Gubat, Sorsogon

SOLID WASTE MANAGEMENT PLAN

(DRAFT)

1. INTRODUCTION

The municipal government is committed to work for the enhancement of the quality life of its people through its solid waste management (SWM). While the local government unit (LGU) has launched its Hamus, Marie Linig! campaign with the purpose of increasing awareness about behavioral change, proper waste segregation, and reduction of solid waste collection among different stakeholders in Gubat, solid waste management problem is still an immense concern of the municipality.

LGU-Gubat believes that sustainable solid waste management cannot be done by the local government alone rather it can only be achieved through collective action between and among the local government, the people's organizations, private sector, academe and the whole community. Thus, the LGU formulated the 10-year Solid Waste Management Plan anchored on Republic Act 9003 which will serve as guide to stakeholders in the implementation of all the projects and programs towards the compliance of RA 9003.

1.1. Purpose

One of the grave concerns the municipal is facing right now is the disposal system of its citizenry which requires serious attention and aggressive action. Along with the economic growth and development of the municipality comes the acceleration of waste generation which is a major challenge for the LGU. Specifically, the key issues facing the LGU in terms of SWM is the lack of cooperation and compliance of barangays, lack of compliance of the households to segregation at source, no available lot and limited funds for the construction of Materials Recovery Facility (MRF) and composting facility, defective machines and heavy equipment used in collection and transport of wastes, maintenance of disposal facility, and lack of skills training for composting and upcycling.

This Ten-year Solid Waste Management Plan aims to promote public health and sanitation in the municipality through the implementation of the projects, programs and activities. To successfully realize the program, it is guided with the following Vision and Mission:

Vision

A Municipality of Gubat wherein all stakeholders
are actively participating to achieve an ecologically sustainable
and economically practical zero-waste management.

Mission

Achieve zero waste management by empowerment
of all stakeholders and through the enactment of an ESWM ordinance.
Implement ecologically and economically sustainable, replicable waste
management initiatives agreeable with local and national laws.

Overall, this 10-year SWM plan purposes to achieve its vision and mission through participation and community mobilization to resolve the solid waste management problem. It shall involve the people and various sectors of the community through multi-Information Education Campaign (IEC) approaches of dialogues and consultations. The LGU also aims to promote the use of alternative eco-friendly containers to replace plastics and Styrofoam. It shall institute the means and schedule of collection, segregation at source, unloading of bio-wastes, shredding of residual wastes, distribution of composting drums, and composting at household level. Coordination will be done by the LGU with plastic and polystyrene industries on recovery and recycling systems and establish an informal People's Organization composed of waste pickers, buyers and scavengers that successfully achieved the twin objectives of minimizing solid waste in the municipality and uplifting the economic status of this vulnerable group.

1.2. Approach

This Solid Waste Management Plan is within the context of the comprehensive, collective, systematic and holistic approach where inputs from various stakeholders as well as data from current situation of solid waste management is taken into consideration as a significant part of the plan. Different methodologies were used to further validate the data and add reference for analysis and planning for future programs. This includes conduct of SWM evaluation in every barangay, conduct of WACS, compilation of existing information, using results of previous studies and involvement of stakeholders. Formulation of future programs is participated also by different stakeholders such as the Municipal Solid Waste Management Board, Barangay Solid Waste Management Board, Municipal Environment and Natural Resources Office, Municipal Planning and Development Office, Municipal Engineering Office, Municipal Health Office, and other Civil Society Organizations to provide data for analysis and development of forecasts.

1.3. Acknowledgements

The Local Government Unit of Gubat wishes to acknowledge and thank the National Solid Waste Management Commission and the Environmental Bureau Regional Office V for their continuous support to the local government units in crafting their 10-year Solid Waste management Plan.

We would also like to give thanks to the members of the Provincial Solid Waste Management Board for their undivided full attention and support to the environmental programs implemented by the municipality.

This municipality is also grateful to all the members of the Municipal Solid Waste Management Board (MSWMB) as well as the Barangay Solid Waste Management (BSWMB) for their consistent efforts and cooperation to the realization of this document.

To the constituents of Gubat, who continuously inspire us to update and finish the 10-year Solid Waste Management Plan for them to experience to live in a healthy, clean and zero-waste community.

Last but not the least, we would like to give thanks to the LGU family, headed by our municipal mayor Hon. Sharon Rose Glipo-Escoto, supported by our vice mayor Hon. Sixto Estareja and the Sangguniang Bayan members, for their continuous support to the program and mandate to maintain and uphold their belief to protect the environment and health of all its constituents.

2. Municipal Profile

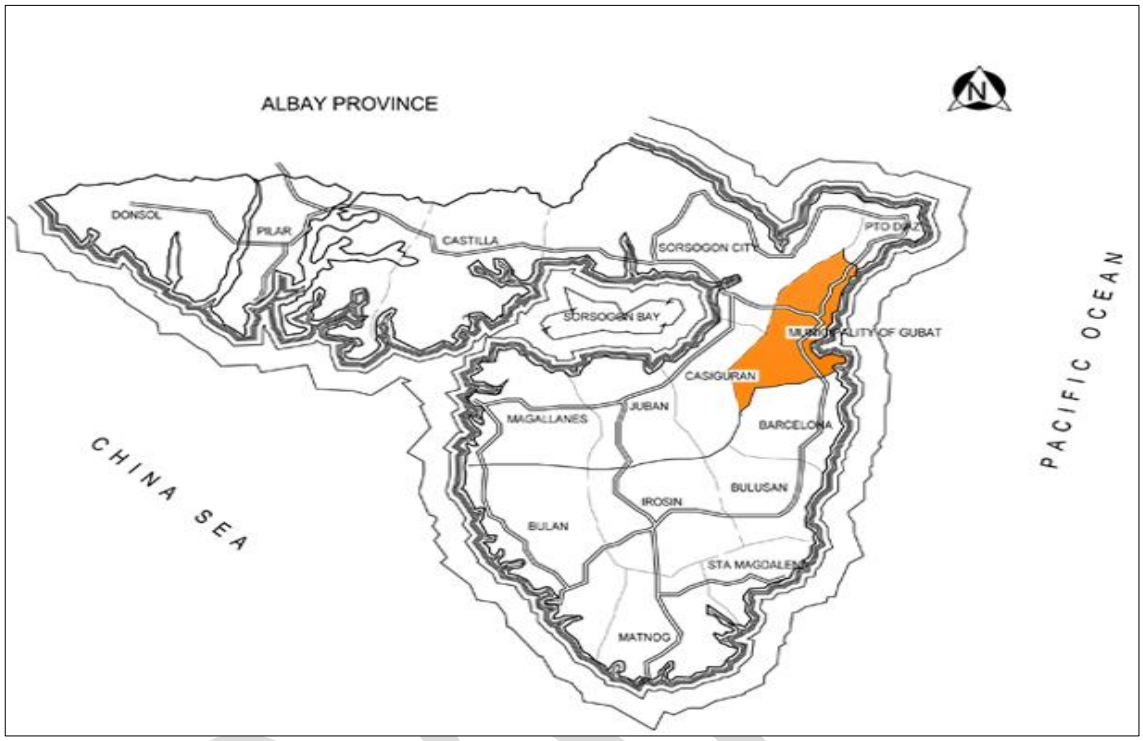
The municipality's location and features are the two main considerations in crafting the precise SWM strategy to be implemented. This does not only include the topographic properties but also its demographic and economic activities.

2.1. Location and Total Land Area

Gubat is a second-class municipality with a total land area of 11,421.17 hectares lying on the eastern side of Sorsogon province in the Bicol peninsula. It has 42 barangays, thirteen of which are located along the coastline of Gubat Bay, East Coast of the Province of Sorsogon. It is bounded on the North by the Municipalities of Bacon and Prieto Diaz, on the South by the Municipality of Barcelona, on the West by the municipalities of Sorsogon and Casiguran , and on the East by the vast Pacific Ocean. It is nineteen (19) kilometers from the capital town of Sorsogon, eighty (80) kilometers from the regional center of Legazpi City, and six hundred twenty one (621) kilometers from Manila. The Municipality lies

on the coordinates 12° 55' 15.63" North Latitude, and 124° 07' 28.66" East Longitude.

Map 1. Location Map of Gubat



- ***Topography***

The municipality is crises-crossed by creeks and rivulets that are mostly tributaries of the three main rivers called the *Bulacao, Basiao* and *Tingting*. The *Bulacao* River has two sources: one originates from Ariman in Barangay Bentuco flowing through Anibong, Malidlid and Calumpit, all sitios of Barangay Bulacao, to Barangay Tabi and Ariman where it meets the seashore. The other source originates from Liyang, Sitio Bentuco, to Lucha in Bulacao and merges at Calumpit.

The *Basiao* River starts from the numerous springs in Barangay Cabigaan, to Pandan in Bulacao, to Arasiang in Barangay Union, to Tanke in Barangay Sta.Ana, to Aropag in Barangay Ariman and into the sea.

The *Tingting* River serves the northwestern part of the municipality. From a small brook in Manapao, it flows to Caragti in Barangay Carriedo, to Carriedo proper, then to Maroc-baroc and Tingting in Barangay San Ignacio, then to the southern part of Barangay Tiris and flows out to the sea. Another source originates from Barangay Casili, to Barangay Payawin, to Barangay Jupi and then merges at Tingting. From Tingting, rivulets and creeks traverse the outlying plains of the

different sitios of Barangay Dita and barangays Lapinig and Patag. All rivers in the municipality empty at the Pacific Ocean.
There are four all-weather roads from the poblacion going to the rural barangays. A national road connects the poblacion to the municipalities of Sorsogon, and Barcelona, while a provincial road connects the poblacion to the municipalities of Prieto Diaz and Casiguran. Unchecked spot elevations in the municipality are found in Barangay Tigkiw at 135 meters, Bentuco at 115 meters, Togawe at 95 meters, Naagtan at 87 meters, and part of Cabigaan and Bagacay at 73 meters. The other barangays have an average elevation of 24 meters.

- ***Climate***

The municipality experiences a Type II climate characterized by a short dry season in the months of April to August, and a pronounced maximum rainfall from November to January. The average rainfall is 6.65 mm while the highest readings occur in the month of February at 14.3 mm and the lowest at .4 mm in the month of May. The mean temperature is 27.245 degrees Celsius.

There are three kinds of wind systems passing the municipality at different times of the year. The Northeast Monsoon occurs during the months of October to February; the North Pacific Trades from March to April; and the Southwest Monsoon from May to September. Gubat is along the path of typhoons of the magnitude 11k from May to December. Normal track of typhoon may occur once a year.

- ***Climate and Rainfall***

The climate of the municipality of Gubat, Sorsogon falls under the Type I of Corona's classification which is characterized by two (2) pronounced seasons: the wet and the dry. The wet season starts from October to January. During these months, the locality is marked by increased rainfall at a rate of 298 - 370 mm. brought about by the southwest monsoon. The area is also frequently visible by tropical cyclones during these months. Average humidity is reached at late dawn when the temperature is minimal. The coldest months are December, January and February with the lowest air temperature of 20 degrees Celsius while the hottest month is April recording the highest temperature of 35 degrees Celsius.

2.2. History

The Gubatnon forebears could have been those who have settled in Jupi, Tigkiw-na-Saday, and Bulacao during the Formative Filipino Period (1,000 BC to 500 A.D.). These assertions were supported by archeological explorations in Barangays Jupi and Bulacao by a team from the National Museum in the 1960s, which unearthed an ancient jar and vessel decorated with strips of clay in Barangay Jupi. It was concluded that the early settlers in Jupi had been there as early as 800 A.D. Further, Dr. Luis Camara Dery, in his essay "Footnotes to the History of Gubat, Sorsogon", cited that two stone bark beaters and four stone axes recovered in Bulacao resembled the pottery-stone tools dated to be about 91 B.C. from the Bato Caves in the neighboring locality of Bacon District of Sorsogon City.

Meanwhile in Tigkiw-na-Saday, also a rural and hilly sitio of Barangay Tigkiw, earth jars covered by flat stones used for burials was discovered in 1978, which suggested that the group of people that lived there had probably settled in that place between 200 B.C. to 200 A.D. From this, it can be inferred that the settlement in Gubat had existed for more than 2,000 years. Recent diggings in Barangay Ariman, the place where the river that originates in Bentuco meets the sea, also reveal that the people who lived in this town were influenced if not actually populated by a number of foreigners. The jars removed underneath revealed that they were used as burial jars as some of them contained necklace beads and some precious stones.

When the Spaniards arrived in Sorsogon in 1569, they were surprised to find the inhabitants living peacefully. Fr. Jose Castaño, a missionary, described the early Bicolanos (including the early Gubatnons) as a race of impetuosity and valor fond of social dealings; more intelligent and vigorous, more active, industrious and warlike, and adjusted to live in compact villages. In the eastern part of province of Sorsogon, the Franciscan missionaries established only two churches. One of them was built in Bacon and another one in Bulusan. These two towns developed much earlier than Gubat. It was also the period when the raiders sometimes called the "Joloans" made frequent raids all over Visayas and Luzon.

1572 document mentioned that there were already 41 settlements within Sorsogon during that time, 34 along the Sorsogon Gulf and 7 in eastern Sorsogon. Gubat belongs to the settlement along the eastern coast, the others being Bacon, Bantugan, Danlog, Bulusan, Busaingan, and probably Tagdon. Aramag, which was then the name of the first settlement in present-day Gubat was located in the mouth of Ariman and Aropag rivers with houses scattered around it. It was the center of activities since during those times, the major means of transportation was by boat through seas and rivers.

When a group of missionaries made a voyage by sea from Bacon to Bulusan, they encountered a heavy storm halfway through that destroyed their ship forcing them to land at Aramag in the morning of June 13, 1731. Aramag, the former name of Gubat, is thought to have been adopted by Alamag, a Sitio of Tabi that is bounded on the east by barangay Ariman, and the site of the earliest settlement in the municipality. Before reaching the heart of the settlement, the missionaries heard several villagers shout **"Gubat!" "Gubat!" (Raid! Raid!)** to give warning to the people after a number of Moro joangas were seen nearing the shore for the surprise attack. The friars, thinking that they had made the villagers scamper around, tried to pacify them. The villagers, nevertheless, continued to shout "**gubat! gubat!**" ignoring the friars. The friars escaped the Moro raid by taking the hills southward until they reached the settlement at Bulusan. Somehow, the name "**Gubat**" struck and thereafter, it was used whenever Aramag is being referred to.

2.3. Population

In 2015, Gubat has a total population of 59,534, a slight increase of about 2,207 individuals from the census year (CY) 2010. The minor increase in population for the past five (5) years demonstrates the low population growth rate in the municipality.

The result of the CY 2015 census also revealed that the municipality has already reached 59,534 counts compared to the recorded population of 57,327 in 2010. The current population of the municipality accounts 7.51% of the total population of the Province of Sorsogon. This shows that the municipality has a lower growth rate of 0.72% compared to the 1.31% growth rate of the province. If this trend continues, the population of the municipality is expected to reach 67,927 by year 2029.

Table 1. Population CY 2015

BARANGAY	2015 (PSA)	Participation Rate (PR)
TOTAL	**59,534**	**1**
Urban		
Balud Norte	1,961	0.03
Balud Sur	1,192	0.02
Cota na Daco	1,707	0.03

Luna Candol	2,356	0.04
Manook	1,401	0.02
Panganiban	2,211	0.04
Paradijon	1,295	0.02
Pinontingan	1,265	0.02
Sub-Total	**13,388**	**0.22**
Rural		
Ariman	1,657	0.03
Bagacay	3,328	0.06
Benguet	543	0.01
Bentuco	1,676	0.03
Beriran	1,007	0.02
Buenavista	997	0.02
Bulacao	2,024	0.03
Cabigaan	1,116	0.02
Cabiguhan	771	0.01
Carriedo	2,244	0.04
Casili	1,101	0.02
Cogon	2,289	0.04
Dita	488	0.01
Jupi	1,095	0.02
Lapinig	485	0.01
Manapao	968	0.02
Naagtan	975	0.02
Nato	1,129	0.02
Nazareno	522	0.01
Ogao	1,327	0.02
Paco	1,552	0.03
Patag	593	0.01
Payawin	1,611	0.03
Rizal	2,690	0.05
San Ignacio	2,244	0.04
Sangat	832	0.01
Sta. Ana	2,015	0.03
Tabi	1,681	0.03
Tagaytay	1,031	0.02
Tigkiw	1,019	0.02
Tiris	2,053	0.03
Togawe	1,265	0.02
Union	1,193	0.02
Villareal	625	0.01
Sub-Total	**46,146**	**0.78**

Table 2. Population Growth Rate

Year	Population
1980	43,866
1990	43,251
1995	49,716
2000	52,707
2007	55,457
2010	**57,327**
2011	57,946
2012	58,572
2013	59,205
2114	59,844
2015	**59,534**
2016	59,963
2017	60,394
2018	60,829

Table 3. Population and Household Projection 2019 – 2029

Year	Population	Households
2019	61,267	13,965
2020	61,708	14,133
2021	62,153	14,303
2022	62,600	14,474
2023	63,051	14,648
2024	63,505	14,824
2025	63,962	15,002
2026	66,423	15,182
2027	64,886	15,364
2028	65,354	15,548
2029	65,824	15,735

Annual Population Growth Rate: 0.72%

Household Growth Rate: 1.2%

Urban-Rural Population

As of CY 2015 census, 13,388 persons live in the poblacion. This number represents 22.49% of the total population of the town, while the rural population is 46,146 or 77.51% of the total population.

While previous records in the 2007 and 2010 census showed that the urbanity movement in the municipality is small, there was an increase of rural population or decreased in urbanity movement in the municipality in the year 2015. This could be attributed to the development of new subdivisions in Barangays Cogon and San Ignacio.

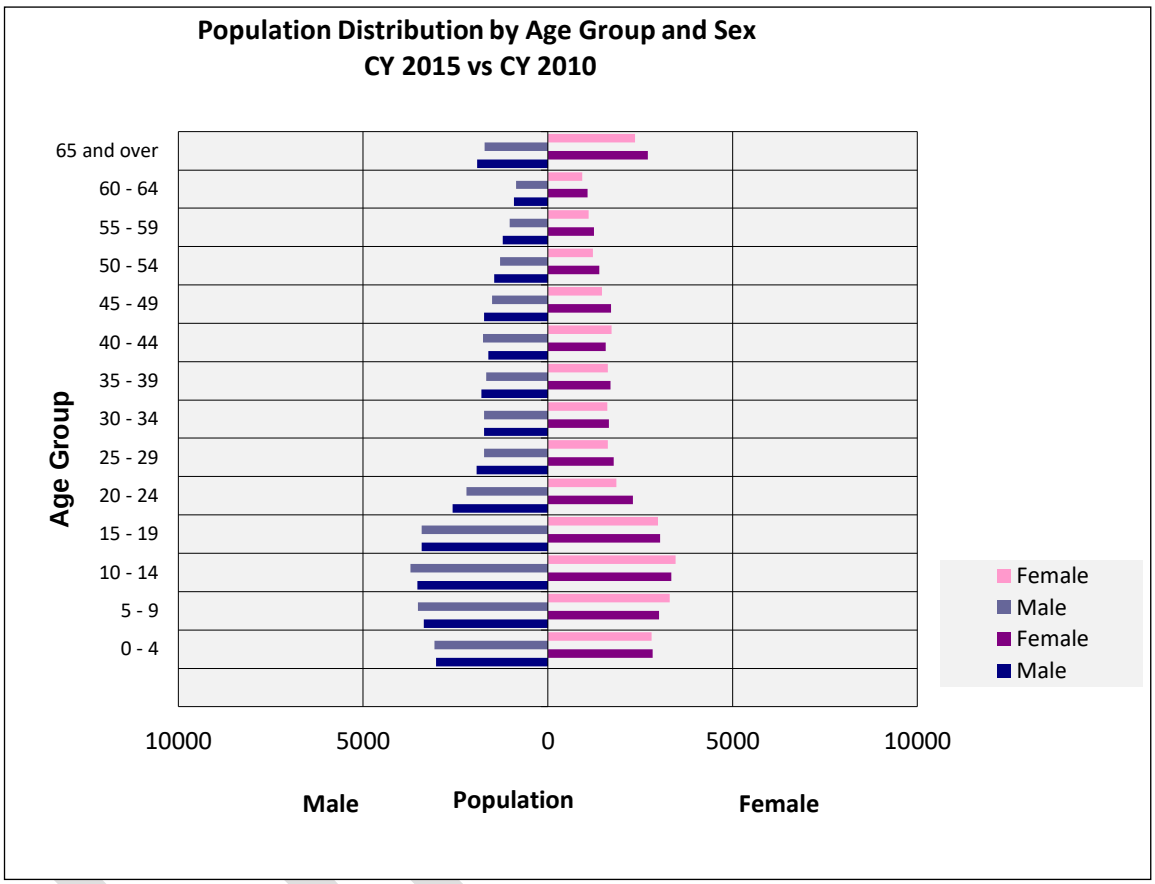
As per result of the census conducted in 2015, age groups 5-9 and 10-14 account for 10.70% and 11.54% of the total population respectively (Table 4). And while the male slightly outnumbered the females from 2010 to 2015, the urban-rural population ratio did not substantially change.

Table 4. Population Distribution 2010 - 2015

Age Group	Censal Year 2 - 2015			Censal Year 1- 2010		
	Male	Female	Total	Male	Female	Total
0 - 4	3,024	2,839	5,863	3,070	2,806	5,876
5 - 9	3,359	3,012	6,371	3,512	3,302	6,814
10 - 14	3,524	3,349	6,873	3,719	3,462	7,181
15 - 19	3,410	3,041	6,451	3,416	2,984	6,400
20 - 24	2,574	2,297	4,871	2,205	1,859	4,064
25 - 29	1,932	1,788	3,720	1,724	1,627	3,351
30 - 34	1,722	1,649	3,371	1,725	1,608	3,333
35 - 39	1,793	1,692	3,485	1,673	1,628	3,301
40 - 44	1,612	1,563	3,175	1,749	1,724	3,473
45 - 49	1,725	1,709	3,434	1,511	1,461	2,972
50 - 54	1,451	1,397	2,848	1,291	1,213	2,504
55 - 59	1,220	1,249	2,469	1,036	1,105	2,141
60 - 64	915	1,074	1,989	866	937	1,803

65 and over	1,907	2,707	4,614	1,704	2,354	4,058
Total	**30,168**	**29,366**	**59,534**	**29,201**	**28,070**	**57,271**

Graph 1. Population Distribution by Age and Group



Rural population accounts about 78% of the total population of the municipality, which is opposite to the provincial level of urbanization. The level of urbanization percentage from 1995 to 2015 showed a decrease from an urban tempo of 26% in 1990 to 22.4% in 2015 (Table 5).

