Education and Training Services	b. Conduct of trainings and massive IEC	11 barangays	MAO	2019-2028		LGU	500,000.00	
High Value Commercial Crops Program	Production Support Services	a.) Seeds distribution b.) Planting materials distribution c.) Establishment and maintenance of nursery	Farmer groups	MAO	2019-2028	-seedsand planting materials distributed - established and maintained nursery	National, LGU, DA, DENR	5,000,000.00	

		d.) Establisment and Maintenance of greenhouses				-greenhouses established and maintaned			
	Market Development Services	a.) Conduct of local and international market-related events	Market associations	MAO	2019-2028	-International and local market activities conducted	LGU	500,000.00	
	Education and Training Services	Conduct of trainings and massive IEC				-trainings and IEC conducted		500,000.00	
Livestock and Poultry Program	Production Support Services	a.) Animals distribution b.) Vaccines and drugs distribution c.) Laboratory services rendering d.) Semen straw distribution e.) Production facilities maintenance	Farmer groups Brgy, Umiray, Ibona and Matawe	MAO	2019-2028	Animals, vaccines and drugs distributed to farmer groups -semen straw distributed - production facilities maintained	National, LGU, DA, DAR	10,000,000.00	
	Education and Training Services	a.) Conduct of trainings and massive IEC	Farmer groups Brgy, Umiray, Ibona and Matawe	MAO	2019-2028	Trainings and IEC condcuted	LGU	100,000.00	
	Research and Development	Conduct of production-related R & D activities	Brgy, Umiray, Ibona and Matawe	MAO	2019-2028		LGU	100,000.00	
Organic Vegetable Program	Production Support Services	a.)Seeds distribution b.) Biological control agents distribution	Farmer groups Brgy, Umiray, Ibona and Matawe	MAO	2019-2028	-seeds and biological control agents distributed	National, LGU, DA, DENR	500,000.00	

	Market Development Services	c.) Conduct of local and international market-related events	Farmer groups	MAO	2019-2028	-International and local market activities conducted	LGU, DA	500,000.00	
	Education and Training Services	Conduct of training and IEC	Brgy, Umiray, Ibona and Matawe	MAO	2019-2028	Trainings and IEC condcuted	LGU, DA	500,000.00	
Farmers' Continuing Education Program	Provide training to farmers on modern farming techniques and entrepreneurship	a.) Hiring of Trainor's b.) Preparation of training modules, equipment and venue c.) Conduct of regular trainings	Farmer groups Brgy, Umiray, Ibona and Matawe	MAO	2019-2028	-trainors hired for continuing education program for farmers -training module, equipment and venue prepared -regular trainings conducted	LGU, DA	1,000,000.00	
Intensified Diversified Organic Farming System	Farmers Field School	Conduct farmers field School Lakbay Aral Development/ Establsiemnt of Leraning Site/ Agri Tourism Site	Farmers Group	MAO	2019-2028		DA, PGA, ATI LGU DOT	3,000,000.00	

ECONOMIC SECTOR:

Objective 3: To intensify marine fishing

PROGRAMS	PROJECT	ACTIVITIES	DESCRIPTION (Target Sector/ no. of beneficiaries, decision areas	Implementing Office	Schedule (Time Frame)	Expected Output)	Funding Source	Budget	Amount of Expenditure

Dingalan Port Improvement Program	Improvement of Municipal Fish Port	a.) Site Development Plan Formulation b.) Facilities and Amenities Development c.) Construction of cold storage facility d.) Fencing of the market area e.) Installation of commercial stalls f.) Expansion of Fish Port g.) Price regulation	Fisherfolks, market associations, Barangay Aplaya and Paltic	MAO, MEO, Feeder Port	2019-2028	-dingalan port improved -site development plan formulated - cold storage facility constructed -commercials stall installed - fish port expanded	DA, BFAR, National, LGU	40,000,000.00	
Inland Fisheries	Improvement of Inland fisheries	Intensification of Inland Fish Production	Inland fishpond owner	MAO, BFAR, OPAG	2019-2028	-inland fishiries improved	MAO, BFAR, OPAG	1,200,000.00	

ECONOMIC SECTOR:

Objective 4: To provide agriculture infrastructure support

PROGRAMS	PROJECT	ACTIVITIES	DESCRIPTION (Target Sector/ no. of beneficiaries, decision areas	Implementing Office	Schedule (Time Frame)	Expected Output)	Funding Source	Budget	Amount of Expenditure

Agricultural Support Facilities Enhancement Program	Farm-to-Market Roads	a.)Detailed Engineering Design and Preparation of Program of Work b.)Mobilization and Site Preparation c.) Construction of FMR	Barangay Umiray, Ibona and Matawe Farmer groups, business sector	MEO, MAO, MENRO, MPDC	2019-2028	-farm to market road constrcuted	National, LGU	50,000,000.00	
Irrigation System and Facilities Improvement	Upgrading of irrigation and drainage networks around agricultural areas	a.) Develop gravity irrigation b.) Install communal pump irrigation c.) Increase water yield of aquifer d.) Secure Budgetary Allocation and requirements	Barangay Umiray, Ibona Matawe Farmer groups	MAO, MEO	2019-2028	-irrigation system and facilities improved -irrigatid and drainage networks upgraded -gravity irrigation developed -communal pump irrigation installed	DA, National, LGU	20,000,000.00	
Post-Harvest Facilities Modernization	Assessment of existing post-harvest facilities	Rehabilitation of Post-harvest facilities	Farmer groups	MAO, MEO	2019-2028	-post harvest facilities assessed -post harvest facilities rehabilatated	DA, LGU	500,000.00	

ECONOMIC SECTOR:

Objective 5: To increase diversified private business establishments
Objective 6: Reduce unemployment rate

PROGRAMS	PROJECT	ACTIVITIES	DESCRIPTION (Target Sector/ no. of beneficiaries, decision areas	Implementing Office	Schedule (Time Frame)	Expected Output)	Funding Source	Budget	Amount of Expenditure
Business Process Improvement Program	Competitive BOSS Updating of Tax Incentives Revenue Code review and update	a.)Establish objectives and timeline within department concerns to BOSS b.)Review and Update of the Municipal Revenue Code c.)Review of the Revenue and Tax Incentive Codes	11 barangays, Business Sector	BPLO, MTO, MO	2019-2028	-tax incentives updated -revenue code reviewed and updated	LGU, National	500,000.00	
Investment Promotion and Facilitation Program	Establishment of Investment Promotion Office	Creation and staffing of Local Investment Promotion Office	11 barangays	BPLO, MO	2019-2028	-local investment promotion Office created	LGU	2,000,000.00	
	Development of Basic Investment Package Development of Investment Promotion Website	a.)Production of Investment b.)Promotion Pamphlet c.)Website development	11 barangays	MPDC, BPLO,	2019-2028	-developed pamphlet- - dingalan website developed and created	LGU, DICT	200,000.00	
	Investment Summit	a.) Build network with key partners in business-related sectors b.) Company visits to determine needs of target companies	11 barangays Business sector	BPLO	2019-2028	-investment summit conducted /organized annualy -	LGU	500,000.00	

		c.) Preparation of sector-specific information for investment areas to be promoted c.) Development of project briefs for specific investment projects d.) Organize business summit/investment summit							

ECONOMIC SECTOR:

Objective 7: Decrease poverty incidence

PROGRAMS	PROJECT	ACTIVITIES	DESCRIPTION (Target Sector/ no. of beneficiaries, decision areas	Implementing Office	Schedule (Time Frame)	Expected Output)	Funding Source	Budget	Amount of Expenditure
Microfinance Development	Development of package offerings	a.)Regular consultation b.) Facilitate organization of businesses and community-based organizations	11 barangays Business sector	BPLO, MAO	2019-2028		LGU,	100,000.00	
Livelihood and Entrepreneurship Program	Livelihood Program for Fisherfolks	a.) Inventory of Skills and Resources b.) Skills Matching c.) Capitalization and Financing Development	Fisherfolks, business sector	MAO,	2019-2028		National. LGU	500,000.00	

	Capacity Building on Agrobusiness	a.)Inventory of Skills and Resources b.)Capitalization and Financing Development		MAO	2019-2028		National. LGU	500,000.00	
	Business Development for the Fishing Industry	a.) Demand and Supply Study b.) Business Model Building and Selection c.) Capitalization and Financing Development	Fisherfolks, business sector	MAO, BPLO	2019-2028		National. LGU	500,000.00	
	Strengthening and Promotion of local entrepreneurship	Livelihood and Entrepreneurship Program, including Young Entrepreneurs	fisherfolks	MAO, DSWD, BPLO	2019-2028	-local enterpreneurship strengthen	DSWDO, LGU, National, DA	500,000.00	
Agro-Processing Development	Construction of facilities for processing, marketing and distribution of basic food stuffs and associated service and input activities	Construction of agro-processing facilities	Fisherfolks, farmer groups	MEO, MAO	2019-2028	-agro- processing facilities constructed -	DA, National, LGU	10,000,000.00	

ECONOMIC SECTOR:

Objective 1: To introduce new tourism activities to offer the target market
Objective 2: To promote Dingalan as a nature-based tourism destination

PROGRAMS	PROJECT	ACTIVITIES	DESCRIPTION (Target Sector/ no. of beneficiaries, decision areas	Implementing Office	Schedule (Time Frame)	Expected Output)	Funding Source	Budget	Amount of Expenditure

Tourism Enhancement Program	Product development	a.) Identify all the municipality's local food and souvenir products and come up with new souvenir items that will be made available in pasalubong centers and regional centers. b.)Create a quality control (QC) procedure that will ensure that Dingalan's local products are export quality. c.) Participate in food and travel expos outside Dingalan.	Business sector, tourguide, bangkero	Tourism Office, MOA, BPLO	2019-2028	-toursim program enhanced -local food and souvenir products identified -Quality control procedure created -particiated in food and travel expos outside dingalan	LGU, National, DOT	500,000.00	
	Hotel, resort, and travel agency accreditation	a.)Ensure that all the accommodation facilities and travel agencies operating in the municipality are registered in the tourism office and have secured an accreditation with the Department of Tourism.	Resort associations	Tourism Office	2019-2028	-accomodation facilities and travel agencies registered and accredited	LGU, National, DOT	500,000.00	
	Infrastructure support development	a.) Construct access roads for tourist spots that are not yet	Barangays with tourist spot	MEO, MPDC, Tourism Office	2019-2028	-access road for tourist spots constructed -studies for additional sources of power to	LGU, National, DOT	100,000,000.00	

		accessible to the tourists. b.) Prepare studies on possible additional sources of power that will be able to support the growing tourism demand in the municipality.				support growing tourism prepared			
	Safety and security initiative	a.) Establish first aid kiosks at the entrance of every tourist attraction under adventure tourism category (hiking and trekking, scuba diving, surfing) b.) Ensure that tourists who will go trekking will register in the tourism office so they will be properly assisted by an accredited tour guide.	Tour guide, Resort association, boatmen	Tourism Office, PNP, MDRRMO	2019-2028	-first aid kiosks established -registered and properly assisted all tourist	LGU, National, DOT	600,000.00	
Capacity Development	Knowledge management system	a.) Maintain an up-to-date inventory of all tourism establishments and amenities, and support facilities. b.)Automate all the available	Barangays with tourism spot (Umiray, Ibona, Matawe, Butas na bato, Paltic and Tanawan)	Tourism Office	2019-2028	-inventory of all tourism establishment and amenities and support facilities updated -	LGU, National, DOT	100,000.00	

		tourism data such as tourism assets, tourist arrivals, tourism maps, revenue generated, etc., through a centralized system. c.) Identify the carrying capacity of each tourism site in terms of physical, economic, social, and biophysical parameters.							
	Human Capital Development	a.) Conduct trainings for tourism employees (boatmen, tour guides, hotel and restaurant workers and owners, LGU) about the basic concepts of carrying capacity, basic life support and first aid, tourism marketing and promotion, and customer service. b.) Record all the tourism employees (tour guides and boatmen) and	Tour guide, boatmen, resort associations	Tourism Office, MDRRMO	2019-2028	-trainings for tourism employees conducted - tourism employees accredited by DOT - courses on tourism and hotel restaurant management promoted	LGU, National, DOT	3,000,000.00	

		have them apply for DOT accreditation. c.) Promote courses on tourism and hotel and restaurant management.							
Marketing and Promotion Program	Tourism branding development	a.)Conduct a public consultation to determine what will be Dingalan's official tourism slogan. b.)Identify what will be Dingalan's primary target market and take it into consideration when making marketing materials. c.)Hire a tourism marketing officer who will be in-charge of updating Dingalan's existing tourism website and social media pages, and improving existing marketing materials. d.)Create tourism packages for the		Tourism Office, MAO	2019-2028	-public consultation to determine Dingalan official tourism slogan conducted -Dingalan primary target identified - tourism marketing officer hired - tourism package created	LGU, National, DOT	2,000,000.00	

		following durations: a. Day tour b. 2D1N c. 3D2N							
	Events and Festivals promotion	a.)Involve the stakeholders in organizing local events and festivals. b.)Identify what will be the municipality's banner event or festival that will be heavily promoted to tourists. c.) Boost the marketing scheme of each event and festival by posting on social media and inviting bloggers and influencers.		Tourism Office, MAO	2019-2028	-stakeholder involved in local events and festivals -municipal banner in event or festival identified -	LGU, National, DOT	500,000.00	
Fund-Sourcing Initiative	Public-private partnership	a.) Identify possible sites for private investments. b.)Invite prospective investors that will be willing to engage under a joint venture with the local government.	Business sector	MO	2019-2028	-possible sites for privte investments identified -prospective investors that willing to engage invited to a joint venture with local government	LGU, National, DOT	100,000.00	

	Tourism-related NGOs	a.) Create partnerships with sustainable tourism NGOs that can assist the municipality in marketing and financial aspects.		Tourism Office	2019-2028	-patnerships with sustainable tourism created	LGU, National, DOT	100,000.00	
	National Government	Ask assistance from National Government Agencies (DOT, TIEZA, TPB)		MPDC, Tourism Office	2019-2028	-assitance from National Government Agencies requested	LGU, National, DOT		
Tourism Enhancement Program	Product development	a.)Identify all the municipality's local food and souvenir products and come up with new souvenir items that will be made available in pasalubong centers and regional centers. b.)Create a quality control (QC) procedure that will ensure that Dingalan's local products are export quality. c.)Participate in food and travel expos outside Dingalan.	11 barangays	Tourism Office, MAO	2019-2028	-tourism program enhanced -local foods and souvenir products identified -	LGU, National, DOT	500,000.00	

INFRASTRUCTURE SECTOR

PROGRAMS	PROJECT	ACTIVITIES	DESCRIPTION (Target Sector/ no. of beneficiaries, decision areas	Implementing Office	Schedule (Time Frame)	Expected Output)	Funding Source	Budget	Amount of Expenditure
Link Improvement Program	Road and bridge construction and rehabilitation	Evaluation of the current road and bridge infrastructure in Dingalan	11 barangays	MEO, MPDC	2019-2028	-road and and bridges constructed and rehabilitated -road and bridge evaluated	National, LGU, DOTR, DPWH	200,000,000.00	
	Construction of a domestic airport in Dingalan	identify the best site for the airport Coordination with concerned government agencies and funding agencies	Barangays Caragsacan	MPDC, MEO	2019-2028	-best site for the airport identified -domestic aiport constructed	National, LGU	500,000,000,00	
	Construction of a cable car or a similar mechanically-operated mode of transport	Identify the best site for the cable car project, and which barangays are in need of its services Coordination with concerned government agencies and funding agencies		MPDC, MEO, Tourism Office	2019-2028	-best site for cable identified -cable car or similar mechanically operated mode of transport constructed	National, LGU, DOT	300,000,000.00	
Tourism Infrastructure Program	Construction and rehabilitation of tourism infrastructure	Evaluation of the current conditions of tourism infrastructure in Dingalan	11 barangays	Tourism Office, MEO	2019-2028	-tourism infrastructure constructed and rehabilitated	DOT, National, LGU	10,000,000.00	
Flood control	Construction of Sea Wall		7 coastal Barangays	MEO, MPDC	2019-2028	-sea wall constructed	DPWH, National, LGU,	250,000,000.00	

	Construction of Line Canal		Flood prones areas	MEO, MPDC	2019-2028	-line canal constructed	DPWH, National, LGU	100,000,000.00	
	Construction of Flood Control		Flood prone areas	MEO MPDC, MDRRMO	2019-2028	-flood control constructed	DPWH, National, PSF, LGU	500,000,000.00	
	Construction of bridge		Barangay umiray and paltic	MEO, MPDC	2019-2028	-bridges constructed	National, DPWH, PSF, LGU	70,000,000.00	
	Construction of box culvert		Barangay umiray, ibona, matawe, butas na bato, caragsacan and paltic	MEO, MPDC	2019-2028	-box culvert constructed	National, DPWH, PSF, LGU	100,000,000.00	
	Construction of hanging bridge with flood control		Barangay umiray and paltic	MEO, MPDC	2019-2028	-hanging bridge with flood control constructed		12,000,000.00	
	Construction of Local Roads		11 barangays	MEO, MPDC	2019-2028	-local road constructed	LGU, National, PSF	110,000,000.00	
Sustainable Energy Program	Construction of a solar power plant/wind mills/ hydropower plant	Identify the best site for the sustainable energy program Coordination with concerned government agencies and funding agencies	11 barangays	MPDC, MEO	2019-2028	-best site for sustainable energy program identified -solar power plant/wind mills/ hydropower plant constructed	DOE, National, LGU	200,000,000.00	
Septic and sewerage system			Commercial zone and populated areas	MEO	2019-2028	-septic sewerage system formulated/developed	LGU, national	100,000.00	
Water treatment facilities			All Barangays	MEO	2019-2028	-water treatment facilities constructed	LGU	100,000.00	
Water suffiency	Construction of potable water system		11 barangays	MEO, MPDC	2019-2028	-Water system constrcuted	-LGU, national, DILG, PSF	50,000,000.00	