Table 5. Household Distribution and Population Density by Barangay (2015)

Barangay	Household	Population	Average Household Size	Population Density
Urban				
Balud del Norte	444	1,961	4.38	215.3
Balud del Sur	270	1,192	4.39	122.9

Cota na Daco	386	1,707	4.39	190.9
Luna Candol	533	2,356	4.38	160.8
Manook	317	1,401	4.40	120.6
Panganiban	500	2,211	4.39	162.2
Paradijon	293	1,295	4.40	92.1
Pinotingan	**286**	1,265	4.40	70.90
Sub-Total	**3,029**	**13,388**	**4.39**	1,135.70
Rural				
Ariman	375	1,657	4.39	6.94
Bagacay	753	3,328	4.36	5.72
Benguet	123	543	4.41	2.69
Bentuco	379	1,676	4.39	5.65
Beriran	228	1,007	4.40	5.34
Buenavista	226	997	4.39	3.82
Bulacao	458	2,024	4.39	4.56
Cabigaan	253	1,116	4.39	5.62
Cabiguhan	174	771	4.42	3.7
Carriedo	508	2,244	4.38	4.97
Casili	249	1,101	4.40	2.89
Cogon	518	2,289	4.38	16.65
Dita	110	488	4.43	1.27
Jupi	248	1,095	4.40	2.95
Lapinig	110	485	4.40	1.65
Manapao	219	968	4.40	2.61
Naagtan	221	975	4.40	4.07
Nato	255	1,129	4.41	3.84
Nazareno	118	522	4.41	1.93
Ogao	300	1,327	4.40	5.34
Paco	351	1,552	4.40	4.35
Patag	134	593	4.42	2.4
Payawin	365	1,611	4.39	4.29
Rizal	609	2,690	4.37	4.61
San Ignacio	508	2,244	4.38	6.65
Sangat	188	832	4.41	3.04
Sta. Ana	456	2,015	4.39	5.29
Tabi	380	1,681	4.40	4.58
Tagaytay	233	1,031	4.41	3.48
Tigkiw	231	1,019	4.39	2.82
Tiris	465	2,053	4.38	5.35
Togawe	286	1,265	4.40	3.32
Union	270	1,193	4.40	3.21

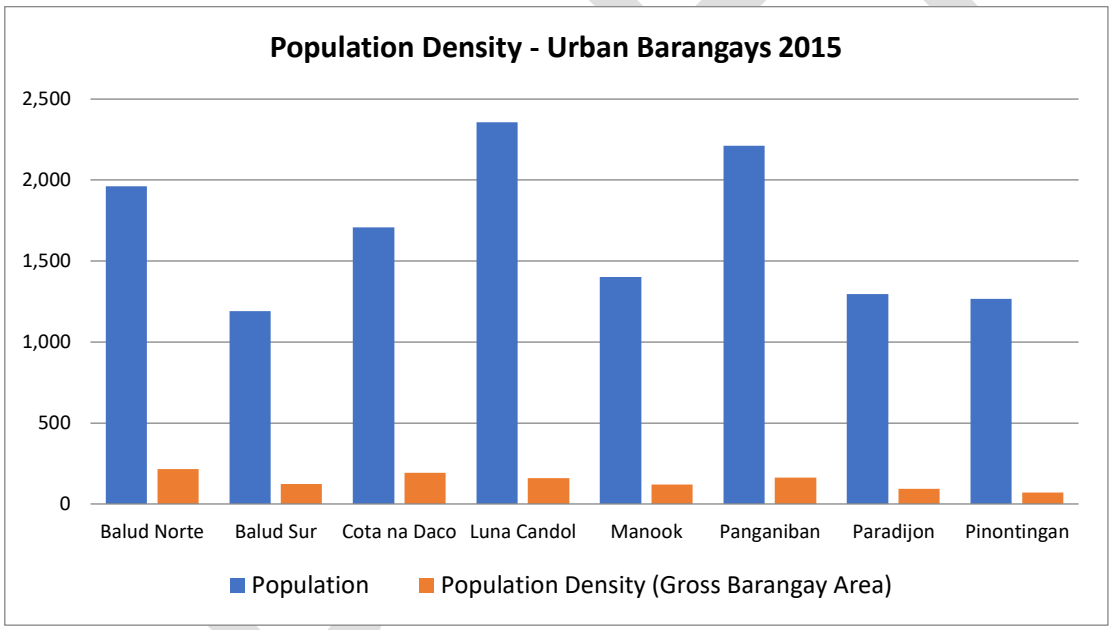
Villareal	141	625	4.42	3.19
Sub-Total	**10,442**	**46,146**	**4.39**	148.79
TOTAL (Urban + Rural)	**13,471**	**59,534**	**4.39**	**1,284.49**

Population Density

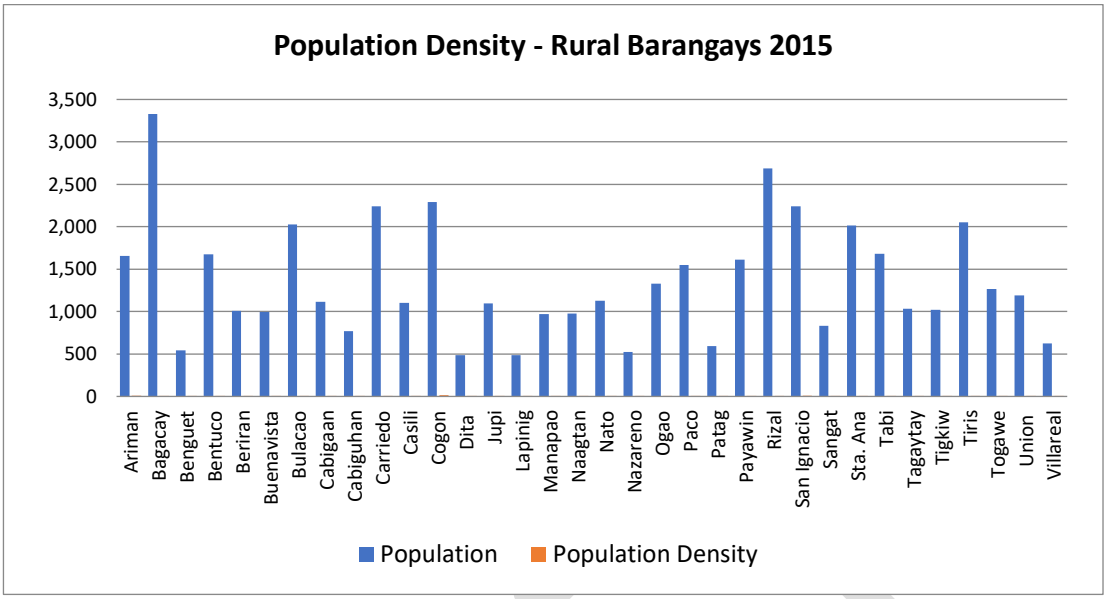
As of 2015, the population density of the municipality stands at 518 per square kilometer, while urban or poblacion barangays remain to have the highest population density with barangay Balud del Norte posting the highest population density of 215.3 per hectare population density.

Only Cogon among the 34 rural barangays posted a double-digit population density: 16.6. The remaining 33 barangays have single-digit densities with Nazareno (1.93), Lapinig (1.65) and Dita (1.27), being the lowest three.

Graph 2. Population Density- Urban Barangays



Graph 3. Population Density – Rural Barangays



2.4. Economic Profile/ Land Use

The Municipality of Gubat is basically an agricultural community whose farmers depend much from the income derived from palay and coconut production. The economy of the Municipality of Gubat, Sorsogon is basically anchored in Agriculture. From the results of the survey conducted thru the Community Based Monitoring System in CY 2011, out of the 12,686 households surveyed, about 35% are engaged in agriculture.

Table 6. Number of Households Engaged in Agriculture

Barangay	Agriculture	Livestock and Poultry	Fishing	Forestry and Hunting
Ariman	69	7	4	0
Bagacay	107	37	14	1
Balud Del Norte	1	0	2	0
Balud Del Sur	8	1	3	0
Benguet	40	13	3	0
Bentuco	75	10	3	1
Beriran	45	10	3	0
Buenavista	53	12	9	0
Bulacao	82	48	0	1
Cabigaan	73	15	0	1
Cabiguhan	41	10	0	4
Carriedo	96	9	0	0
Casili	57	11	1	2
Cogon	17	7	11	2
Cota Na Daco	18	1	11	0
Dita	33	9	0	0
Jupi	86	19	0	1

Lapinig	18	11	0	0
Luna-Candol	72	9	1	0
Manapao	78	26	0	3
Manook	1	0	0	0
Naagtan	75	16	0	1
Nato	72	19	0	0
Nazareno	44	16	1	1
Ogao	50	22	5	0
Paco	61	21	14	5
Panganiban	38	2	1	0
Paradijon	17	0	0	0
Patag	42	16	0	0
Payawin	92	29	0	0
Pinontingan	23	1	5	0
Rizal	155	38	8	0
San Ignacio	59	19	5	29
Sangat	91	11	0	6
Santa Ana	100	26	1	1
Tabi	82	9	4	1
Tagaytay	58	13	1	0
Tigkiw	68	15	0	2
Tiris	136	35	16	0
Togawe	85	31	1	4
Union	87	31	0	2
Villareal	45	14	0	0
TOTAL	**2550**	**649**	**127**	**68**

Table 7. Number of business establishments by industry sectors

Business/ Commercial Establishments		2012	2013	2014	2015	2016	2017	2018
Total Number of Registered Business Establishments to date		500	529	553	469	499	753	761
	With Plate	370	342	369		268		
	Without Plate	130	187	184		231		
Fish	Existing					80	79	71
	Registered					9	35	34
Meat	Existing					23	23	15
	Registered					8	11	11
Carenderia	Existing					27	35	13
	Registered					16	29	8
Vegetable	Existing					30	45	54
	Registered					16	32	41

Sarisari	Existing					105	112	72
	Registered					83	88	64
Grocery	Existing					31	45	76
	Registered					26	33	63
Vegetable	Existing					17	16	15
	Registered					16	15	14
Others	Registered						447	526

Table 8. Income from Local Sources

Year	Income
2014	PHP 12,632,458.50
2015	10,143,895.98
2016	15,756,845.25
2017	11,561,717.69
2018	16,357,921.65

Existing Land Use

The major categories of land classification of the municipality are: alienable and disposable land, and the mangrove that grows on coastal barangays. Agricultural, urban and rural land use, and recreation are the major capabilities of land in the municipality.

Agricultural lands occupy the major part or the municipality's landscape, with a total area of 9,921.59 hectares or 86.87% of the total land area. Agricultural lands can be found in all barangays and small portion in the urban barangay (Luna Candol) except the urban poblacion barangays, namely: Cota na Daco, Balud del Norte, Balud del Sur, Manook, Paradijon, Pinontingan, and Panganiban. These are primarily devoted to permanent crops like palay, coconut, and other crops. High value crops like vegetables, citrus, fruit trees, banana, and root crops are found in areas not planted to permanent crops, or intercropped on coconut lands.

Urban use area comprises 1.5% of the total land area or 170.44 hectares. Residential areas cover 544.1953 hectares. Commercial and institutional areas cover 22.55 hectares and 79.843 hectares, respectively. There is 24.3104 hectares devoted for tourism purposes, 0.477 hectares for agri-industrial purpose, 18.6939 hectares for cemeteries and 3.012 hectares for parks and playgrounds. The controlled dumpsite

located at Tagaytay covers an area of 1.12 hectares. Mangrove forests cover an area of 486.7274 hectares.

Table 9. Land Allowable Use

Land Use Categories/ Sub-Categories	Location and Area	Description and Land Use Policies
Forest Reserve: 14.285 hectares		
Forest Reserve	• Watershed area of Bentuco, Bulacao, Manapao, Nazareno, Ogao, Sangat, and Villareal	• lands of the public domain which have been the subject of the present system of classification and determined to be needed for forest purposes • man-made forests to be grown to protect watershed
Agriculture – Production, 780.3318 hectares		
Crops	• Lands planted to perennial crops mostly coconuts found in 34 barangays; and rice found in 35 barangays	• Agricultural areas will decrease from the existing 9,429.07 hectares to 8,480.6866 hectares or a difference of 948.3834 hectares equivalent to 10% of which crop planted was rice and coconut. The decrease will be due to re-classification of agricultural land into other uses. • Agricultural lands outside of SAFDZ and declared for production agriculture use and may be converted other use • Coconut areas with cover mix of abaca, cacao, turmeric, pili, corn, pineapple and other crops • Abaca • Allowable uses include those for SAFDZ, poultry and piggery, pastoral activities, rice mills (single pass) and warehouses, agricultural research facilities, nurseries, slaughterhouse
Agriculture – Protection: 6,512.30 hectares		

Land Use Categories/ Sub-Categories	Location and Area	Description and Land Use Policies
Strategeic Agriculture and Fisheries development Zone (SAFDZ)	• Lands planted to perennial crops mostly coconuts found in 34 barangays; and rice found in 35 barangays	• Allowable uses are cultivation of rice and other staple crops, growing of diversified fruit trees, fishponds, backyard livestock raising, single-detached dwellings, customary agriculture support facilities, farmhouses, home business and home industries
Agri-Industrial: 5.573 hectares		
Agri-Industrial	• Payawin, Bagacay, and Bentuco	• Existing rice mills in the poblacion areas which will be non-conforming to land use to this CLUP will be relocated to designated agri-industrial areas • An area intended primarily for integrated farm operations and related product processing activities such as mills, warehouses, manufacturing, processing, factories and slaughterhouses • Proposed agricultural processing centers will be sited in the designated agri-industrial areas • Slaughterhouse to Double A standard • Seaweed processing center – drying facility • Fishery product and food processing • CFLC
Residential: 674.9903 hectares		
General Residential	• All existing residential areas in urban and rural barangays • Expansion areas for urban housing needs will be in Cogon, Beriran, Sta. Ana, and	• An area intended principally for dwelling/housing purposes • Allowable uses are single-detached and semi-detached dwelling units, townhouses, apartments, residential condominium, subdivisions, boarding houses,

Land Use Categories/ Sub-Categories	Location and Area	Description and Land Use Policies
	San Ignacio in the north; and Buenavista, Ariman, and Rizal in the South.	dormitories, pension houses, hotel apartments or apartels, hotels, museums, libraries, home occupation for the practice of one's profession, home industry classified as cottage industry, recreational facilities for the exclusive use of the members of the family residing within the premises, parks and open spaces, nursery/elementary school, high school, vocational school, tutorial services, sports club, religious use, multi-purpose/barangay hall, clinic, nursing and convalescing home, health center, plant nursery, parking buildings (aboveground/underground), and customary accessory uses incidental to any of the principal uses • Expansion of urban residential areas to all barangays except those located along the shoreline and riverbanks • Residential area will increase from 544.1953 hectares to 674.9903 hectares. This area is intended to accommodate the future demand for housing such as the projected increase in households of the municipality, the families that are located in danger/hazard-prone areas and the informal settlers. These residential areas are also expected to sprout around the proposed growth nodes/centers, along the major transportation

Land Use Categories/ Sub-Categories	Location and Area	Description and Land Use Policies
		routes, and the expansion of Bicol University Gubat campus
Socialized Housing: 20.4906 hectares		
Socialized Housing	• Exisitng NHA resettlement – 3.7 hectares in San Ignacio • A socialized housing project is proposed to be located in Sta. Ana, Beriran, San Ignacio, Carriedo, and Payawin to the North; and Bulacao, Villareal, Nazareno, and upland portion of Rizal (Sitio Dalingding) to the south.	• Areas designated to housing projects to be undertaken by the government or private sector for the informal settlers and double-up households
Commercial: 47.44 hectares		
General Commercial	• Ariman, Bagacay, Cogon, Balud del Sur, Beriran, Cota na Daco, Luna Candol, Mannook, Panganiban, Paradijon, Payawin, Pinontingan, San Ignacio, Sta. Ana	• The commercial area will increase from 22.55 hectares to 47.44 hectares. The increase of 110% hectares is due to the increase of commercial establishments in the urban core and the establishment of satellite markets in Bagacay, Payawin, and Bulacao. • An area intended for trading/services/business purposes • Allowable uses are wholesale stores, wet and dry markets, shopping center, malls and supermarkets, retail stores and shops, food market and shops, product showroom/display store, warehouse/storage facility for non-pollutive/non-hazardous finished products, personal service shops,

Land Use Categories/ Sub-Categories	Location and Area	Description and Land Use Policies
		bayad centers, laundries, internet café and cyber stations, photo/video, lights and sounds services, catering services, event planners, water stations, courier services, security agencies, janitorial services, travel agencies, repair shops, recreational centers/establishments, restaurants and other eateries, bars, sing–along lounges, bistros, pubs, beer gardens, disco, dance halls, lotto terminals, off-fronton, on-line bingo outlets and off-track betting stations, parks, playgrounds, pocket parks, parkways, promenades and play lots, plant nurseries, vocational/technical schools, special education (SPED) school, short term special education, embassies/consulates,libraries/museums, exhibit halls, convention centers and related facilities, financial institutions/services, offices, business process outsourcing services, radio and television stations, parking lots, garage facilities, parking buildings (aboveground/underground), transportation terminals/garage with and without repair, display for cars, tractors, etc., motor pool, hauling services and garage terminals for trucks, tow trucks and buses, auto repair, tire, vulcanizing shops and carwash, auto sales and rentals, automotive handicraft, accessory and spare parts shops,

Land Use Categories/ Sub-Categories	Location and Area	Description and Land Use Policies
		marine craft and aircraft sales yards, gasoline filling stations/service stations, vehicle emission testing center, machinery display shop/center, machine shop service operation, welding shops, medium scale junk shop, engraving, photo developing and printing shops, printing, publication and graphics shops, manufacture of insignia, badges and similar emblems except metal, glassware and metalware stores, household equipment and appliances, signboard and streamer painting and silk screening, printing/typesetting, copiers and duplicating services, recording and film laboratories, construction supply stores/ depots, gravel, sand and CHB stores, lumber/hardware, paint stores without bulk handling, gardens and landscaping supply/contractors, manufacture of ice, ice blocks, cubes, tubes, crush except dry ice, lechon stores, chicharon factory, biscuit factory—manufacture of biscuits, cookies, crackers and other similar dried bakery products, doughnut and hopia factory, shops repacking of food products, manufacture of wood furniture including upholstered, manufacture of rattan furniture including upholstered, manufacture of box beds and mattresses, funeral parlors (all categories), commercial condominium (with residential

Land Use Categories/ Sub-Categories	Location and Area	Description and Land Use Policies
		units in upper floors), commercial housing, all uses allowed in all Residential Zones, and customary accessory uses incidental to any of the above uses
Industrial: 3.33 hectares		
Industrial	• Beriran, Arriman, Bentuco, Buenavista, Payawin	• Industrial activities will be limited to medium scale manufacturing or production industries that are pollutive/non-hazardous and pollutive/hazardous • All industrial activities will be located along non-protective agricultural areas with the corresponding buffer requirements
Instituitional: 88.3324 hectares		
Institutional	• Existing areas of institutional establishments such as government offices, hospitals, schools, academic centers and places of worship in Pinontingan and Ariman • Expansion of institutional areas at proposed along Hiway 59 in Barangay Ariman • Construction of institutional establishments (Bagacay ES annex, Payawin NHS, Evacuation centers, barangay health	• An area intended principally for general type of institutional establishments • Future offices of national government agencies and local government unit can be located along Hiway 59 • All institutional establishments should comply with the requirements of existing laws and regulations (building permit, fire code) • Construction of climate adaptive/resilient institutional establishments • Institutional establishments should be gender-sensitive and must comply with the guidelines of the accessibility law • Green technology should be observed in construction of new institutional facilities

Land Use Categories/ Sub-Categories	Location and Area	Description and Land Use Policies
	centers, ALS Multipurpose Halls) • Expansion of academic facilities will be located in Buenavista	
Parks and Recreation: 38.590 hectares		
Parks and Recreation	• Existing barangay open air auditoriums and basketball courts • Christ the King Park in Pinontingan • Development of North and South Parks in Cogon and Bulacao • Development of a Municipal Park inside the Municipal compound in Pinotingan • Construction of a Cultural Center in the poblacion • Conversion of Dumpsite to botanical garden at Brgy. Tagaytay • Construction of a multi-purpose covered courts, parks and playgrounds to be used by clusters of barangays • Restoration of Monreal Ruins in Pinontingan • Relocation of Cockpit Arena in Carriedo	• Allowable uses are parks, playgrounds, promenades, open air or outdoor activities facilities, ball courts, memorial/shrine monuments, parking spaces • Sports and recreation facilities should not be constructed on a hazard-prone area

Land Use Categories/ Sub-Categories	Location and Area	Description and Land Use Policies
Cemetery/ Memorial Park: 24.6939 hectares		
Cemetery/ Memorial Park	• Existing Catholic Cemetery in Cota na Daco and public cemetery in Buenavista, Togawe, and Bentcuo • Development of a new civil (interfaith) cemetery in Bulacao	• An area intended for the interment of the dead • Proposed Memorial Park in Cogon • Construction of new cemetery should follow the guidelines of PD 856 (Sanitation Code of the Philippines) • The existing cemetery will stop its operation once the new cemetery is completed but will be maintained continuously. • Proposed Memorial Park in Cogon inter-faith • Vertical development in existing cemetery
Tourism Area: 35.191 hectares		
Tourism	• Ariman, Rizal, Cogon, and Buenavista will function as the tourism growth hub • Gubat bay	• No major tourism project shall be undertaken without the compliance to Municipal Tourism Council and/or DOT standards and other concerned government agencies guidelines • Allowable uses are agri-tourism, resorts, tree parks and botanical gardens, tourism accommodation facilities, souvenir shops, outdoor sports activities, food production and processing for tourism and parking areas, cultural tourism, culinary experience, boardwalks, dining facilities, recreation rental equipment shops, retail shops • Foreshore use is subject to the Municipal Tourism code and FLA • The natural environment of eco-tourism sites shall be preserved,

Land Use Categories/ Sub-Categories	Location and Area	Description and Land Use Policies
		and the materials and design of facilities should blend with the natural environment • Subject to existing national laws and local ordinances on tourism, environment, fisheries, and other applicable laws
Utilities, Transportation, and Services: 15.957 hectares		
Utilities, Transportation, and Services	• Existing telecommunication towers in Luna Candol, Manook, and Carriedo • PAMANA Terminal in Paradijon • Proposed Central Integrated Transport Terminal in Sta. Ana, and satellite terminals in Bagacay, Bentuco, Casili, Rizal, Luna Candol • Existing solid waste disposal facility in Tagaytay; 1.12 hectares • Proposed sanitary landfill site in Tagaytay; 5 hectares • Proposed water spring sources in Bentuco, Bulacao, Manapao, Nazareno, Ogao, Sangat, and Villareal	• An area designated for low to high density community support functions such as terminals, power facilities, wastewater facilities, telecommunication facilities • The existing solid waste disposal facility in Tagaytay shall be upgraded to a sanitary landfill • Establishment of sanitary landfills shall be in accordance with the guidelines as provided in the IRR of RA 9003 • Measures will be put in place to reduce the waste being disposed at the landfill • Post-closure rehabilitation measures will be put in place for closed disposal sites • Trees will serve as buffer zones for the disposal facility

G. Water Use Plan

Table 10. Establishment of Water Clusters

Established Clusters	Barangays Covered
Cluster 1	Rizal, Buenavista, Ariman
Cluster 2	Panganiban, Pinontingan, Balud Sur, Balud Norte, Cota na Daco
Cluster 3	Cogon, Tiris, Ocgao, Paco, Bagacay

The municipal water of Gubat is zoned following the six (6) major coastal zones, determined complementarily and in harmony with the overall bay-wide zoning framework, without prejudice to additional zones that may later be identified and established. The zonation map formulated and generated is a result of consultation among the stakeholders and validated in the field.

The municipal waters shall be designated into the following zones:

Zone 1 or Protected Zone

Zone 2 or Tourism Zone

Zone 3 or Stationary Fishing Zone

Zone 4 or Navigational Zone

Zone 5 or Docking/Landing Zone

Zone 6 or Mobile Fishing Zone

Protected zones

These zones include sub-zones and other sites identified and reserved for protection of critical habitats, marine species and organism(s). It includes those protected areas declared before the enactment of the Municipal Fisheries Ordinance and those that may later be declared by subsequent Ordinance.

Fish Sanctuary

The Municipal Government, in coordination with the barangays, FARMC and concerned organization shall manage the following fish sanctuaries:

Ragnas Fish Sanctuary- declared under Municipal Ordinance No. 003, series of 2012. The Ragnas Fish Sanctuary covers an area of 16 hectares and located along Barangay Bagacay, specifically located with the following coordinates:

Table 11. Ragnas Fish Sanctuary Coodinates

Point	Latitude	Longitude
A	12° 58' 47" N	124° 09' 09" E
B	12° 58' 38" N	124° 09' 21" E
C	12° 58' 51" N	124° 09' 25" E
D	12° 58' 57" N	124° 09' 13" E

Namantaw Fish Sanctuary- declared under Municipal Ordinance No. 003, series of 2012. The Namantaw Fish Sanctuary covers an area of 15 hectares and located along Barangay Rizal, specifically located with the following coordinates:

Table 12. Namantaw Fisch Sanctuary Coordinates

Point	Latitude	Longitude
A	12° 54' 03" N	124° 08' 15" E
B	12° 54' 14" N	124° 08' 27" E
C	12° 54' 54" N	124° 08' 26" E
D	12° 53' 53" N	124° 08' 24" E

The fish sanctuaries of the municipality shall have the following zones:

a. Core Zone
b. Buffer Zone
c. Navigational Zone as appropriate
d. Other zones as deemed necessary

Stationary Zone

For the enjoyment of the municipal fisherfolk, a stationary zone is also assigned. The stationary zone covers a total area of 1,110.45 hectares and identified as areas for fish corral construction, fish traps and pots, fry gathering areas, gleaning, areas for atras, establishment of fish cages i.e. seaweed culture and other species.

Tourism Zone

As a policy to promote coastal tourism in the municipality, the following area is hereby designated as tourism zone, which covers a total area of 142 hectares and located at the following geographic coordinates:

Table 13. Tourism Zones

Point	Latitude	Longitude
1	12° 54' 44.21" N	124° 07' 15.85" E
2	12° 54' 23.81" N	124° 07' 19.42" E
3	12° 53' 53.21" N	124° 07' 33.71" E
4	12° 53' 38.31" N	124° 07' 47.54" E
5	12° 53' 30.50" N	124° 08' 02.76" E
6	12° 53' 26.74" N	124° 07' 54.46" E
7	12° 53' 27.62" N	124° 07' 43.38" E
8	12° 53' 34.15" N	124° 07' 30.65" E
9	12° 53' 52.18" N	124° 07' 12.20" E
10	12° 54' 17.28" N	124° 07' 01.67" E
11	12° 54' 30.27" N	124° 07' 00.94" E

Navigational Zone

Maritime zone of the municipality is composed of areas in Bagacay - Danao, Karayat, Muwalbuwal, Pasabayan, Sabang; Paco – Ogao; Tiris ;Cogon; Cota na Daco; Balud Del Norte; Balud Del Sur; Pinontingan; Panganiban; Ariman; Buenavista, and Rizal

Docking Zone

Every coastal barangay shall have a designated docking zone(s).