	Expansion of potable water supply		11 barangays	MEO, MPDC	2019-2028		- LGU, national, DILG, PSF	20,000,000.00	
Climate- SMART industries and services and establishment of local economic enterprise enough and structurally resilient to generate local revenue for the local government	Construction of local economic enterprise		11 barangays	MEO, MAO, MODC	2019-2028	-local economic enterprise constructed	LGU, National	40,000.00	
	Construction of storage facility		11 barangays	MEO, MAO, MPDC	2019-2028	-storage facility constructed	LGU, national	30,000,000.00	
	Construction of Pasalubong center		Barangay tanawan, Poblacion, Paltic, and Ibona	MEO, MAO, MPDC	2019-2028	-pasalubong center constructed	LGU, National	40,000,000.00	
	Construction of food processing center			MEO, MAO,	2019-2028	-food processing center constructed	LGU, National	44,000,000.00	
	Construction of Bagsakan center			MEO, MAO	2019-2028	-bagsakan center constructed	LGU, National	28,000,000.00	
IEC to enhance the awareness of local regarding the historical resiliency and capacity to adapt and mitigate in different hazards	Rehabilitation of historical sites		11 barangays	MEO, MPDC, Tourism Office, NCIP	2019-20228	-historical site rehabilitated	LGU, National, DOT	55,000,000.00	
	Installation of street lighting system		11 barangays	MEO, MPDC,	2019-2028	-street lighting installed	LGU, national, PSF	55,000,000.00	

Disaster Resilient Evacuation Centers and temporary shelters provided for identified evacuees during Calmities brought by Natural- disaster	Construction of Evacuation center		11 baramgays and schools	MEO, MPDC	2019-2028	-evacuation centers constructed	LGU, NAtiona, PSF	250,000,000.00	
	Purchase of Engineering Equipment			MEO	2019-2028	-heavy equipment purchased	LGU, National, PSF	110,000,000.00	

ENVIRONMENTAL SECTOR

PROGRAMS	PROJECT	ACTIVITIES	DESCRIPTION (Target Sector/ no. of beneficiaries, decision areas	Implementing Office	Schedule (Time Frame)	Expected Output)	Funding Source	Budget	Amount of Expenditure
Ecological Solid Waste Management Program	Integrated Solid Waste Management Project Waste-to-Win project MRF construction IEC campaign on relevant environmental issues especially on solid waste management and water	Creation of Solid Waste Management Board	11 barangays	MENRO, MAO	2019-2028	-ecological solid waste management program implemented -waste to win project implemented -IEC campaign relevant to environmental issues conducted -earth day and environmental week conducted -solid waste management board created	National, LGU, DENR, PSF, DA	100,000,000.00	

	quality management Earth Day and Environment Week Program								
		Formulate and Enforce ESWM Ordinances	11 barangays	MENRO	2019-2028	-ESWM ordinance formulated and enforced	LGU	200,000.00	
		Provide citizens with waste disposal capacity, waste collection services and waste reduction opportunities;		MENRO	2019-2028	-citizens with waste disposal capacity, waste collection services and wastes reduction provided	LGU	50,000.00	
		Increase the efficiency and cost effectiveness of the solid waste management program of the municipality;	11 barangays	MENRO	2019-2028	- efficiency and cost effectiveness of the solid waste management program increased	LGU	50,000.00	
		Educate the public on recycling and maximize the number and types of materials that can be recycled;	11 barangays	MENRO	2019-2028	-	LGU	50,00.00	
		Minimize improper waste disposal and littering;	11 barangays	MENRO	2019-2028	-improper waste disposal and literring minimized	LGU		
		Identify financing sources, including user fees for major waste generators to support Plan implementation activities;	11 barangays		2019-2028	-financing sources identified	National. LGU		

		Procurement of garbage truck (dump truck)	11 barangays	MENRO, MAO	2019-2028	-garbage truck procured	LGU, national, PSF	30,000,000.00	
Disaster Risk Reduction and Management Program	Health Emergency Disaster Preparedness, Response and Recovery Program Infrastructure Support Project IEC Campaign	a.)Clean-up drive b.)Maintenance, repair of existing canals/drainage network/ expansion of drainage system c.)Disaster Emergency Drills, Exercises, and IEC Campaign d.)Capacity Enhancement on Disaster Preparedness and Response e.)Monitoring and Evaluation of Dingalan Disaster Risk Reduction and Management Program f.)Installation of early warning and communication system g.)Quick Response Fund (Relief Assistance, Cash Assistance, Medical	11 barangays	MENRO, MDRRMO, MHO, MEO	2019-2028	-disaster risk reduction and management program implemented -iec campaign conducted -clean up drive conducted -existing canals/ drainages maintained -disaster emergency drills and exercise conducted -disasster risk reduction and management program monitored and evaluated -early warning and communication system installed -	DENR, National, LGU, DSWD, DOTr	50,000,000.00	

		Assistance, Rental of h.)Transportation, Livelihood Assistance, Cash for Work, Rehabilitation, Emergency Shelter Assistance, and Assistance to other LGU.)							
Natural Resource Management (NRM) Program	Community-Based Forest Management Project	Community tree planting	11 barangays	MENRO, MDRRMO	2019-2028	-natural resources management program implemented -Community based forest management project implemented -community tree planting conducted	DENR, DA, LGU	1,000,000.00	
		Multi-stakeholder participation and partnership in natural resources management and governance	11 barangays	MENRO	2019-2028		LGU		
		Institutional strengthening and IEC campaign.	11 barangays	MENRO	2019-2028	-IEC campaign strengthened	LGU	100,000.00	
	Integrated Coastal Resource Management (ICRM) Project	Formulation of an integraged Coastal Resource Management Program	7 coastal barangays (Umiray, ibona, Matawe, Butas na Bato, Aplaya, Paltic and Dikapanikian	MENRO	2019-2028	-integrated coastal resources management project implemented -Integreted coastal resources management plan formulated	BFAR, DA, DENR, National, LGU	200,000.00	
		Conduct of resource		MENRO	2019-2028	-resource assessment	BFAR, DA, DENR,	100,000.00	

		assessment including identification of threats to determine the current status (baseline conditions) of covered marine key biodiversity areas and MPAs				including identification of threats to determine the current status conducted	National, LGU		
		Establishment of Marine Protected Area to include more marine key biodiversity areas under protection and conservation measures		MENRO	2019-2028	-marine protected area established	BFAR, DA, DENR, National, LGU	200,000.00	
		Capacitating of people's organizations in MPA management planning, biophysical monitoring, business and financial planning, etc.;		MENRO	2019-2028	-peoples organization trained and capacitated in management planning, biophysical monitoring, business and financial planning	BFAR, DA, DENR, National, LGU	200,000.00	
		Establishment and operation of biodiversity-friendly enterprise including improvement of existing ecotourism sites and development of those areas with potential		MENRO	2019-2028	-operation of biodiversity- friendly enterprise established	BFAR, DA, DENR, National, LGU, DOT	200,000.00	

INSTITUTIONAL SECTOR

PROGRAMS	PROJECT	ACTIVITIES	DESCRIPTION (Target Sector/ no. of beneficiaries, decision areas	Implementing Office	Schedule (Time Frame)	Expected Output)	Funding Source	Budget	Amount of Expenditure
Capacity Building of the CSOs, NGOs, And POs	Trainings, seminars and workshops	a.) Conduct of training needs analysis and capacity assessment	NGO, POs, CSOs	HRMO, MPDC	2019-2028	-CSOs, NGOs and POs trained and capacitated -trainings and seminar conducted -training need analysis and capacity assessment conducted	LGU	1,000,000.00	
Participatory, Transparency, and Accountability Governance	Public Assembly	a.) Conduct barangay assembly (BA) in accordance with Section 397 (b) of the RA 7160	11 barangays	DILG, MO	2019-2028	-public /barangay assembly conducted -	LGU	1,000,000.00	
		b.) Deliver State of Barangay Address during BA highlighting physical and financial accomplishments of the current period, new programs and projects, and new enacted ordinances, policies or guidelines	11 barangays	DILG, MO	2019-2028	-SOBA conducted to all barangays 2x a year	LGU	1,000,000.00	
		c.)Discuss compliance of the barangay on national laws and issuances	11 barangays	DILG, MO	2019-2028	-national laws and ordinance	LGU		

						discussed to barangay			
		d.)Report on the constitution and organization of barangay-based institutions	11 barangays	DILG, MPDC	2019-2028		LGU		
		e.) Discuss issues and concerns affecting the barangay such as peace and order, disaster preparedness, and solid waste management		MDRRMO, PNP, MO, MENRO	2019-2028		LGU	1,000,000.00	
Kapihan	Public Forum	a.) Development of a periodical (i.e. 6-months) forum agenda	11 barangays	MO	2019-2028	-periodical forum agenda developed		1,000,000.00	
		b.) Enter into Memorandum of Agreement with concerned stakeholders representing all sectors	11 barangays	MO	2019-2028	-memorandumof agreement signed with concerned stakeholders		1,000,000.00	
		c.)Conduct of periodical Kapihan	11 barangays		2019-2028	-kapihan conducted		10,000,000.00	