Mobile Zone

Fishing activities allowed in the mobile zone are subject to the limitations set by the national laws and the municipal fisheries ordinance.

Currently, Gubat has three (3) main sources of drinking water: the Kadaop Spring in Brgy. Bentuco, Patong Spring in Brgy. Naagtan, and Cabigaan Spring in Brgy. Cabigaan. Average capacity of these springs is 39, 166 m^3 in a month, but is still inadequate for maximum day demand of the resident population. This compelled the GWD to suffice water needs from 17 deep-well pump, which runs from 8:00 in the evening until 8:00 the

following morning, and by purchase water in Casiguran Water District. These water sources can produce an average of 98, 299.51 m^3 per month. However, water supply is still inadequate to provide sufficient water to all consumers.

The municipality has no categorized forestland. Watersheds are part of the municipality's agricultural lands. Deep wells utilization is an augmentation measure of GWD from the drastic low water productions from the watersheds due to the devastating effect of the typhoons that ravaged the municipality in past years.

Table 14. Water Zone Allowable Use

Water Use Categories/ Sub-Categories	Location and Area	Description and Water Use Policies
Municipal Waters: **19,078.02 hectares**		
Fishery Refuge and Sanctuary Sub-zone	Bagacay, Pinontingan, Rizal **80.5 hectares**	• an area within the Municipal Waters Zone of the municipality "where fishing or other forms of activities, which may damage the ecosystem of the area is prohibited and human access may be restricted".
Foreshore Land Sub Zone	Ariman, Bagacay, Buenavista, Cogon, Panganiban, Rizal **17.96 hectares**	• an area within the Municipal Waters Zone of the municipality defined as a "string of land margining a body of water; the part usually at the seaward margin of a lowtide terrace and the upper limit of wave wash at high tide usually marked by a beach scarp or berm".
Mangrove Zone	The only forest area that can be found in the municipality are those that grows along the seashore. These are the mangroves that grow abundantly in the coastal barangays of Rizal, Panganiban,	• Allowable uses are reforestation, recreational tourism, educational or environmental awareness values and scientific studies that do not involve gathering of species or any alteration in the area; • No permanent buildings or structures are allowed

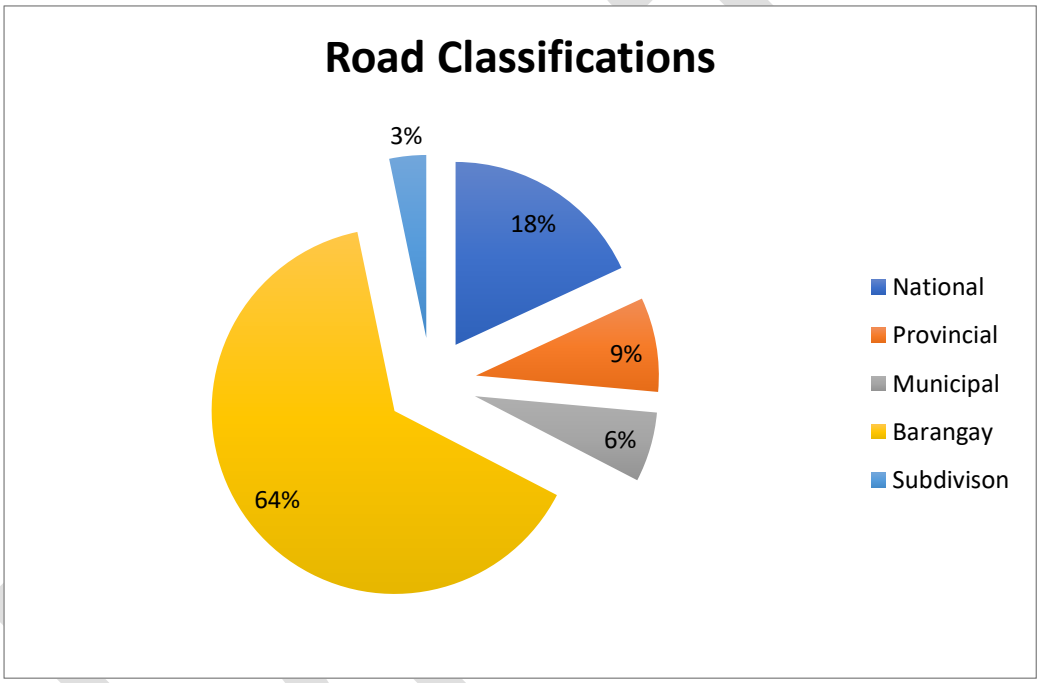
Water Use Categories/ Sub-Categories	Location and Area	Description and Water Use Policies
	Pinontingan, Cogon, Tiris, Paco, and Bagacay. **486.7274 hectares**	
Aquaculture Sub Zones	Bagacay, Tiris, Paco, Cogon, San Ignacio **486.997 hectares**	• an area within the Municipal Waters Zone of a city/ municipality designated for "fishery operations involving all forms of raising and culturing fish and other fishery species in fresh, brackish and marine water areas"
Mariculture Zone and Park Sub Zones	Paco	• an area "designed to produce fisheries through seacage culture such as bangus, siganids, groupers, red snappers, seaweeds farming, aquasilviculture, mussel culture, oyster culture, sea ranching of lobsters and seahorses in coral reefs and seagrass areas, and others that may be developed through the continuing research and development program of the Bureau of Fisheries and Aquatic Resources (BFAR) and other institutions".
Municipal Fishing Sub Zones	Ariman, Buenavista, Rizal, Panganiban, Pinontingan, Tiris, Cogon, Cota na Daco, Balud del Sur and Balud del Norte and Paco, Bagacay	• an area within the Municipal Waters Zone of a city/ municipality where only municipal fishing, as defined in the Fisheries Code, is allowed

Water Use Categories/ Sub-Categories	Location and Area	Description and Water Use Policies
	1,180.4 hectares	
Sealane Sub Zones	Bagacay, Paco, Tiris, Cogon, Cota Na Daco, Balud Del Sur, Pinontingan, Ariman, Panganiban, Buenavista, Rizal **283.62 hectares**	• an area within the Municipal Waters Zone of a city/municipality that is designated as an established route for water vessels traversing the municipal waters. Also referred to as Navigational Lane
Docking Sub Zones	Bagacay, Tiris, Cogon, Cota Na Daco, Pinontingan, Ariman, Buenavista, Rizal **22.3878 hectares**	• a designated area where municipal fishing boats and fishing vessels are secured and protected
Rivers and Creeks	Bulacao, Basiao, Tingting	• Rivers and riparian buffer zones are protection policy areas • Areas within 20 meters of river banks in agricultural areas and 3 meters in urban areas are restricted areas and declared as “no dwelling zone” and “no build zone”, except for the construction of flood and erosion control structures • Allowable uses are regulated fishing and aquaculture, tourism • Quarrying activities will be confined to minor quarry activities with appropriate permits • Water source for irrigation • Potable water source • Renewable energy

Transportation and Road Network

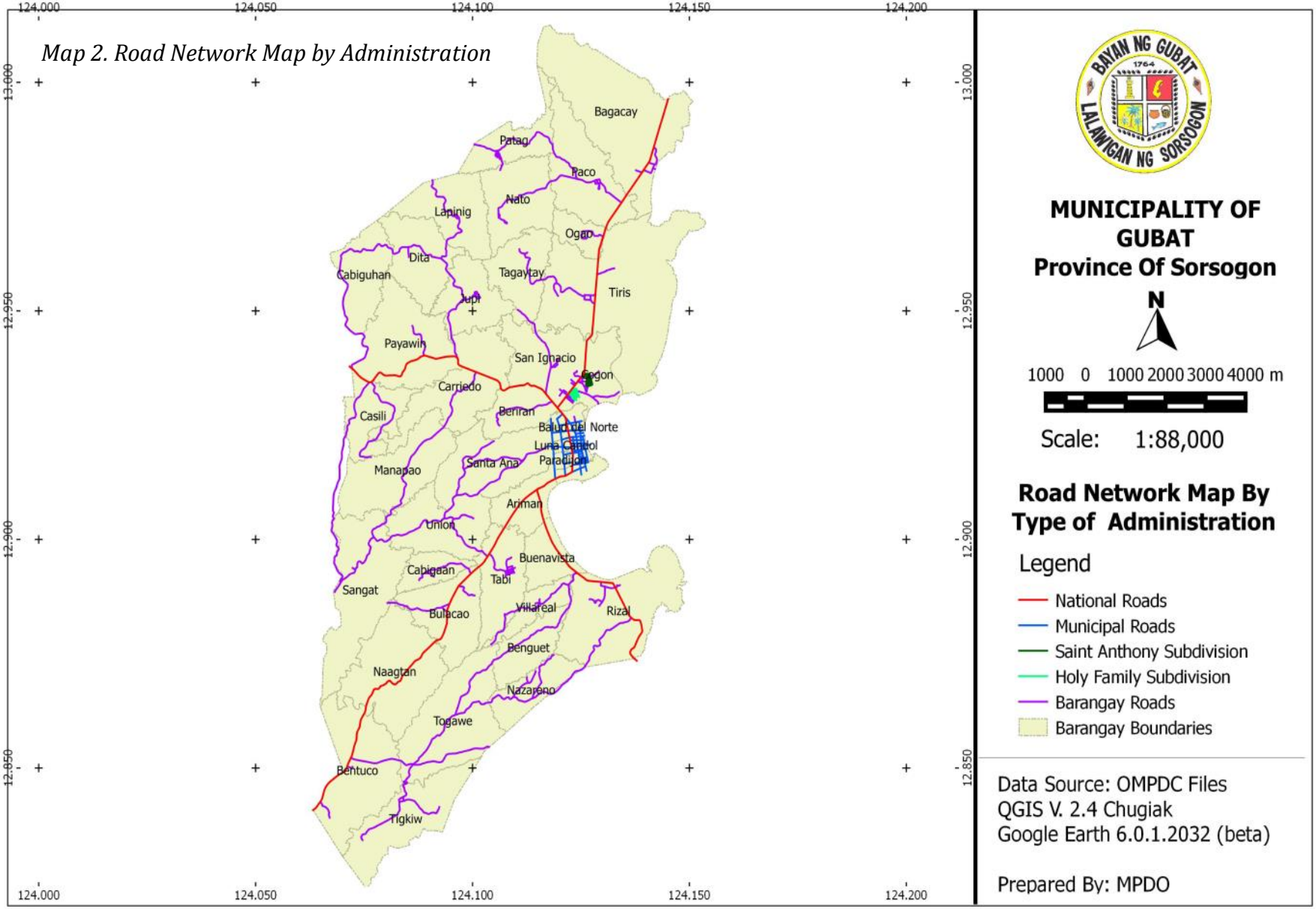
The existing road network of Gubat provides access to the urban center from all rural barangays. A tertiary national road is the main road artery linking Gubat to adjacent municipalities and other places in the country. The existing roads are classified into national, municipal, barangay and subdivision roads. The national tertiary road has a total length of 28.93 kilometers stretching from Jct. Abuyog-Gubat-Ariman; Jct. Ariman-Bentuco-Casiguran; Jct. Gubat-Prieto Diaz; and, Jctn. Ariman-Bulusan The existing municipal roads within the poblacion area have a total length of 13.34 kilometers, while provincial roads traverse 9.87 kms. Roads classified as barangay roads have a total length of 102.58 kilometers. Subdivision roads have a total length of 5.21 kilometers. The total length of the road network in the municipality is 171.234 kilometers.

Graph 4. Road Classifications

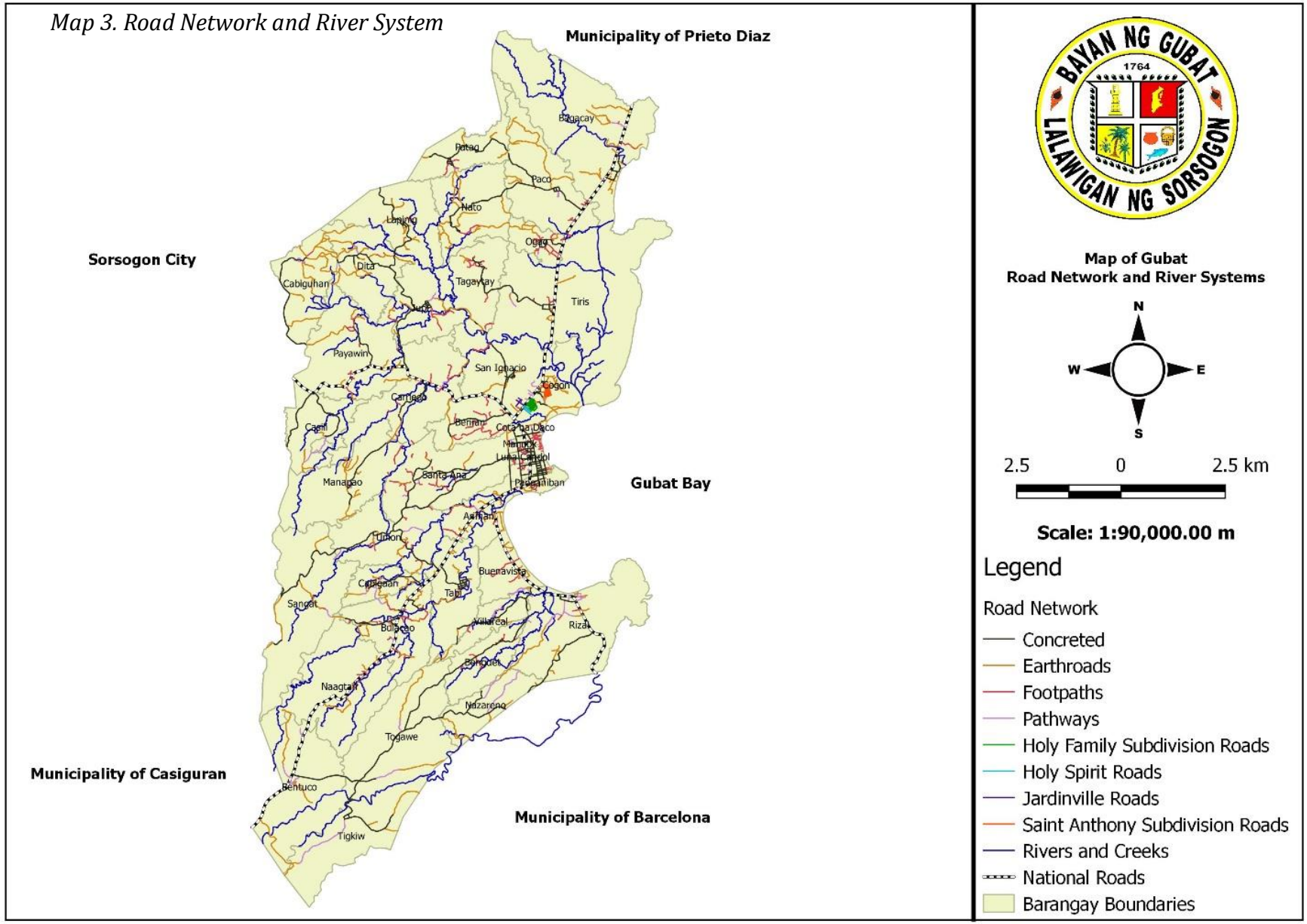


As to the type of road surface, 66.5% (19.26 kms) of the national roads are Portland Cement Concrete Pavement (PCCP), with asphalt portions covering 9.67 kms (33.5%). The entire length of the municipal roads are concreted. Meanwhile, 80.9 kms (79%) of the barangay roads are concreted and the remaining 21% (21.68 kms) are unpaved with gravel and earth surfacing.

Map 2. Road Network Map by Administration



Map 3. Road Network and River System



There is a total of 11 bridges in the municipality, all located along the national roads made of concreted asphalt overlayed. Majority of the bridges have 15-ton load capacity, with those located along national roads ranging 10-, 15- and 20-ton load capacity.

For inter-barangay mobility of people and produce, the main modes of transportation are trimobiles, jeepneys, and light trucks. In the town proper, trimobiles dominate the main thoroughfares. Land transportation facilities in Gubat include a public transport terminal for jeepneys only. Trimobiles generally utilize portions of municipal streets for parking, while there are private terminals for some jeepney and bus companies. There are four gas refilling stations. A significant number of automotive and vulcanizing shops for vehicle repair are available.

Gubat is located two hours away from the regional airport at Legazpi City, and can be reached mostly through land transport from Manila by bus, taking about 12 hours. There are several bus companies that operates daily from Manila to Gubat and vice versa: Alps, JVH Transport/Pamar, Elavil Tours Phils. Inc., St. Jude Transit, Raymond Transport, CUL Transport, DLTB Co, Penafrancia Tours/RSL/Isarog, and Philtranco.

There are also jeepneys that provide transportation to Sorsogon City, Bulusan, Barcelona, Pto. Diaz and local barangays like Nato, Tigkiw, Bentuco, and Benguet.

2.5. Physical Characteristics

Topography

The municipality is interspersed by creeks and rivulets that are mostly tributaries of the three main rivers called the *Bulacao, Basiao* and *Tingting* (Map 3). The *Bulacao* River has two sources: one originates from Ariman in Barangay Bentuco flowing through Anibong, Malidlid and Calumpit, all sitios of Barangay Bulacao, to Barangay Tabi and Ariman where it meets the seashore. The other source originates from Liyang, Sitio Bentuco, to Lucha in Bulacao and merges at Calumpit. The *Basiao* River starts from the numerous springs in Barangay Cabigaan, to Pandan in Bulacao, to Arasiang in Barangay Union, to Tanke in Barangay Sta.Ana, to Aropag in Barangay Ariman and into the sea.

The *Tingting* River serves the northwestern part of the municipality. From a small brook in Manapao, it flows to Caragti in Barangay Carriedo, to Carriedo proper, then to Maroc-baroc and Tingting in Barangay San Ignacio, then to the southern part of Barangay

Tiris and flows out to the sea. Another source originates from Barangay Casili, to Barangay Payawin, to Barangay Jupi and then merges at Tingting. From Tingting, rivulets and creeks traverse the outlying plains of the different sitios of Barangay Dita and barangays Lapinig and Patag. All rivers in the municipality empty at the Pacific Ocean.

The town is predominantly level to nearly level to very gently sloping (0-9%) spread over 7,350 hectares that represent 70.4% of the total land area (Map 4). The town has an average coastal elevation of no higher than 10 meters above sea level, which makes it susceptible to storm surges. The gently sloping (9-18%) is 857 hectares or 8.3% of the total land area widely scattered over the whole municipal area. Moderately sloping or rolling to strongly sloping or strongly rolling has an area of 2,032 hectares contributing 19.6% of the total land area. This type is situated in the northern part of the municipality. The strongly hilly to mountainous portion of more than 30 % and located on the southwest side of the municipality has a total land area of 181 hectares and is 1.7% of the total land area. Unchecked spot elevations in the municipality are found in Bentuco, 115 meters; Togawe at 95 meters; Naagtan at 87 meters; and part of Cabigaan and Bagacay at 73 meters. The highest point in Gubat is 166 meters above sea level at Tigkiw, at the southernmost part of the municipality. The other barangays have an average elevation of 24 meters.

B. Vegetation Cover

Around 82.56% or 9429.07 hectares out of the total land area of 11,421.17 hectares is classified as agricultural (Map 9). All 34 rural barangays are agricultural while one urban barangay, Luna Candol, has a small portion of its area devoted to palay and coconut. As of 2018, coconut areas accounted for 7,251.21 hectares or 76.90% of the total agricultural area while farms grown to palay totalled 2,032.69 hectares or 21.56%.

Meanwhile, there is an estimated 22.42 hectares planted to abaca under coconuts in the barangays of Tigkiw, Togawe, and Bentuco. For the year 2018, pili under coconut was around 320.22 hectares, with 10,971 number of productive trees. Banana was estimated at 50 hectares planted under coconut, while rootcrops is at 16.27 hectares. Vegetable are planted in backyard gardens while a few farmers also venture in commercial vegetable raising. Collectively for all vegetable crops, a total area of 19.05 hectares was planted during the year 2018.

C. Soil

Different soil types characterize the terrestrial territory of the Municipality of Gubat (Map 5). These are Bascaran clay, comprised of 2,834 hectares; clay loam, 4,877 hectares; sandy loam, 240 hectares; hydrosoil, 354 hectares; fine sandy loam, 406 hectares; and fine clay loam, 1,709 hectares. The coastal barangays are the hydrosoil type or the beach type of soil.

The clay loam, fine clay loam, and the Bascaran clay are the primary medium, of agriculture in the municipality. The clay loam, which has the biggest area coverage, is found in the low lands, while the Bascaran clay is found exclusively in the highlands.

Soil Characteristics

Clay Loam

Depth	Characteristics
0-40 cm	Surface soil, clay loam, dark brown to brick reddish brown; coarse granular to blocky; highly plastic when wet, but becomes brittle upon drying. It has a fair organic matter content and is well penetrated by roots. Boundary to the subsoil is wavy and diffused.
40-110 cm	Subsoil, clay, reddish brown, dark brown to brown; coarse granular to columnar. It is mottled black and gray, highly plastic and sticky when wet , and brittle and hard when dry. It is moderately compact. Boulders are present in some places in this layer. It has diffused and wavy boundary to the lower layer.
110-170	Lower subsoil, clay, dark brown to reddish brown; blocky to columnar. Presence of gray and bluish streaks and concretions. Boundary to the substratum is clear.
170-200	Substratum, clay, dark brown to reddish brown; moderately compact and columnar with plenty of concretions. Underneath is reddish orange and gray and highly weathered parent material.

Bascaran Clay

0-40	Surface soil, clay, brownish gray to grayish brown and light reddish brown; moderately compact; blocky structure; slightly plastic when wet; fair amount of organic matter. Gravel is present.
40-65	Subsoil, silty clay to clay, grayish brown to dark brown with abundant brick red streaks; plastic when wet and brittle when dry; coarse columnar. Weathered yellowish gravel is present in this layer. Boundary is diffused and smooth to the lower horizon.

65-115 Lower subsoil, clay, brownish gray splotched with red; columnar and contains yellowish orange gravel. Boundary is smooth and diffused.

115-150 Substratum, clay, yellowish brown, grayish brown to brownish gray, massive. Compact.

Hydrosoil

The hydrosoil in the Municipality of Gubat comprises the areas of swamps and marshes. The areas are under water practically the whole year round, and are extensive along the Gubat coastline. The hydrosoil is generally characterized by a brackish aqueous horizon that is about 100 centimeters deep or more depending upon the rise and fall of the tide. Underneath the aqueous layer is the sub-aqueous horizon. It is slimy, brownish gray to grayish brown to light gray, fine to coarse sandy clay to silty clay with plenty of plant remains. The depth ranges from 35 to 80 centimeters. The basal horizon is also slimy, ashy gray sandy clay. The depth ranges from 80 to 150 centimeters or more from the sub-aqueous surface.

Fine Sandy Loam

0-15 Surface soil, fine sandy loam, black to grayish black; friable; fine granular; loose and mellow in all moisture conditions. Fair in organic content and no stones. boundary to the subsoil is smooth and clear.

30-60 Lower subsoil, silt loam, brown to grayish brown and mottled brown; structureless; very compact in dry and wet conditions. Boundary to substratum is smooth and diffused.

60-150 Substratum, sandy loam, light gray and compact. Below the substratum is a layer of dark gray clay.

Clay Loam

0-60 Surface soil, clay loam; grayish black to reddish brown; coarse granular and moderately compact; slightly sticky and plastic when wet and very crumbly when dry. Contain good amount of organic matter and coarse skeleton is present on areas along rivers. Boundary to the subsoil is clear and weavy.

60-80 Subsoil, clay; reddish brown to strong brown; coarse granular to columnar; moderately compact; very sticky and plastic when wet. In some places, stones are present. Boundary to the lower layer is diffused and wavy.

80-120 Lower subsoil, clay; dark brown to reddish brown with bluish black mottling; coarse columnar. Free from stones. Boundary to the substratum is clear and smooth.

120-below Substratum, clay; arrange brown to reddish brown speckled yellow and black; coarse granular. This layer rests on highly weathered sandstone and tuff.

D. Municipal Waters

Gubat is interspersed by creeks and rivulets that are mostly tributaries of the three main rivers called the *Bulacao, Basiao* and *Tingting*. The *Bulacao* River has two sources: one originates from Ariman in Barangay Bentuco flowing through Anibong, Malidlid and Calumpit, all sitios of Barangay Bulacao, to Barangay Tabi and Ariman where it meets the seashore. The other source originates from Liyang, Sitio Bentuco, to Lucha in Bulacao and merges at Calumpit. The *Basiao* River starts from the numerous springs in Barangay Cabigaan, to Pandan in Bulacao, to Arasiang in Barangay Union, to Tanke in Barangay Sta.Ana, to Aropag in Barangay Ariman and into the sea.

The *Tingting* River serves the northwestern part of the municipality. From a small brook in Manapao, it flows to Caragti in Barangay Carriedo, to Carriedo proper, then to Maroc-baroc and Tingting in Barangay San Ignacio, then to the southern part of Barangay Tiris and flows out to the sea. Another source originates from Barangay Casili, to Barangay Payawin, to Barangay Jupi and then merges at Tingting. From Tingting, rivulets and creeks traverse the outlying plains of the different sitios of Barangay Dita and barangays Lapinig and Patag. All rivers in the municipality empty to the Pacific Ocean.

Meanwhile, the territorial waters of Gubat, Sorsogon mean as the area confined within the line from and between the political boundary of Prieto Diaz and Gubat extending westward up to the point of the vertical line from and between the political boundary of Barangay Bagacay. In the South, it is bounded by the municipal waters of Barcelona and Gubat.

As described by the National Mapping and Resources Information Agency (NAMRIA), the territorial waters of Gubat are bound by its general coastline and the lines technically described as follows:

Table 15. Territorial Waters Boundaries

Point	Latitude	Longitude	Remarks
Beginning at 1	12° 59’ 57”	124° 08’ 38”	Coastal Terminal Point, MBM 38
Thence 2	12° 57’ 11”	124° 19’ 42”	
Thence 3	12° 55’ 11”	124° 19’ 08”	

Thence 4	12° 54' 30"	124° 18' 09"	
Thence 5	12° 53' 52"	124° 17' 44"	
Thence 6	12° 52' 26"	124° 08' 15"	Coastal terminal Point, MBM 01
Thence following the coastline to 1			

E. Climate

The municipality experiences a Type II climate characterized by a short dry season in the months of April to August, and a pronounced maximum rainfall from November to January. The average rainfall is 6.65 mm while the highest readings occur in the month of February at 14.3 mm and the lowest at .4 mm in the month of May. The mean temperature is 27.245 degree Celsius.

There are three kinds of wind systems passing the municipality at different times of the year (Map 2). The Northeast Monsoon occurs during the months of October to February; the North Pacific Trades from March to April; and the Southwest Monsoon from May to September. Gubat is along the path of typhoons of the magnitude 11k from May to December. Normal track of typhoon may occur once a year.

Average humidity is reached at late dawn when the temperature is minimal. The coldest months are December, January, and February with the lowest air temperature of 20 degree Celsius, while the hottest month is April recording the highest temperature of 35 degree Celsius.

F. Natural Hazards and Constraints

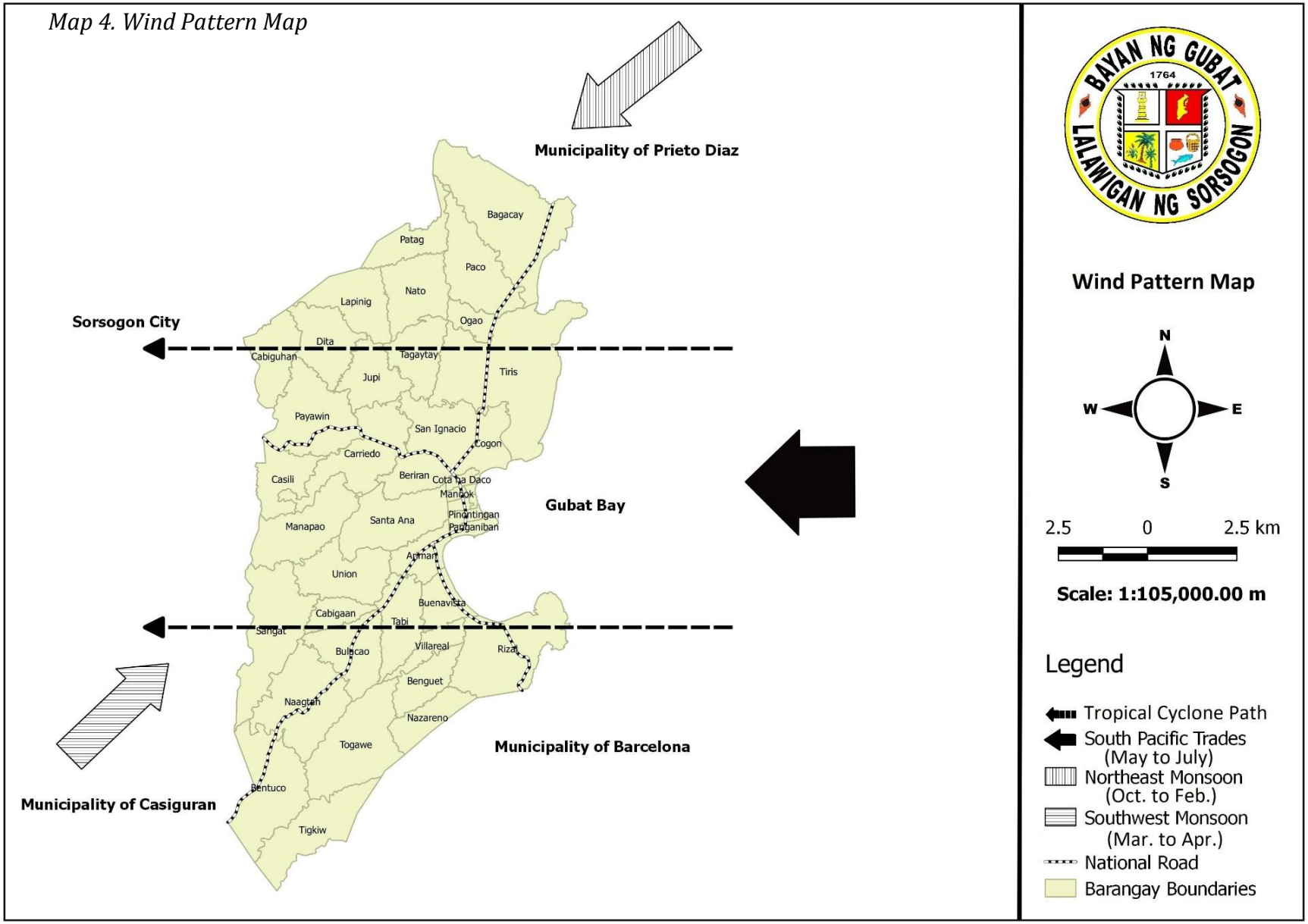
With a vulnerability index of 1 - 30%, all barangays of the municipality are vulnerable to El Nino and La Nina phenomena. Aside from these, the municipality also experiences series of tropical cyclones over its geographical zone.

Based on the study conducted by the MPDO, it is estimated that an area of 1,475.72 hectares, or 13% of the total land area, are susceptible to flooding (Map 6). Of this, 1,13.72 hectares is regularly-frequently flooded and 312 hectares are occasionally-rarely flooded.

With regard to storm surge, total area susceptible is 2,111.59 hectares, broken down as follows: high susceptibility – 1,945.54 hectares, moderate susceptibility – 126.51 hectares, low susceptibility – 39.54 hectares. Meanwhile, 1,796 hectares is affected by landslide, broken down as follows: highly susceptible – 276.94 hectares, moderately susceptible – 81.69 hectares and low susceptible – 1,438.27 hectares (Map 7).

In case of a tsunami with a wave height of 7 meters at the coast, all urban poblacion barangays and 10 coastal barangays will be inundated (Map 8).

Map 4. Wind Pattern Map



Map 5. Map of Rivers and Creeks

MUNICIPALITY OF GUBAT
Province of Sorsogon

N

1000 0 1000 2000 3000 4000 m

Scale: 1:100,000

MAP OF RIVERS AND CREEKS

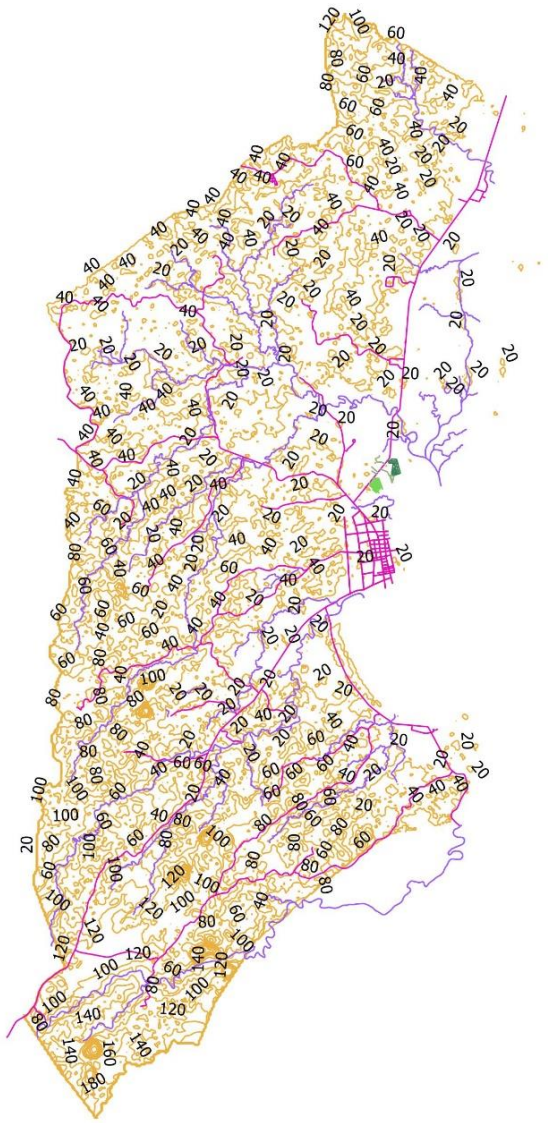
Legend

- Rivers_Creeks
- Road Network
- Barangay Boundaries

Data Source: OMPDC Files
Google Earth 6.0.1.2032 (beta)
QGIS v2.4, Chugiak

Prepared by: MPDO

Map 6. Elevation Map



MUNICIPALITY OF GUBAT

N

Elevation Map

1 0 1 2 3 4 km

1:90,000

Legend

- St. Anthony Subdivision Sts
- Holy Family Subdivision Sts
- Rivers_Creeks
- Relocation Site
- Road and Streets
- Poblacion Streets
- contour

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Local Government Unit of Gubat
Gubat, Sorosogon
QGIS V. 2.2.0, WGS 84/UTM 51N

Sources:
Google Earth Satellite Imagery 2010
ASTER-GDEM 2011

G. Climate Change Vulnerability

Located on the eastern side of Sorsogon facing the Pacific Ocean, Gubat is directly in the path of typhoons and had suffered several destructive typhoons. Gubat was identified at high risk to climate change events because of their location, their coastal topography (narrow low-lying plains bordered by the ocean and the volcanoes), and the population (largest population center facing the Pacific in the province of Sorsogon). Additionaly, because the presence of rivers, the town is potentially at risk to additional climate stresses, i.e., extreme weather events, changes in precipitation and increase in temperature. Graph 5 shows the projection of sea level rise based on different models and indicates various municipalities of Sorsogon that are prone to this hazard.

Graph 6 shows the annual mean temperature anomaly in the Philippines with respect to (1971-2000) – RCP 4.5 and RCP 8.5 projections. Large amount of warming by the end of the century is shown, with all models agreeing on warming for both RCP 4.5 and RCP 8.5. Projected future change in tropical cyclones to affect the Philippines indicates a slight decrease in frequency and increase in intensity.

The climate projections for Gubat, Sorsogon were based on the projected changes of different climate variables for 2020 and 2050 using the observed baseline from 1971 to 2000 (PAGASA, 2011). Based on this climate projection, the municipality will experience an increase in temperature by 2020 and 2050 for all seasons with the highest increase in temperature during the months of March, April, and May (summer months). Decrease in rainfall will occur in the months of March, April, May, while the number of hot days is expected to have a significant increase by 2020 and will continue by 2050, and would be hotter during Amihan season (December, January, February). Although there will be more dry days in 2020 compared to 2050, days would be drier in both years compared to the baseline. However, it is also expected to have more days with extreme daily rainfall of >200mm for 2020 and 2050.

Inherent with the climate stresses are the increased exposure to various hazards like sea level rise, riverine and coastal flooding, rain-induced landslides, prolonged dry spells and strong winds. Projected impacts of climate change to agriculture include decrease in crop yield, increase in post-harvest losses, increase in crop pests and diseases and decrease in livestock production, thereby negatively affecting food security.

The environment and biodiversity will also be impacted, resulting in extinction of certain species of flora and fauna in a fragile environment. Water use will likewise be affected, including siltation of water bodies, declining water quality, reduction of potable water supply and increased demand in water for use in irrigation. Health impacts include

increase in incidence of water- and vector-borne diseases. Extreme weather events will damage social and economic support infrastructures like schools, hospitals, lifelines and other utilities. Human settlements are projected to have increased property damages due to flooding, landslide and storm surge, resulting in increased number of climate-induced casualties and displaced individuals.

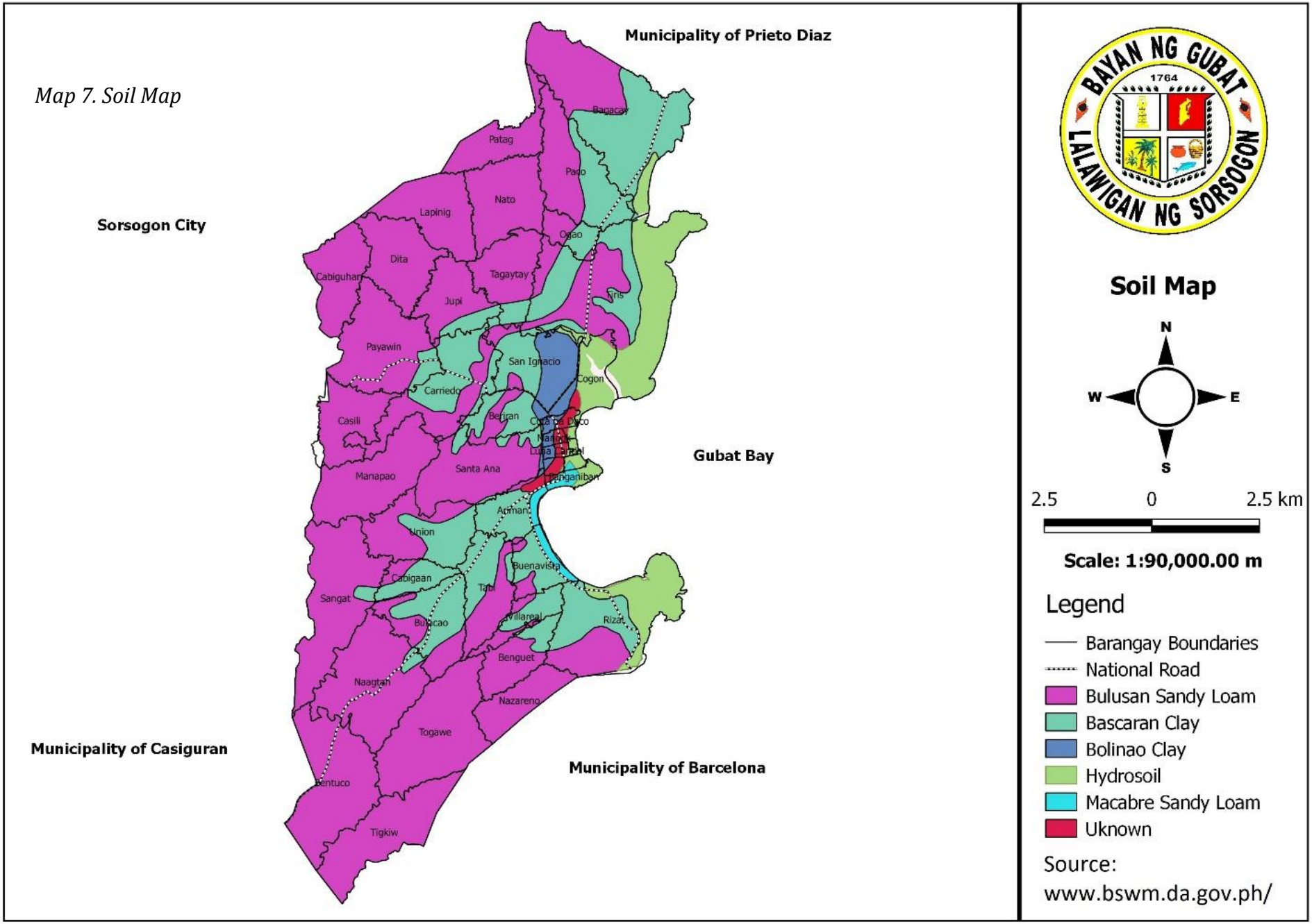
Based on marine geological study, Gubat has lost about seventy meters of its shore land to erosion over the past fifty years. Recent results of the Climate and Disaster Risks Assessment show that flooding and landslide in some barangays also affect the town. Natural flooding caused by overflow of adjacent rivers combined with the area's physical characteristics affecting five barangays located on the north-western side of the municipality. It must be noted that the low portions of the poblacion experience drainage overflow. Depth of these overflows measure less than one meter and usually subsides within an hour. Although these cannot entirely be categorized as flooding, they still pose an obstacle to the normal functions of the affected sections.

With regard to storm surge, the total area susceptible is 2,111.59 hectares broken down to: highly – 1,945.54 hectares; moderate – 126.51 hectares; and, low – 39.54 hectares. Meanwhile, 1,796 hectares is susceptible to tsunami, which is broken down as follows: highly susceptible – 276.94 hectares; moderately susceptible – 81.69 hectares; and, low susceptible – 1,438.27 hectares. Should there will be a tsunami with a wave height of seven (7) meters, all the urban barangays including ten (10) coastal barangays will be severely affected.

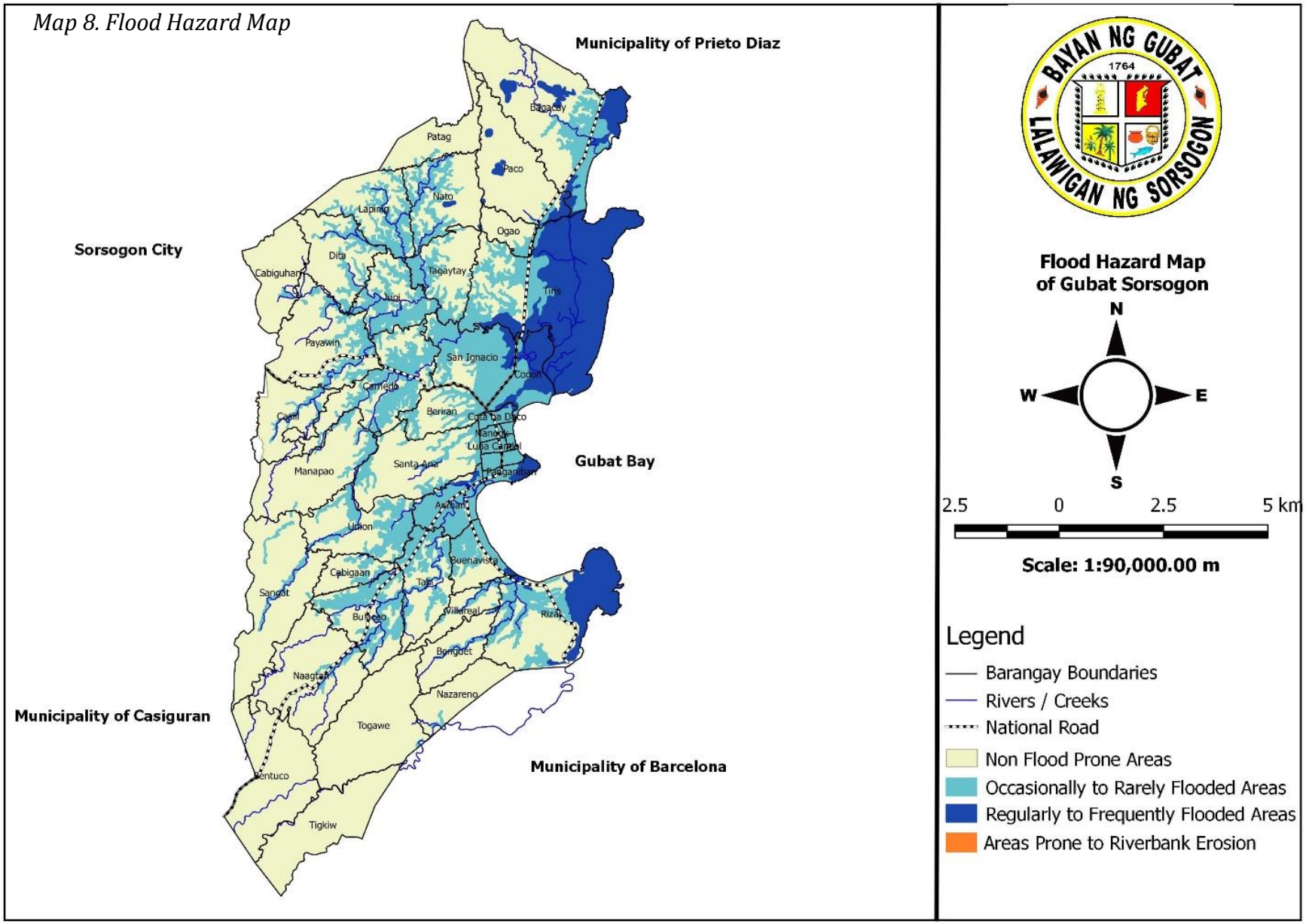
In 2008, the World Bank carried out *in situ* vulnerability assessment to establish which of Gubat's thirteen coastal villages were at highest risk and to establish areas of engagement. Adopting the UNDP formula for risk, i.e., Risk = Hazard x Exposure x Vulnerability, the villages of Bagacay and Rizal were found to rank highest in the risk index. Bagacay, with a population of 3,181 in 2007, has a third of its population living within 500 meters of the shoreline. In Rizal, one-fifth of the population is similarly situated. Villagers living directly behind the seawall were found to be at highest risk. Most of them were fisherfolk whose houses would not withstand strong typhoons, with or without climate change. Found to be at high risk of flooding, in addition to the fishing village, were the elementary school, the village hall, and the health center in Bagacay, which were situated a few meters from the seawall.

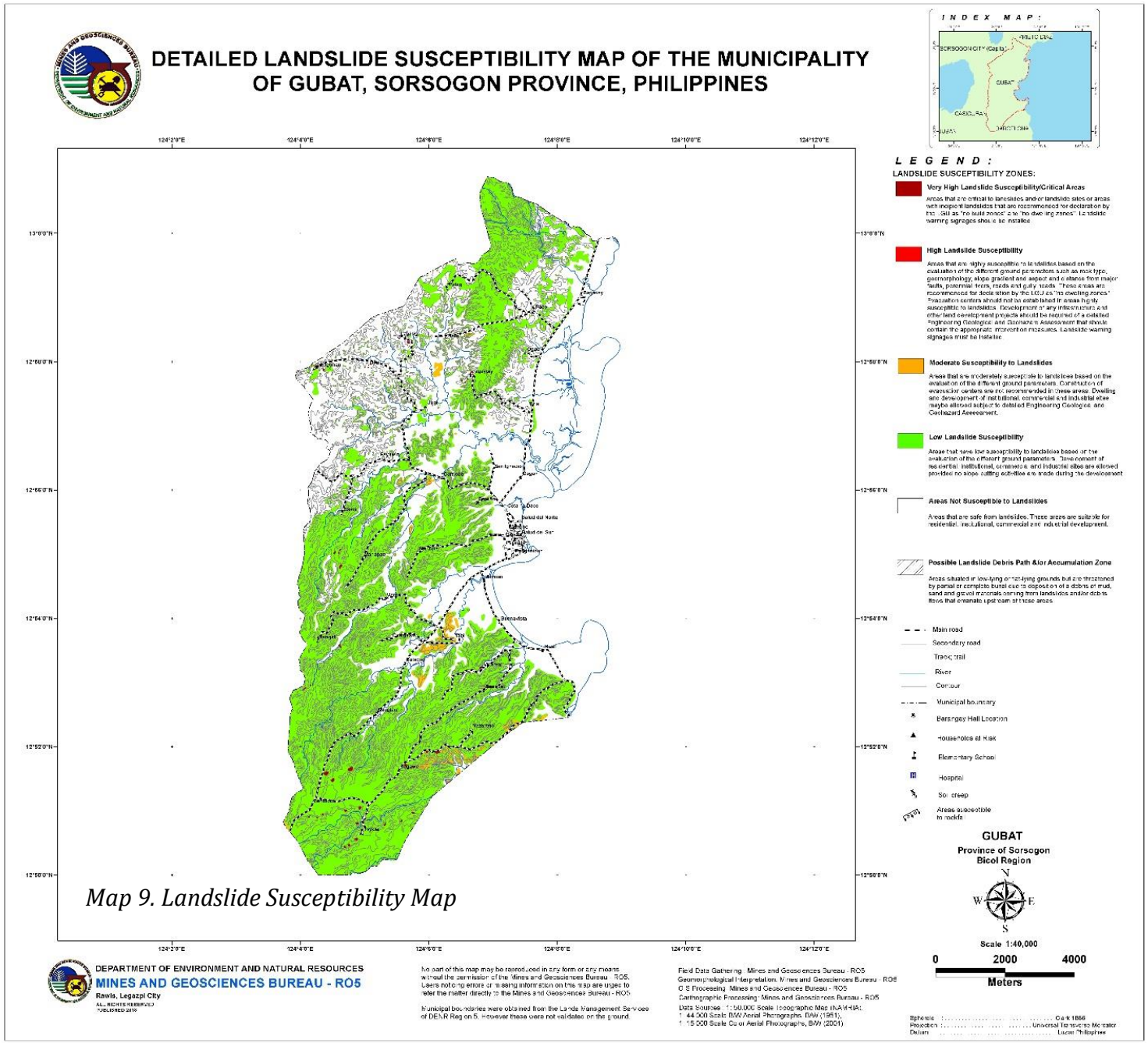
The state of physical infrastructure in Bacagay and Rizal also posed potential hazards. The main roads and public buildings lacked drainage that worsened the extent and magnitude of rain-induced flooding. The studies concluded that, given the projected increase in frequency and intensity of typhoons, inaction would exacerbate flooding in these communities.