PROJECT BRIEF

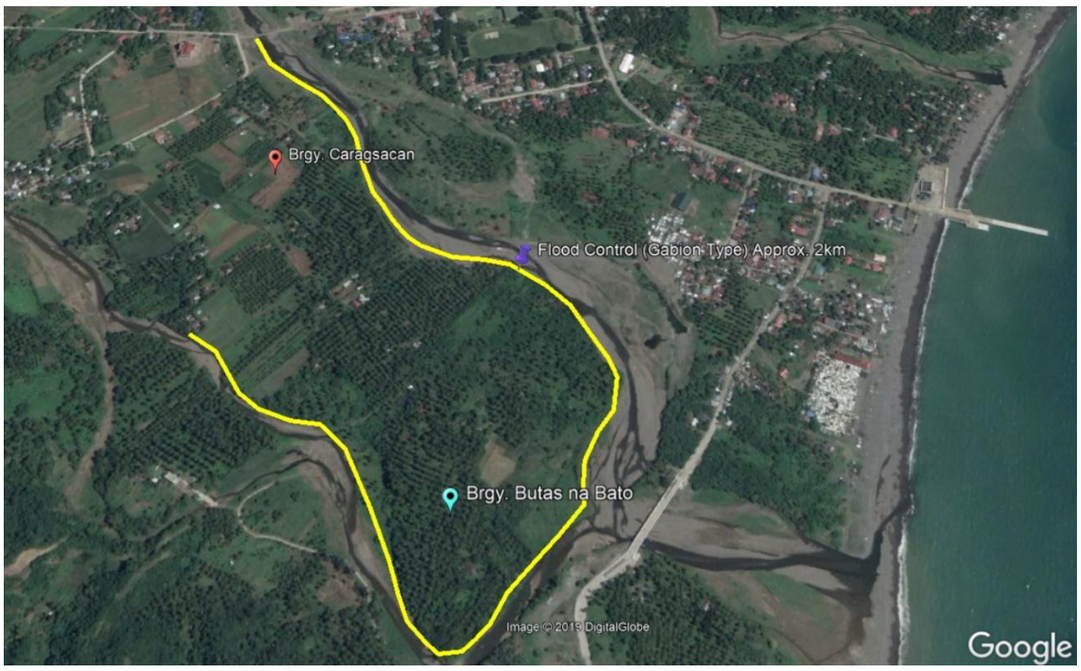
Project Title	**Construction of Flood Control Facility**
Target Sector & No. of Beneficiaries	All residents and their properties living and located near the rivers of Langawan
Decision Areas	Brgys. Caragsacan and Butas na Bato
Timeframe of Implementation	2020-2022
Indicative Cost	Php 40, 000, 000.00
Potential Partners	All Barangay LGUs, responders, LGU Aurora

Rationale:

The Municipality of Dingalan has been experiencing different types of hazards such as typhoon, storm surges, landslides and floods due to its geographical location and terrain. Last 2004, 135 casualties were recorded due to flashfloods brought by consecutive and destructive Typhoons Violeta, Winnie and Yoyong. Dingalan was hit so hard that it was carried so much burden in the life of every individual including their properties and their source of living. It is very important that these issues are addressed immediately for mitigation must be felt and seen by our constituents especially when life is at stake hence the need for Construction of Flood Control Facilities.

Location:

The Flood Control Facility (Gabion Type) will be located along the Langawan River that will stretch along Brgy. Caragsacan and Butas na Bato.



Objectives:

1. To provide assistance during pre-disaster activities such desilting, clearing of roads, transportation for the prepositioning of goods, among others.

2. To provide assistance during disaster such as transportation for pre-emptive evacuation, clearing of debris especially along roads, delivery of foods and non-foods necessities on hard to reach areas, among others.

3. To provide engineering assistance to disaster-related projects by the local government like flood control facilities, roads, bridges, evacuation centers, etc.

Project Description:

1. See attached Program of Works and Detailed Engineering

Expected Benefits/Impacts:

1. Improved delivery of transportation-related services especially to remotest areas of Dingalan which are not easily accessible by four-wheel vehicle.

2. Expedition of disaster mitigation and engineering-related activities like desilting, hauling, clearing and others.

3. Improve the security of boats along coastline by relocation

4. Helps in securing foods and non-foods items outside the municipality such relief goods, medicines, medical supplies and equipment and others.

5. Promote the trust of the evacuees by providing consistent and reliable transportation medium during evacuation.

Estimated Cost:

Php 40, 000, 000.00

Possible Sources of Funding:

People Survival Fund (PSF)

Indicative Implementation Schedule:

1. Meeting with MDRRMC and MDC with stakeholders Year 1
2. Adoption of Resolution Year 1
3. Submission of Project Proposal and other Documents Year 1

Proposed Implementing Agency:

LGU Dingalan, Aurora or the funding agency

PROJECT BRIEF

Project Title	Purchase of Heavy Equipment (Dump Truck)
Target Sector & No. of Beneficiaries	All residents living near the riverbanks, landslide prone areas and costal area
Decision Areas	The whole municipality especially in the southernmost part of Dingalan (Brgys. Umiray, Ibona and Matawe)
Timeframe of Implementation	2020-2021
Indicative Cost	Php 3, 500, 000.00
Potential Partners	All Barangay LGUs, responders, LGU Aurora

Rationale:

The Municipality of Dingalan has been experiencing frequent and disastrous hazards like typhoons, storm surges, landslides and floods due to its geographical location an exposure. Considering the frequency of these hazards, the local government needs more resources especially the heavy equipment in such activities like desilting, hauling of debris, among others. It is very important that these issues are addressed immediately for response must be felt and seen immediately by our constituents especially when life is at stake hence the need for augmentation for additional heavy equipment (Dump truck).

Location:

Staging of Dump Truck will on Brgy. Poblacion where the Municipal Hall is located. Deployment will be municipal deployment but most especially of the southernmost brgys.

Objectives:

1. To provide assistance during pre-disaster activities such desilting, clearing of roads, transportation for the prepositioning of goods, among others.

2. To provide assistance during disaster such as transportation for pre-emptive evacuation, clearing of debris especially along roads, delivery of foods and non-foods necessities on hard to reach areas, among others.

3. To provide engineering assistance to disaster-related projects by the local government like flood control facilities, roads, bridges, evacuation centers, etc.

Project Description:

Expected Benefits/Impacts:

6. Improved delivery of transportation-related services especially to remotest areas of Dingalan which are not easily accessible by four-wheel vehicle.

7. Expedition of disaster mitigation and engineering-related activities like desilting, hauling, clearing and others.

8. Improve the security of boats along coastline by relocation

9. Helps in securing foods and non-foods items outside the municipality such relief goods, medicines, medical supplies and equipment and others.

10. Promote the trust of the evacuees by providing consistent and reliable transportation medium during evacuation.

Estimated Cost:

Php 3, 500, 000.00

Possible Sources of Funding:

Provincial Government of Aurora

Indicative Implementation Schedule:

4. Meeting with MDRRMC and MDC with stakeholders	Year 1
5. Adoption of Resolution	Year 1
6. Submission of Project Proposal and other Documents	Year 1

Proposed Implementing Agency:

Provincial Government of Aurora

PROJECT BRIEF

Project Title	**Construction of Evacuation Center**
Target Sector & No. of Beneficiaries	Residents of barangays Umiray, Ibona and Matawe
Decision Areas	Brgys Umiray , Ibona and Matawe
Timeframe of Implementation	2020-2022
Indicative Cost	90,000,000.00
Potential Partners	Barangay Umiray, Ibona and Matawe, LGU Aurora

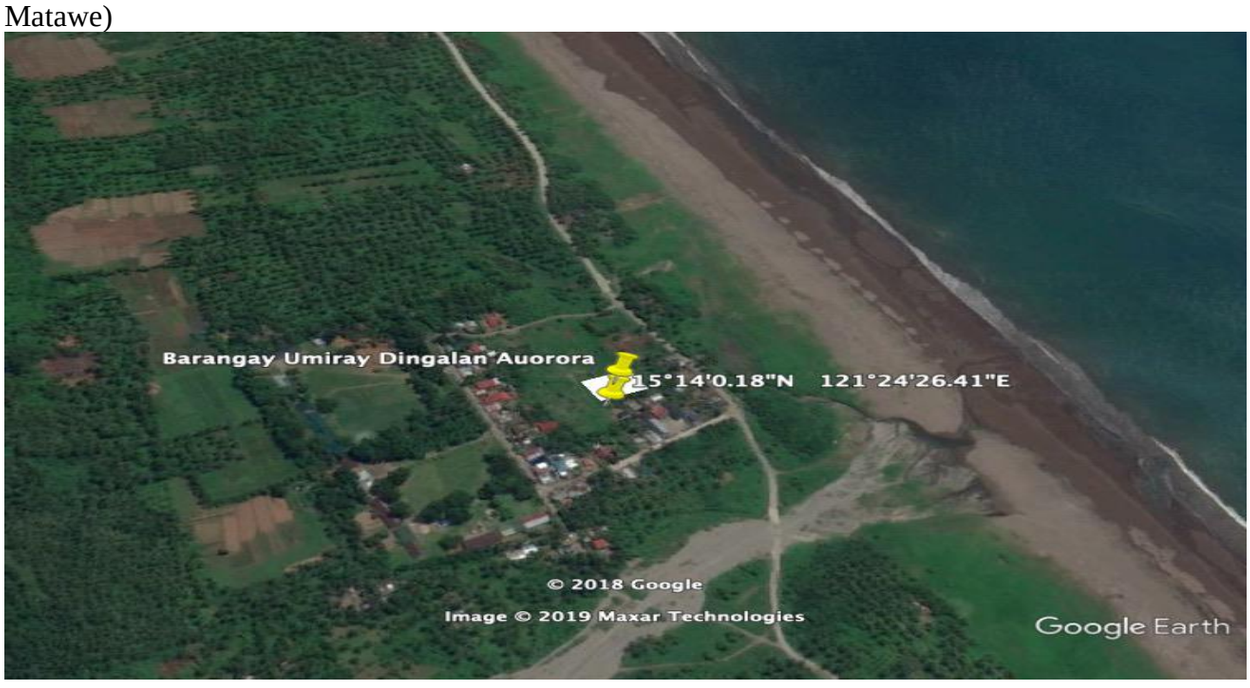
Rationale:

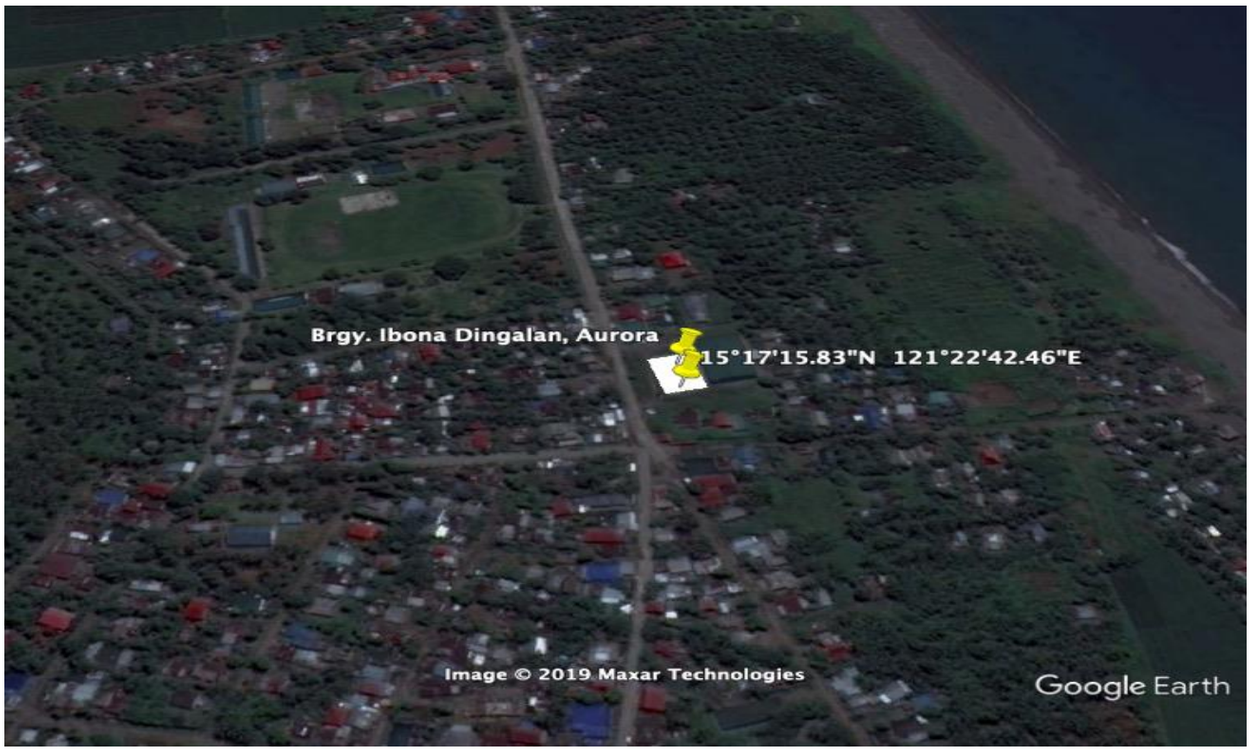
The Municipality of Dingalan is located facing the vast of Pacific Ocean, as it is, our municipality is frequently threatened by typhoons, tsunami, heavy rainfalls caused by northeast monsoon and other natural disaster. Dingalan mostly consisted of rivers, mountain and ocean. This is the reason why we are more prone to landslide, flashfloods, tsunami and earthquake. The said natural disaster leads to the thousands of families to evacuate their homes and settle into evacuation center.

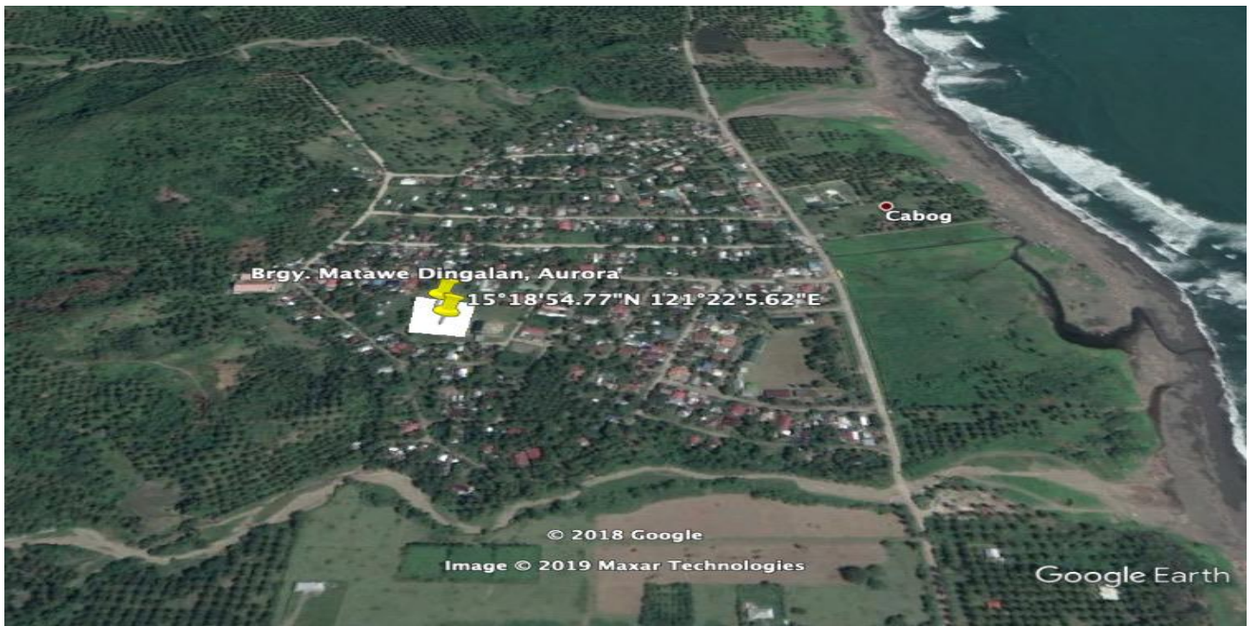
During disaster, we are lacking adequate evacuation center and settle for public schools that we commonly used as evacuation center, these cause over congestion of families per evacuation center. Although this help a lot of families in times of disasters and calamities it is not an ideal set up. The school facilities are not adequate to accommodate the needs of all the evacuees, to name a few the common problems are inadequacy of bathroom, sleeping areas, are to small due to all the things that classroom has like chairs, books, tables and the likes. Other problem are Epidemic diseases due to confined spaces, lack of clean water and most of all, damages to school properties. Moreover, after calamities there are instances that the evacuees are not ready to leave the evacuation centers due to damages that their homes had suffered. Some doesn't even have a home to return to, and these leads to late start of school days

Location:

The Construction of Evacuation Center will be located at three (3) Barangay (Umiray, Ibona and Matawe)







Objectives:

1. To provide temporary shelter for evacuees during disaster and calamities.
2. To lessen the usage of public school building as evacuation center.
3. To save lives during the occurrence of disaster and calamities.

Project Description:

2. See attached Program of Works and Detailed Engineering

Expected Benefits/Impacts:

11. Serves as temporary shelter of residents who will displaced in time of disaster or calamities

12. Ennhance the preparedness and response capabilities of communities to disasters and emergencies.
13. Provide safey and security to evacuees

Estimated Cost:

Php 90, 000, 000.00

Possible Sources of Funding:

People Survival Fund (PSF), DPWH, NDRRMC

Indicative Implementation Schedule:

7. Meeting with MDRRMC and MDC with stakeholders	Year 1
8. Preparation of Program of Works (if necessary)	
9. Adoption of Resolution	Year 1
10. Submission of Project Proposal and other Documents	Year 1

Proposed Implementing Agency: LGU Dingalan, Aurora or the funding agency

PROJECT BRIEF

Project Title	**Construction of Sanitary Land Fill**
Target Sector & No. of Beneficiaries	All Households and Establishments in Dingalan, Aurora that Generate Any Form Waste
Decision Areas	The whole municipality especially in the southernmost part of Dingalan (Brgys. Umiray, Ibona and Matawe)
Timeframe of Implementation	2020-2023
Indicative Cost	Php 38, 000, 000.00
Potential Partners	All Barangay LGUs, CSOs especially those concerning environment concern, PSF (People Survival Fund)

Rationale:

The Municipality of Dingalan is generating at least 19, 197 kgs of waste every day. 7, 854.44 kgs for biodegradable, 1, 963.22 kgs for recyclable, 1, 417.24 kgs of residual waste with potential for diversion, 792.37 kgs for disposal and 169.82 for special wastes. Some of these wastes are still being burnt, despite of the continuous campaign of the national and local government. These activities contribute a bad effect to the environment such production of carbon monoxide to the atmosphere which causes the increase in temperature of the atmosphere. It is very important that these issues are addressed immediately for response to environmental challenge must be felt and seen by our constituents especially when life and environment are at stake hence the need for the Completion and Construction of Sanitary Land Fill.