Map 7. Soil Map



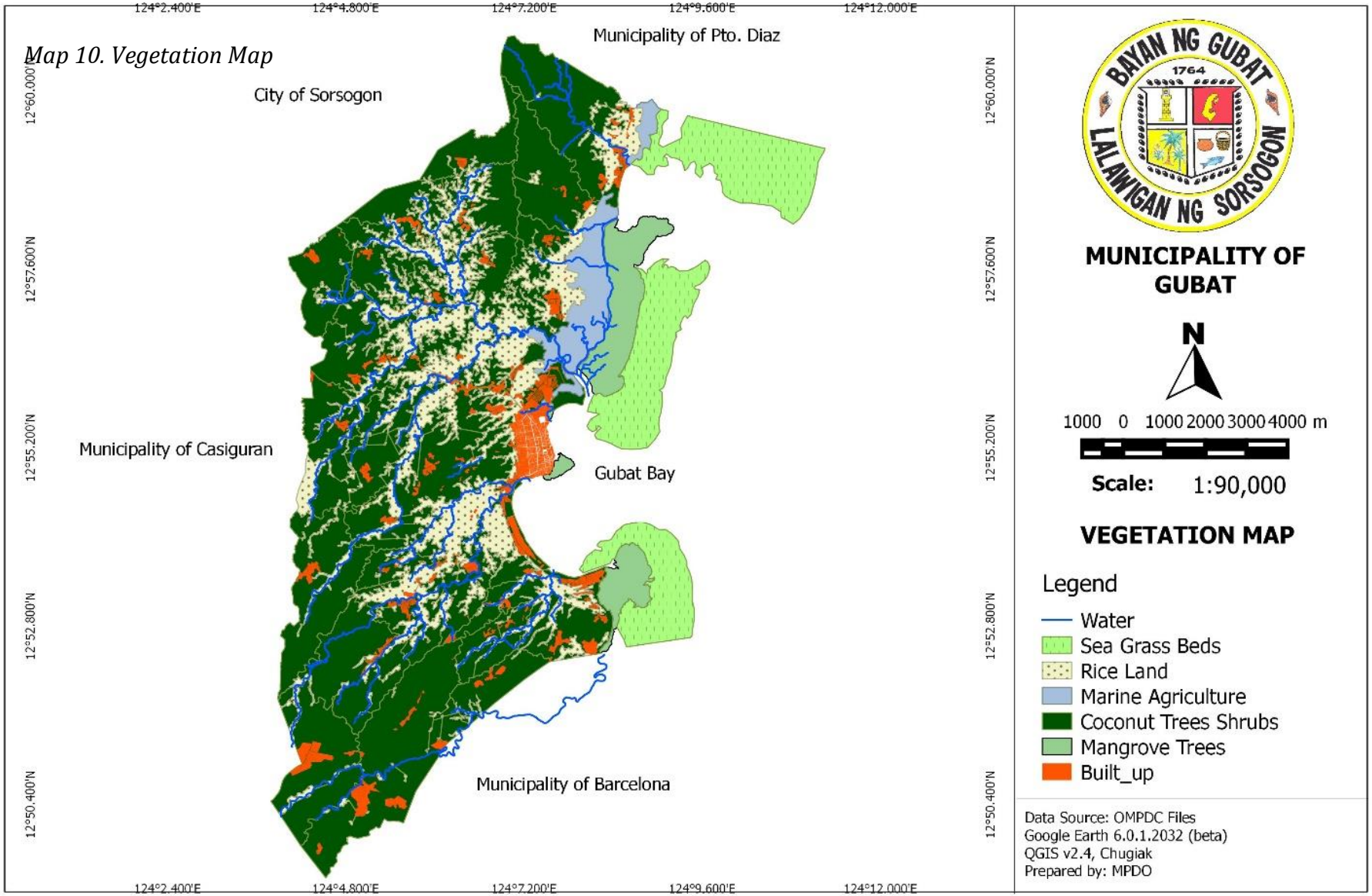
Map 8. Flood Hazard Map



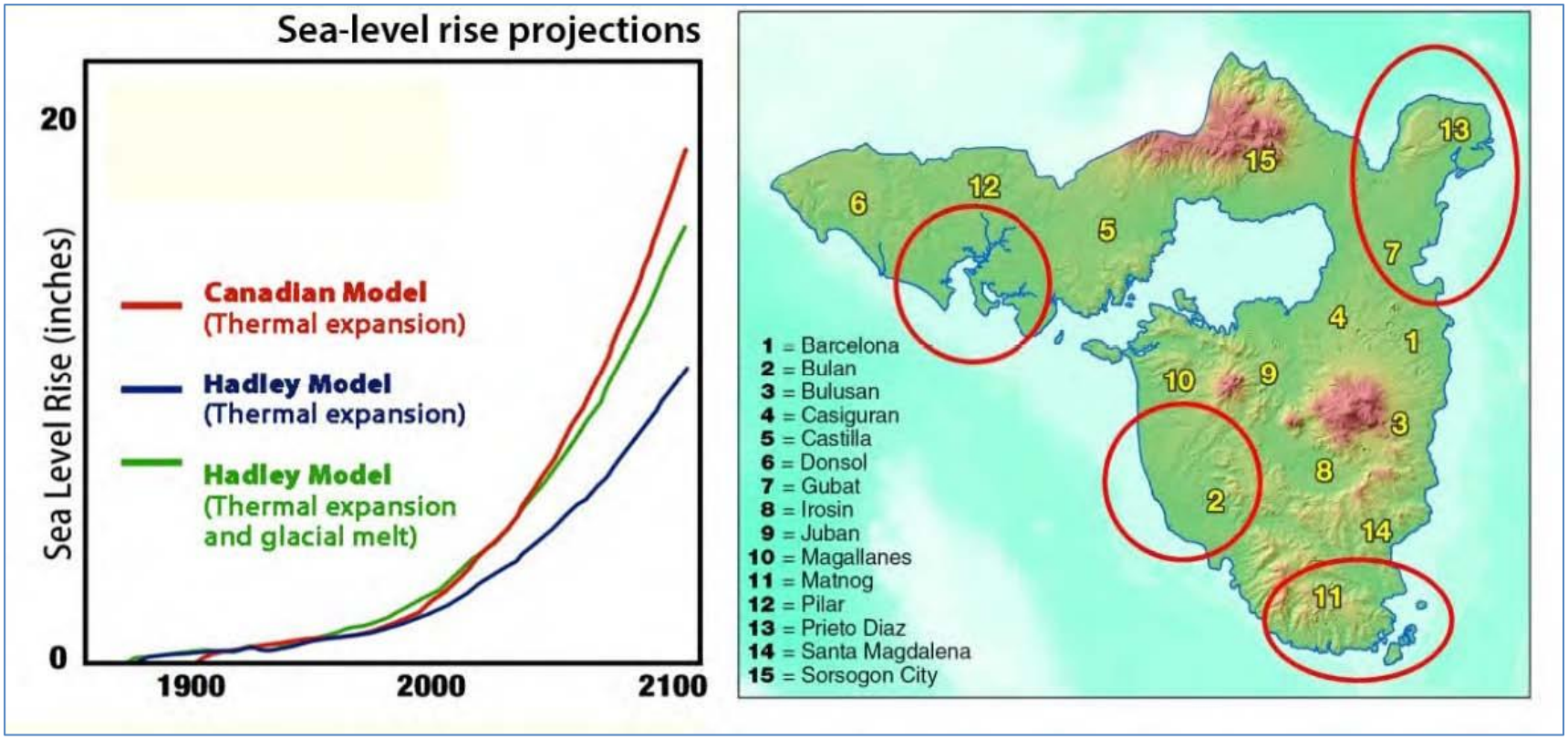


Map 9. Landslide Susceptibility Map

Map 10. Vegetation Map

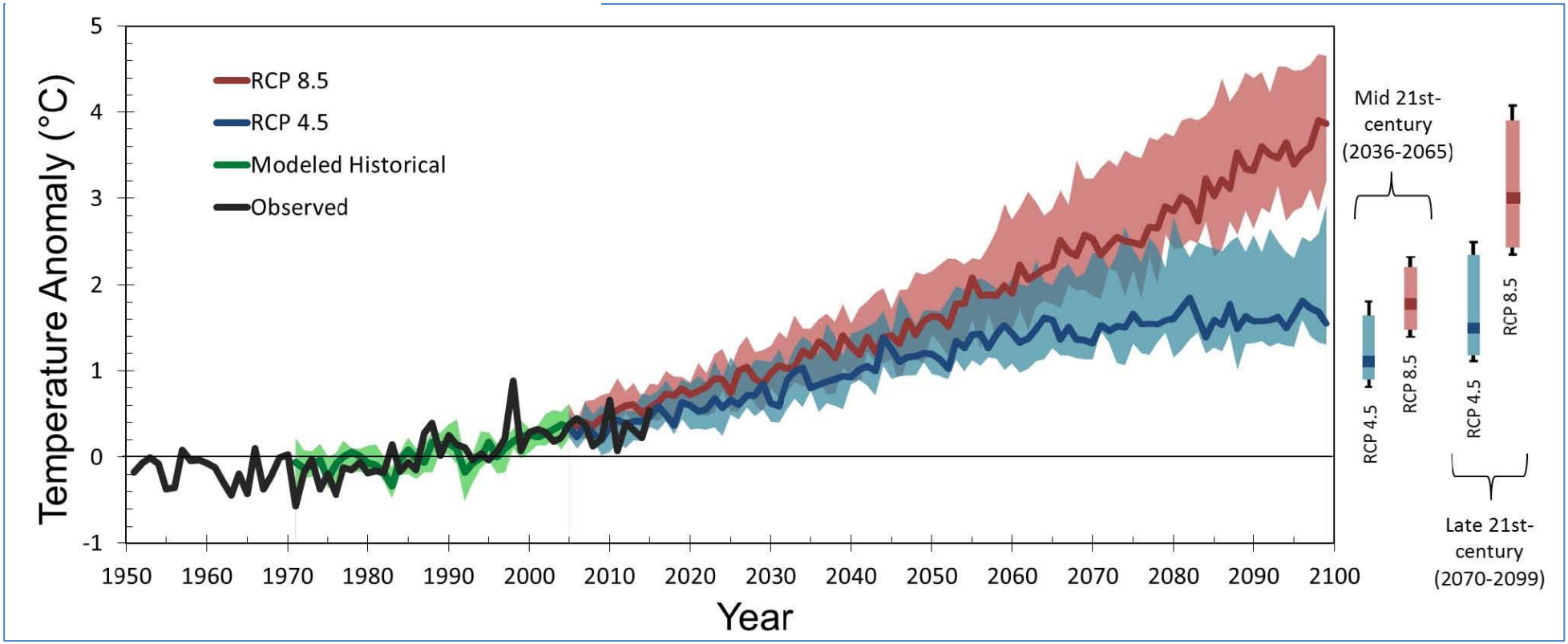


Graph 4. Sea Level Rise Projection



Graph 5.

Graph 5. Temperature Anomaly



3. Current Solid Waste Management Conditions

3.1. Institutional Arrangements

The Municipal Environment and Natural Resources Office (MENRO) under the Mayor's Office is responsible in handling the entire waste management activities to include but not limited to garbage collection, dumping of residual wastes, and IEC program initiatives.

Figure 1. MENRO Organizational Chart

Currently, the SWM is supervised mainly by designated MENRO from a direct command coming from the Mayor and has one (1) MENRO staff who is a Permanent Employee. MENRO-Designate is in-charged in facilitating and monitoring the facilities and different projects for solid waste management. Garbage Collectors, Dump Truck Drivers, MRF/Final Disposal Facility Staffs employed by the LGU, who are responsible for collection, transport, and disposal of residual waste. All of them are directly reporting to the MENRO Designate.

There is a Municipal Solid Waste Management Board reorganized through Executive Order No. 2018-020, chaired by the Municipal Mayor with the councilors particularly the SB chairman on Committee on Environment and Natural Resources and Committee on Health and Sanitation. Primarily, they are responsible for the following:

1. Develop the 10-year Solid Waste Management Plan of the municipality that shall ensure long-term management of solid waste as well as integrate the SWM plans and strategies of the barangays;
2. Adopt specific revenue-generating measure to promote the viability of its SWM plan;

3. Develop the specific mechanic and guidelines for the implementation of the 10-year SWM plan;
4. Oversee the implementation of the 10-year SWM plan;
5. Monitor the implementation of the 10-year SWM plan through its various political subdivisions and in cooperation with the private sector and the NGOs;
6. Coordinate the efforts of its barangays in the implementation if the 10-year SWM plan;
7. Recommend to appropriate local government authorities specific measures and project proposals for franchise or build-operate-transfer agreements with duly organized institutions pursuant to RA 6957, to provide either exclusive or non-exclusive authority for the collection, transfer, storage, processing , recycling or disposal of solid waste;
8. Review every two years as needed the 10-year SWM plan to ensure its sustainability, viability, effectiveness, and relevance to local and international development in the field of SWM.

In the barangay level, aspect on information, education and communication (IEC) campaign is well-implemented. The barangay local government unit (BLGU) together with the elementary and secondary schools and some local organizations were involved in the distribution and posting of educational materials as well as discussions of proper waste segregation through barangay assemblies. "Bayabay", Gubat's version of *umalohokan*, an ancient practice of going around the village to make people aware of new laws and policies, was observed as a very effective way of IEC dissemination.

All 42 barangays have created their Barangay Solid Waste Management Committees which primarily responsible in terms of collection, recycling, disposal, IEC, accounting, implementation and enforcement of regulations. However, some BSWMB are not functional. Major factor seen to its non-functionality is the absence of SWM plan drafted by each barangay. Nonetheless, absence of policies did not deter the BLGU's to implement SWM-related programs. Most of the households practice proper waste segregation, although it is observed that no proper waste disposal facility is being provided by the BLGUs. This positive result is mainly attributed to vermicomposting which was implemented way back in 2014. Vermicomposting or the diversion of organic wastes through earthworms to produce valuable soil and organic fertilizers was once a thriving alternative source of livelihood for the people of Gubat. Recyclables e.g. plastic and glass bottles, tin cans, and paper and cartons

were also segregated to be regularly collected by itinerant-waste buyers and junkshop operators.

3.2. Inventory of Equipment and Staff

The LGU currently owns one (1) mini reconditioned hydraulic excavator acquired last August 18, 2009. To date, the mini excavator is the only equipment used in the maintenance of the dumpsite. The roller of excavator is already broken and once it undergoes repair, no heavy equipment will be used in the maintenance of the dumpsite.

The LGU also owns one (1) Garbage Compactor which is acquired in the year 1999. It was converted into a mini dump truck and is now fully depreciated. It is being used in garbage collection together with another mini dumptruck - REZ61, NKR66E-7110172 acquired in the year 2009. Other utilization of these dump trucks are for hauling of construction materials, transport of tables and chairs and other requested materials from LGU.

The heavy equipment owned by the LGU is currently being operated by the Municipal Environment and Natural Resources Office for its Solid Waste Management Program. The excavator is operated by Mr. Gerald Panuga used since the start of operation of the Gubat Municipal Dumpsite in the year 2005.

The two mini dump trucks are operated by Mr. Santos Encela and Mr. Juan Jarabelo, together with the following garbage collectors: Edwin Estopace, Gil, Tremevilla, Tomas Em, Anthony Domdom, Ariel Escora, Antonio Ergina, Rene Erepol, Diron Fajardo, Rey Tremevilla, Renato Escota and Algen Estopace.

There is no existing motor pool for the heavy equipment. The mini excavator is retained in the dump site in Tagaytay, Gubat, Sorsogon, while the two dump trucks are parked in Encinas Pavilion every after garbage collection.

Currently the collection is done by the people manually. The responsibility of the personnel is to facilitate dump trucks during their collection and to maintain the cleanliness of the area. There are also dump site personnel who facilitate in the segregation at the "end-of pipe" for the possible recovery and reduction of the amount of solid waste that proceeds to the landfill.

Below is an inventory of personnel involved in solid waste management services.

Table 16. Inventory of MENRO Personnel

Position	Employment Status	Number of Employees
MENRO-Designate	Permanent	1
MENRO Staff	Permanent	1
Garbage Collector	Permanent	2
	Casual	2
	Job Order	7
Backhoe Operator	Casual	1
Dumpsite Personnel	Job Order	2
Total		16

There are also various orientations and trainings attended by these personnel such as proper segregation of wastes; training on proper handling of solid wastes, the risk of hazards to them and the public and how to minimize or avoid them. They have observe the standards and requirements for the collection, transport and handling of solid wastes as required under the IRR of RA No. 9003.

3.3. Source Reduction

At present the household/residential, commercial, industrial, institutional, market sources are required to segregate their solid waste into biodegradable and non-biodegradable wastes. The households are currently practicing segregation at source and encouraged for waste diversion through the application of recycling and backyard composting.

3.4. Collection

Under RA 9003, the local government is responsible for collecting residual and special wastes, while barangay units are given the task and responsibility of collecting and segregating the biodegradable, compostable, and reusable wastes. But since the MSWM Board has just re-organized and Barangay Committees for SWM are inactive mixed collected wastes are collected and dumped to disposal site at Barangay Tagaytay. Below is the scheduled collection of wastes per urban barangay:

Table 17. Schedule of Garbage Collection

Barangay	Non - Biodegradable	Biodegradable
Luna Candol	Monday	Tuesday
Manook	Tuesday	Wednesday
Tiris	Wednesday	

Balud Sur	Wednesday	Thursday
Balud Norte	Wednesday	Thursday
Pinontingan	Thursday	Friday
Panganiban	Friday	Saturday
Cogon	Saturday	____
Cota Na Daco	Sunday	Monday
Paradijon	Sunday	Monday

Table 15. Collection Schedule

Those other barangays not catered by garbage collection managed their own collection and disposal. Unfortunately, due to lack of knowledge and capacity, most of them resort to open burning of wastes or dumping them in their backyard.

3.5. Transfer

Basically, the transfer of solid waste is done through the use of the two dumptrucks. Garbage are being collected everyday from the households and hauled directly at the final disposal in Barangay Tagaytay. Garbage collection is also being done in other barangays with operational MRF. Once the MRF reach a specific volume of waste, the BLGU request for pick up at the MENRO. In addition, the solid wastes collected from the public market are being stored from morning until evening in one designated location near it. After cleaning time of the market at around 9PM, the solid wastes are loaded inside the truck, ready for hauling early next day.

3.6. Processing Facilities

There is an existing materials recovery facility located at Highway 59, Barangay Ariman, due for rehabilitation. Currently, the MRF is only accepting biodegradable wastes. There is an available composting facility in the MRF which is used to process biodegradable wastes collected from the public market and the Municipal Agriculture Office. The organic soil is used to grow plants in the greenhouse garden, also located within the MRF.

As of March 31, 2021, there are already 38 out of 42 barangays with operational MRF. However, the problem lies in poblacion barangays due to lack of available lot where they can construct their MRF. The Local Government Unit under the 20% Local Development Fund last 2020 distributed mobile MRF to 42 Barangays

3.7. Final Disposal

The Gubat Municipal Dumpsite lies at Lot No. 7869 of Barangay Tagaytay. It is a government-owned lot purchased from the Esteves Family. Hauling distance from the town proper is about six kilometers. It can be reached from the town proper via Gubat-Prieto Diaz road then turn to Barangay Tiris heading off to the site. It is situated approximately one kilometer before the *visita* of the barangay with a size of 40, 336.42 square meters (sqm). However, 2,040 sqm of this lot was used as part of the barangay road to Barangay Tagaytay proper. Of the remaining three hectares, only 1 hectare was designed to be utilized as the disposal facility of Gubat with an estimated capacity of 30,000 cubic meters.

The dumpsite is primarily operated by the LGU. It is supposed to be a controlled dumpsite, however, due to lack of manpower and equipment for the maintenance of the dumpsite, the quality operation weakened, rendering it to be an open dumpsite. There are three job orders assigned in the dumpsite to maintain and guard the area together with one backhoe operator. There are presence of more or less seven waste pickers who gather recyclable materials from the dumpsite as part of their livelihood. Dumping of garbage collected from households of 10 barangays is done daily from 9:00 AM to 10:00 AM. There is another schedule which is 9:00 PM to 10:00 PM for dumping of waste collected from the public market. Approximately 1.4 tonnage per day (tpd) of waste is generated from this daily collection and is directly dumped in the dumpsite. Since its operation in 2005, an estimated 54,000 tons of solid waste has been dumped in the active dumpsite.

Safe closure of this dumpsite already started in December of 2018 and set to be completed by June 2019. Of the one hectare designed to be utilized as dumpsite, only 5, 431 sqm is active and will be closed and rehabilitated. A Temporary Residual Containment Area (TRCA) will be constructed on the unutilized area to accommodate the residual waste generated by the municipality while the establishment of an area for sanitary landfill is on-going. The SCRP has the following components:

1. Site clearing;
2. Construction of TRCA;
3. Site grading and stabilization of critical slopes;
4. Installation of final cover;
5. Vegetation;
6. Drainage control system;
7. Leachate management;
8. Gas management;

9. Fencing and security;
10. Putting up of signage; and
11. Social action plan

When disposal operations have ceased and final cover has been applied to the waste, the disposal facility is considered as permanently closed, wastes will no longer be dumped in the area and post-closure management will be put into effect. Post-closure maintenance shall be for a period of ten years. There will be two assigned personnel who will oversee the dumpsite in two shifts. Aside from the two, the Municipal Project Monitoring Committee will conduct regular and special inspections as discussed below.

As the waste in the closed dumpsite decomposes, it is reduced in size and settlement occurs. Most of the expected settlement usually occurs within the first five years after closure. A proposed after use shall be evaluated carefully from a technical and economic point of view. The following land uses and projects are possible in the area:

1. Ecological Park (Eco Park) is an alternative facility in the absence of a sanitary landfill. The solid waste collected in the city shall be properly managed and items with value shall be recycled and be made marketable to provide source of income to the people living near the municipal dumpsite.

2. Bamboo Park is a project that will not only address the concern on soil erosion but it will also be a source of sustainable income for farmers and livelihood for their families and the community, to be achieved by turning bamboo, "the poor man's timber," into a cash crop, not only through pole sales but also through nursery raising, plantation and primary processing for bamboo-based products and for food processing.

   The bamboo varieties set to be planted, he explained, could be used for handicrafts. The leaves are proven effective in sequestering carbon dioxide, reducing pollution in the process. The roots of bamboos also spread wide, a good way to control soil erosion. The LGU will seek the support of Philippine Bamboo Foundation for this project.

3.8. Special Wastes

The municipality does not have proper accounting when it come to the volume of special wastes. Special wastes are unfortunately dumped together with all the other wastes in the dumpsite.

3.8.1. Health Care Wastes

As to the health care wastes, the Municipal Health Office (MHO) follows the standard provided by the Department of Health (DOH). The MHO have a septic vault for placenta and other infectious wastes located at the back of the Lying-in Clinic. The sharp wastes such as syringes and other infectious wastes are placed in the safety box provided by the DOH then deposited in the septic vault located at Gubat Cemetery, Barangay Ariman.

There is also one district hospital in Gubat managed by the Provincial Government. Their health care wastes are being collected by an accredited Treatment, Storage, Disposal (TSD) Facility. While awaiting for collection, the hospital treats and stores their health care waste in a tightly sealed container and placenta are deposited in a placenta pit. Proper inventory is being observed.

As for the private Hospitals and Clinics, they all observed proper protocols in handling Health Care and Hazardous Wastes. Health care wastes are placed in septic tanks after disinfection and safekeeping in tight containers.

Health care wastes from funeral parlors are clothings of the deceased. Which are usually taken by relatives or buried in septic vault in the cemetery.

3.9. Market for Recyclables

There are four junk shops operating in the municipality. However, only one has a business permit from the LGU. Some recyclables like bottles, tin cans, iron are being bought by the said junk shops through their roving buyers in varying prices. However, these four junkshops do not buy other variety of recyclables like cartons and papers. These recyclables eventually go directly to the disposable site.

Currently, the Ariman Eco Youth Club, a non-government organization formed through the ABS-CBN Bantay Kalikasan, launched the Art Pillow Project where they convert plastics into throw pillows. The canvass pillowcase is artfully hand painted by the Gubat Artist Association and other volunteer artists. Since its launch in 2018, the Ariman Eco Youth Club gained a steady market for its product.