Location:

The Sanitary Land Fill will be located at Brgy. Caragsacan, Dingalan, Aurora though the access road will be Brgy. Butas na Bato. Currently, there is already constructed and established Material Recovery Facility with Residual Containment Area on site.

Objectives:

11. To established and construct Sanitary Land Fill as mandated by law (RA 9003).

12. To properly sort all collected wastes for proper disposal

13. To establish collection system managed by LGU and increased collection coverage from existing five (Caragsacan, Poblacion, Paltic, Davildavilan and Tanawan) to all remaining brgys.

Project Description:

The Sanitary Land Fill will be composed of the following scope of works.

1. Facilities for Engineer
2. Other General Requirements
3. Earthworks
4. Subbase and Base Course
5. Surface Courses
6. Drainage and Slope Protection
7. Miscellaneous Structure
8. Special Work Items
9. Support Facilities

Expected Benefits/Impacts:

14. Centralized waste collection and disposal in the community of Dingalan, Aurora

15. Increased livelihood among members of the community that benefited from waste collected

16. Production of bricks and hollow blocks out of residual waste processed by technology-based equipment

Estimated Cost:

Php 38, 000, 000.00

Possible Sources of Funding:

LGU Dingalan, LGU Aurora, PSF, DENR-EMB

Indicative Implementation Schedule:

14. Meeting with MSWMB and MDC with stakeholders	Year 1
15. Adoption of Resolution	Year 1
16. Submission of Project Proposal and other Documents	Year 1

Proposed Implementing Agency:

LGU Dingalan or the funding agency

PROJECT BRIEF

Project Title	**Construction of Flood Control Facility**
Target Sector & No. of Beneficiaries	All residents and their properties living and located near the rivers of Umiray River
Decision Areas	Brgys. Umiray
Timeframe of Implementation	2020-2028
Indicative Cost	Php 65,000,000.00
Potential Partners	All Barangay LGUs, responders, LGU Aurora

Rationale:

Mitigation Structure are very important factors in attaining a more conducive and sustainable structure as well as the community hence living a worry- free lives which people in brgy. Umirat truly derserve

Location:

The Flood Control Facility (Gabion Type) will be located along the Umiray River that will stretch along sitio ferry to sitio market site

Objectives:

1. To construct a flood control facility along the Umiray river to prevent flooding
2. To promote tourism for the locals hence uplifting its economic growth
3. To lessen the evacuation of locals during flooding hazards

Project Description:

3. See attached Program of Works and Detailed Engineering

Expected Benefits/Impacts:

Estimated Cost:

Php 65,000,000.00

Possible Sources of Funding:

People Survival Fund (PSF) and other funding agencies

Indicative Implementation Schedule:

Activities	Time Frame	Person responsibilities
1. Coordination within the LGU		Mayors Office/ MPDC
2. Preparation of Project Proposal		MPDC
3. Preparation of Program of works		MEO
4. Submission of all documents needed with cover letter		MO

Proposed Implementing Agency:

LGU Dingalan, Aurora or the funding agency

PROJECT BRIEF

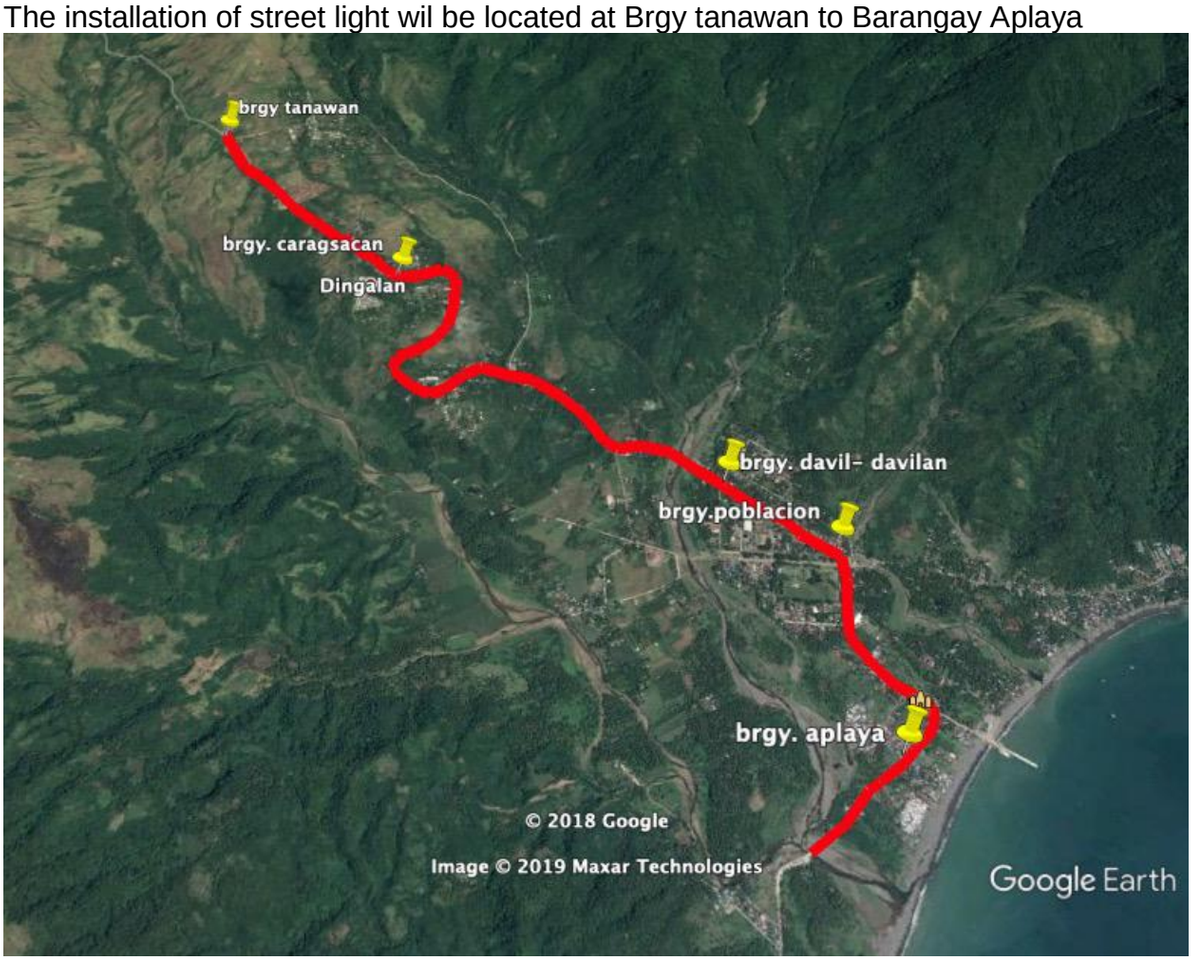
Project Title	**Purchase and Installation of Solar Lights**
Target Sector & No. of Beneficiaries	Brgy. Tanawan- 642 HH, Brgy Caragsacan- 2287 HH, Brgy Davil-davilan- 863, Brgy Poblacion- 801 and brgy Aplaya- 1798 HH
Decision Areas	Brgys. Tanawan, Caragsacan, Davil davilan, Poblacion and brgy Aplaya
Timeframe of Implementation	2020-2028
Indicative Cost	Php 100,000,000.00
Potential Partners	All Barangay LGUs, responders, LGU Aurora

Rationale:

Roads are one of the main tools of achieving increase in local economic growth by providing ease of transportation. Roads must be efficient enough to cater its purpose for the community. Dingalenos are more progressive during daytime for there are no sufficient street lights to lighten up the night

Location:

The installation of street light wil be located at Brgy tanawan to Barangay Aplaya



Objectives:

1. To construct street lighting facility power-up by renewable source of energy.
2. To promote peace and order and security in the community by providing sufficient street light
3. To increase local tourism and economy especially during night time

Project Description:

4. See attached Program of Works and Detailed Engineering

Expected Benefits/Impacts:

Estimated Cost:

Php 100,000,000.00

Possible Sources of Funding:

People Survival Fund (PSF) and other funding agencies

Indicative Implementation Schedule:

Activities	Time Frame	Person responsibilities
4. Coordination within the LGU		Mayors Office/ MPDC
5. Preparation of Project Proposal		MPDC
6. Preparation of Program of works		MEO
7. Submission of all documents needed with cover letter		MO

Proposed Implementing Agency:

LGU Dingalan, Aurora or the funding agency

SECTION 4. CLIMATE CHANGE ADAPTATION AND MITIGATION MEASURES

The greenhouse gas emissions that are causing global warming come from a wide range of sources including cars and trucks, power plants and others. Because of these sources there are many options for reducing emissions. The manifestations of climate change in the form of temperature increase, flooding, land subsidence and others have impacts on the municipality's economy, infrastructure, and use and on Dingalan's 11 barangays. In response to all of these and in consonance with the Climate Change Act which provides the policy framework with which to systematically address the growing threats on community life and its impact on the environment.

Table 97. Climate Change Adaptation and Mitigation Measures

Infrastructure	Description	Impacts	Mitigation	Adaptation
Buildings	Refers to residential dwellings, commercial, industrial and institutional buildings	• Increased residential, commercial and industrial property damage • Increased maintenance, repair and replacement of residential, commercial and industrial buildings • Reduction in capacity of businesses to operate due to property damage • Reduction in use of buildings and facilities due to inundation, flooding, ground movement and structural integrity	• Promotion of green buildings such as building with energy efficient designs (natural lighting and ventilation) • Adopt alternative and more efficient construction methods (pre-fabrication and off-site construction) • Increase density of homes and mixing uses to minimize transportation	• Locate settlements away from vulnerable areas (waterways, powerlines, road-right-of ways, etc.) • Improve building design (e.g. use of climate change resilient materials, stronger roof fixing connections, installation of essential vulnerable equipment on higher elevations)
Transportation	Refers to roads, highways and bridges	• Increased roads, highways and bridges damage and deterioration • Increased maintenance, repair and replacement of roads, highways and bridges • Reduction in use of transport infrastructure due to inundation, flooding, ground movement and structural integrity	• Promotion of electric vehicles • Planning for efficient transport system to minimized trip generation • Anti-smoke belching campaign • Encourage non-motorized transport (i.e. cycling and walking)	• Locating major transport infrastructure away from vulnerable areas • Improve transport infrastructure design such as higher road embankment elevation, use of elevated roads, walkways, pathways and thicker pavement • Ensure new settlements are accessible by all-weather roads • Improve traffic management

Water Supply	Water supply includes sources of water, reservoirs, treatment facilities, and transmission and distribution lines. As water is crucial to man's existence, climateproofing this infrastructure is of utmost importance	• Reduction in available water for consumptive use-potable, commercial and industrial • Declining water quality leading to higher treatment costs • Accelerated degradation and increased failure of water distribution infrastructure (i.e. pipe breakage due to increased ground movement) • Increase in water cost per unit of production	• One way to mitigate the impact of climate change in the field of water supply is through the use of water supply systems with minimal contribution to climate change, e.g. gravity over pumped systems, which does not require power.	• Encourage water use efficiency and conservation (technology, behavioral and pricing solutions and incentives) • Develop and implement rainwater harvesting systems • Promote water reuse and/or recycling
Stormwater and Drainage	Stormwater and drainage infrastructures are very important in conveying flood water from settlements and thereby preventing flooding. It is thus crucial that these facilities are strengthened in the face of climate change.	• Increased stormwater flows • Increased flood occurrence • Wider areas of inundation	• Prioritize drainage system options with mini	• Develop and implement flood plain zones • Improving natural and artificial drainage system • Improve drainage infrastructure design such as accounting for increased rainfall intensities in design flow calculations • Create and develop flood and storm shelters • Develop locally specific flood protection programs • Water river management by avoiding bank erosion and creating buffer zones
Waste Water System	Wastewater systems are those infrastructures that deal with the collection, conveyance and treatment of wastewater or sewage generated from households, commercial and industrial establishments and including institutional establishments.	• Increased wastewater flows due to inflow/infiltration, which would require larger sewer lines and treatment facilities, thus more expensive facilities • Increased damage to pipes and appurtenances due to flooding, ground movement and structural integrity, which would require higher maintenance costs	• Prioritize wastewater system options with minimal contribution to climate change such as conveying wastewater by gravity as opposed to pumped systems • Construction and operation of energy-neutral wastewater treatment facilities	• Locating major wastewater infrastructure away from vulnerable areas. Example of this is situating certain components such as electrical and electronic equipment in higher elevations to avoid damage by flooding • Improve wastewater infrastructure design to account for climate change e.g. increase design flows • Adopt formal asset management

				approach that can effectively consider climate inputs to maintain wastewater infrastructures
Solid Waste Systems	Refers to solid waste disposal facilities	• Higher generation rate of methane due to increasing temperature • Increased leachate production due to increased rainfall intensities		• Full implementation of proper solid waste management program • Reserve local sites to accommodate waste sorting, recycling and re-use; locate sites away from climate change vulnerable areas
Power Systems	Largely refers to transmission and distribution systems	• Damage to transmission and distribution lines resulting in increased blackouts • Reduced network capacity • Accelerated deterioration and depreciation of assets due to highly variable climate • Potential blackout due to increased demand especially in areas where temperature is increasing thus increased air-condition units use	• Promote alternative energy sources that will minimize need for transmission and distribution infrastructure.	• Improve power infrastructure design such as us of climate change resilient materials, changes of design parameters • Use of locally sources energy to minimize transmission infrastructure • Adopt formal asset management approach that can effectively consider climate inputs to maintain power infrastructures

SECTION 5. PLAN IMPLEMENTATION

In order to address climate change, it is imperative that concrete actions towards climate change adaptation and mitigation are taken now. Local Climate Change Action Plans are only effective if they are implemented and championed by strong authority and leadership.

Dingalan is well positioned to build on the foundational work of their LCCAP to create a more robust, long-term plan for the future. The following key principles should be incorporated within the planning process as the municipality moves forward.

CORPORATE LEADERSHIP: DINGALAN LEADING BY EXAMPLE

No plan can be successful without strong corporate leadership at the local government. A commitment from the Municipal Government to act as a role model to the Dingalenos is required to educate and inspire the public on best practices.

Dingalan is poised to affect positive municipal-wide change in climate change action through strong corporate leadership. Political leadership and support were reflected positively in the municipal staff survey and it will help drive sustainable action within its jurisdiction. This will ultimately trickle down to the barangay and household level.

COMMUNITY LEADERSHIP: ROLE OF THE PUBLIC IN CLIMATE CHANGE ACTION

Active public participation and engagement is vital for true sustainable development. Community and citizen leadership takes time and requires government support for development. Fostering climate leadership occurs through the strengthening of skills, competencies, and knowledge of individuals and communities. The government's role in empowering its citizens will also directly contribute to increasing community resiliency.

Once citizen capacity is built, participatory efforts by the public will support climate planning through:

- Building mutual accountability for both the public and elected officials in climate change action;
- Assisting climate change planning by providing information related to the public's lived and local experience of climate change, particularly important for monitoring;
- Decreasing local vulnerability to climate-related hazards:
- Generating increased public support for adaptation and mitigation efforts through mainstreaming climate change issues into public consciousness.

COLLABORATION

Collaboration is a key part of planning for climate change and it should be taking place in a variety of ways. Not only should the Municipality seek opportunities for collaboration within its Offices, it should also seek opportunities to pool resources with other governmental, non-governmental, and civic organizations.

Intra-Governmental Collaboration

There is the misconception that the responsibility of climate change action planning falls solely with those sectors dealing with environmental or disaster-related issues. However, at the end of the day, it is important to remember that every sector will be impacted by climate change.

All municipal offices need to be brought into the conversation on climate change action and they should each have input into the long-term planning process. Different Offices may take a different approach to climate change action and there is much to be learned through the process of sharing solutions.

Collaboration between areas within the Municipal Government allows for the following:

- Knowledge and experience sharing;
- Interdisciplinary solutions;
- Pooled financial and capital resources.

Inter-Govermental Collaboration

Climate change is an issue that is addressed by all levels of government given that the impacts span across all geographic areas and areas. In developing solutions to climate-related issues, it is beneficial to take a more comprehensive or regional approach, as opposed to working within the boundaries of local jurisdictions. This allows for solutions to be developed that will address the issues present in an entire system, rather than a select portion of it.

The pooling of knowledge and resources would allow for the following:

- Asset, resource, and knowledge sharing across local governments;
- Strengthened voice in advocating for support from senior levels of government;
- Projects that could be developed and executed at a regional scale.

Extra-Governmental Collaboration

Not only should local governments seek to collaborate with other governmental actors in their region, they should also create opportunities to collaborate with non-governmental actors. This includes non-profit organizations, civic organizations, and the public in general. Benefits include:

- Knowledge of the local context;
- Vested interest in long-term conditions;
- Flexibility to act without direct political implications.

SECTION 6. MONITORING AND EVALUATION

MEANS OF IMPLEMENTATION

The following Strategies in the areas of governance, coordination, financing, valuation and partnerships are adopted to facilitate the implementation of the Framework. Other mechanism that may be appropriately during the formulation of the Action Plan shall be included.

- Establish appropriate management and institutional arrangements and coordination mechanisms for climate change at the national, sub-national and local levels.
- Maximize government financing instruments and local levels as source of funds for the National Framework Strategy.
- Install policy and incentive mechanism to facilitate and leverage private sector investments in climate change.
- Provide and access scaled-up, new and additional financial resources to support the requirements of the National Framework, including sectoral and local financing requirements.
- Development of appropriate assessment tool such as carrying capacity assessment incorporating an appropriate environmental valuation methodology to inform decision-making, policy development, research and development (R&D), payment and incentive mechanism, and other climate change-related endeavors.
- Establish partnerships among national and local government agencies, business, professional and other private groups, community-based organizations, academic and scientific organizations, and civil society organizations.