3.10. IEC

Solid Waste Management Information Education Campaign (SWM-IEC) Team for the LGU was created. Team effort was utilized in crafting and preparation of IEC and Social Marketing materials. Continuous meeting and deliberation of the team on the strategies, approach and materials to be used to make the IEC effective. Target audience for IEC dissemination is the whole community since focus of the plan is behaviour change on solid waste management.

Various IEC activities was held since the launching of Hamus, Marie Linig! (Come, let's clean!) campaign in April 2017. Lead by the MENRO, a municipal wide IEC campaign was done and all the barangays were informed on how to come up with a sound BSWMP and its importance, the different classifications of wastes, source reduction, segregation at source, recycling and composting. Consequently, the barangays relayed the message to the household through their regular barangay assemblies. The LGU also conducts evaluation of the SWM implementation of the barangays where they are given technical advice depending on the result of the evaluation. In addition, school-based IEC were also done in Bicol University Gubat Campus, Gubat National High School, Bagacay National High School, and Gubat South Central School.

3.11. Costs and Revenues

Budget allocation for SWM is part of the budget allocated under the Office of the Mayor. – Environmental Program. The appropriated budget for Environmental Program is shown on Table 18. Statement of expenditures is also shown in Annex A.

Table 18. Budget Allocation for SWM

Year	Appropriation (General Fund)	Appropriation (Local Development Fund)
2016	2, 513,000.00	
2017	2,400,000.00	500,000.00
2018	3,014,000.00	5,150,000.00
2019	1,823,000.00	840,000.00

Although there is an ordinance that provides for the charging of garbage collection fees on households and other penalties for violation of the code, this is not properly implemented. The only income coming from solid waste as shown in Table ___ comes from the charging of garbage collection fee during renewal of permits for businesses.

Table 19. Collection for SWM during Business Permit Renewal

Year	Amount Collected
2016	P249,000.00
2017	P376,000.00
2018	P380,000.00
2019	P317,000.00

3.12. Key Issues

Gubat is one of the most fast growing municipalities in the Bicol Region. Along with development comes the growth in waste generation, not only from households, but also from public spaces such as the public market, schools, business establishments, and terminals among others. It is complicated by the failure to manage the continuing increase in waste generation, on one hand and the decreasing availability of space for waste disposal, on the other. Much progress has been attained in the implementation of the SWM programs in the municipality. However, there are still a lot of key issues facing the municipality, to wit:

1. No institutionalized MENR Office in the LGU;
2. Lack of MENRO staff focusing on SWM programs;
3. No permanent office and facilities for MENRO;
4. 10-year SWM plan not yet approved;
5. Limited budget for SWM activities;
6. Limited IEC materials and activities;
7. Inactive Municipal SWM Board;
8. Non-compliant barangays;
9. Indiscriminate littering of wastes in public spaces;
10. Open burning of wastes;
11. Lack of heavy equipment and facilities for SWM efforts;
12. MRF not fully functional; and

13. Unimplemented ordinances on SWM.

4. Waste Characteristics

Part of the task in preparing the plan is the conduct of the Waste Analysis and Characterization Study (WACS). There are three stages in conducting a WACS. First is the **Preparation and Training** which is needed to ensure that all the needed skills and materials are ready for the actual WACS. Second is the **Actual Waste Characterization** which provides detailed guidelines for the efficient collection, segregation, measurement and proper recording of the waste generated. Last is the **Data Processing and Analysis** which illustrates how the gathered data are process and analyzed for SWM planning.

The municipality of Gubat plans to conduct the WACS in partnership with DENR-EMB. A representative from EMB came to Gubat to conduct a 2-day orientation on the proper conduct of WACS. Participants of the said orientation were MENRO, garbage collectors, garbage segregators, market/street cleaners, MRF staff, slaughterhouse staff, dumpsite staff, OMAD MPDO, PDT, MEO, MHO, SB members, selected barangay captains and committee on environment/ health and sanitation.

The WACS was conducted last August 16-18, 2018 on the selected cooperators for three sample days, one weekday, one weekend, and one market day. They were given labeled garbage bags where they place their one-day waste to be collected the next day. These collected wastes was segregated in to compostable, recyclable, residual and special wastes.

Upon completion of the actual waste characterization, the next task was to transform the raw data into information useful for SWM planning and decision-making. The activities covered in this process go beyond data entry and performing calculations to derive waste generation rates. Also, included here are the analysis and interpretation of results or processed data and preparation of projection for the SWM period plan.

4.1. Disposed Waste

Gubat approximately generates 2,015.405 kg of solid wastes per day within the collection area. This is composed of 60.84% biodegradable, 19.27% recyclable, 17.16% residual and 2.73% special. The estimated waste generation per capita is **0.14** kilogram per person per day.

The top three major waste generators are households, general services composed of different business establishments and recreation centers. Together they produce 95% and 87% of biodegradable and recyclable wastes, respectively in the collection area. Household Households and business establishments will be the major challenge to the LGU because of their number and their dispersed geographic spread.

Table 20. WACS Summary

Major Sources	Kgs./ day	Percen-tage	Biodegra-dable	Recycla-ble	Residual with Potential for Diversion						For Disposal	Total Residual Waste	Special
					Sando bags	Thin films	Compos ite	PP	OTHER S	Sub Total	Others		
· Households	1,379.33	80%	746.020	320.660	31.300	17.460	30.370	31.510	139.590	250.230	14.320	264.540	48.110
· Food Establishments	10.07	0.58%	6.319	3.375	0.114	0.000	0.184	0.076	0.000	0.374	0.000	0.374	0.000
· General Stores	51.14	2.96%	9.16	18.45	0.33	0.13	2.28	10.94	0.60	14.28	6.05	20.34	3.19
· General Services	175.53	10.15%	127.65	17.57	0.24	0.08	1.79	1.22	22.28	25.61	1.15	26.76	3.56
· Recreation	0.08	0.00%	286.57	0.04	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.01	0.00
· Slaughter House	12.87	0.74%	12.87	0.01	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.08	0.00
· Public Market	0.575	0.03%	0.090	0.343	0.000	0.000	0.000	0.034	0.105	0.139	0.004	0.142	0.000
· School	2.877	0.17%	0.015	1.518	0.000	0.000	0.000	1.335	0.009	1.344	0.000	1.344	0.000
· Offices	8.403	0.49%	4.192	3.037	0.480	0.000	0.693	0.000	0.000	1.173	0.000	1.173	0.000
· Banks	0.540	0.03%	0.000	0.540	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
· Health Related Sources	5.250	0.30%	0.87	2.09	0.21	0.00	0.00	0.57	0.00	0.79	1.46	2.24	0.05
· Agro	56.947	3.29%	26.211	19.369	0.150	0.000	0.462	0.194	0.216	1.023	10.259	11.282	0.084
· Manufacturing	25.172	1.46%	6.295	1.302	0.000	0.000	0.033	0.000	17.542	17.575	0.000	17.575	0.000
TOTAL	**1,728.78**	**100%**	**1226.260**	**388.287**	**32.835**	**17.672**	**35.817**	**45.898**	**180.344**	**312.562**	**33.244**	**345.863**	**54.994**

The LGU will need a massive education campaign, a strong enforcement system and an incentive scheme to make households comply with waste segregation and segregated waste collection requirements.

4.2. Diverted Waste

Given the data, the LGU can potentially achieve a minimum of 80.11% waste diversion through composting and recycling. It suggests that if full diversion (80.11%) is achieved, only 400.86 kg will be disposed daily in the disposal site. This is significantly lower than current practice. This means less waste to collect and manage at the disposal site; it also means longer life to the planned sanitary disposal facility.

4.3. Generated Waste

The estimated waste generation per capita is **0.14** kilogram per person per day. Therefore, based on the 2018 population of 60,829, the estimated waste generated is 8,516.06 kg per day. Using the projected population, daily waste projection was calculated for the next ten years. This is under the assumption that no effort from the LGU for source reduction and diversion is implemented.

Table 21. Projected Waste Generation

Year	Projected Population	Estimated Waste Generation	Biodegradable	Recyclable	Residual	Special
			60.84%	19.27%	17.16%	2.73%
2019	61,267	8,627.78	5249.14	1662.57	1480.53	235.54
2020	61,708	8,639.12	5256.04	1664.76	1482.47	235.85
2021	62,153	8,701.42	5293.94	1676.76	1493.16	237.55
2022	62,600	8,764.00	5332.02	1688.82	1503.90	239.26
2023	63,051	8,827.14	5370.43	1700.99	1514.74	240.98
2024	63,505	8,890.70	5409.10	1713.24	1525.64	242.72
2025	63,962	8,954.68	5448.03	1725.57	1536.62	244.46
2026	66,423	9,299.22	5657.65	1791.96	1595.75	253.87
2027	64,886	9,084.04	5526.73	1750.49	1558.82	247.99
2028	65,354	9,149.56	5566.59	1763.12	1570.06	249.78
2029	65,824	9,215.36	5606.63	1775.80	1581.36	251.58

5. Legal/ Institutional Framework

5.1. Local Laws and Regulations

The following are the local laws and regulations passed by the LGU:

1. Environment Code of the Municipality of Gubat – which provide for the comprehensive solid waste management system of the municipality;
2. Anti-Littering Ordinance – which provides for the strict and absolute prohibition of littering
3. Municipal Ordinance 2013-002 - Ordinance Prohibiting The Use Of Plastic Bags on Dry Goods, Regulating Its Utilization on Wet Goods and Prohibiting the Use Of Styrofoam/Styrophor in the Municipality of Gubat, Province of Sorsogon, and Prescribing Penalties for Violations Thereof;

Permitting procedures for solid waste facilities as well as inspection and compliance procedures are as follows:

1. Shredders, autoclaves, balers, and compactors used by junkshop owners, refer to compliance procedures of EMB;
2. Facilities that process on-site-generated, nonhazardous, petroleum-contaminated and debris from underground storage tank, refer to compliance procedures of EMB;
3. Construction/demolition-debris disposal facilities that receive only on-site-generated construction/demolition debris, refer to compliance procedures of EMB;
4. Wood waste facilities of furniture shops, the facility shall comply with the perimeter barrier, security, and buffer zone requirements plus refer to compliance procedures of EMB;
5. Hospitals and other health care facilities that store or treat regulated infectious waste generated on-site or that accept waste from off-site wholly- or partly-owned subsidiaries, refer to compliance procedures of EMB .

5.2. Roles

The preparation of a sound SWM plan needs inputs from a range of disciplines and careful consideration of all stakeholders. Each sector plays a vital role and duties to fulfill in terms of solid waste management.

Households are the main producers of waste. Source reduction and segregation of wastes begins at this level. It is very crucial that they are educated and encouraged to segregate their wastes.

Commercial, institutional and industrial establishments are heavy producers of wastes. These includes restaurants, grocery stores, bakeries, schools, banks, offices, clinics, farms, among others. In the application or renewal of their permits, they are required to comply with all the requirements of the ordinance on solid waste management. In school, solid waste management is integrated in their curriculum and implementation of recycling and composting begins here in a form of school project and school gardening.

Transport Sector is a transient producer of wastes. Public utility vehicles carry with them trash bins inside their vehicle to cater the wastes of their riding passengers to avoid littering in public places.

Local Government Unit of Gubat is responsible for collecting the residual wastes and transporting them to the final disposal facility. It is also primarily responsible in the operation and maintenance of the final disposal facility. Through its MENRO, the implementing arm of the solid waste management program, various activities such as IEC campaign, capacity enhancement trainings, clean up drives, centralized MRF operation, incentive mechanisms, among others.

Barangay Local Government Units is the responsible in the collection and secondary segregation of the solid wastes in the barangay level specifically the biodegradable and recyclable.

Non-Government Organizations such as Ariman Eco Youth Club, Gubatnon for Adventourism, Inc. and Gubat Sorsogon Surfriders Association who have strong concern for environmental protection conducts their own projects and programs on SWM such as waste segregation, recycling/ upcycling, composting, and MRF operation.

DENR – EMB Regional Office 5 provides trainings, technical and financial assistance to ensure that the LGU is on the right track in preparing its SWM plan as well as its effective implementation.

5.3. Municipal Solid Waste Management Board

There is a Municipal Solid Waste Management Board reorganized through Executive Order No. 2018-020. It is composed of the following:

Chairman:	Hon. Sharon Rose G. Escoto, Municipal Mayor
Vice Chairman:	Hon. Sixto Estareja, Municipal Vice Mayor
Focal Person:	Lea E. Santos, MENRO
Members:	Hon. Ramon Entico, SB Chairman, Committee On Environment and Natural Resources
	Hon. Valentin A. Pura IV, SB Chairman, Committee on Health and Sanitation
	Hon. Jose Arturo Enano, Liga ng mga Barangay President
	Hon. Norven Ariola, SK Federation President
	Roque Feratero, Recycling Industry Representative
	Violy Dioleste, Recycling Industry Representative
	Jaime Erlano, Recycling Industry Representative
	Noli Mercader, GubAT, Inc
	Bienvenido Villaroya, GSSA
	Luzviminda Dino, Rural Sanitary Inspector
	Rizalde P. Ermino, Municipal Engineer
	Yolanda F. Patriarca, Municipal Agriculturist
	Rhalen E. Endeno, MDRRMO
	Faustino E. Taclan Jr., MPDO
	Noel L. Agnote, Public School District Supervisor
	Ramon P. Estur, Secondary School Principal II, GNHS
	Rosemarie R. Jadie, Ph. D., Campus Director, BUGC

The same Executive Order provides for the creation of its Technical Working Group, composed of the following:

Chairman:	Lea E. Santos
Members:	Patrick Omar B. Erestain
	Kevin E. Espineda
	Kristin E. Antivola
	Renz Bino
	Annabel Lanon
	Michael Ferreras

Primarily, they are responsible for the following:

1. Develop the 10-year Solid Waste Management Plan of the municipality that shall ensure long-term management of solid waste as well as integrate the SWM plans and strategies of the barangays;
2. Adopt specific revenue-generating measure to promote the viability of its SWM plan;
3. Develop the specific mechanic and guidelines for the implementation of the 10-year SWM plan;
4. Oversee the implementation of the 10-year SWM plan;
5. Monitor the implementation of the 10-year SWM plan through its various political subdivisions and in cooperation with the private sector and the NGOs;
6. Coordinate the efforts of its barangays in the implementation if the 10-year SWM plan;
7. Recommend to appropriate local government authorities specific measures and project proposals for franchise or build-operate-transfer agreements with duly organized institutions pursuant to RA 6957, to provide either exclusive or non-exclusive authority for the collection, transfer, storage, processing , recycling or disposal of solid waste;
8. Review every two years as needed the 10-year SWM plan to ensure its sustainability, viability, effectiveness, and relevance to local and international development in the field of SWM.

The MSWMB conducts its regular meeting at least once a year. Part of their planned activities includes the revision of the 10-year SWM plan; drafting of IRR for the Anti-Plastic Ordinance and its IEC campaign; safe closure and rehabilitation of the Gubat Municipal Dumpsite; acquisition of land for the proposed sanitary landfill; rehabilitation of the municipal MRF; acquisition of equipment for waste diversion; construction of the waste water treatment facility in the municipality; recycling and composting programs, among others.

5.4. Barangay Solid Waste Management Committees

The BLGUs also created their respective Barangay Solid Waste Management Committees (BSWMC) through a barangay ordinance or resolution. To date, there are already 38 barangays with created BWSMC. Although not all barangays have created their BSWMC, all of them have their SWM plans and programs being implemented all throughout the year. Other barangays are already encouraged to institutionalize their BSWMC.

5.5. Stakeholders Participation

Stakeholder has a specific, clear and active role to improve the efficacy and efficiency of SWM by active participation and continuous interaction. Stakeholders involves:

- PNP: Enforcement of laws and administrative issuances relative to RA9003;
- Department of Education: Incorporation of recycling and composting activities in school premises;
- Academe/DOST: Conduct of researches on SWM and Technology Transfer;
- Brgy. Council /HH: Consistent Waste Segregation At Source Activities; Regular Clean-up Activities
- MSWMB: Policy formulation, planning and implementation of 10 year Solid Waste Management Plan;
- SWM IEC Team: IEC Activities;

Information regarding participation of stakeholders will be required to analyze the efficacy of the plan. Feedbacks from them will be used as basis for improvement or if in need revision of the plan.

6. Plan Strategy

6.1. Vision

A Municipality of Gubat wherein all stakeholders are actively participating to achieve an ecologically sustainable ad economically practical zero-waste management, through a doable ESWM ordinance.

Goals

- To update the SWM plan of Gubat, Sorsogon.
- To enhance the affectivity of the Solid Waste Management Board in the implementation and monitoring of the SWM plan.
- To pursue the continued education the Gubat stakeholders on the values and practices of Ecological Solid Waste Management.
- To source out and network with various government and private sector agencies on the best ecologically and economically sustainable practices of ESWM for Gubat, Sorsogon.

- To source out resources and funds that will support the development and implementation of ESWM in Gubat, Sorsogon

6.2. Targets

The Plan is to reduce and manage the solid waste through source reduction, waste minimization measures, waste segregation, and establishment of solid waste management facilities. Intensification of proper handling of waste and recycling methods involving technologies that will yield income for the LGU and livelihood to Gubatnon with a starting capital afford by the government.

Table 22. Target Diversion per Year

Year	Residual	Target Diverted Waste
	17.16%	5.00%
2019	1480.53	74.03
2020	1482.47	74.12
2021	1493.16	74.66
2022	1503.90	75.20
2023	1514.74	75.74
2024	1525.64	76.28
2025	1536.62	76.83
2026	1595.75	79.79
2027	1558.82	77.94
2028	1570.06	78.50
2029	1581.36	79.07

A projected 5% waste reduction yearly on generation rate is being targeted upon implementation of the plan enabling maximization of the final waste disposal facility. Increasing public awareness regarding solid waste is deemed necessary since the plan is targeting main source of generated solid waste particularly the households, business establishments, institutions and recreation centers.

6.3. Strategies

These targets could be achieved by strict implementation of the ordinances that controls the usage and disposal of the specific wastes like biodegradable,

residual, and the controlled collection of recyclable wastes. The LGU shall draft the IRR for the enforcement of its ordinances on SWM. The main strategies to be used are the establishment of the MRF to accommodate the biodegradable and recyclable wastes of the poblacion barangays and to improve the IEC of the citizens especially on segregation of wastes.

7. SWM System

The Solid Waste Management Board should be responsible for planning and implementing solid waste management and recycling initiatives, programs and systems in the municipality. Accordingly, SWM board has developed priorities that build upon its successes and provide a roadmap for the succeeding ten (10) year planning period while continuing to protect public health and the environment.

Every year, the MSWMB shall conduct a municipal-wide evaluation on the implementation of the plans in every barangay. With this, it can collect data and information to supplement the current SWM situation, discuss its implications and consent on a range of options that can be considered practical for implementation in the municipality. Further, the MSWMB shall incentivize barangays and establishments who have exemplary implementation and compliance to RA 9003.

7.1. Source Reduction

An effective Ecological Solid Waste Management Program must necessarily begin at the source. Thus, this first strategy refers to activities undertaken by households institutions, and establishments to manage prior to collection in order to minimize the overall volume of waste and increase the effectiveness of other management efforts “downstream”.

There are three main components of this stratagem – reduction at source, segregation at source, and diversion. Intensive IEC and public education, households, institutions, establishments, and other producers of waste will be done in order to encourage reduction in waste produced, to properly segregate their wastes according to classification so as to streamline collection and diversion processes, and to divert wastes that can be removed from the waste stream at the household level. This will be done through distribution of flyers and installation of information boards in strategic locations in every barangay. Continuous orientation and technical assistance will be given especially to problematic barangays.

Biodegradable wastes will managed primarily by the barangays in their MRF. Households will also be encouraged to make their composting facility. An agreement with hog raisers can also be made for them to collect food wastes that can still be used to feed their hogs. The municipal composting facility shall cater to the biodegradable wastes of the poblacion barangays.

For the recyclable materials, segregated recyclable wastes shall be managed also by the barangays. Implementation of their recycling program or creating an agreement with local junkshops will be a vital role in the reduction of these wastes.

Residual wastes will be collected by the LGU. IEC plays an important role in the reduction of these wastes by encouraging the people to buy products in bulk and avoid those in sachets.

Special wastes collected by the LGU except for health care wastes where the respective health care providers are responsible in managing their wastes. The LGU will partner and utilize the service of accredited TSD Facility for the treatment and disposal of the healthcare wastes.

Through the help of the Sangguniang Bayan, the enforcement of the Anti-Plastic Ordinance will be put to effect. It will be done in phasing so as to prepare the manufacturers and distributors will be able to adjust. In addition, an ordinance on composting shall be created to divert the biodegradable wastes which is the major part of the wastes dumped in the dumpsite. Should these programs be implemented effectively, 80.11% of the waste generated by the municipality will be diverted into something useful, reducing the wastes being dumped in the dumpsite.

7.2. Collection

7.2.1. Overview

LGU's waste collection service will be expanded to cover additional barangays with operational MRF. No segregation, no collection policy will be strictly enforced. All types of wastes will be collected from Public Market, Municipal Compound, and Central Business District (CBD). Only segregated residual and special wastes will be collected from households, schools, agricultural and coastal industries, resorts and, government and private offices without available space for composting. For barangays outside collection area, collection schedule will be arranged between barangays and municipal LGU for collection of residual and special wastes. Collection points will be designated. SWM fees will be collected from all sources based on the approved municipal ordinance.

7.2.2. Collection and Equipment Routes

Starting the second quarter of 2019, only residuals will be collected by the LGU from rural barangays. The "no segregation, no collection" policy will be strictly enforced. Each barangay shall establish their MRF which will be the designated location for collection. Respectively, the barangays will be the one responsible in the collection of wastes from the households. As assistance, the LGU will provide a sidecar to be connected to a barangay-owned motorcycle for the purpose of collecting waste within their area of jurisdiction.

To aid the LGU in terms of financing, they have sought the help of Municipal Development Fund Office to grant them a loan for the purpose of acquiring a set of heavy equipment particularly Road Roller Machine, Crawler Excavator, Wheel Loader, Dump Truck with Compactor and Backhoe. This will be in addition to the old and dilapidated dump truck used in the Solid Waste Management Program of the municipality. The dump trucks will be used to dispose properly the residual wastes generated by the municipality and to maintain the desired elevation of the proposed sanitary landfill.

7.2.3. Private Collection Service

The LGU, through its MENRO, will be the one to collects the generated wastes of the municipality. No private collection service will be employed.

7.2.4. Storage and Setout

Part of this plan is the fabrication of sturdy garbage bins to be placed strategically within the Central Business District and other public spaces. All business establishments, offices, schools shall be enjoined to provide separate garbage bins for biodegradable, recyclable, and residual.

The established MRF per barangay will be the storage of the residual wastes while waiting for pick up. Upon pick up, the residual will also be transported and stored in the constructed Temporary Residuals Containment Area (TRCA). It is located on the unutilized area within the perimeters of the municipal dumpsite while its closure is ongoing. The RCA shall only cater the residual wastes of the municipality. With an area of 75 sqm, it will be sufficient to accommodate the net residual waste for a period of six months provided that the wastes are segregated, stocked inside a sack and properly piled inside the

RCA. It will not include provision of area for biodegradable, recyclable and hazardous. It shall have a concrete flooring so that the waste will not be in contact with the ground. A roofing will protect the piled wastes from the rainwater, as well as the proper drainage system will ensure that rainwater run-off shall not be in contact with the residual waste. Security fence will be provided to prevent illegal access, trespassing and animal entry. In order to avoid foul odor to escape from the TRCA, zeolite will be applied to the stored wastes.

The LGU shall maintain a daily record of the residual waste being piled in the RCA. It will monitor the facility, its equipment and surroundings for evidence of failure and shall immediately take the necessary action to correct the same.

Upon fully operations of the Materials Recovery Facility – Refused Derived Fuel (MRF-RDF) operated by Greenways Waste Management Services, a third party which the LGU partnered in processing Solid Waste in lieu of establishment of Sanitary Landfill. All the residual and special wastes will be processed in the MRF-RDF

7.2.5. Segregated Recyclables

The LGU will collect the recyclable wastes of the poblacion barangays namely: Cota na Daco, Balud del Norte, Balud del Sur, Manook, Luna Candol, Pinontingan, Paradijon and Panganiban as shown in Table 23. It will be transported to the centralized MRF of the municipality using the two existing dumptrucks while the LGU is still in the process of acquiring a new dumptruck with compactor. No collection of recyclable wastes will done in rural barangays.

Table 23. Proposed Schedule of Residual Wastes Collection

Barangay	Non- biodegradable
Luna Candol	Monday
Manook	Tuesday
Balud del Sur	Wednesday
Balud del Norte	Wednesday
Pinontingan	Thursday
Panganiban	Friday
Cota na daco	Saturday
Paradijon	Sunday

7.2.6. Segregated Compostable

In the same manner the recyclable wastes are being collected, the barangays will be the one responsible in collecting and managing their biodegradable wastes. Using the sidecar given to them by the LGU, a container with lid will be used in collecting biodegradable. One container is for the yard wastes to be dumped directly in the barangay's compost pit. Another container is for the kitchen wastes which can be sold to hog raisers as food for their hogs.