MONITORING AND EVALUATION OF THE FRAMEWORK

The Climate Change Commission, in coordination with concerned agencies and stakeholder groups, shall install a monitoring and evaluation (M&E) system to tack the implementation progress of the provisions of this Framework and resulting National Climate Change Action Plan and Local Climate Change Action Plan.

As per Rule VIII, Sec.1 of the Implementing Rules and Regulations of the Climate Change Act of 2009, review the provisions of this Framework every three (3) years using a participatory evaluation process.

MONITORING AND EVALUATION

Objectives (Per Sector)	Priority Programs, Activities, Projects & Policies			Indicators (objectively Verifiable Indicators of Success/ performance)	Institutions/ Sectors Or Department Involved/ In charge	Resources required (identify Where it in included: (LDIP or AIP of Yr____)
	Short Term (1-3 years)	Medium Term (4-6 years)	Long Term (7 years & above)			
Social						
To increase availability of health services	Hiring of additional health personnel Provision of additional Ambulance Capacity building of health personnel Sustained supply of medicine	Construction of additional Barangay Health station Improvement of road access to health services	Establishment of diagnostic facilities Expansion and upgrading of hospital	80% of the total population has equal access to health services	MHO, MEO, MPDC	AIP and LDIP
To provide decent and human life condition among the residents of the municipality	Dental Program Food Fortification Program IEC on nutrition Nutrition in essential maternal and child health services Provision of sanitary latrines Livelihood for OSY Implementation of sustainable livelihood Dengue Prevention Rabies control program	Construction of Level II water system to cover household without water connection Establishment of Community Mortgage Program Construction of Municipal Extension Construction of home for the aged facility Purchase and development of land for the relocation of informal	Relocation and resettlement of ISF to government housing project Construction of Standard Evacuation Center Construction of convention center		MDWDO, MHO, MEO, MPDC, MDRRMO, MASSO, PESO	AIP and LDIP

	TB control program Malarai Control and Elimination Construction of fence for government buildings and establishment	settlers and relocations of victims of calamities				
To maintain peace and order	Strict Implementation of laws and ordinance Procurement of protective services and security equipment Strengthening of Barangay Police Auxiliary Conduct Fire drills earthquake and Tsunami Drill	Installation of streetlights and cctv cameras in public places	Acquisition of modern equipment under protective services (i.e. fire trucks, police vehicles, ambulances)	10% in crime Clearance Efficiency (CCE) and Crime Solution (CSE) per year	PNP, MDRRMO,	

MONITORING AND EVALUATION

Objectives (Per Sector)	Priority Programs, Activities, Projects & Policies			Indicators (objectively Verifiable Indicators of Success/ performance)	Institutions/ Sectors Or Department Involved/ In charge	Resources required (identify Where it in included: (LDIP or AIP of Yr____)
	Short Term (1-3 years)	Medium Term (4-6 years)	Long Term (7 years & above)			
ECONOMIC						
To increase and have a higher yield per hectare for palay and corn production	Seed distribution Pesticide distribution Fertilizer distribution Memorandum of agreement with farmer groups Conduct training and Massive IEC	Construction of Farm to Market Road Irrigation System and Facilities Improvement		Increase rice production by 10% with an average yield per hectare of 2.96 MT for rainfed and 4.3 MT for irrigated by year 2022 Increase corn production by 10% with an average yield per hectare of 4.15 MT for yellow corn by year 2022	MAO, Farmers Association, MEO	AIP and LDIP
To increase supply of meat products from local source	Animal distribution Vaccine and drugs distribution		Construction of agro- processing facilities	Supply at least 60% of the town's meat requirements (beef, pork, chicken, etc.) from local source, by year 2022	MAO	

To intensify marine fishing	Improvement of Municipal Fish Port	Construction of Cold Storage Facilities Installation of commercial stalls	Expansion of Fish Port Public-Private Partnership; Philippine Economic Zone Authority (PEZA)	Double (1,070 MT) the annual average of fish catch from the town's marine waters by year 2025	MAO, Fish Port manager, MEO, MPDC	
To provide agriculture infrastructure support	Construction of irrigation		Post Harvest Facilities Modernization and Infrastucture Support Development	Construct additional agricultural infrastructure such irrigation system, farm-to-market roads, and pre- and post-harvest facilities		
To increase diversified private business establishments	Establisment of Investment Promotion Office Creation and staffing of local investment office Regular consultation	Organize business/ investment summit Build network with key patner in business related sector		Double the number of private businesses in Dingalan by year 2025		
To decrease unemployment rate	Livelihood Program for fisherfolks Skill matching Recruit of more locals to be tourism employees			Decrease unemployment rate from 7.6% to 5.6% by year 2025		
To reduce poverty incidence	Livelihood program for fisherfolks			Reduce poverty incidence from 57.1% to 30% by year 2025		

MONITORING AND EVALUATION

Objectives (Per Sector)	Priority Programs, Activities, Projects & Policies			Indicators (objectively Verifiable Indicators of Success/ performance)	Institutions/ Sectors Or Department Involved/ In charge	Resources required (identify Where it in included: (LDIP or AIP of Yr____)
	Short Term (1-3 years)	Medium Term (4-6 years)	Long Term (7 years & above)			
ECONOMIC						
1. To introduce new tourism activities to offer the target market	Product development Conduct trainings for tourism employees (boatmen, tour guide etc.	Eventss and Festival promotion	Infrastructure support development Prepare studies on possible additional sources of power that will be able to support the growing tourism demand in the municipality	Double the number of activities being offered in tourist attractions.	Municipal Tourism Office	
2. To promote Dingalan as a nature-based tourism destination	Promotion of Dingalan to private investors Participate in food and travel expos outside Dingalan	Construct access roads for tourist spots that are not yet accessible to the tourists.	Promote courses on tourism and hotel and restaurant management	Double the number of activities being offered in tourist attractions.	Municipal Tourism Ofiice	

MONITORING AND EVALUATION

Objectives (Per Sector)	Priority Programs, Activities, Projects & Policies			Indicators (objectively Verifiable Indicators of Success/ performance)	Institutions/ Sectors Or Department Involved/ In charge	Resources required (identify Where it in included: (LDIP or AIP of Yr____)
	Short Term (1-3 years)	Medium Term (4-6 years)	Long Term (7 years & above)			
ENVIRONMENTAL						
Improve Environmental Quality for a Cleaner, Safer and Healthier Environment	Construction of MRF Community tree planting				MAO, MENRO, MEO, DENR	
Enhance Adaptive Capacities of the local community and ecosystem to natural hazards	Creation of Solid waste management board Information Education Campaign Establisment of marine protected area	Capacitating peoples organization in MPA management, planning, biophysical monitoring, business ad financial planning			MENRO, MO, DENR	
Enhance conservation, protection and rehabilitation of natural resources	Minimize improper waste disposal and littering Clean up drive				MENRO	

MONITORING AND EVALUATION

Objectives (Per Sector)	Priority Programs, Activities, Projects & Policies			Indicators (objectively Verifiable Indicators of Success/ performance)	Institutions/ Sectors Or Department Involved/ In charge	Resources required (identify Where it in included: (LDIP or AIP of Yr____)
	Short Term (1-3 years)	Medium Term (4-6 years)	Long Term (7 years & above)			
INFRASTRUCTURE						
To better facilitate the movement of people form one place to another, as well as the flow of goods and services	Evaluation of the current road and bridge infrastructure in Dingalan Identify the best site for the airport	Road and bridge construction and rehabilitation Coordination with concerned government agencies and funding agencies Construction of line canal Constructin of hanging bridge with flood control Construction of bridge Construction og box culvert Construction of local roads	Construction of cable car or similar mechanically-operated modeof transport Construction of domestic airport in dingalan	Connect all the barangays and sitios by means on concrete roads by the year 2024	MEO	
To improve and create new support infrastructure for tourism, especially along the coastal areas	Evalaution of the current condition of tourism infrastructure in Dingalan Construction of food processing center Installation of street lighting system	Construction and rehabilitation of tourism infrastructure Construction of local economic enterprise Construction of Pasalubong center Construction of Bagsakan center Construction of Evacuation center	Construction of Sea Wall Rehabilitation of historical sites		Municipal Tourism Office, MEO	
To have facility which generates renewable source of energy	Identify best site for the sustainable energy program		Construction of solar power plan/ wind mills/ hydropower plant		MEO, MPDC	

MONITORING AND EVALUATION

Objectives (Per Sector)	Priority Programs, Activities, Projects & Policies			Indicators (objectively Verifiable Indicators of Success/ performance)	Institutions/ Sectors Or Department Involved/ In charge	Resources required (identify Where it in included: (LDIP or AIP of Yr____)
	Short Term (1-3 years)	Medium Term (4-6 years)	Long Term (7 years & above)			
INSTITUTIONAL						
Enhance participative mechanisms between government and the public	Capacity Building of the CSOs, NGOs, And POs Trainings, seminars and workshops Participatory, Transparency, and Accountability Governance Public Assembly Kapihan				DILG, SB, MPDO	

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