Similarly, the compostable wastes will also be collected by the LGU only those from the poblacion barangays. These will be transported directly to the composting facility within the municipal MRF. Diverted compostable wastes will be used for the production of organic fertilizer.

7.2.7. Mixed Solid Waste/ Residuals

For the collection of the residual and special wastes, which contribute 17.16% and 2.75% of the total generated wastes, respectively, the rural barangays will first collect them from the households ensuring that it is not mixed with biodegradable and recyclable. These wastes will be stored in the barangay MRF awaiting pick up by the LGU dumptruck. The two existing dumptruck manned by 1 driver and 6 garbage collectors each will collect the residual wastes following the schedule as requests for pick up are received from the barangays. After a year of implementation, data on frequency of collection per barangays can be established which can be used to make a schedule of regular collection on all 42 barangays.

In the case of the poblacion barangays, during the first three months of the implementation of the collection of residual wastes only, the garbage collector will collect the residual from the households. The households will be advised that residual waste should be properly sealed in a garbage bag or sack. Once the collection veicle of poblacion barangays are ready for use, they will be the one to collect the residual wastes from the household and transport them to their barangay MRF where the dumptruck will pick them up.

By the second year during the implementation of this plan, the LGU has acquired at least one additional dumptruck to the two existing dump truck, preferably with a compactor. One truck can serve 2 barangays per day, one in the morning and one in the afternoon. The plan is to acquire another two dump trucks by year 3 and 4 since the existing dumptruck will then be fully depreciated.

7.3. Segregation, Recycling, and Composting

Residential, business establishment and commercial must practice segregation, recycling and composting at their level to reduce the volume of waste. The SWM Barangay and Municipal Ordinances shall focus on creating policies regarding this. The LGU will continue existing programs and complete the following new activities during the ten (10) year planning period, subject to annual budget appropriations. Below are proposed steps to achieve waste reduction and reuse.

- Use of multiple containers for separation of waste. No segregation, no collection policy.
- Converted to once-a-week residential collection of trash to compliment recycling and biodegradable waste collection.
- Sponsoring Community Clean-up events that provide opportunities to recycle scrap metal.
- Growing a small business recycling and waste diversion program. Coordinate with government agencies regarding possible outlet of produced products from recyclable materials including product trials and marketability.
- Promote composting in at least three (3) ways: within literature such as recycling guidelines, in advertisements, and during workshops or special events.
- Implement a recycling, waste reduction and reuse seminars/trainings in public schools, colleges, LGU employees and Departments
- Expand multi-family unit recycling and waste reduction and reuse education and outreach.
- Distribute bins on areas feasible for backyard composting
- Conduct recycling and waste reduction and reuse exhibits at local festival fairs or similar events.
- Advertise public workshop events demonstrating proper food waste composting techniques.
- Adopt technologies regarding conversion of residual waste into useful materials
- Maintain a local procurement policy advancing the purchase of materials that promote reduced waste generation.
- Incorporate green building goals/requirements in construction.
- Production of alternative energy sources.

7.3.1. Segregation

Segregation has long been a part of the solid waste management in the ten barangays where collection is present as the LGU implements the "No Segregation, No Collection" policy. Continuous enforcement of this is needed. While for the other 32 barangays which will now be catered by the garbage collection, start up will be needed. IEC campaign on RA 9003, segregation at source and pertinent provisions of the local ordinance will be done.

To guide the constituents on the proper way of segregating their wastes, the LGU shall provide printed materials such as flyers and billboards to be distributed and installed by the barangays. Particularly, these materials shall contain the different classifications of wastes. Members of the MSWMB shall be present in their barangay assemblies to reorient the public regarding the implementation of this program. Barangay-to barangay IEC campaign will also be lead by the MSWMB. The implementation of the expansion of collection shall start on the 2nd quarter of 2019. Thus, IEC shall be done as early as January 2019.

To countercheck the effectiveness of this program, the garbage collectors will also undergo further reorientation and trainings on the classification of wastes as well as their proper handling. Still, the "No Segregation, No Collection" policy will be enforced. Incentive mechanisms will be done recognizing barangays with effective segregation practices while penalizing those barangays who have violated the rules on segregation.

7.3.2. Recycling

Recycling programs is another important part of this plan as it constitutes 19.27% of the generated wastes. It shall start from the households first where the LGU can provide trainings on how to reuse, recycle, or upcycle their wastes. Consequently, the barangays shall implement their own recycling projects. Each barangay shall establish their own barangay MRF where recyclable waste will be temporarily stored.

The idea is to establish an agreement among the barangays to segregate further the recyclable wastes as to its type and assign each type to a respective barangay. The purpose is to create focus for each barangay so that they will only have to think of a recycling project for a specific type of recyclable waste. Furthermore, this is to avoid replication of products for the market which can result to "one barangay, one product". Series of seminars and trainings will be provided by the LGU to help them realize the importance of recycling and how they can turn trash into a livelihood.

To assist the barangay, the LGU shall create an agreement with the Department of Education to integrate recycling projects in their curriculum. It is important that as early as elementary level, the students will appreciate the value of recycling, its importance in protecting the environment while providing livelihood for the citizens.

Another option of the barangay and the municipality is to create an agreement with junkshop owners as to the bulk of recyclable wastes that they can buy, the price and frequency. Once they have established that, regular buy and sell of recyclable wastes can be implemented.

Lastly, through the help of the NGOs who have already started and launched their recycling projects, they shall provide technical assistance to every barangay to help them start the project. One important factor is organizing a group of people who will commit in the start-up implementation and sustain the recycling projects.

7.3.3. Composting/ Management of Biodegradable Waste

Diversion of potentially reusable and recyclable material from waste stream is a top priority of this 10-year SWM Plan. The most important aspect of the diversion strategy will be mandatory composting at multiple levels. Because biodegradable waste constitutes such a large percentage of the total waste stream, this category of waste should be the focus of special and intensive efforts to minimize volume and capitalize on potential value of this material. With this in mind, a new ordinance will be drafted to the effect that each household, institution, or establishment will implement its own composting program.

Household compost pits or other mechanism will be used to divert biodegradable waste and preempt the necessity of collecting this waste. Mechanisms will be established to assist households in profiting from their composting activities by selling their final product to gardeners or farmers. Hands on training on composting for household members including farmers shall be conducted regularly. At its MRF, each barangay will be encouraged to establish a composting area to handle overflow of biodegradable wastes from households and other sources, especially in the central urban barangays where space for composting facilities is an issue. For its part, the municipal government will establish an Eco-center, which will include an area dedicated to composting

waste originating from the public market. In addition, the LGU will also set up a static composting area to serve as a model for barangays and households.

7.3.4. Marketing and Market Development

To make the diversion projects sustainable, there should be a potential market for all the finishes products. The LGU shall seek the help of the Department of Trade and Industry on how and where to promote and sell their products. The LGU shall gather all finished products from various barangays to be displayed in the DTI Negosyo Center. As the vision of the LGU to be a place of eco-tourism, it is only rightful to promote products which came from recyclable wastes.

One advantage seen by the LGU is its strong partnership with NGOs such as ABS-CBN Bantay Kalikasan Foundation, Rare Philippines, Gubatnon for Adventourism, Inc among others whose goal is one with the LGU – to protect the environment through an effective solid waste management. These NGOs shall help the LGU in the marketing aspect of its recycling projects finished products.

7.4. Transfer

In the duration of the implementation of this 10-year plan, transfer facility is not applicable to the LGU.

7.5. Alternative Technologies for Residual Wastes

MRF-RDF

The LGU shall appropriate funds for the construction of its sanitary landfill for the residual waste without the potential for diversion. This constitutes 1.65% of the total waste generated. The nominal volume is a preliminary estimate of the capacity of the landfill. The actual total capacity shall be take into consideration the initial weight of the waste as it is places in the landfill, the impact of waste compaction and waste decomposition.

The wastes with potential of diversion are composed of sando bags (1.63%), thin films (0.88%), composites (1.78%), polypropylene (2.28%), and other (8.95%). The LGU plans to convert these waste into foot pavers. It is another diversion project which creates paving tiles from plastic waste such as plastic bags, plastic film and water pouches. This tried-and-tested technique is very low-cost and helps keep plastic waste out of the environment. With this project, the LGU can produce a variety

of building materials that are cheaper than the concrete version which set quickly and are very strong. The LGU cam employ the help of WasteAid UK for this project.

7.6. Disposal

Under this plan, final disposal of waste will be managed according to the classification of waste, so as to maximize the efficiency of the program. The most salient aspect of the final disposal strategy will be the establishment if a new sanitary landfill as the disposal site for the residual and special wastes generated in the municipality. The plan is to acquire a property adjacent to the existing dumpsite since based on the DENR-MGB assessment, the permeability of the soil in barangay is low which is suited to be utilized as a sanitary landfill. The five-hectare land to be acquired will be allocated into four chambers of the SLF including a Septic Vault, Leachate Pond, Monitoring wells, Filtering Chambers and a Static Composting area. A guard house and an administrative building will be established also. The rest of the area will be used for Agro-Forestry Project. Forest and Fruit bearing trees will be planted to cash crops under them.

7.6.1. Solid Waste Disposal Capacity

Projection of the annual wastes for disposal and the capacity needed to accommodate residual and special wastes was computed for the next ten years as shown in Table 24.

Table 24. Projection of Residual and Special Wastes

Year	Projected Population	Estimated Waste Generation	Residual	Special	Total
			17.16%	2.73%	
2019	61,267	8,577.38	1471.88	40.18	1512.06
2020	61,708	8,639.12	1482.47	40.47	1522.94
2021	62,153	8,701.42	1493.16	40.76	1533.93
2022	62,600	8,764.00	1503.90	41.06	1544.96
2023	63,051	8,827.14	1514.74	41.35	1556.09
2024	63,505	8,890.70	1525.64	41.65	1567.29
2025	63,962	8,954.68	1536.62	41.95	1578.57
2026	66,423	9,299.22	1595.75	43.56	1639.31
2027	64,886	9,084.04	1558.82	42.56	1601.38
2028	65,354	9,149.56	1570.06	42.86	1612.93
2029	65,824	9,215.36	1581.36	43.17	1624.53

The safe closure and rehabilitation of the municipal dumpsite commenced last December 2018 and is set to be completed by June 2019. A TRCA was constructed within the perimeters of the dumpsite to function as storage area for the residual and special waste pending the construction of the sanitary landfill.

To start up, the implementation of the changes in garbage collection shall be implemented on May 2019. Only the residual and special wastes shall be collected from all 42 barangays and will be stored in the TRCA. Once the construction of the SLF is completed, the stored waste in the TRCA will be transferred to the SLF.

7.6.2. Existing Facilities

The Gubat Municipal Dumpsite is set to be closed by June 2019. The LGU started the works last December 2018 following the Safe Closure and Rehabilitation Plan (SCRP). The SCRP is within the context of the comprehensive, collective and systematic solid waste management approach of the municipality. The LGU, through the Provincial Environment and Natural Resources (PENRO) and with the help of the Department of Environment and Natural Resources – Environmental Management Bureau (DENR-EMB), shall facilitate the implementation of the closure, rehabilitation and monitoring activities.

In parallel, the LGU will be applying for the assessment of the lot which is part of the existing dumpsite, however, not active, if it can be converted and utilized for the proposed sanitary landfill. Likewise, continuous IEC on segregation at source, composting and recycling as well as construction of MRF shall be implemented at the barangay level.

Of the one hectare designed to be utilized as dumpsite, only 5, 431 sqm is active and will be closed and rehabilitated. A Residual Containment Area will be constructed on the unutilized area to accommodate the residual waste generated by the municipality while the establishment of an area for sanitary landfill is on-going. The SCRP has the following components:

Site Clearing

There is no presence of structures or facilities within the boundaries of the dumpsite. However, there is one damaged heavy equipment previously used to maintain the dumpsite which was abandoned in the area. This will be removed together with the insignificant shrubs in order to clear the area. The existing solid waste will be transferred to the proper dumping area using heavy equipment. Except for the RCA, no makeshift huts and other structures will be constructed in the area during closure and post closure.

Site Grading and Stabilization of Critical Slopes

The existing operational procedures done in the controlled dumpsite resulted to a precariously high heaps of garbage. Although, it is regularly flattened by a backhoe, the current estimated height of the garbage is three meters. Thus, after transferring of the solid waste to the proper dumping area, it will be compacted to the designated grade, elevations and slope.

The exposed waste will be compacted to a target height of 1.5 meters. The shape or the slope of compacted waste will be modified and graded to slope ranging from 2% to 4% to prevent ponding and promote natural drainage. The cut side slopes shall have the ratio less than 1:3.

Should there be a depress area during compaction, materials to fill the depress area will come from the daily waste collection of the municipality. The completion of the fill will be to the designed grade and elevations. Along with the stabilization of the slopes, a concrete dyke will be constructed to prevent the compacted garbage from wearing down.

Final Cover

Upon compaction, the graded site will be covered with soil and clay to reduce water infiltration, reduce gas migration, prevent emergence of insects and rodents, minimize escape of odor and support vegetation growth. The placing of soil cover to areas where re-profiling is completed will be done according to the sheet 3 of the engineering plan. The clay will be spread in a uniform manner with a thickness of 45 cm and compacted by dozer to the designed elevation and slope.

The soil cover with a permeability of not less than 1×10^{-6} cm/sec and usually not compacted will serve as the topsoil layer as well as support for plant growth. It will be spread over the clay with varying thickness depending on the type of vegetation. As shown in Annex A, the topsoil cover thickness varies across the dumping area ranging from 15 cm to 100 cm in preparation for the planting of flower, vetiver grass and small trees. In between the dumping area and lagoon, a buffer zone will be planted with trees. The thickness of the top soil shall be not less than 150 cm.

The soil cover will be taken from the aggregates collected from quarrying the hill in Barangay San Ignacio, the location for the proposed Municipal Slaughter House. The said hill is an agricultural land planted with coconut and other different trees.

Vegetation

Vegetation and greening shall be done upon completion of the gas vents installation. It shall be planted in areas where the slopes are steeper than 1:3. This is intended to prevent soil erosion. Vetiver grass shall be planted because it has extensive and thick root system that can control erosion and stabilize the slope.

Different plants and trees will also be planted in the periphery of the disposal site to serve as buffer zone to adjoining areas. Plants classified as resistant to air pollution that will be planted in the dumpsite are Yellow bell, Bougainvillea, Ipil-ipil and Bandera de Española. Trees such as Bunga/ Areca Palm and Yemane Tree.

Drainage Control System

Run-on and run-off of surface waters can cause erosion and scouring of the final cover, as well as water ponding. Thus, to mitigate these effects, a proper drainage system around the dumping area will be provided to channel the rainwater from the disposal site to the discharge drains. This will reduce the surface water percolating into the waste layers, prevent soil erosion and reduce leachate production.

Other drains will be provided such as cast-in-site concrete channel, U-Shaped drains and concrete pipes. Earth trenches or drains may be provided in areas where the ground is hard and impermeable. Trenches are simple to excavate and economical to provide and to maintain. The length of canal is 60.81 meters. Its discharge point is indicated on Annex A. Since the topsoil cover is sloped at 2% to 4%, the drainage canal as well as the traversing water will also follow its elevation. To prevent the soil from entering the pipe, there will be a 0.20m elevation increase of the canal wall from the topsoil cover and it has an opening with an interval of 15 meters with a screen to filter out the dirt.

An open canal will be excavated to catch the rain surface run off coming from the mound. Water will be collected at the collection pump pit for discharge to the outfall area. To ensure that it will not be clogged, regular maintenance of the trenches will be performed. To prevent erosion of the soil, coconet will be installed over the topsoil and Vetiver grass will be panted at an interval of 10cm to 15cm

Leachate Management

Leachate from the waste mound may contaminate the surface water that might drain into the creeks, stream and other natural water bodies. Although there are no natural water bodies near the existing dumpsite, the seepage might contaminate the ground water considering the time where the garbage has been deposited in the dumpsite.

In case of the collection of the leachate, the existing dumpsite lies on a terrain with a slope of 45 degrees and an underlying clay ground with a very low-permeability property and can be used as a barrier to intercept leachate. Influenced by its geological feature conditions, the leachate produced by the compacted solid waste will not seep into the groundwater sources and contaminate the groundwater sources due to its impenetrable property, thus there is no need to install lining at the bottom of the waste. With the slope, the leachate will drain by a natural flow on the surface of the clay or the bottom of the solid waste to the 450 mm perforated spun leachate collection pipe (Class H) implanted at the lower toe of the waste mound. From there, a canal will be built as point of discharge of leachate and facilitate collection. The collected leachate will flow through the pipe embedded within the drainage canal and is then channeled towards the three lagoons for its treatment.

The stabilization pond will be constructed adjacent to the final disposal site covering an area of 607.7 sqm. The leachate coming from the leachate pipe will first pass through the anaerobic stage which is usually the first in a series of ponds that treat leachate. It is two to four meters deep and have a small surface area relative to its depth and a low permeable sludge at the bottom.

Next, it will go through facultative process in the second lagoon which usually receives the effluent from the anaerobic pond. It has a depth of 1.5 to 2.5 meters and designed based on the maximum biological oxygen demand load per unit area at which the pond will still have a substantial aerobic zone.

Lastly, to receive the effluent from the facultative pond is the aerobic maturation. It has a depth of 1 to 1.5-meter which is used for polishing the effluent. The final treated effluent will then be discharged into the leachate pond The treated water will not be discharged to any water bodies. Instead, it will be collected manually and recirculated into the surface of the waste mound. Through this treatment facility, the groundwater contamination will be prevented by improving the leachate quality through contact with air and aeration. It will also accelerate the decomposition process of the compacted solid waste while reducing the production of methane gas.

Gas Management

The decomposition of the solid waste also generates gases, mainly methane and carbon dioxide. As methane is formed, it builds up pressure and then begins to move through the soil, following the path of least resistance. Often it moves sideways for a time before breaking through the surface of the ground, which eventually would contaminate groundwater sources. Also, both methane and carbon dioxide, when released to the atmosphere, greatly contribute to the depletion of the ozone layer. That is why it is necessary to collect the gas and vent it freely, flare it, or recover it for energy use. Extracting gas from the dumpsite has an advantage of reducing the concentration of various chemicals in the leachate.

A total of 8 HDPE pipes gas vents shall be installed spaced 50 meters apart upon completion of the final cover. Perforated 150 mm gas venting pipe shall be buried at least 4 meters down the waste mound with perimeter of the buried pipe filled with the gravel around the pipe perforation until about half meter from the surface. The remaining half meter will be back filled with soil. The top of the protruding pipes will be capped with a 150 mm double elbow with 90-degree bend so that the gas will be able to escape to the atmosphere.

The disposal site gas ventilation system will be operated for a period of ten years subject to extension should it be deemed necessary. This is to prevent build up of toxic gases that might be a cause of fire and explosion hazards. The pipes will also act as ventilation allowing oxygen to enter the waste mound and expedite waste degradation process.

Fencing and Security

To ensure that there will be no unauthorized entry of waste pickers, children, illegal settlers and stray animals, a fence shall be constructed around the perimeter to secure the dumpsite. There is an existing concrete fence facing the Barangay road with an extent of 140.95 meters. Perimeter fence made from indigenous plants and shrubs such as kakawate will be planted at the sides and back of the dumpsite with an extent of 279.4 meters.

7.6.3. New Facilities

A Residual Containment Area (RCA) will be constructed on the unutilized area while the closure of the dumpsite is ongoing. The RCA shall only cater the residual wastes of the municipality. With an area of 75 sqm, it will be

sufficient to accommodate the net residual waste for a period of six months provided that the wastes are segregated, stocked inside a sack and properly piled inside the RCA. It will not include provision of area for biodegradable, recyclable and hazardous. It shall have a concrete flooring so that the waste will not be in contact with the ground. A roofing will protect the piled wastes from the rainwater, as well as the proper drainage system will ensure that rainwater run-off shall not be in contact with the residual waste. Security fence will be provided to prevent illegal access, trespassing and animal entry. In order to avoid foul odor to escape from the TRCA, zeolite will be used

The LGU shall maintain a daily record of the residual waste being piled in the RCA. It will monitor the facility, its equipment and surroundings for evidence of failure and shall immediately take the necessary action to correct the same. Upon completion of the Municipal Sanitary Landfill (SLF), all residual wastes in the RCA shall be transferred immediately to the SLF and the RCA will be converted into an MRF.

Another facility to be put up is the Special Wastes Treatment Facility. Pharmaceutical wastes, sharps, electronic and other hazardous wastes will be safely disposed in this site wherein it will be enclosed in concrete cubicle with dividers that separate each kind of special waste.

7.6.4. Categorized Disposal Facilities (Sanitary Landfill) Design Materials Recovery Facility – Refused Derived Fuel

In compliance with RA 9003 Materials Recovery Facility – Refused Derived Fuel (MRF-RDF) will be the final disposal of the Solid Wastes generated from the Municipality.

The MRF-RDF will be constructed on the property adjacent to Lot No. 7869 of Barangay Tagaytay where the municipal dumpsite is located. Hauling distance from the town proper is about six kilometers. It can be reached from the town proper via Gubat-Prieto Diaz road then turn to Barangay Tiris heading off to the site. It is situated approximately one kilometer before the *visita* of the barangay. A 5-hectare property will be acquired designed to be utilized as the disposal facility of Gubat with an estimated capacity of 150,000 cubic meters.

7.7. Special Wastes

The plan for domestic hazardous waste or special waste shall be formulated but not limited to the following items:

- Existing storage, collection, disposal practices and the proper handling, reuse and long-term disposal;
- Estimated quantities of special wastes to be generated in the future; and
- Formulation of the programs to be implemented by the LGU describing.

7.7.1. Health Care Wastes

Health care wastes will temporarily be stored and treated in the septic vault located at the back of the Municipal Health Office and Gubat Cemetery. The Gubat District Hospital also has an existing septic vault where they store their special waste. The LGU will be employing the service of a DENR-accredited TSD facility to collect these waste for proper treatment, storage and disposal.

Healthcare and infectious wastes from the Rural Health Unit are placed in standard safety box provided by Department of Health (DOH) then stored in the septic vault located at the back of the Municipal Health Office in Municipal Compound and at Gubat Cemetery. Other Medical and Dental Clinics from the Municipality also has their own septic vault located

7.8. Information, Education and Communication

7.8.1. Introduction

Information, Education and Communication (IEC) stressed the need for a serious and sincere behaviour change that will ease the overhaul of the personal and societal practices that contribute to the generation and mismanagement of waste in the households, businesses and institutional establishments in the municipality

The LGU through the SWM IEC Team continues to refine its IEC to ensure that recycling programs are understood and fully utilized by the residents and customers of the municipality. IEC Team will be using Social Marketing to address IEC's issues. Through social marketing the basic objectives of the reduction, reuse, and recycling of solid waste will be dealt with. Social marketing also coordinates both new and old strategies to inform and educate residents, businesses, and multi-family units on why and how to best manage their solid waste. The basic objectives of social marketing are the following:

- To increase the recycling rate.

- To decrease waste generation.
- To increase participation in residential recycling programs.
- To reduce collection and processing costs.
- To reduce the quantity of residue from residential collection programs.
- To increase customer awareness of recycling opportunities and waste reduction options.

The LGU has planned to utilize the following outreach activities to support, manage, improve and enhance the recycling and solid waste initiatives and programs:

- Developed a social marketing campaign designed to promote information sharing within, providing them with the tools and motivation needed to be successful in reaching the current recycling and waste reduction goals.
- Provided information, encouragement and resources to students (school aged children), families and staff so that they will recycle more at school and ultimately more at home.
- Solicited and implemented customer suggestions and feedback through maintaining an open line of communication with the residents and facility customers.
- Maintained a constant presence in the public eye utilizing the latest emerging mediums such as the internet, cable television, public service announcements to communicate recycling messages.
- Educated residents on ways to practice source reduction.

The LGU intends to continue these initiatives, along with new approaches, during the ten (10) year planning period, to provide a clear message to residents and facility customers that recycling is an integral part of waste reduction, landfill preservation, and stability. The LGU will continue to implement public communication and outreach programs to achieve the goals, objectives and policies of this plan to make the public understand the program and achieve their support on how they can contribute to environmental protection through a proper solid waste managemet.

7.8.2. Core Messages

To promote the SWM program to the community, there is a need to relay the core message to the people in a manner understandable to them. The table below will show the core messages that the LGU will impart to its constituents:

Table 25. SWM IEC Core Messages

Target Audience	Key Messages	IEC Activities	Desired Behavior
Constituents in the Poblacion Area Business owners, commercial units operators, land transport Offices, schools, banks Youth	1. Segregate waste at source 2. Proper segregation and handling of the different types of wastes 3. Prohibition on the open burning of wastes 4. Prohibition on dumping of wastes 5. Incentives and penalties of the ordinance	1. House to house IEC Campaign 2. Posting of billboards and posters 3. Distribution of flyers 4. Dialogue with concerned stakeholders 5. Radio Broadcast 6. Facebook posts	1. Sorting of waste at source 2. High level of awareness as to the types of wastes 3. No open burning 4. No dumping of wastes 5. Collective support from all stakeholders achieved.
Constituents in rural barangays	1. Segregation at source 2. Creation of compost pit in the backyard (if possible) 3. Prohibition on the open burning of wastes 4. Prohibition on dumping of wastes 5. Incentives and penalties of the ordinance	1. Adoption of pyramid system 2. Regular Barangay Assemblies 3. Creation of barangay policies	

7.8.3. Approach

The IEC is within the context of the comprehensive, collective and systematic solid waste management approach of the municipality. The LGU, through the Provincial

Environment and Natural Resources (PENRO) and with the help of the Department of Environment and Natural Resources – Environmental Management Bureau (DENR-EMB), shall facilitate the implementation of the IEC activities.

8. Implementation Strategy

8.1. Framework

The key output of this stage is a successful MSWM system, which has been improved in line with the priorities, objectives and targets established in the plan, while it is supported by stakeholder groups. The following framework shall be followed in the implementation of this SWM plan.

Table 26. SWM Framework

GOAL/ OBJECTIVE	INPUT	ACTIVITIES	TIMEFRAME	OUTCOME
1. Awareness-raising on solid waste management to all Gubatnon	Comprehensive Information and Education Campaign on SWM with the use multi-media	1. Create a character that will represent the IEC campaign on SWM (Marie Linig) 2. Launch the SWM campaign (Marie Linig) during the Earth Hour celebration. - short program that will include distribution of leaflets Participants will be: - academe, school children - government employees esp. from LGU - PNP -BFP	Phase 1 Phase 1	Increased awareness and participation of all Gubatnon in SWM, and other environmental issues.

		- DOH and health practitioners -CSOs -POs	Phase 1-3	
		3. Put-up billboards, infographics in every barangay, schools, government offices, and public spaces re: basic info on waste disposal, 4Rs	Phase 1	
		4. Design a community-based activity on SWM i.e. Earth Day activity (April 22)	Phase 1-3	
		5. Initiate school-based Marie Linig activities – elementary, high school, tertiary (private and public)	Phase 1-3	
		5. Develop other IEC materials i.e. flyers, comics - basic info on waste disposal, RA9003 and municipal ordinance on ESWM, 4Rs	Phase 1-3	
		6. Maximize social media to promote IEC on ESWM (Gubat LGU facebook account)		

		6. Radio broadcasts through the current LGU program at Padaba 7. Create other Marie Linig activities at schools, market, government offices, and communities e.g. read-along; Marie Linig mascot touring around market place and other public places 8. Create Marie Linig activities for LGU employees e.g. regular and mandatory GMEU clean and green drive 8. Initiate sectoral forum /seminars/municipal assemblies –i.e. solid waste management, environmental issues discussion; coastal management etc.	Phase 1-3 Phase 1-3 Phase 2-3 Phase 2-3	
2. Institution of a municipal-wide waste disposal system	Rehabilitation of existing dumpsite Establishment of waste	1. Source out funds to be used in the rehabilitation of Tagaytay dumpsite i.e. submission of project proposals	Phase 1	Effective and efficient waste disposal system from municipal, barangay, and

	disposal system at the barangay-level Apply source reduction scheme from municipal to barangay and household level Fill-in hardware and manpower components for ESWM	2. Research and (feasibility) study on the rehabilitation of Tagaytay dumpsite i.e. consultation with expert/s 3. Consultation with all barangay captains re: SWM campaign, waste disposal system 4. Reactivate and empower eco-aides in all barangays - ESWM training -envi training - skills trainings- organizational, leadership, speakers, basic RD 5. Construction and operation of MRFs, composts schemes in all barangays 6. Revival of the municipal MRF located at Highway 59- includes sourcing out of funds/resources (project proposal making)	Phase 1 Phase 1 Phase 2 Phase 2 Phase 2-3 Phase 1-3	household level.

		7. Hire enough personnel for MENRO, garbage collectors, segregators, heavy equipment operators 8. Purchase of heavy equipment i.e. 2 dump trucks, backhoe, bulldozer 9. Purchase a plastic shredder and densefier to create post-waste materials out of recyclables. 9.Create centralized (municipal) and decentralized (at least one for each barangay) composting facilities 10. Design and implement waste disposal program for the new market	Phase 2-3 Phase 3 Phase 1-3 Phase 2	
3. Implement existing policies (municipal ESWM ordinance i.e. anti-littering, plastic; RA 9003/ESWM Act)	Unify LGU and all stakeholders-public and private sectors, CSOs, people's organizations re: ESWM ordinance	1. Consultation with barangay officials to iterate the need for a barangay-level ESWM ordinance e.g. no segregation, no collection policy; composting of biodegradable wastes	Phase 1	Multi-stakeholder participation in implementation and decision-making process

	Policy support of ESWM through barangay ordinances	2. Consultation with Municipal Solid Waste Management Board and MENRO 3. Regular coordination of MENRO, Liga ng mga Barangays, MSWMB re: implementation and practice of ESWM 4. Partnership with other stakeholders-CSOs, NGOs, POs, private sectors, academic institutions 5. Create incentive program for barangays, household and individuals 6. Implement/ enforce municipal and barangay-level ESWM ordinance	Phase 1 Phase 1 Phase 1-3 Phase 3 Phase 2-3	
4. Generate ecologically sustainable source of livelihood from by-products of waste management	Create post-material recovery facilities Create market for recyclables and other	1. Design a sanitary landfill with revenue-generating project e.g. bamboo forest/plantation, eco-park etc. 2. Organize and utilize existing IWS	Phase 2-3 Phase 3	Minimal environmental impact Livelihood for Gubatnon Green jobs

	waste by-products Create safe working conditions for IWS	(Tagaytay dumpsite) – bamboo or eco-park caretakers, segregators 3. Design waste to energy projects - Residual by-products (bricks, LFG, fill and building materials) 4. Utilize recyclable wastes; partnership with existing junkyards/shops 5. Establish barangay-level organic (communal) gardening	 Phase 3 Phase 2 Phase 3	Additional revenue for the LGU Improved health and nutrition

8.2. Diversion Projections

Waste generation based from WACS conducted on a same type of municipality is composed of 60.84% biodegradable, 19.27% recyclable, 17.16% residuals and 2.73% special wastes. Table 20 shows that 97.27% of the generated wastes will be diverted. Residual wastes will be processed and diverted using technologies suitable for the type of waste. The remaining 2.73% of the waste that is composed of special wastes will go to the final disposal facility ensuring proper handling and storage of it. All biodegradables will be processed into organic fertilizer.

8.3. Monitoring Program

An active SWM board under MENRO should be primarily responsible in the regular monitoring and evaluation of the implementation of the programs and strategies in the SWM plan. A task force solely dedicated for the clean and green program will be organized composed of selected members coming from the different related departments or units of the local government. They will be trained and

conduct monthly and quarterly supervision of the solid waste management programs especially focused on the source minimization and large turnout of marketed recyclables. They will report to the SWM Coordinator, MENRO and Office of the Mayor.

The central MRF will be fully functional and an assigned supervisor will manned the said facility. He will report directly to MENRO officer regarding the facility and dumpsite status since central MRF will be located near the site itself. MENRO officer must prepare and submit monthly, quarterly and annual performance reports of the operation of the MRF and the categorized disposal facility. Table below shows goal and its indicator once the plan has been properly implemented and executed.

Table 27. SWM Goals and Indicators

Goals	Indicator
Prepared SWM Plan	SWM Plan created, implemented, and approved along with streamlined environmental authorization
Waste minimization	• Mandated waste recovery system included in securing permit for establishment • Custom designed waste bin that separates in the same bin was created • Jobs from waste minimization generated
Composting Facility	Guidelines and standards for composting facilities developed
Monitoring and output report	Prepared monitoring audit/report on agreed frequencies
Effective IEC campaign	New projects created and implemented regarding waste minimization projects
Energy recovery from waste	Feasibility study for land fill gas (LFG) -Waste to energy conversion is an area with significant potential. Particularly in the light of energy shortages. Utilization of methane from anaerobic digesters should be investigated.

Eco-parks	Establishment of eco-parks to introduce waste minimization and recycling
Recycled residuals	Residuals will be recycled through pelletizing and mixing to cement blocks or bricks as aggregates.
MRF	• Source separation mandated • MRF's established
No segregation No collection Policy	Proper reprimand for those who will not follow the No segregation, No collection Policy,
Systematized site collection	Plan for site collection prepared
Disposal Facility	• Well engineered sanitary landfill established • Weigh bridges and landfill sites operational • Sorting area at landfill provided
Fines	Fines aligned with national government standard
Safety at disposal facility	Utilities are issued with personal protective clothing

8.4. Incentive Programs

Every March of each year, the LGU shall conduct an evaluation of the implementation of the SWM plan per barangay in search for the most outstanding SWM implementer. Cash coming from the general fund or sourced out will be given as prizes. Other awards to be given shall include but not limited to:

- Outstanding SWM implementer per category (households, schools, business establishments, etc)
- Most clean and green barangay
- Outstanding garbage collector

9. Institutional Aspects

As one of the operative principle of decentralization, it is imperative that the LGU shares with other stakeholders the duties and responsibilities in maintaining an ecological balance within the area of jurisdiction.

9.1. Roles

The Municipal Solid Waste Management Board is the primary responsible in ensuring that the implementation of this plan is realized. The MSWMB shall be responsible for the following:

- Adopt specific revenue-generating measure to promote the viability of its SWM plan;
- Develop the specific mechanic and guidelines for the implementation of the 10-year SWM plan;
- Oversee the implementation of the 10-year SWM plan;
- Monitor the implementation of the 10-year SWM plan through its various political subdivisions and in cooperation with the private sector and the NGOs;
- Coordinate the efforts of its barangays in the implementation if the 10-year SWM plan;
- Recommend to appropriate local government authorities specific measures and project proposals for franchise or build-operate-transfer agreements with duly organized institutions pursuant to RA 6957, to provide either exclusive or non-exclusive authority for the collection, transfer, storage, processing , recycling or disposal of solid waste;
- Review every two years as needed the 10-year SWM plan to ensure its sustainability, viability, effectiveness, and relevance to local and international development in the field of SWM.

Currently, the MENRO is designated to the permanent Market Supervisor. For the municipal solid waste management program to be effective a plantilla position for MENRO should be created. Various offices of the municipality must work together and synergize their efforts. This is done through the establishment of Committees for various aspects of the solid waste management plan.

Committees to be established are proposed committees due to inactive SWM board. Organizing the committee enables to further improve the solid waste management plan. For the proposed programs, establishment of a sanitary landfills, creation of high value products from residuals, manufacture of briquettes and fertilizers from biodegradables and some waste-to-energy initiatives.

MRF Operations Committee

Objectives:

- Ensure the proper segregation of solid wastes collected by the designated collectors, specifically the residuals, biodegradables and special wastes
- Quantification of residuals for forwarding to the residual waste management committee
- Quantification of biodegradable wastes for forwarding to the composting facility operations committee
- Make sure the cleanliness and orderliness of the facility.
- Handles the market of recyclable materials.

Residual Waste Processing Committee

Objectives:

- Monitor the current program of pelletizing residuals as aggregates for cement blocks and bricks production
- Investigate the potential of residual products as eco-bags, containers, ornaments or other high value products
- Conduct feasibility studies on the possible markets for the products previously mentioned
- Investigate the possibility of use of residuals for cogeneration in cement plants
- Offer logistics for the forwarding of residual wastes to the different programs
- Further recommend programs and activities with regards to residual management.

Biodegradable Processing Committee

Objectives:

- Monitor composting programs
- Explore the possibility of using other composting techniques such as Bio-quick and Bio-fix, which are manufactured from BIOTECH
- Consider the use of biodegradables from market and commercial sector in conjunction with yard wastes and household wastes for further improvement of compost quality

- Ensure the compost quality set by Department of Agriculture is maintained
- Determine the amount of biodegradables that would be diverted for coal-briquette making and other biodegradable solid waste management activities
- Evaluate the possibility of using windrows and mechanical composting equipment for the increase of compost production efficiency
- Conduct continuous search for market for compost to ensure sustainability
- Research for new and alternative methods for composting.

Eco-Farming/Eco-Tourism Operations Committee

Objectives:

- Locate possible sites to serve as eco-farms
- Monitor the performance of eco-farms
- Establish guidelines from which will the performance of eco-farms are based.

Committee for Study of New Solid Waste Management Programs

Objectives:

- Explore the possibility of using municipal wastes for cogeneration in cement manufacturing plants
- Study the possibility of constructing a sanitary landfill for residuals disposal
- Create a catalog of possible high-value products for use as containers and ornaments
- Conduct a research for briquette-making of excess biodegradable waste
- Investigate other areas for possible waste-to-energy initiatives, such as biofuels from municipal solid wastes and the like.

9.2. Legal

An office for the Municipal Environment and Natural Resources should be created providing funds therefor. Consequently, a plantilla position for the MENRO and its staff should be created. This will ensure that proper focus is given to the implementation of the programs in this plan.

As to ordinances, the LGU shall look into the passage of the following local laws:

1. An ordinance regulating the use of plastic bags and other non-recyclable containers thate are provided for packaging or trasnsporting goods. It is recommended to develop a timetable for gradual transition and eventual phase-out of plastic bags and other secondary packaging;
2. An ordinance regulating the use of disposable plastic straws, cutleries, plates, cups, and other single-use items, oftem provided in food establishments and public events. The regulation may be an expansion of the existing ordinance regulating the use of non-recyclable products;
3. Ordinance incentivizing the RA 9003-compliant barangays which seeks to promote best practices by recognizing barangays that have successfully implemented their BSWM plans. Incentives can sourced from garbage collection fees and penalties as well as support from private sector. Other incentive option include additional training for LGU or barangay staff, or equipment for improving sorting and composting activities;
4. Ordinance on tax breaks for RA 9003-compliant businesses and social enterprises that create jobs, livelihood opportunities, that are managing their own waste properly. Other incentives such as waived payment for business permit renewal, cash awards, public recognition, and the like may also be given;
5. Ordinance on mandatory organic wastes recovery, composting in every barangay This will result in less waste sent to landfill, thereby extending its life, less methane build up, less need for hauling, increased savings for the LGU. This policy will also complement and strengthen the segregation at source program.

10. Social and Environmental Aspects

Sustainable 10-year solid waste management plan requires social acceptability. It requires both to be socially and environmentally friendly. The assessment of its environmental impact is another crucial factor to be analyzed. This will be a factor in the ease of its implementation in the LGU.

A paradigm shift from conventional waste management practices to Integrated Solid Waste Management (ISWM) is essential for all municipalities in order

to effectively manage the waste stream. An effective ISWM system considers how to prevent, recycle, and manage solid waste in ways that most effectively protect human health and the environment. Although Donsol as observed did not generate much waste compared to cities that must adopt an integrated solid waste management system, the LGU prevents the arising problem of solid waste to occur by adopting the said approach. Table 12 shows the comparison of both systems and advantage of the ISWM compared to a conventional one.

10.1. Social Aspects

Table 28. Impacts to the Community

Risks to Waste Pickers	Risks to the Communities

Informal waste pickers, who most often operate without any protective measures, are exposed to a wide range of health risks such as: • HIV (due to handling of hospital waste) • Tetanus (due to handling of jagged metals) • Respiratory problems (due to exposure to smoke) • Neural damage (due to lead) • Injuries • Premature drinking • Stress • Skin and gastric problems *Source: Gunn, S. (2009), UN-HABITAT (2009) with modifications*	• There is a significant increase in the incidence of sickness among children who live in households where garbage is dumped or burned in the yard. • Uncollected solid waste clogs drains and causes flooding and subsequent water-borne diseases. • People living downwind of a burning dumpsite will likely suffer from respiratory diseases. • Contaminated liquids or leachate, leaking from dumpsite could pollute drinking water supplies. • Waste dumps potentially serve as breeding ground for Malaria, thus having implications in achieving Millennium Development Goals (MDGs).

10.2. Environmental Aspects

Table 29. Impacts to the Environment

Risk due to Conventional Waste Management	Opportunities from Integrated Solid Waste Management System
Poor efficiencies, undesirable health impacts (such as vector-borne diseases), environmental problems (such as deterioration of ground water quality due leachate contamination) and social issues (such as informal communities working in unsafe conditions) due to centralized approach to waste management	Combination of centralized and decentralized options with effective pollution control systems (such as leachate treatment and gas capture systems) leading to economic gains due to improved efficiency, overall cost reduction, minimal environmental impacts and social acceptance.
Developmental activities and consumption driven lifestyles leading to increased generation of waste	Strategically planned waste minimization and green procurement programmes leading to more sustainable consumption patterns along with economic development
Valuable resources go unutilized	Facilitates recycling of valuable resources such as plastic, glass, paper and metals, recovery of alternate energy sources such as Refuse Derived Fuel (RDF) from high-calorific value fraction of waste, recovery of biogas or compost from biodegradable waste
No extensions towards innovation and creation of safe jobs	Encourages innovative technology development in newer areas such as waste to energy and recycling and promotes green jobs that ensure safe working conditions
Fails to involve all stakeholders , particularly neglecting the contribution of communities and private sector participation	Ensures multi-stakeholder participation in decision-making process by involving Non-Governmental Organization (NGOs), Community Based Organization (CBOs), rag pickers, private sector, residential and commercial communities with the government
Health hazards to waste workers and prevalence of social evils like child labour	Brings waste workers into the formal economy and providing them with safe working conditions

No attention given to other newer waste streams for special handling as well as recovering resources	Addresses management of both MSW and other newer waste streams such as e-waste, construction waste and scrapped vehicles.

11. Cost Estimates/ Financial Aspects

11.1. Investment Costs

Table 30. Investment Costs

Item	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
IEC Campaign											
Printing of flyers	5T	5T	5T	5T	5T	5T	5T	5T	5T	5T	5T
Installation of billboards and posters	20 T		20 T		20 T		20 T		20 T		20 T
Segregation at Source											
Drop off containers	42 T					42 T					
Collection and Transport											
Dumptruck Acqusition	20 M	20 M									
Sound System	50 T	50 T									
Materials Recovery Facility											
Rehabilitation of municipal MRF	500 T										
Composting											
Construction of Compost pits	100 T										
Trainings	50 T										
Recycling											
Start up capital for barangays	840 T										

Trainings	50 T										
Acquisition of equipment for residual	150 T										
Final Disposal											
Acquisition of Land	5 M										
Construction of Sanitary Landfill	5M	5M	5M	5M	5M						

11.2. Annual Costs

Table 31. Annual Costs

Expense Item	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
Fuel	370 T	370 T	370 T	370 T	370 T	370 T	370 T	370 T	370 T	370 T	370 T
Vehicle Maintenance	200T	200T	200T	200T	200T	200T	200T	200T	200T	200T	200T
Insurance/ Registration	100 T	100 T	100 T	100 T	100 T	100 T	100 T	100 T	100 T	100 T	100 T
PPE	30 T	30 T	30 T	30 T	30 T	30 T	30 T	30 T	30 T	30 T	30 T
MRF Supplies and Materials	50 T	50 T	50 T	50 T	50 T	50 T	50 T	50 T	50 T	50 T	50 T
Building and Ground Maintenance	30 T	30 T	30 T	30 T	30 T	30 T	30 T	30 T	30 T	30 T	30 T
Utilities	15 T	15 T	15 T	15 T	15 T	15 T	15 T	15 T	15 T	15 T	15 T
Laboratory Tests for Closed Dumpsite	10 T	10 T	10 T	10 T	10 T	10 T	10 T	10 T	10 T	10 T	10 T

Maintenance of Equipment	30 T	30 T	30 T	30 T	30 T	30 T	30 T	30 T	30 T	30 T	30 T
Office Supplies	10 T	10 T	10 T	10 T	10 T	10 T	10 T	10 T	10 T	10 T	10 T
Travel	20 T	20 T	20 T	20 T	20 T	20 T	20 T	20 T	20 T	20 T	20 T

11.3. Funding Options

Fund can be taken from the Internal Revenue Allotment (IRA) of the LGU, SWM revenues such as fees from households and establishments and penalties. Fund can also be sourced out from National Government Agencies (NGA), Non-Government Organization (NGO), and private sectors.

Table 32. Funding Options

SWM Revenues	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
General Fund	2.5 M	2.5 M	2.5 M	2.5 M	2.8 M	2.8 M	2.8 M	2.8 M	3M	3M	3M
20% LDF	5M	5M	5M	5M	5M						
Fees (Households)	50 T	50 T	50 T	50 T	50 T	50 T	50 T	50 T	50 T	50 T	50 T
Fees (Establishments)	300 T	300 T	300 T	300 T	300 T	300 T	300 T	300 T	300 T	300 T	300 T

11.4. Cost and Evaluation Comparison

The costs and expenditures for the year 2016, 2017, and 2018 is shown in Annex A.

12. Plan Implementation

12.1. Phases and Responsibilities

Table 33. SWM Phasing of Activities

Activity	Year											Person Responsible
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	
Engineering Component												
Feasibility study for the planned disposal facility												MEO, MTWG, Consultants
Submission of FS on possible agencies and NGO's for possible source of investment												MENRO
Construction of categorized sanitary landfill												MEO,Contractor
Acquisition of necessary equipments												MENRO, BAC
Operation and maintenance of dump trucks and other existing machineries												MENRO
Operation of the controlled dumpsite												MENRO
Improvement of central MRF and construction of barangay MRFs												MENRO

Perimeter fence and access road												MEO
Closure of controlled dumpsite and rehabilitation												MENRO
Conversion of rehabilitated area into eco-park												MENRO, MEO, MPDC
Information, Education and Component												
Conduct SWM orientation on locals												MENRO, IEC Team
Conduct of IEC campaign												IEC Team
Prepare IEC materials												IEC Team
Conduct seminars on waste to cash programs												MENRO, IEC Team
Create games,events, contests promoting green revolution												MENRO, IEC Team, LGU
Distribute, print, and post articles regarding solid waste on bulletins and social media												IEC Team

Policy Support Component												
Creation of ordinances and resolutions regarding solid waste and its IRR												MENRO, SB
Instruct BSWMC to formulate their own waste management plan												MENRO, MSWMB, BC
Assessment of activities												MSWMB
Administrative/Management Matters												
Create MENRO												Mayor's Office, SB
Activate MSWMB												Mayor's Office, SB
Development of SWM database												MENRO, MSWMB
Implement approved solid waste management plan												MENRO
Capability Building												

Training of personnels involved in SWM including MRF and disposal facility operation, marketing and recycling of recyclables, biodegradable, and residual waste including immersion on some disposal facility												MENRO, DENR-EMB, DTI, LGU
Orientation of garbage collectors on proper handling & efficient garbage collection & transport												MENRO
Training on BSWMC												MENRO, MSWMB
Training and support on technical studies regarding waste management												MENRO, DENR-EMB
Conduct research, feasibility studies, and cost-benefit analysis on												MENRO, MTWG

potential SW Technologies												
Conduct technical trainings on alternative technical recycling technology, composting technology, and residual waste processing												MENRO, PENRO, DENR-EMB
Economic Enterprise Component												
Conduct livelihood seminars for potential source of income; generate green jobs												MENRO, LGU, PENRO, TESDA, DTI
Establishment of organized and accredited junkshops and waste pickers												MENRO
Promote backyard composting												MENRO, DA
Market linkaging												MENRO, DTI
Conduct and undergo training on product development and marketing												DTI, LGU

12.2. Milestones

The Plan was created as a guideline and basis for management of municipal waste. Although deviations may occur on the near future compared from what is expected on the Plan LGU will ensure that to cope up with the standard certain milestone must be established:

- Implementation of the approved solid waste management plan by 2017
- Setting up an active and functional organizational structure (MENRO and MSWMB) by 2016
- Intensive IEC campaign for a 100% literacy regarding solid waste management by 2016 (continuous IEC is needed to maintain effectiveness of the Plan)
- Establish cost efficient and effective solid waste collection system by 2016
- Sustain the established Materials Recovery Facility (MRF) and construct additional barangay MRFs. It should be fully operational by 2017
- Establish a sanitary landfill by 2022
- 100% diverted waste by 2021
- Establish an operational large scale composting facility by year 2017
- Feasibility studies regarding brick making and briquette production already finished and trial runs has been conducted by year 2017
- Sufficient appropriation of funds for SWM program, 100% by year 2019

12.3. Implementation Schedule

Table 34. SWM Plan Implementation Schedule

Activities	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Approval of 10-year SWM Plan											
Intensive and continuous IEC on the municipality											
Establishment of an effective collection system											
Operational MRFs											

Establish a sanitary landfill											
Closure of open dumpsite											
Development of eco-park											
Development of IRR for SWM Ordinance											
Monitoring and evaluation											
Acquisition of Heavy Equipment											
Acquisition of Equipment for diversion											
Creation of new ordinance											
Creation of MENRO											

References

Republic Act 9003

NSWMC Guidebooks

Waste Analysis and Characterization Study – A Manual

Guidebook for Formulation of Solid Wastes Management Plan

Guidebook for Safe Closure of Disposal Sites

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